FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

THE DEVELOPMENT OF THE PROPOSED LESLIE 1 COAL MINING PROJECT, MPUMALANGA PROVINCE

12 September 2018

DMR Reference: MP 30/5/1/2/2/10207 MR

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH THE DEVELOPMENT OF THE PROPOSED LESLIE 1 COAL MINING PROJECT, MPUMALANGA PROVINCE

DMR Reference Number: MP 30/5/1/2/2/10207 MR

Mining Right Application

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 (AS AMENDED).

Name of Applicant: Anglo Operations (Pty) Ltd

Tel No: 013 653 5341

Postal Address: Private Bag X1, Marshalltown, 2107, Johannesburg

Physical Address: 55 Marshall Street; Johannesburg

File Reference Number SAMRAD: MP 30/5/1/2/2/10207 MR

Document prepared by: Kongiwe Environmental (Pty) Ltd

Final Environmental Impact Assessment Report Information

Project:	Leslie 1 Mining Project
Report Title:	The construction and operation of the Leslie 1 Coal Mining Project, Mpumalanga Province
DMR Reference No:	MP 30/5/1/2/2/10207 MR
Client:	Anglo Operations (Pty) Ltd
Project No:	GLEN#003
Compilation Date:	12 September 2018
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Verification	Capacity	Name	Signature	Date
By Author	Principal EAP	Gerlinde Wilreker		18 July 2018
Reviewed by:	Legal Review	Michael Hennessy		19 July 2018
Reviewed by:	Peer Review	Kim Haycock		27 July 2018
Authorised by:	Director	Bradly Thornton		31 July 2018

SECTION 1:

ENVIRONMENTAL IMPACT ASSESSMENT REPORT OVERVIEW

Important Notice

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

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of Regulation 16(3) (b) of the Environmental Impact Assessment Regulations 2017, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of Regulation 17 (1) (c) the Competent Authority must check whether the application has considered any minimum requirements applicable or instructions or guidance provided by the Competent Authority to the submission of applications.

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

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

Objective of the Environmental Impact Assessment Process

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

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

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

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

Environmental Quality

Kongiwe Environmental (Pty) Ltd is committed to Environmental Quality. Environmental Quality refers to the total environment, not just the natural environment. It is a measure of the health of the environment (including the fauna and flora it supports), and of the effects it has on the health, comfort, and psychological state of the people that inhabit it.

Environmental Quality ensures that the value of South Africa's land is preserved, protected and sustained, and not unacceptably exploited or degraded. All members of this project team, including the appointed specialist professionals, are committed to protecting the environment and encouraging its sustainability.

Kongiwe believes that with the co-operation of the Applicant and I&APs throughout the project process, Environmental Quality can be achieved in for each mining stage of the Leslie 1 Project.

Public Review Period for the Draft EIA/EMPr Report

Members of the public, local communities, and stakeholders were invited to comment on the Draft Environmental Impact Assessment and Environmental Management Programme Report (EIA/EMPr) which was made available for public review and comment from **03 August to 03 September 2018.** The Draft EIA/EMPr was also be submitted to the Department of Mineral Resources (DMR) and was made available at the following locations.

Location	Physical address	Contact person
Hardcopies		
Lebohang Public Library	1095 Butana Tabula, Lebohang, 2265	Ms Rosina Mosako, Librarian (073) 324 5451 speed dial 16769
Leandra Public Library	8 Pretorius Street, Eendrag, 2266	Mr Natalie Potgieter, Librarian (072) 236 3357
Devon Public Library	399 Schuurman Street, Devon	Ms Nelia Nienaber Tel: 017 688 0028
Electronic Copies		
For a CD copy please contact the stakeholder engagement team (Sibongile Bambisa / Vanessa Viljoen) Tel: 010 140 6508		
Kongiwe Environmental website: http://www.kongiwe.co.za/publications-view/public-documents/		

Policy, Legislation and Conditional Requirements

The Department of Environmental Affairs (DEA) in consultation with the DMR, identified the need for the alignment of Environmental Authorisations and promulgated a single environmental system under the NEMA whereby the DMR has become the Competent Authority for the authorisation of mining-related projects under the EIA Regulations of 2014, as amended in 2017. This has resulted in simultaneous decisions in terms of NEMA, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) and other specific environmental management Acts.

As from 2 September 2014 the statutory dispensation regarding environmental management on mines changed with the implementation of the One Environmental System and the commencement of the National Environmental Management Laws Amendment Act (Act No. 25 of 2014) (NEMLAA). In line with the One Environmental System the EIA Regulations were promulgated and came into force on 8 December 2014.

This Final EIA/EMPr is prepared in support of the Environmental Authorisation application and Mining Right Application (MRA) and complies with the requirements of the EIA 2014 Regulations (as amended in 2017) read with the Regulations published in terms of the MPRDA (GNR 527 of 23 April 2004). The proposed Leslie 1 MRA process therefore requires Environmental Authorisation in terms of the NEMA and will follow a Scoping and EIA (S&EIA) process in terms of the EIA 2014 Regulations (as amended in 2017). The aforesaid regulations enforce a strict timeframe and require a decision by the Competent Authority, the DMR, within 300 days from submission of the Environmental Authorisation application.

The nature and extent of the project, as well as the potential environmental impacts associated with the construction, operation and decommissioning of a facility of this nature is assessed and presented in this Final EIA/EMPr. This Final EIA/EMPr has been compiled in terms of the provisions of Appendix 2 of the EIA 2014 Regulations (as amended in 2017), and the Directive set out in the template prescribed by the DMR. Table A-1 cross-references the various sections in this report with these requirements.

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

No.	NEMA Regulation Requirement	DMR Report Section	Page Number
(a)	**Details of -**		
(i)	The EAP who prepared the report and;	Section 1.1 Appendix A	Page 1
(ii)	The expertise of the EAP, including a CV	Section 1.2 Appendix A	Page 1
(b)	**The location of the activity, including –**		
(i)	The 21-digit Surveyor General code of each cadastral land parcel	Section 2.1	Page 3
(ii)	Where available, the physical address and farm name	Table 2-1	
(iii)	Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties	N/A	N/A
(c)	**A plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is –**	Section 2.2 Figure 2-1	Page 4

No.	NEMA Regulation Requirement	DMR Report Section	Page Number
(i) (ii)	A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken On land where the property has not been defined, the coordinates within which the activity is to be undertaken		
(d) (i) (ii)	**A description of the scope of the proposed activity, including –** All listed and specified activities triggered A description of the activities to be undertaken, including associated structures and infrastructure	 Section 4.1 Section 4.2	 Page 17 Page 20
(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**	Section 5	Page 53
(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**	Section 6	Page 70
(g)	**A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report**	Section 7.1	Page 76
(h)	**A full description of the process followed to reach the proposed preferred activity, site and location within the site, including -**	Section 7	Page 76
(i) (ii) (iii) (iv) (v) (vi) (vii) (viii)	Details of the alternatives considered Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs 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. The environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks 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 The possible mitigation measures that could be applied and level of residual risk	Section 7.1 Section 8 Appendix C Appendix C.9 Section 9 Section 10 Section 10 Section 10.2 Section 10.2	Page 76 Page 89 - Page 100 Page 409 Page 409 Page 411 Page 411

No.	NEMA Regulation Requirement	DMR Report Section	Page Number
(ix) (x)	If no alternative development footprints for the activity were investigated, the motivation for not considering such A concluding statement indicating the preferred alternatives, including preferred locations of the activity	Section 7.3 Section 7.8	Page 77 Page 87
(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-**	Section 10.1	Page 409
(i)	a description of all environmental issues and risks that were identified during the environmental impact assessment process	Section 10.2	Page 411
(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	Section 10.2 Section 10.3	Page 411 Page 485
(j) (i) (ii) (iii) (iv) (v) (vi) (vii)	**An assessment of each identified potentially significant impact and risk, including-** cumulative impacts; the nature, significance and consequences of the impact and risk; the extent and duration of the impact and risk; the probability of the impact and risk occurring; the degree to which the impact and risk can be reversed; the degree to which the impact and risk may cause irreplaceable loss of resources; and the degree to which the impact and risk can be mitigated;	Section 10.3	Page 485
(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**	Section 10.4	Page 549
(l) (i) (ii) (iii)	**an environmental impact statement which contains-** a summary of the key findings of the environmental impact assessment: 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 a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 10.6 Section 10.6 Section 7 Section 10.6	Page 550 Page 550 Page 76 Page 550
(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**	Section 11.2	Page 561
(n)	**The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;**	Section 7	Page 76

No.	NEMA Regulation Requirement	DMR Report Section	Page Number
(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**	Section 11.2	Page 561
(p)	**A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed**	Section 11.1	Page 551
(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**	Section 11.5	Page 564
(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**	Section 11.6	Page 564
(s) (i) (ii) (iii) (iv)	**an undertaking under oath or affirmation by the EAP in relation to-** the correctness of the information provided in the reports the inclusion of comments and inputs from stakeholders and I&APs the inclusion of inputs and recommendations from the specialist reports where relevant any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Section 11.8	Page 565
(t)	**Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;**	Section 12	Page 566
(u) (i) (ii)	**an indication of any deviation from the approved scoping report, including the plan of study, including-** any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation;	Section 3	Page 15
(v)	**Any specific information that may be required by the competent authority**	Section 11.7	Page 564
(w)	**Any other matters required in terms of section 24(4)(a) and (b) of the Act**	Section 11.7	Page 564

Kongiwe Environmental has compiled a table (refer to Table A-2 below) outlining the comments and conditional requirements as read within the acceptance of the Final Scoping Report dated 31 May 2018. The information below highlights key conditions to be addressed within the EIA/EMPr. Failure to abide by these conditions could result in the MRA as being rejected by the Competent Authority.

Table A-2: Information requested by the DMR, as per the acceptance of the Final Scoping Report, 31 May 2018.

No.	DMR Information requirement	EAP Comments
a)	The Department has evaluated the submitted Scoping Report (SR) and Plan of the Study for Environmental IMPACT Assessment dated 10 May 2018 and is satisfied that the documents comply with the minimum requirements of Appendix 2(2) of the National Environmental Management Act, 1998 (as amended) (NEMA) Environmental Impact assessment (EIA) Regulations, 2014. The SR is hereby accepted by the Department in terms of Regulation 22(a) of the NEMA EIA Regulations, 2014.	Comment noted.
b)	You may proceed with the Environmental Impact Assessment process in accordance with the tasks contemplated in the Plan of Study for Environmental Impact Assessment as required in terms of the NEMA EIA regulations, 2014.	Comment noted.
c)	Please ensure that comments from all relevant stakeholders are submitted to the Department with the Environmental Impact Assessment Report (EIAR). This includes but is not limited to the Provincial Heritage Resources Authority, Department of Agriculture, Forestry and Fisheries (DAFF), Department of Water and Sanitation (DWS), Mpumalanga Department of Public Works, Roads and Transport and the local municipality. Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should be submitted to the Department.	Section 7 Appendix C9- Comments and Response Report
d)	It should be noted that the Department requires the following to be provided/included and form part of the final EIR and EMPr to be submitted. ❖ A map at an appropriate scale which superimposes the proposed activity(ies) and its associated infrastructures on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; ❖ Details of financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts. ❖ 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 Environmental Impact Report. ❖ Proof of correspondence with the various stakeholders must be included in the EIAR. Should you be unable to obtain comments, proof of the attempts that were made to obtain comments should	Section 4 Figure 4-2 and Figure 4-3 Section 12 Section 8 Appendix C9 – Comments and Response Report Appendix C9 – Comments and Response Report

No.	DMR Information requirement	EAP Comments
	be submitted to the Department.	
	❖ All comments from interested and affected parties must be adequately addressed in the final environmental Impact Report.	Appendix C9 – Comments and Response Report
	❖ Further, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permits or authorisations in terms of the provisions of any Specific Environmental Management Acts (SEMAs), proof of such application will be required	EMPr
	❖ Any other matters required in terms of Appendix 3 (3) and Appendix 4 (1) of the EIA Regulation 2014.	Section 11.7
e)	The applicant is hereby reminded to comply with the requirements of regulation 3 of the EIA regulations, 2014 with regards to the time and period allowed for complying with the requirements of the Regulations.	Comment noted
f)	Please be ensure that the EIAR includes the A3 size locality map of the area and illustrates the exact location of the proposed development. The map must be of acceptable quality and as a minimum, have the following attributes, maps are related to one another, Co-ordinates, Legible legends, Indicate alternative, Scale and Vegetation types of the study area.	Figure 2-1 – Locality map
g)	Your attention is brought to Section 24F of the NEMA which stipulates "that no activity may commence prior to an environmental authorisation being granted by the competent authority".	Comment noted

Executive Summary

Anglo Operations (Pty) Ltd (AOL) holds a Prospecting Right (PR) (PR No: MP 30/5/1/1/2/344 PR) over farms covering approximately 9 750 hectares (ha) in the Govan Mbeki Local Municipality (GMLM). AOL has lodged an application for a Mining Right (MRA) over the Project properties, as well as an application to obtain the relevant environmental authorisations (EAs) required to construct and operate the Project. Should the rights be awarded, they would then be ceded to a Joint Venture (JV), namely Leslie Coal Mine (Pty) Ltd (Leslie Coal Mine).

Kongiwe, an independent and contemporary consulting company, has been appointed to conduct a Scoping and Environmental Impact Assessment (S&EIA) as part of a MRA. The S&EIA is aimed at critically evaluating the potential environmental, social and economic impacts of the proposed **Leslie 1 Coal Mining Project** (hereafter the Proposed Project). Based on surveys and studies done over the land currently held under the PR, five mining areas have been identified as containing sufficient coal resources and reserves. **The MRA and the EA application were submitted to the DMR on 28 March 2018.** The Final EIA/EMPr was made available for public review on 03 August 2018, until 03 September 2018.

AOL proposes to develop an underground coal mining operation (approximately 9 750 ha), with limited surface disturbance, near Leandra in the Mpumalanga Province. As noted above, five (5) mining areas have been identified. These mining areas identified will be discussed in greater detail in Chapter 2. The infrastructure layout for the development footprint is described in Chapter 2.5.

Extracted raw coal will be supplied directly to the local or export market, and/or to the nearest Eskom beneficiation plant or colliery at a rate of approximately 4 million tonnes per annum (mtpa) of Run of Mine (ROM) coal. It is anticipated that the mine will be active for a total mine life of at least 35 years[1], including rehabilitation and closure periods. Where possible, infrastructure will be shared between the mining areas. Where the sharing of infrastructure is not possible, ROM coal will be transported via various transport modes, including access/haul roads.

Project Site Selection

Methods of site selection by the project proponent have been based on favourable technical and economic factors. The mining areas were selected based on the following criteria:

- The measured, indicated and inferred coal resources belonging to AOL within the approved PR area;
- The practical and least invasive requirements for gaining access to the coal seams from the surface;
- The initial findings of the geological and specialist studies;
- As far as possible, existing infrastructure within the landscape to be utilised by the Leslie 1 Project
- Land/ farms that are currently captured under the PR held by AOL; and

[1] Although the Mining Right application will be in respect of the maximum period of 30 years as set out in the Mineral and Petroleum Resources Development Act, 2002, applications for extension will be lodged when required.

- Existing land-uses of the immediate and broader regional setting.

Considering the specialist inputs upon completion of their studies and a 'Specialist Workshop', and based on the site sensitivity assessment, a preferred development footprint was identified for the placement of surface infrastructure.

Evaluation of the Leslie 1 Project

The EIA process comprises of two phases, namely the Scoping Phase, and EIA Phase.

- The Scoping Phase included the identification of potential issues associated with the Leslie 1 Project through desktop studies, which consider existing information, and consultation with affected parties and key stakeholders. The completed Scoping Phase considered the broader site to identify any potential environmental fatal flaws, "no-go" areas or sensitive areas. Following the public review of the Draft Scoping Report, the Final Scoping Report (FSR), as well as a Plan of Study for EIA (PoSEIA) was submitted to the DMR. The FSR was submitted to the DMR on 07 May 2018 and acceptance of the FSR was received on the 31 May 2018.
- The EIA Phase involves a detailed assessment of potentially negative direct, indirect and cumulative impacts identified during the Scoping Phase. This phase considers the proposed development footprint and includes detailed specialist investigations, field work and public consultation. Following the review of the Draft EIA/EMPr, this phase culminated in the preparation and submission of the Final EIA/EMPr, including recommendations of practical and achievable mitigation and management measures, to the DMR for review and decision making.

Impacts Associated with the Leslie 1 Project

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

Impact	Rating Pre-Mitigation	Construction	Operation	Decommissioning	Post closure	Rating Post Mitigation	Construction	Operation	Decommissioning	Post closure
Negative (-)	Major (high)	❖ Soils horizon ❖ Soil fertility ❖ Soil compaction ❖ Arable land ❖ Wetland capability ❖ Land use ❖ Heritage ❖ Property loss / damage ❖ Economic displacement ❖ Cultural ❖ Municipal services ❖ Disease ❖ Accidents	❖ Soil compaction ❖ Soil quality ❖ Water quality ❖ Groundwater quantity ❖ Groundwater quality ❖ Air Quality 1C ❖ Night Noise 1C ❖ Visual ❖ Heritage ❖ Cultural ❖ Municipal services ❖ Disease ❖ Cumulative climate change	❖ Soil compaction ❖ Groundwater quality ❖ Visual ❖ Influx ❖ Property loss / damage ❖ Economic displacement	❖ Groundwater quality	Major (high)	❖ Soil horizon ❖ Arable land ❖ Land use	❖ Groundwater quantity ❖ Visual		
Negative (-)	Moderate (medium)	❖ Soil quality ❖ Soil erosion ❖ Grazing land ❖ Water quality ❖ Water runoff ❖ Drainage patterns ❖ Groundwater quantity ❖ Air quality ❖ Day Noise 1A ❖ Vibration on heritage & roads ❖ Air blast on houses ❖ Fly rock ❖ Visual ❖ Influx ❖ Sense of place ❖ Health ❖ Climate change	❖ Soil erosion ❖ Water quantity ❖ Water seepage ❖ Groundwater quality ❖ Air quality 1A ❖ Day Noise 1C ❖ Night Noise 1A ❖ Night Noise 1A ❖ Visual ❖ Heritage ❖ Sense of place	❖ Soil quality ❖ Surface water quality ❖ Groundwater quantity		Moderate (medium)	❖ Soil fertility ❖ Soil compaction ❖ Grazing land ❖ Groundwater quantity ❖ Fly rock ❖ Visual ❖ Influx ❖ Property loss / damage ❖ Economic displacement ❖ Cultural ❖ Municipal services ❖ Disease ❖ Health ❖ Accidents ❖ Climate Change	❖ Soil compaction ❖ Soil quality ❖ Soil erosion ❖ Water quantity ❖ Water quality ❖ Water seepage ❖ Groundwater quality ❖ Air quality 1A ❖ Air quality 1C ❖ Day Noise 1C ❖ Night Noise 1C ❖ Visual ❖ Stockpiles ❖ Heritage ❖ Influx ❖ Property loss / damage ❖ Economic displacement ❖ Cultural ❖ Municipal services ❖ Disease ❖ Sense of place	❖ Soil erosion ❖ Groundwater quantity ❖ Groundwater quality	
Negative (-)	Minor (low)	❖ Groundwater quantity ❖ Groundwater quality ❖ Vibration on houses & boreholes	❖ Day Noise 1A	❖ Noise		Minor (low)	❖ Soil quality ❖ Soil erosion ❖ Wetland capability ❖ Water quality ❖ Water runoff ❖ Drainage patterns ❖ Groundwater quantity ❖ Groundwater quality ❖ Air quality	❖ Night noise 1C ❖ Night Noise 1A ❖ Day Noise 1A ❖ Night Noise 1A	❖ Soil quality ❖ Water quality ❖ Noise	❖ Groundwater quality

Impact	Rating Pre-Mitigation	Construction	Operation	Decommissioning	Post closure	Rating Post Mitigation	Construction	Operation	Decommissioning	Post closure
							❖ Noise 1A ❖ Vibration on houses & boreholes ❖ Vibration on heritage & roads ❖ Air blast on houses ❖ Heritage ❖ Sense of place			
No Impact	No Impact					No Impact				
Positive (+)	Major (high)					Major (high)	❖ Employment ❖ Economic multiplier	❖ Employment ❖ Economic multiplier ❖ LED projects		
Positive (+)	Moderate (medium)	❖ Employment ❖ Economic multiplier	❖ Employment	❖ Rehabilitation	❖ Groundwater quantity	Moderate (medium)	❖ LED projects		❖ Visual ❖ rehabilitation	❖ Groundwater quantity
Positive (+)	Minor (low)	❖ LED projects	❖ Economic multiplier ❖ LED projects			Minor (low)				

During the risk assessment process, it was found that the proposed project would result in a number of impacts with a "High" significance rating post-mitigation. Only these impacts have been listed below.

Specialist Studies	Environmental Aspect	Finding	Significance After Mitigation
Negative Impacts			
Soil, Land Capability and Agricultural Potential	Soil	Disturbance of in situ horizon organisation	High
	Land Capability	Loss of arable land capability	High
	Land Use	Change in land use from agriculture to mining	High
Groundwater	Quantity	Dewatering	High
Visual	Visibility	Light pollution at night	High
Positive Impacts			
Social	Project commencement Mining Activities	Employment opportunities	High
		Multiplier impacts on the local economy	High
		Community development through LED projects	High

Conclusion

Based on the information contained in this report, it is the opinion of the EAP and the specialists that the negative environmental impacts, aside from the negative high impacts in the table above) resulting from the Leslie 1 Project can be mitigated to within acceptable limits and that the project should be authorised. This opinion holds provided all the recommendations proposed in the specialist studies and the EIA and EMPr as well as legal requirements are implemented and adhered to.

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

The findings of the impact assessment have shown that the Leslie 1 Project would conclusively result in certain negative impacts to the environment, however, none of the specialist studies objected to the project. Moreover, the scientific specialist mitigations measures have been included into this EIA and EMPr to reduce the significance of all the identified negative impacts. Most negative impacts can be reduced through the implementation of mitigation measures.

It is important to note that the surface infrastructure plans were significantly revised during the EIA process to significantly reduce environmental impacts. The reduced surface infrastructure reduced the impacted soil areas and avoided sensitive wetland and river areas, as well as reduced the air quality impact zone.

The potential positive impacts include the creation of jobs, generation of wealth within the community and an additional coal resource towards the economy. The quality of coal makes it suitable for use in the domestic thermal market (Eskom). The Leslie 1 Project will thus facilitate the planned mining activities and will have rollover benefits in terms of local employment, local economic development and, increased government revenue and taxes.

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- **Appendix C3** – Background Information Document
- **Appendix C4** – Newspaper Advert
- **Appendix C5** – Site Notice Report and Map
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Appendix D: Specialist Studies

- **Appendix D1** – Soil, Land Use and Land Capability
- **Appendix D2** – Surface Water
- **Appendix D3** – Groundwater
- **Appendix D4** – Biodiversity: Terrestrial Ecology
- **Appendix D5** – Biodiversity: Aquatic Ecology
- **Appendix D6** – Biodiversity: Wetlands

- **Appendix D7** – Air Quality
- **Appendix D8** – Noise
- **Appendix D9** – Blasting and Vibration
- **Appendix D10** – Visual
- **Appendix D11** – Traffic
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Abbreviations

Abbreviation/ Symbol	Description
%	Percent
AOL	Anglo Operations Limited
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plan
AEL	Atmospheric Emissions Licence
AP	Action Plan
BAR	Basic Assessment Report
BBBEE	Broad Based Black Economic Empowerment
BID	Background Information Document
Bgl	Below Ground Level
CA	Competent Authority/Authorities
CARA	Conservation of Agricultural Resources Act (No. 43 of 1983)
Capex	Capital expenditure
CBA	Critical Biodiversity area
CBD	Convention on Biological Diversity
CER	Centre for Environmental Rights
COP	Code of Practice
CRR	Comments and Response Report
CV	Calorific Value
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
DRDLR	Mpumalanga Department Rural Development and Land Reform
DSR	Draft Scoping Report
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAD	Environmental Authorisation Decision
EAP	Environmental Assessment Practitioner
EHS	Environmental, Health, and Safety
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMPr	Environmental Management Programme Report
EP	Equator Principles
ESMP	Environmental and Social Management Plan
ESMS	Environmental and Social Management System
FSR	Final Scoping Report
GDP	Gross Domestic Product
GHG	Greenhouse Gas

Abbreviation/ Symbol	Description
GMLM	Govan Mbeki Local Municipality
GSDM	Gert Sibande District Municipality
GVA	Gross Value Added
ha	Hectare
HDV	Heavy duty vehicle
HDPE	high-density polyethylene
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IFC	International Finance Corporation
IUCN	International Union for Conservation of Nature
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
JV	Joint Venture
Km	Kilometre
kV	Kilovolt
L/s	Litres per second
LOM	Life of Mine
LDV	Light duty vehicle
M	Metre
Ma	Million years
Mamsl	Metres above mean sea level
MAP	Mean annual precipitation
mg/m^2/day	Milligram per cubic metre per day
MJ/kg	Mega joule per kilogram
Ml	Megalitre
mm/a	Millimetres per annum
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
MPHRA	Mpumalanga Heritage Resources Authority
MRA	Mining Right Application
MDARDLEA	Mpumalanga Department of Agriculture and Rural Development and Land Administration
MEGDP	Mpumalanga Economic Growth and Development Path
mS/m	Millisiemens/ metre
Mtpa	Million tonnes per annum
MVA	Megavoltampere
MWP	Mining Work Programme
NDP	National Development Plan
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)

Abbreviation/ Symbol	Description
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEMLAA	National Environmental Laws Amendment Act, 2014 (Act No. 25 of 2014)
NFA	National Forest Act, 1998 (Act No 84 of 1998)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
Opex	Operational expenditure
PCD	Pollution control dam
PGDS	Provincial Growth and Development Strategy
PPP	Public participation process
PR	Prospecting Right
PS	Performance Standards
RoD	Record of Decision
ROM	Run-of-mine
S&EIA	Scoping, Environmental Impact Assessment and Environmental Management Programme
SAHRA	South African Heritage Resources Agency
SDF	Spatial Development Framework
SER	Stakeholder engagement report
SIA	Social Impact Assessment
SLP	Social and Labour Plan
SOP	Standard Operating Procedures
SPLUMA	Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013)
SSC	Species of special concern
WMA	Water Management Area
TSF	Tailings storage facility
WML	Waste Management Licence
WRD	Waste rock dump

SECTION 2:

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1 Details of the EAP

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

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

1.1 Contact Person and Corresponding Address

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

Table 1-1: Details of EAP.

Name of Practitioner	Gerlinde Wilreker, Kongiwe Environmental (Pty) Ltd
Tel No	+27 (10) 140 6508
Fax No	083 476 6438
e-mail address	gwilreker@kongiwe.co.za

1.2 Expertise of the EAP

Gerlinde Wilreker has an M.Sc. in Environmental Management from the previous Rand Afrikaans University, now the University of Johannesburg, and is a registered Professional Natural Scientist (Environmental Management) (Registration No: 400261/09). She has over twelve years' work experience, predominantly in the mining industry. Qualifications in Appendix A.

1.3 Summary of the EAP's Past Experience

Gerlinde Wilreker has over 12 years' work experience as an environmental consultant, predominantly in the mining industry. Her practical experience in the mining and construction industry has given her a depth of knowledge regarding project processes from pre-feasibility phase through to implementation. She is adept at working in different contexts, and problem-solving with her team to meet client needs. She has particular expertise in relation to Environmental Authorisation Processes in terms of the South African legal regime.

1.4 Additional Project Team Members

Team members that have been integral in the successful production of this EIA/EMPr are represented in Table 1-2 below.

Table 1-2: Kongiwe Team Members

Team Member	Position in the Company	Role and Responsibilities
Bradly Thornton	Director	High-Level project management and report review
Sibongile Bambisa	Principal Stakeholder Engagement and Social Consultant	Stakeholder Engagement and all other Public Participation requirements Social Impact Assessment
Nokuthula Ndala	GIS and Environmental Consultant	GIS Mapping Visual Impact Assessment
Ashleigh Blackwell	Environmental Consultant	Soil Impact Assessment
Michael Hennessy	Associate Legal Consultant	Legal review of report documentation
Vanessa Viljoen	Associate Social Consultant	Assistance with Stakeholder Engagement and all other Public Participation requirements
Stephen Horak	Associate Social Consultant	Assistance with Stakeholder Engagement and all other Public Participation requirements

2 Location and Properties Considered

2.1 Property Description

AOL holds Prospecting Right (PR) No: MP 30/2/1/1/2/344 PR over farms covering approximately 9 750 ha in the Govan Mbeki Local Municipality (GMLM) (Table 2-1). This PR was renewed until 23rd April 2018. This Scoping and Environmental Impact Assessment (S&EIA) process is being conducted in parallel to the Mining Right Application (MRA) that will be confined to portions of the farms listed in Table 2-1 and Table 2-2.

Table 2-1: Farms included in the Project Area

Leslie 1A	
❖ Brakfontein 310 IR	❖ Goedehoop 308 IR
❖ Springboklaagte 306IR	❖ Weltevreden 307 IR
Leslie 1B	
❖ Frishgewaadt 87 IS	
Leslie 1C, D and E	
❖ Watervalshoek 350IR	❖ Grootlaagte 311 IR
❖ Salpeterkranz 351	❖ Klipfontein 357 IR

Figure 2-1 indicates the locality of the Proposed Project. Table 2-2 provides a summary of the affected properties under consideration for the MRA.

Since no previous mining has taken place on the properties, this project is considered a "Greenfields Project". The potential negative and positive impacts of the Proposed Project on the environmental, social (including cultural) and economic aspects will be objectively considered though studies undertaken by specialist professionals.

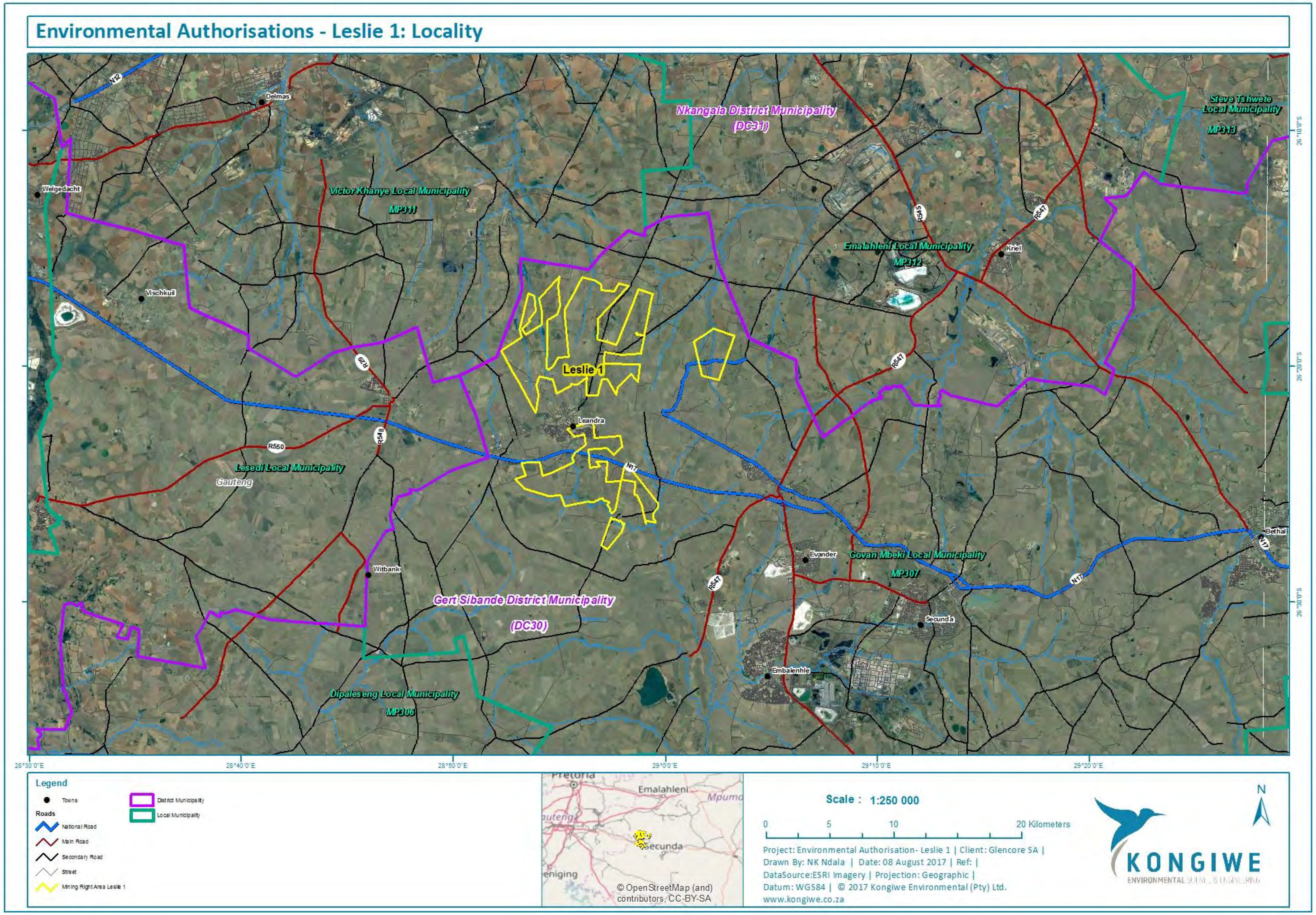


Figure 2-1: Locality map depicting the location of the project area.

Table 2-2: Description of the Property.

Farm Names	Farm Name:	Portion	Landowner
	The farm Weltevreden 307 IR		
		RE/307	Cameron John Benjamin Robert
		3 / 307	Frederik Christoffel Truter
		4 /307	Bezuidenhout Daniel Jacobus Opperman
		5/ 307	Hermanus Arnoldus Erasmus
		7 /307	Moedverloren Pty Ltd
		8 /307	Erasmus Hermanus Arnoldus
		9/ 307	Erasmus Hermanus Arnoldus
		12/ 307	Vooros Boerdery Pty Ltd
		13 /307	Daniel Cornelius Saaiman
		15 / 307	Tobias Jacobus Janse
		16 / 307	Bauermeister Anna Helena Petronella
		17 /307	Vooros Boerdery Pty Ltd
		18 /307	Vooros Boerdery Pty Ltd
	The farm Goedehoop 308 IR		
		RE/308	Goedehoop Beleggings Pty Ltd
		1/ 308	Andries Hansen Familie Trust
		5 /308	Jabula Plant Hire Pty Ltd
		10 /308	John Roderick Graeme Polson
		15 /308	Wallin Farming cc
		16/ 308	Wallin Farming cc
		18 /308	John Cameron Trust
		19 /308	Moedverloren Pty Ltd
		26 /308	Van Niekerk Andries Jacobus
		27/ 308	Van Niekerk Andries Jacobus
		29/ 308	Jabula Plant Hire Pty Ltd
	The farm Brakfontein 310 IR		
		RE/1/310	P Z J P Boerdery
		12 /310	Boshoff Boerdery Pty Ltd
		13 / 310	B & G Van Coller Trust
		RE/14/ 310	Katz Michael Saul
		15 /310	Boshoff Boerdery Pty Ltd
		18 /310	Brakfontein Trust
		19 / 310	Van Niekerk Andries Jacobus
		20/ 310	Leshiba Mokgotledi Ben
		21/ 310	P Z J P Boerdery
		3/ 310	Swanepoel Petrus Wilhelmus Schalkwyk & Cornelia Susanna Swanepoel
	The farm Springboklaagte 306 IR		
		11/ 306	Springboklaagte Boerdery Pty Ltd
		8 /306	Springboklaagte Boerdery Pty Ltd
	The farm Grootlaagte 311 IR		
		7 /311	Pfuka Africa Business Channel cc
		RE/8/311	Nu_Way Housing Developments Pty Ltd

	Lebohang Ext 17 (subdivision of RE/311)	Local Council of Leandra
	Lebohang Ext 18 (subdivision of RE/311)	Local Council of Leandra
	Lebohang Ext 19 (subdivision of RE/311)	Local Council of Leandra
	Lebohang Ext 20 (subdivision of RE/311)	Local Council of Leandra
	Lebohang Ext 21 (previously 18/311)	Local Council of Leandra
	Lebohang Ext 22(Previously 19/311)	Local Council of Leandra
	Lebohang Ext 23(Previously 17/311)	Local Council of Leandra
	24 /311	SANRAL
	25 / 311	SANRAL
	RE/12 / 311	SANRAL
The farm Watervalshoek 350 IR		
	Re/ 11/ 350	Haig Kelly Douglas
	RE/12/ 350	Govan Mbeki Municipality
	13/ 350	Wasserman Johan George
	15 / 350	Johan George Wasserman
	16/ 350	National Government of The Republic of South Africa
	17 /350	National Government of The Republic of South Africa
	18 / 350	National Government of The Republic of South Africa
	19 / 350	Ammarensia Stoffelina Maria Kruger
	20/ 350	National Government of The Republic of South Africa
	21 /350	National Government of The Republic of South Africa
	27 / 350	Ammarensia Stoffelina Maria Kruger
	28 / 350	Ammarensia Stoffelina Maria Kruger
	33 / 350	Nicolaas Franscois Jansen Van Rensburg
	34 / 350	Ernest Hannes Rachmann
	4/ 350	Ammarensia Stoffelina Maria Kruger

		RE/9/350	Nu-Way Housing Developments Pty Ltd
		51 /350- subdivision of Ptn 12	SANRAL
		52/ 350-subdivion of Ptn 9	SANRAL
		63 /350 - subdivision of Ptn 11	SANRAL
	The farm Salpeterkranz 351 IR		
		1/ 351	Bitou Landgoed Pty Ltd
		10 / 351	National Government of The Republic Of South Africa
		13/ 351	Mako Piet
		18 / 351	Land & Agricultural Development Bank of South Africa
		4/ 351	Magaretha Helena Liversage
		9 /351	Bitou Landgoed Pty Ltd
	The Farm Klipfontein 357 IR		
		6	De La Rey Mattheus Hendrikus
	The Farm Frischgewaag 87 IS		
		1	Witwatersrand Gold Mining Realisation Trust

Application Area (ha)	9 750 ha
Magisterial District	GMLM of the Gert Sibande District Municipality (GSDM)
Distance and Direction from Nearest Town	The Proposed Project is situated North and South of the town of Leandra (comprising the former Eendrag and Leslie) in the Mpumalanga Province.

21-digit Surveyor General (SG) Code for each Farm Portion	**Farm Name:**	**Portion**	**SG Code**
	The farm Weltevreden 307 IR		
		RE/307	T0IR00000000030700000
		3 / 307	T0IR00000000030700003
		4 /307	T0IR00000000030700004
		5/ 307	T0IR00000000030700005
		7 /307	T0IR00000000030700007
		8 /307	T0IR00000000030700008
		9/ 307	T0IR00000000030700009
		12/ 307	T0IR00000000030700012
		13 /307	T0IR00000000030700013
		15 / 307	T0IR00000000030700015
		16 / 307	T0IR00000000030700016
		17 /307	T0IR00000000030700017
	The farm Goedehoop 308 IR		
		RE/308	T0IR00000000030800000
		1/ 308	T0IR00000000030800001

	5 /308	T0IR00000000030800005
	10 /308	T0IR00000000030800010
	15 /308	T0IR00000000030800015
	16/ 308	T0IR00000000030800016
	18 /308	T0IR00000000030800018
	19 /308	T0IR00000000030800019
	26 /308	T0IR00000000030800026
	27/ 308	T0IR00000000030800027
	29/ 308	T0IR00000000030800029
	The farm Brakfontein 310 IR	
	RE/1/310	T0IR00000000031000001
	12 /310	T0IR00000000031000012
	13 / 310	T0IR00000000031000013
	RE/14/ 310	T0IR00000000031000014
	15 /310	T0IR00000000031000015
	18 /310	T0IR00000000031000018
	19 / 310	T0IR00000000031000019
	20/ 310	T0IR00000000031000020
	21/ 310	T0IR00000000031000021
	3/ 310	T0IR00000000031000003
	The farm Springboklaagte 306 IR	
	11/ 306	T0IR00000000030600011
	8 /306	T0IR00000000030600008
	The farm Grootlaagte 311 IR	
	7 /311	T0IR00000000031100007
	RE/8/311	T0IR00000000031100008
	Lebohang Ext 17 (subdivision of RE/311)	T0IR00000000031100000
	Lebohang Ext 18 (subdivision of RE/311)	T0IR00000000031100000
	Lebohang Ext 19 (subdivision of RE/311)	T0IR00000000031100000
	Lebohang Ext 20 (subdivision of RE/311)	T0IR00000000031100000
	Lebohang Ext 21 (previously 18/311)	T0IR00000000031100018
	Lebohang Ext 22(Previously 19/311)	T0IR00000000031100019
	Lebohang Ext 23(Previously 17/311)	T0IR00000000031100017
	24 /311	T0IR00000000031100024
	25 / 311	T0IR00000000031100025
	RE/12 / 311	T0IR00000000031100012
	The farm Watervalshoek 350 IR	
	R/ 11/ 350	T0IR00000000035000011
	RE/12/ 350	T0IR00000000035000012

	13/ 350	T0IR00000000035000013
	15 / 350	T0IR00000000035000015
	16/ 350	T0IR00000000035000016
	17 /350	T0IR00000000035000017
	18 / 350	T0IR00000000035000018
	19 / 350	T0IR00000000035000019
	20/ 350	T0IR00000000035000020
	21 /350	T0IR00000000035000021
	27 / 350	T0IR00000000035000027
	28 / 350	T0IR00000000035000028
	33 / 350	T0IR00000000035000033
	34 / 350	T0IR00000000035000034
	4/ 350	T0IR00000000035000004
	RE/9/350	T0IR00000000035000009
	51 /350- subdivision of Ptn 12	T0IR00000000035000051
	52/ 350-subdivion of Ptn 9	T0IR00000000035000052
	63 /350 - subdivision of Ptn 11	T0IR00000000035000063
	The farm Salpeterkranz 351 IR	
	1/ 351	T0IR00000000035100001
	10 / 351	T0IR00000000035100010
	13/ 351	T0IR00000000035100013
	18 / 351	T0IR00000000035100018
	4/ 351	T0IR00000000035100004
	9 /351	T0IR00000000035100009
	The Farm Klipfontein 357 IR	
	6/ 357	T0IR00000000035700001
	The Farm Frischgewaag 87 IS	
	1/ 87	T0IS00000000008700001

2.2 Surrounding Land Uses

Current land use in the GSDM is dominated by agriculture with 3 urban conglomerates, namely Leandra (Leslie, Lebohang and Eendracht) in the western edge; the Greater Secunda (Trichardt, Evander, Kinross and Secunda / Embalenhle) conurbation in the central part; and Bethal / Emzinoni in the east. The land use across the project area is predominantly agricultural in nature. Figure 2-2 illustrates the current land uses around the proposed Leslie 1 Project.

2.2.1 Natural Features

The GMLM forms part of the Highveld region. The municipality generally features an undulating landscape with intermittent hills. The topography consists of a fairly flat terrain, ranging between 1 500 and 1 820 metres. The area is drained by a number of rivers, notably the Waterval River, Trichardspruit and the

Steenkoolspruit (SDF, 2014).

2.2.2 Land Use

The most prominent land use in the GMLM area is agricultural/rural with sections of urban areas (Figure 2-2). Large parts of the area are utilized for dry land crop cultivation (crops such as maize, sunflowers and beans) while unimproved grasslands are used for cattle and sheep grazing and chicken farming operations. A section of the area is defined by rural settlements which consist of homesteads, farm store and farm workers accommodation.

The Lebohang township is situated north of the Leslie 1C area and is planned to extend into the northern portion of Leslie 1C.

It must be noted that there is an overlap of the Lebogang Township, possible future extensions to Lebogang Township and a potential mixed-use development at Grootlaagte portion 7, with the MRA. It is deemed that prior to any mining in this area takes place, a land survey must be undertaken to determine surface features and infrastructure and then a geotechnical assessment performed. These assessments must inform the Life of Mine plan and the mine plan must be revised to ensure that these surface structures are secure and safe from any form of surface subsidence or distortion. The applicant must demonstrate competence to the DMR in the ability to undermine these areas, as well as abide by all legislation relating to underground mining.

2.2.3 Existing Infrastructure

The following infrastructure exists in the Project Area and surrounds:

- The town of Leandra and Lebohang Township;
- The N17 toll road;
- The R50 national road;
- Farm roads;
- Farm dams;
- The railway line from Johannesburg to Richard's Bay;
- Power lines;
- Telephone lines;
- Agricultural homesteads; and
- Dwellings.

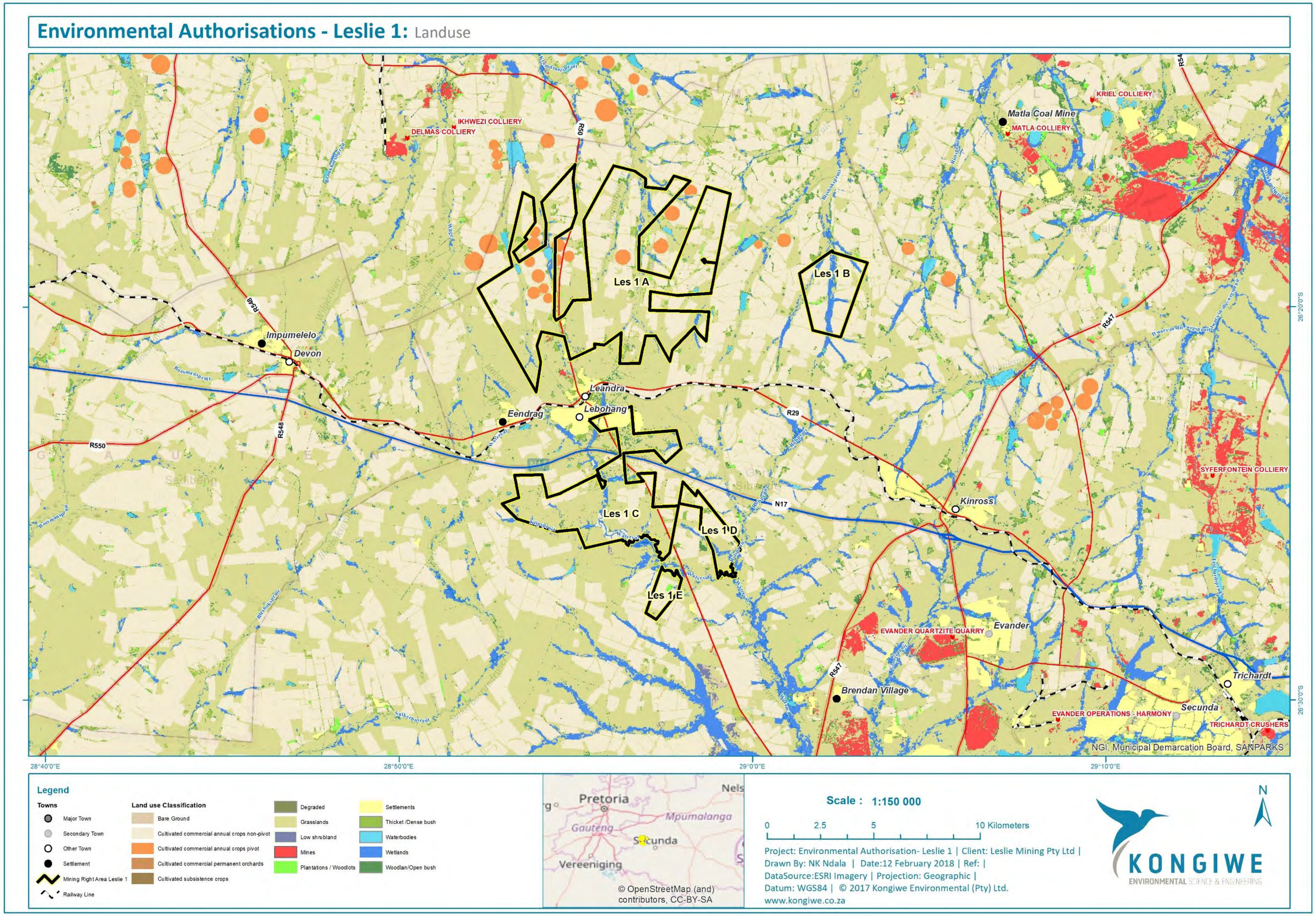


Figure 2-2: Current Land Use for the Immediate and Surrounding Areas of the Leslie 1 Project.

2.2.4 Other Mining Rights in the Area

The assessment of cumulative impacts is required under the EIA 2014 Regulations (as amended in 2017) promulgated in accordance with Section 44 of the National Environmental Management Act, Act No. 107 of 1998 (NEMA). In support of the above, Kongiwe has assessed the impact of the Proposed Project in the context of other similar activities in the local area.

The 2014 GSDM Spatial Development Framework (SDF, 2014), shows the mining activities in the area (Figure 2-3). Since 2014, additional prospecting/mining rights and applications have been submitted to the Department of Mineral Resources (DMR). These are illustrated in Figure 2-4.

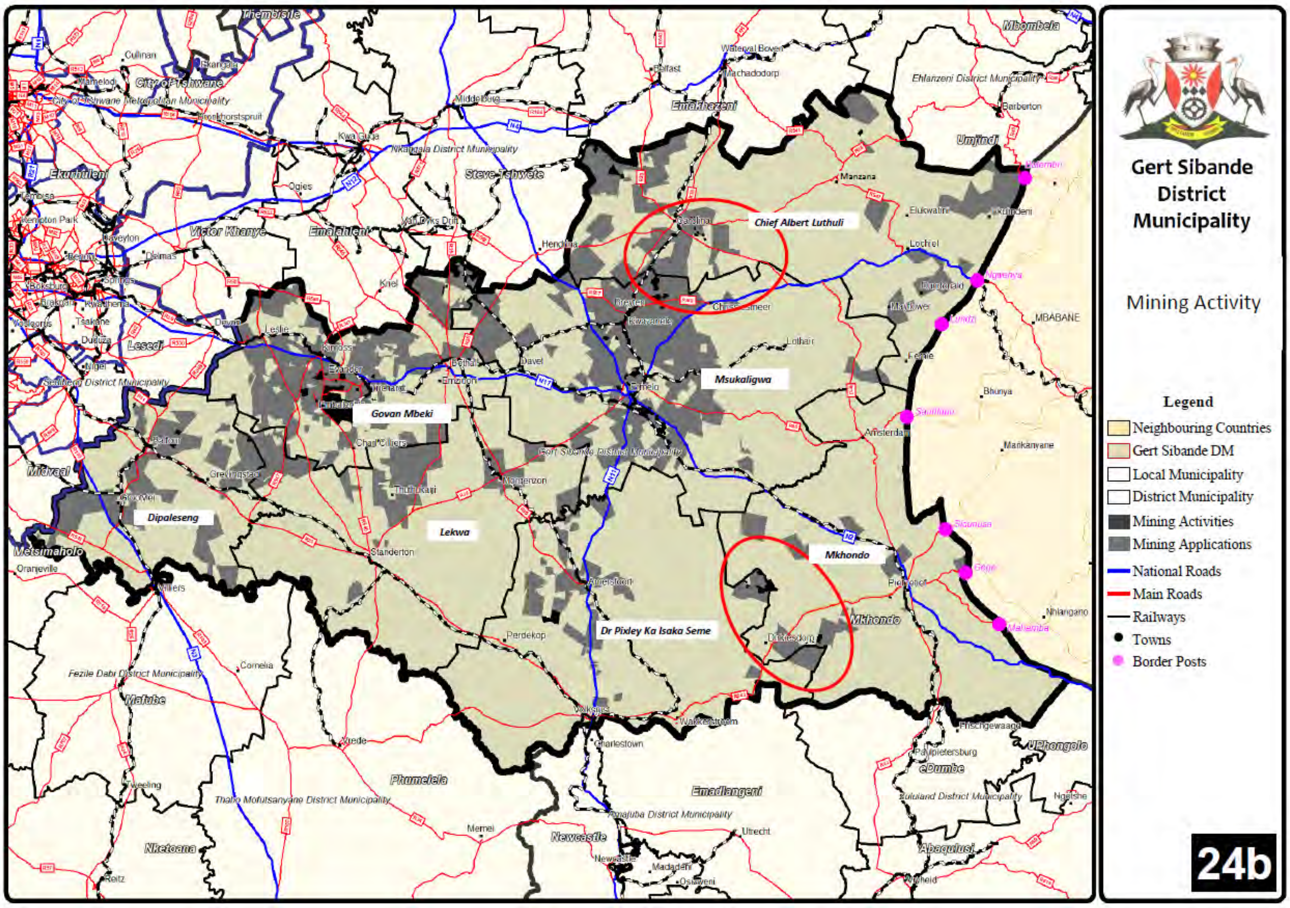


Figure 2-3: Mining Activity in the GSDM (Gert Sibande SDF, 2014)

Mining rights overlapping with the Leslie 1 project area have been identified. These are illustrated in Figure 2-4.

Pan African Resources (PAR) has submitted an application for prospecting rights for gold and Platinum Group Metals (PGM) overlapping with the proposed Leslie 1A and 1B areas, furthermore, they also have an existing mineral right for gold and PGMs which overlays with the proposed Leslie 1 C, D and E areas.

It must be noted that the MPRDA allows for the overlap of mineral rights for different mineral resources over the same area, and thus the overlapping rights of the Leslie 1 Project and PAR's prospecting and mining activities is not a fatal flaw. This is further demonstrated by the successful mining of coal and gold simultaneously over the same areas in the Evander area over a period of the last 80 years. It is the view of the EAP that the DMR must instruct the applicant and PAR to set up a working forum prior to the commencement of any mining activity where there are overlapping rights to ensure that there is understanding between the parties as to where surface infrastructure is to be placed, who is mining where and when, where intersecting boreholes are, and management of water and environmental liabilities between the parties.

South 32 also has an approved PR for coal on the north-western portion of Leslie 1A, this is an administrative issue as there should be no overlapping rights for the same mineral class as per the MPRDA, this is being investigated in consultation with the DMR and South 32.

There are a number of adjacent prospecting rights and mineral rights as per Figure 2-4.

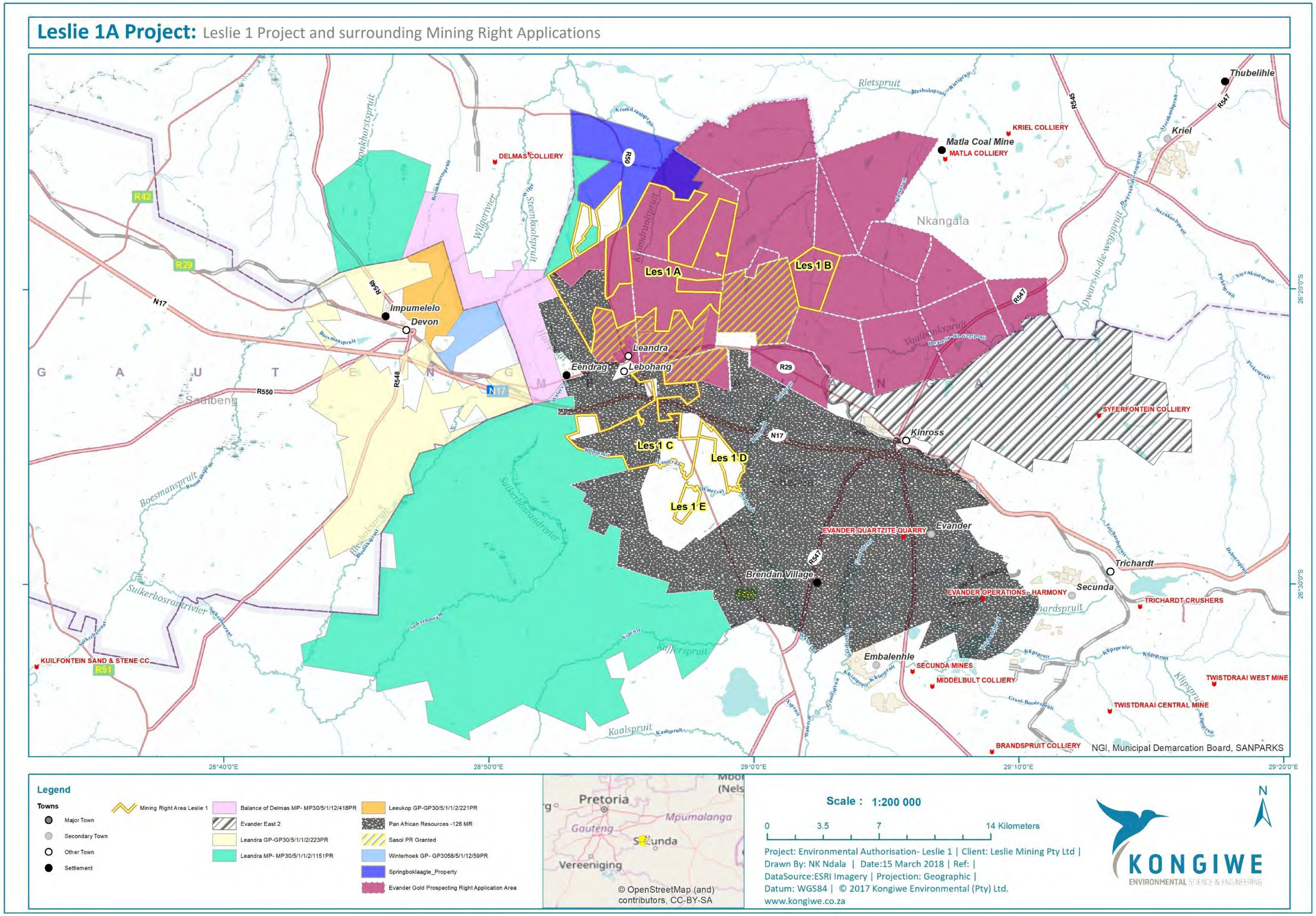


Figure 2-4: Prospecting and mining rights and applications around the Leslie 1 Project area.

3 Deviations from the Approved Scoping Report and Plan of Study

A number of additions to the plan of study as stipulated in the Scoping Report were made and presented below.

Specialist studies were undertaking on the basis of the initial surface infrastructure layouts as described in the Scoping Report. A number of High Negative impacts were identified, namely:

- Soil and land capability: High impact on Leslie 1A as a result of high potential agricultural land.
- Biodiversity: Numerous sensitive features at 1A and 1C.
- Air quality: High impacts at Leslie 1C, especially affecting the town of Leandra.

Based on the findings of the specialist studies and sensitivities of the project areas, the facility layouts for Leslie 1A and 1C were revised to significantly reduce environmental impacts, and the specialist studies further expanded to cover the revised layouts. The changes included:

- Changing from box cuts to incline shafts for all sites.
- Reducing the size of the surface infrastructure and moving it out of sensitive areas.
- Having one co-disposal facility rather than two waste facilities at both Leslie 1A and 1C.
- ROM to be transported to the plant via conveyors rather than by trucks to reduce dust impacts.
- Removal of the eastern access road to the eastern section of Leslie 1A.
- Reducing the length of roads on site.
- Removing the railway sidings at Leslie 1A and 1C.

By changing the facility layouts, the potential negative impacts on sensitive features has been significantly reduced. Chapter 7 addresses the advantages and disadvantages of the amendments to the facility designs and locations.

Chapters 9 and 10 of this report ONLY present the findings following the change of infrastructure layout. The initial findings are presented in the specialist reports in the appendices.

4 Description of the Scope of the Overall Activity

The farms covered by the Proposed Project approximate **9 750 ha in extent**. It is AOL's intention to develop underground mining operations, with mining predominantly exploiting the No. 2 and No. 4 coal seams within the Witbank Coalfield. The mineral to be mined will be Bituminous Coal, with Pseudocoal and Torbanite being mined if encountered. Coal produced by the Proposed Project will be for the local South African market, primarily Eskom and some for other domestic and export markets. It is expected that the following infrastructure and ancillary buildings will be constructed:

- Offices, workshops, change houses, storehouses, warehouses;
- Internal roads, fuel storage facilities;
- Incline Shafts, underground sections, crushing circuits, a wash plant, conveyors;
- Water supply networks, storm water networks, pollution control dams, raw water dams, effluent dams, water treatment works; and
- Topsoil stockpiles, discard dumps, and Run-of-Mine (ROM) stockpiles.

Based on previous prospecting work conducted within the development footprint, five (5) mining areas have been identified as containing feasible ore deposits worth developing. It is envisaged that two (2) plants will be operated, one situated at Leslie 1A and one at Leslie 1C.

The proposed mine infrastructure requirements include existing private (farm) and public roads (including the N17), as well as Eskom electricity infrastructure. Water will be sourced from boreholes and recycled from underground dewatering and pollution control dams. Potable water will be sourced from GMLM or groundwater sources. The water usage strategy for the colliery is being designed to operate as a closed water system and most of the water on site is to be recycled where possible. Electricity for the project is to be supplied by Eskom. Other ancillary infrastructure may include stockpile areas, loading bays, water diversion berms for dirty water/clean water separation, storm water management systems, mobile security offices for access control, a weighbridge(s), potable water tanks, bulk diesel storage facility, oil storage facilities, explosive storage facilities and stores (for spares and material), and mobile ablution facilities.

It is expected that the total Life of Mine (LOM) period will be approximately **35** years, including 1 year for a ramp-up period, and a 2-year tapering-down and rehabilitation period. The mining areas will be designed to process a total of approximately 125 million tonnes of coal during the LOM. At full production, the project is expected to employ approximately up to 685 people, with the intention that most of the labour is sourced from the GMLM and the surrounding areas. All employment will take place in line with the relevant legislation, codes and statutes. Each mining area may be reached via a network of all-weather gravel roads that branch off from the main tar roads, linked to the N17 and R50.

The nearest sizeable town is Leandra (comprising the former Eendrag and Leslie).

Information that provides perspective on the scale of the Proposed Project is presented in the table below.

Table 4-1: Project perspective and technical details.

Group	Specific	Details
Mining	Target Mineral	Bituminous Coal mined from No 2. and No 4 coal seams.
	Minable Area	MRA: 9 750 ha, of which estimated 8 486 ha may be impacted.
	Depth of minerals	The depth of the coal seams generally varies from sub-outcrop to 80 to 120m.
	Rate	Average ROM of 4 Mt/pa
	Extent of area for infrastructure	To be determined.
	Product	Coal
Mine Residues	Waste Rock	Minimal waste rock is expected. This will be placed around the incline shafts for use in rehabilitation.
	Co-disposal Discard	Coal discard is expected.
Resource Use	Water demand	3 Mega Litre (ML)/day
	Power demand	To be determined.
Employment	Staff allocation: construction	To be determined.
	Staff allocation: operation	Approximately up to 685 at full capacity
	Operating Times	From 6am – 10pm, 7 days a week

4.1 Mining and Associated Activities

The following mining areas have been delineated:

- Leslie 1A;
- Leslie 1B;
- Leslie 1C;
- Leslie 1D; and
- Leslie 1E.

4.1.1 Mining Method

It is proposed for the coal to be mined by underground mining methods, with Continuous Miners (CM) and shuttle cars. The "**bord and pillar**" mining technique will be used to ensure that the surface remains stable. In mechanized bord and pillar mining, extraction is achieved by developing a series of roadways (bords) in the coal seam and connecting them by splits (cut-through) to form pillars that act as the primary roof support system. No pillar extraction is going to be pursued.

An incline shaft (70m wide by 500m long to bottom) will be sunk and from there the seams will be accessed. Leslie 1A will have an East and West incline shaft to access the east and west portions of the mining area. Leslie 1B, 1C, 1D and 1E will have one incline shaft each. The incline shafts allow for conveying and travelling, as well as return airways and escape routes. Ventilation within the underground pits will be via mine ventilation shafts, where required. Coal will be transferred via conveyor belt from the underground to the surface infrastructure from where it will be processed and sent to its final destination by truck.

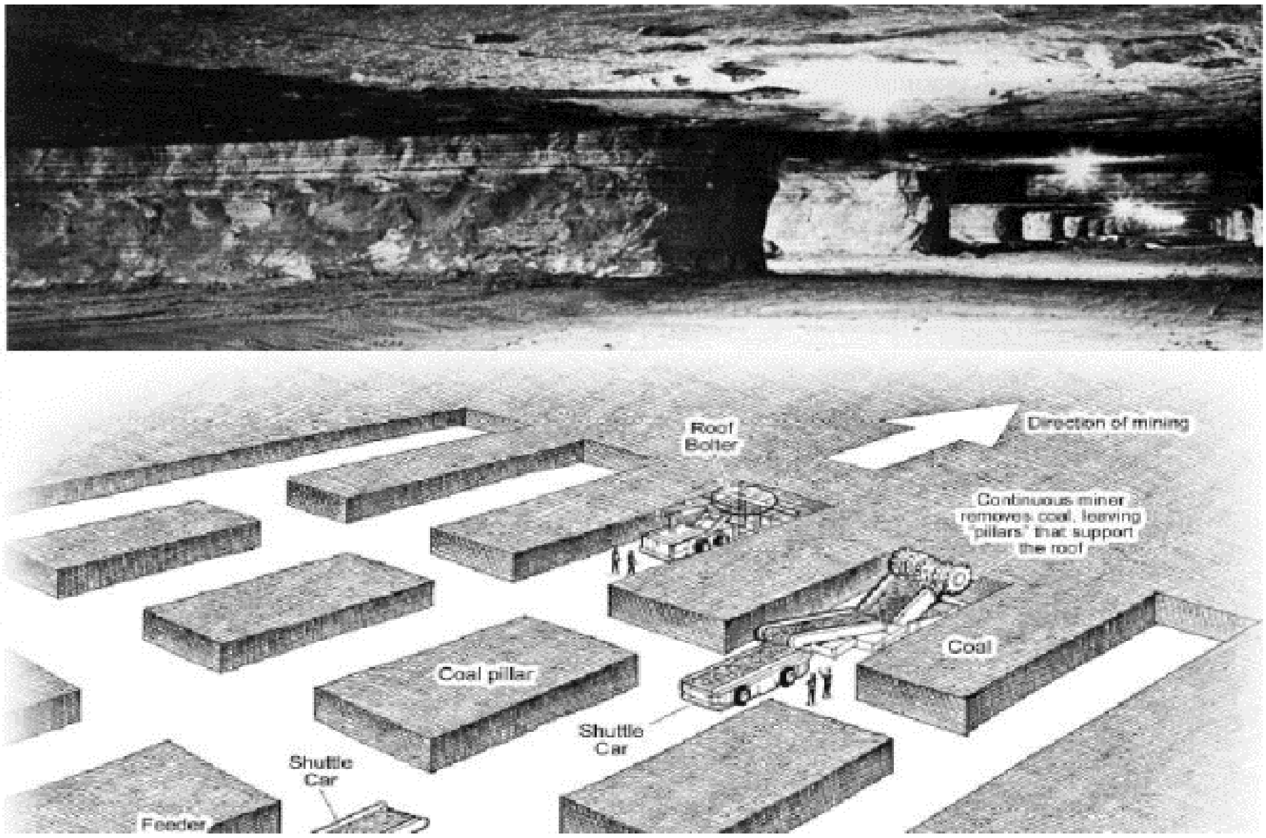


Figure 4-1: Underground mining using the Bord and Pillar Mining Technique (Source: https://wvcoalassociation.wordpress.com)

4.1.2 Spoil Handling

Overburden comprises the surface materials overlaying the mineral deposit/coal that require removal. Spoil refers to the excavated materials (i.e. removed overburden) that will be used during rehabilitation. To facilitate rehabilitation, the applicant will undertake stripping and rehabilitation practices that involve:

- Topsoil (the most fertile soils usually containing the vegetation seed bank) on the infrastructure and incline shaft areas is removed first and placed on stockpiles to be re-used in the final rehabilitation.
- Overburden/spoils/waste rock will be removed by truck and shovel and stockpiled for reuse as fill material during incline shaft and portal closure. The overburden will be placed around the entrance of the portal for ease of backfilling during rehabilitation.

4.1.3 Coal Handling and Processing

Coal beneficiation (also known as coal washing) involves crushing the coal into smaller pieces and passing it through a process called dense medium separation (DMS). This process utilises the differences in mass density (mass per unit volume) between the coal and the impurities such as ash, rock and soil particles to separate the coal from the impurities. The waste that is removed during the coal washing process, known as coal discard, is a combustible, physically and chemically unstable waste that requires special handling and long-term disposal and management. The waste will be disposed of on a co-disposal facility.

It is expected that the extracted coal will be crushed and placed on ROM stockpiles at the two plant areas. ROM or product coal will then be transported off site to its final destination which is expected to be primarily Eskom and possibly other domestic and export markets.

Infrastructure required for coal beneficiation, as well as the beneficiation process has been included below:

Wash Plant

The primary plant will consist of a DMS drum and a cyclone. The plant will have the flexibility to bypass the fine fraction of the ROM coal whilst washing the coarse fraction. Some of the drum and cyclone products could also be washed for sized inland products.

Eskom Plant

This will be a crushing and screening facility where raw coal from the pit will be crushed to market specifications.

Water Supply

It is anticipated that the operations will require a volume of 3ML/day to ensure effective and efficient mining operations.

Domestic Water Requirements

Water required for the wash plant, crusher, service systems and dust suppression will be extracted from the dirty water system. Water supply options are being considered for the project. These may include any of the following: recycling of water, collection of rainfall and runoff on site, water from underground dewatering operations, water from the municipality, boreholes drilled into aquifers to provide water, or a combination of the above.

Run-off water (dirty water) collected from disturbed areas will be collected and stored in holding ponds/pollution control dams (PCD). The water will be routed by utilising a series of diversion berms and stormwater channels. Collected water will be used for the mining and treatment processes and all water generated by the mining activities will be stored in a high-density polyethylene-lined (HDPE) return water dam (RWD) and re-used in the beneficiation plant as well as for dust-control purposes on the haul roads.

The location of a water treatment plant has not been determined at this point, as it is considered that water treatment might only be required during post-closure.

Electricity Supply

Power will be required during the construction and operational phase. At this stage it is assumed that Eskom supply will be used.

Road Network

Direct access to the mine areas will be via main roads. As far as possible, existing access roads will be utilised, and where not possible, these will be constructed as a two-by-two road way, operating in both directions. Where access roads are to be constructed, these will be 4m wide gravel road with storm water earth channels and mitre drains to protect the road structure from flood damage. Intersections will be properly designed to provide safe entry and exit into the mining area. Approvals from the provincial roads authority will be obtained where necessary and a Water Use Licences (WUL) will be applied for where haul or access roads are anticipated to impact on water courses.

4.2 Infrastructure Plan for Activities at each Mine Area

Plant areas are planned at Leslie 1A and 1C. A combination of crushing and screening and partial washing of the ROM coal is planned. Coal from some of the areas is of a suitable quality to be trucked directly to the local market and/or Eskom plant. The layout of infrastructure at each plant area has been informed by the relevant specialist studies, aerial surveys and investigations.

For instance, pollution control dams have been strategically placed at the lowest topographical point within the development footprints as to ensure that all clean/dirty surface water is separated (via berms) and channelled into the dam. This water will be recycled and re-used to minimise the need to use borehole water. Figure 4-2 and Figure 4-3 below are representations of the infrastructure proposed for Leslie 1A and 1C.

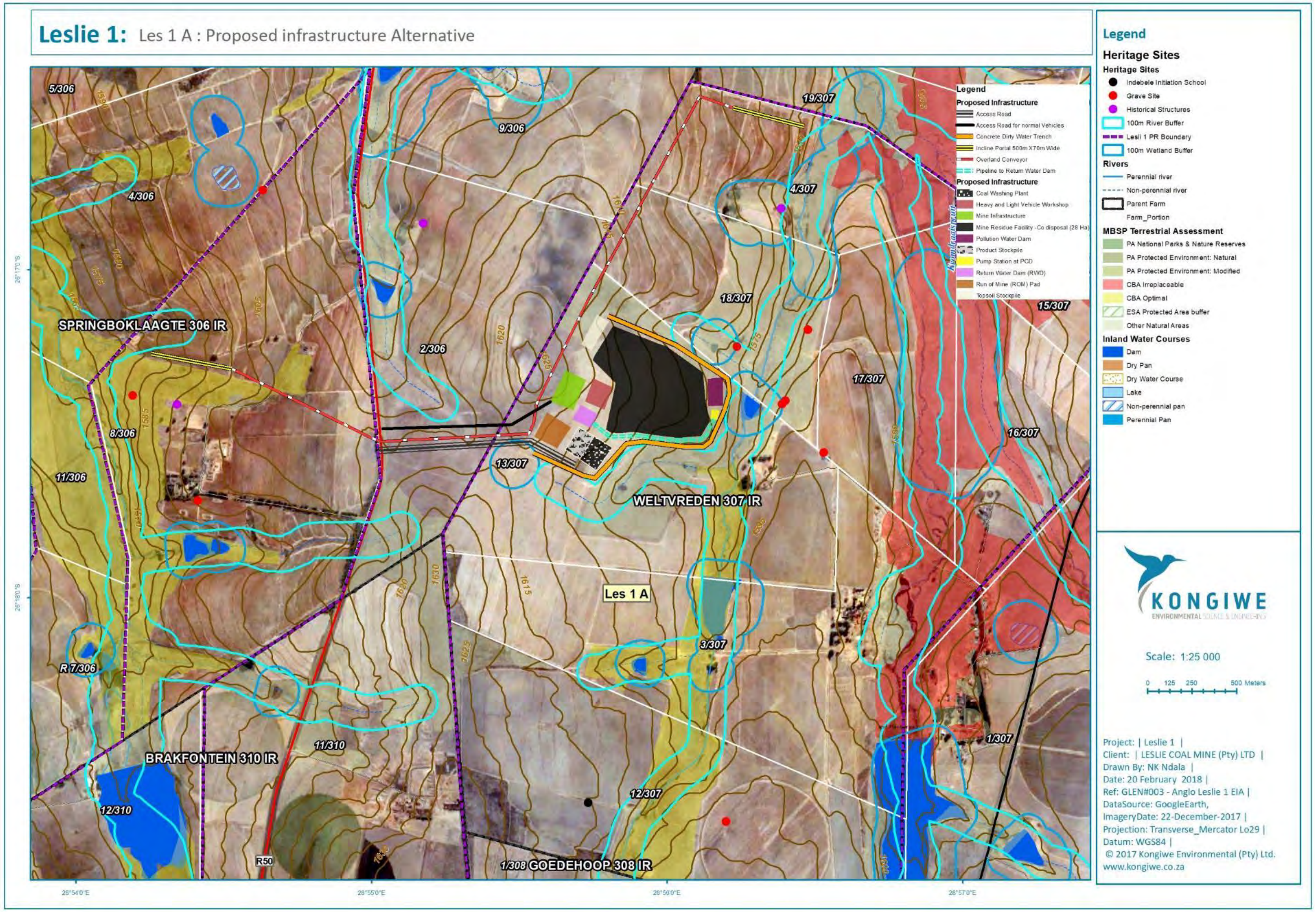


Figure 4-2: Project infrastructure proposed on Leslie 1A.

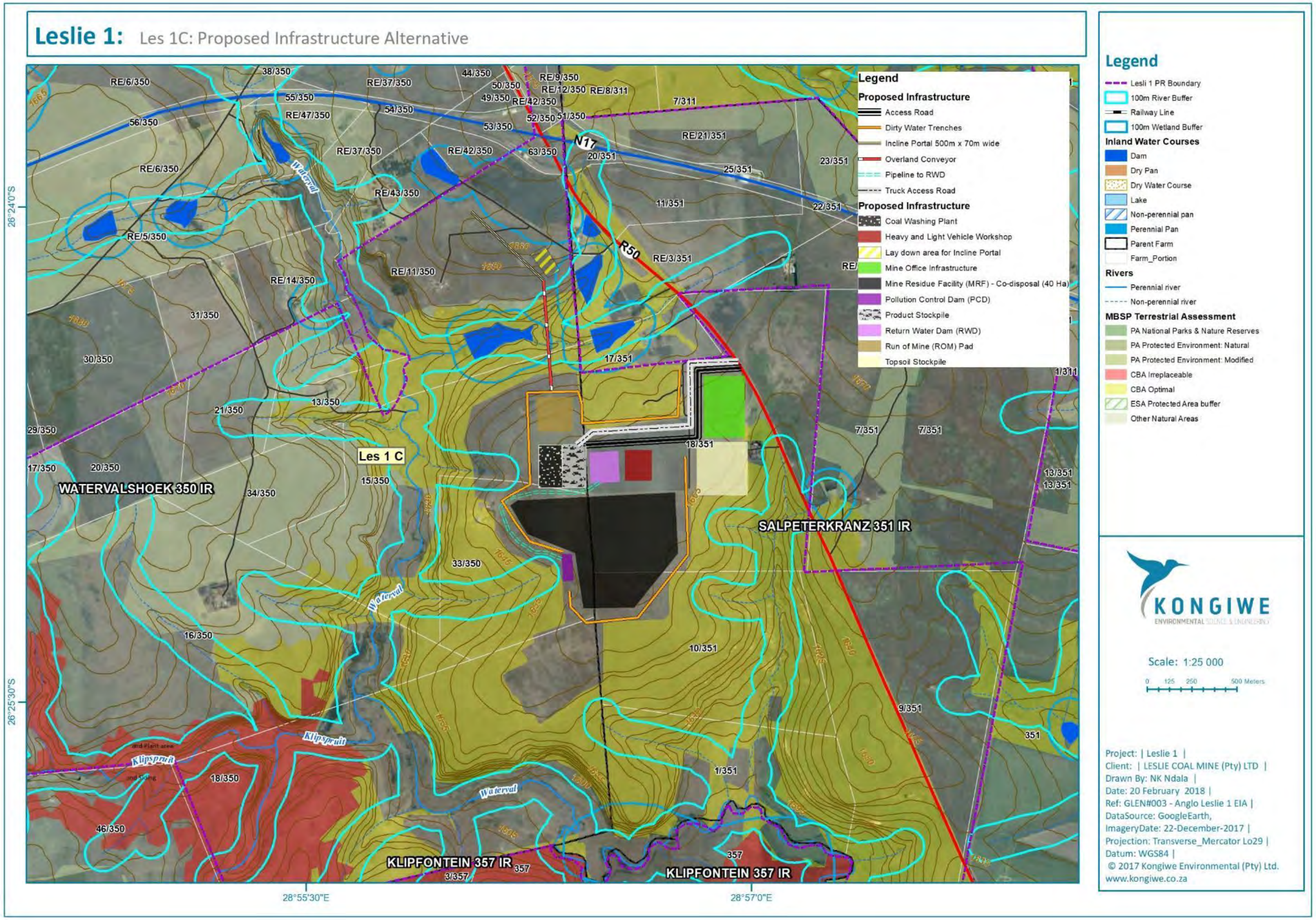


Figure 4-3: Project infrastructure proposed on Leslie 1C.

4.3 Rehabilitation

Rehabilitation will consist of the incline shafts being sealed and levelled and the topsoil replaced on the levelled spoils, as well as the removal of infrastructure from site. Topsoil will be replaced after final levels have been achieved. Natural revegetation and succession will be encouraged. The Rehabilitation Plan is described in more detail in Section 9.8 of the Environmental Management Programme Report (EMPr) and Appendix D17.

Prior to mining, the surface elevations will be surveyed and during the levelling operation the final levels will be maintained to similar elevations wherever possible. This will ensure that surface drainage patterns post mining will be as close as possible to those pre-mining. Topsoil will be replaced after final levels have been achieved. Natural revegetation and succession will be encouraged.

Closure and rehabilitation are a continuous series of activities that begin with planning prior to the project's design and construction, and end with an achievement of long-term site stability and the establishment of a self-sustaining ecosystem. During closure, Leslie Coal Mine will consider the Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision provided by a Mine[2]. This document is an official guideline as contemplated in Regulation 54(1) to the Mineral and Petroleum Resources Development Regulations, 2004. Section C of the guidelines references acceptable closure methods as well as measures to be considered used when dismantling structures. Leslie Coal Mine will conduct rehabilitation and closure to achieve the following main objectives as shown in Figure 4-4 below.

[2] The NEMA Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN R 1147) provide for a final rehabilitation, decommission and mine closure plan must be developed which includes the determination of financial provision to guarantee the availability of sufficient funds to undertake rehabilitation and remediation of the adverse environmental impacts of mining. This is dealt with more fully in Section 11 below

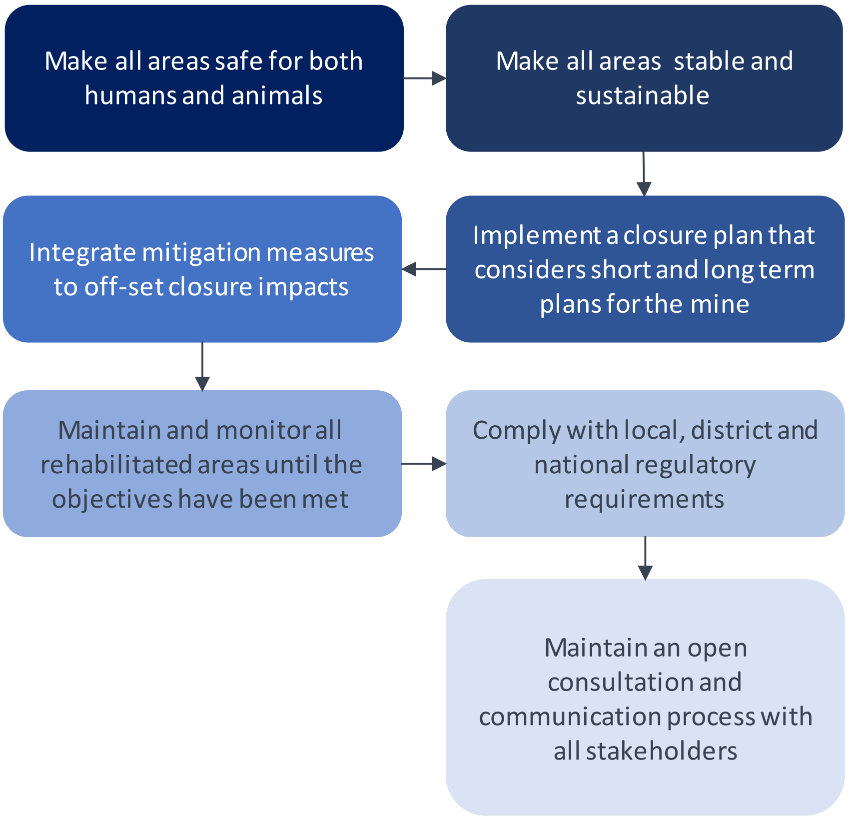


Figure 4-4: Rehabilitation guidelines for the Leslie 1 Project.

Considering the above, the following main activities will be undertaken during the closure and rehabilitation phase:

- Dismantling of processing plant and related structures;
- Demolition of steel buildings and structures, reinforced concrete buildings and structures, administration facilities and housing;
- Rehabilitation of access roads;
- Sealing of shafts and adits;
- Portal rehabilitation;
- Rehabilitation of overburden, spoil and process plant waste;
- Underground rehabilitation;
- General surface rehabilitation including:
  - Grading and shaping; and
  - Re-vegetation.
- Waste removal; and
- Water management.

4.4 Mine Works Schedule

It is anticipated that mining will commence in Year one (Y1) at Leslie 1A. The first operation would commence at the Leslie 1A East-block. Production from the underground sections will commence during Year 2 (Y2).

The second operation will be towards the west of the Leslie 1A block (West-block). The establishment of the portal will commence in Year 6 (Y6), and underground production will commence in Year 7 (Y7).

The Leslie 1 Project will relocate to Leslie 1C as the reserves in Leslie 1A reach a point of depletion. Thereafter the reserves of Leslie 1D, 1E and finally 1B will be extracted. The decline in production will commence in Year 32 (Y32) when the underground sections will reduce production as the reserve is depleted.

Table 4-2 below illustrates the mine works schedule for the implementation of activities at the Mine Areas. Figure 4-5 to Figure 4-7 show the planned mine works schedule for each mining area.

Table 4-2: Indication of the mine works programme and mining method per mine area:

Mine area	Area (ha)	Mine schedule	LoM	Total ROM (tonnes)
Leslie 1A	4842.350367	East: Year 1 to Year 25 West: Year 7 to Year 15	25	49 444 000
Leslie 1B	785.688292	As the reserves in Leslie 1E reach a point of depletion	14	14 041 000
Leslie 1C	2312.601909	Year 11 to Year 35 As the reserves in Leslie 1A reach a point of depletion	28	46 612 000
Leslie 1D	345.81425	As the reserves in Leslie 1C reach a point of depletion	4	8 000 000
Leslie 1E	200.233237	As the reserves in Leslie 1D reach a point of depletion	9	6 483 000

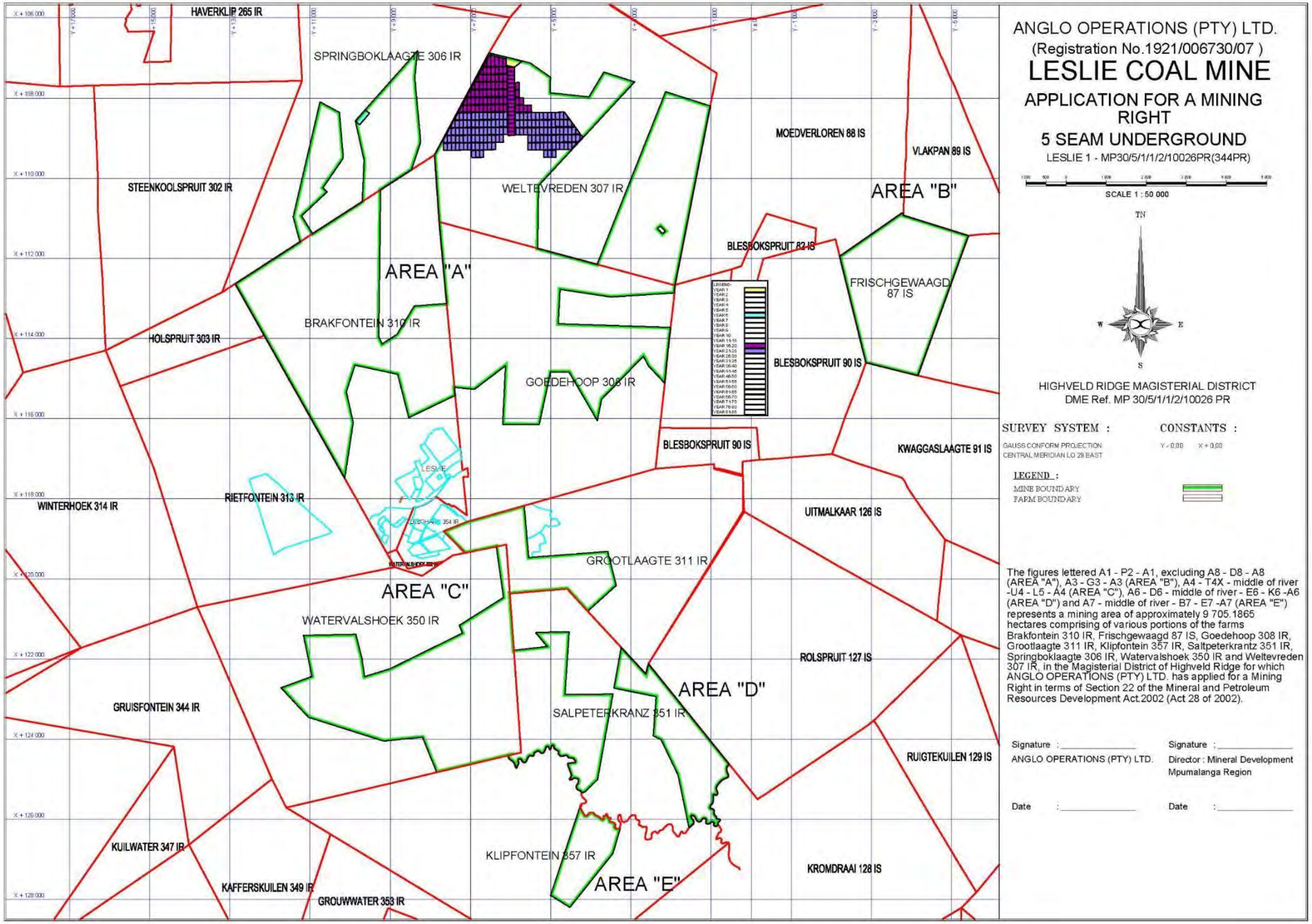


Figure 4-5: Leslie 1 No. 5 Seam Mine Works Schedule.

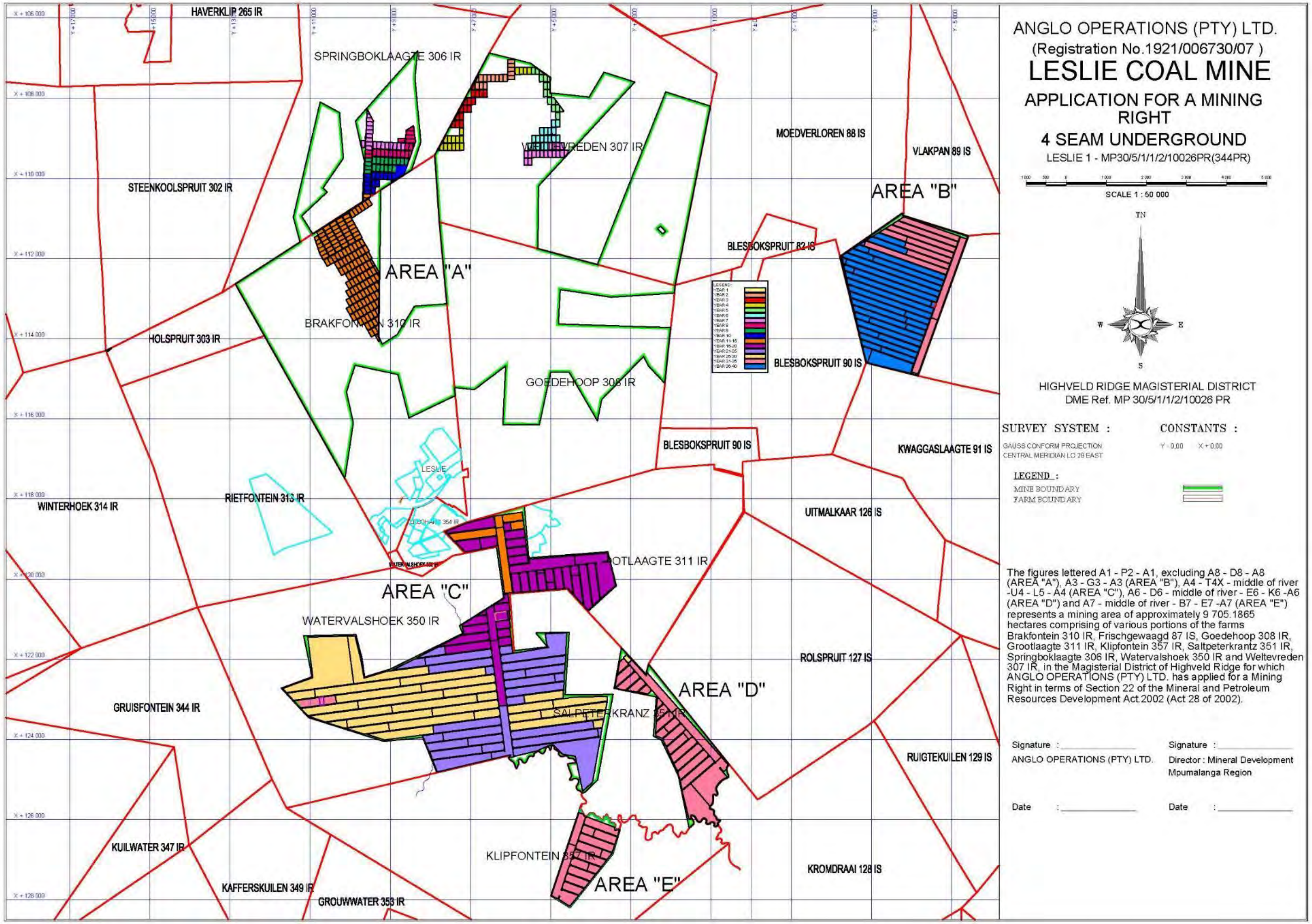


Figure 4-6: Leslie 1 No. 4 Seam Mine Works Schedule.

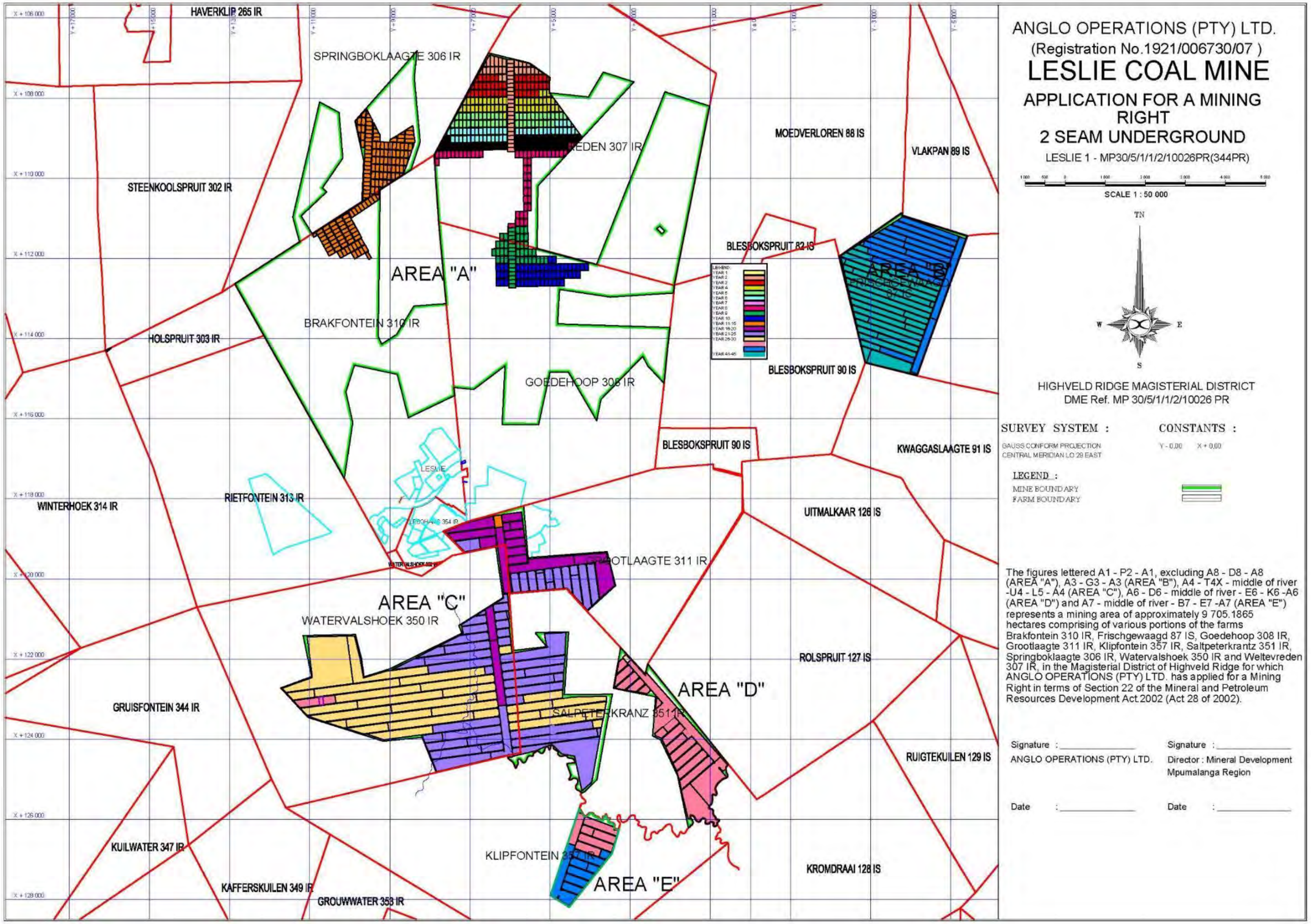


Figure 4-7: Leslie 1 No. 2 Seam Mine Works Schedule.

4.5 Listed and Specified Activities

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

Table 4-3 below contains all the listed activities identified in terms of NEMA, National and Environmental Management: Waste Act, Act No. 59 of 2008 (NEM:WA), and the EIA 2014 Regulations (as amended by GNR 326 of April 2017) and Listing Notices 1, 2 and 3 (GN R983, GN R984 and GN R985 of December 2014, as amended by GNR 327, GNR 325, and GNR 324 of April 2017, respectively) which may be triggered by the Proposed Project, and for which an application for EA has been submitted. The table also includes a description of those project activities which relate to the applicable listed activities. The DMR will act as the Competent Authority (CA) on the project, with the Mpumalanga Department of Agriculture and Rural Development and Land Administration (MDARDLEA) and the Department of Water and Sanitation (DWS) also reviewing the EIA/EMPr.

Table 4-3: Listed Activities Triggered by the Proposed Project.

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Underground Mining					
Leslie 1A					
Incline shaft and portal East Entry Incline shaft and portal West Entry Ventilation shaft	3.5 ha (70m*500m) 3.5 ha (70m*500m)	X	**GNR 983 (amended by GN 327) – 12, 19, 27** **GNR 984 (as amended by GN 325) – 6, 15, 17** **GNR 985 (as amended by GN 324) – 12**		X
Leslie 1B					
Incline shaft and portal Ventilation shaft	3.5 ha (70m*500m)	X	**GNR 983 (amended by GN 327) – 12, 19, 27** **GNR 984 (as amended by GN 325) – 6, 15, 17** **GNR 985 (as amended by GN 324) – 12**		X
Leslie 1C					
Incline shaft and portal Ventilation shaft	3.5 ha (70m*500m) 3.5 ha (70m*500m)	X	**GNR 983 (amended by GN 327) – 12, 19, 27** **GNR 984 (as amended by GN 325) – 6, 15, 17** **GNR 985 (as amended by GN 324) – 12**		X
Leslie 1D					

[3] The total area of the mining and associated areas is approximately 9 507 hectares. The approximate area to be mined is 8 486 ha.

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

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Incline shaft and portal Ventilation shaft	3.5 ha (70m*500m) 3.5 ha (70m*500m)	X	**GNR 983 (amended by GN 327) – 12, 19, 27** **GNR 984 (as amended by GN 325) – 6, 15, 17** **GNR 985 (as amended by GN 324) – 12**		X
Leslie 1E					
Incline shaft Ventilation shaft	3.5 ha (70m*500m) 3.5 ha (70m*500m)	X	**GNR 983 (amended by GN 327) – 12, 19, 27** **GNR 984 (as amended by GN 325) – 6, 15, 17** **GNR 985 (as amended by GN 324) – 12**		X
Storage Dumps, Residue Stockpiles & Deposits and Waste Dumps					
Leslie 1A					
Topsoil stockpiles	1.4 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		X
Co-disposal Mine Residue Facility (MRF) Possible MRF expansion	28.03 ha 25.07 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**	**GN 921**[5] (Category B – 7, 10, 11)	X

[5] List of Waste Management Activities that have, or are likely to have, a detrimental effect on the environment published in Government Notice 921 in Government Gazette 37083 on 29 November 2013 (as amended)

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Overburden stockpile	Total area not yet determined	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**	**GN 921** (Category B – 9, 10, 11)	X
ROM/ raw material stockpile Buffer ROM 1 Buffer ROM 2	2.24 ha 2.76 ha 1.61 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Leslie 1C					
Topsoil stockpiles	7.59 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		X
Co-disposal MRF	39.91 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**	**GN 921**[6] (Category B – 7, 10, 11)	X
Overburden stockpile	Total area not yet determined	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**	**GN 921** (Category B – 9, 10, 11)	X
ROM/ raw material stockpile ROM Buffer	3.93 ha 2.14 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

[6] List of Waste Management Activities that have, or are likely to have, a detrimental effect on the environment published in Government Notice 921 in Government Gazette 37083 on 29 November 2013 (as amended)

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Infrastructure					
Infrastructure for the two plant areas situated at Leslie 1A and 1C is inclusive of structures and facilities below, precise areas not yet determined, except where stipulated.					
Leslie 1A	East 4.1 ha West 3.7 ha				
Fencing		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Gate house complex		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Entrance/ exit and 2 x weighbridges		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Employees under cover waiting areas		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Employees turnstile access control and induction office		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Office complex	2.54 ha	X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Temporal change house and office (east) Temporal change house and office (west)	1.46 1.07 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Clinic		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Canteen		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Fire control facility		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Solid waste sorting facility		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Gas store		X	**GNR 327 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
General workshop Temporal workshop	0.24 ha	X	**GNR 983 (amended by GN 327) – 12, 19 GNR 324 – 14**		
Chemical store		X	**GNR 983 (amended by GN 327)– 14, 19 GNR 984 (as amended by GN 325) – 4 GNR 985 (as amended by GN 324) – 10**		
Flammable store		X	**GNR 983 (amended by GN 327)– 14, 19 GNR 984 (as amended by GN 325) – 4 GNR 985 (as amended by GN 324) – 10**		
Hazardous material store		X	**GNR 983 (amended by GN 327) – 14, 19 GNR 984 (as amended by GN 325) – 4 GNR 985 (as amended by GN 324) – 10**		
Electrical workshop		X	**GNR 983 (amended by GN 327) – 12, 19 GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Instrumentation workshop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Welding shop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Combined stores		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
LDV/ HDV workshop	1.61 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
LDV/ HDV wash bay		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
LDV/HDV fuel storage and refuelling		X	**GNR 983 (amended by GN 327)– 12, 14, 19** **GNR 984 (as amended by GN 325) – 4** **GNR 985 (as amended by GN 324) – 10, 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Used oil storage tanks		X	GNR 983 (amended by GN 327) – 12, 14, 19 GNR 324 – 14		
Under crane warehouse		X	GNR 983 (amended by GN 327)– 12, 19 GNR 985 (as amended by GN 324) – 14		
HDV tyre storage		X	GNR 983 (amended by GN 327)– 12, 19 GNR 985 (as amended by GN 324) – 14		
HDV tyre change assembly station		X	GNR 983 (amended by GN 327) – 12, 19 GNR 985 (as amended by GN 324) – 14		
HDV tyre change hard stand		X	GNR 327 (amended by GN 327)– 12, 19 GNR 985 (as amended by GN 324) – 14		
Leslie 1C					
Fencing		X	GNR 983 (amended by GN 327) – 12, 19 GNR 985 (as amended by GN 324) – 14		
Gate house complex		X	GNR 983 (amended by GN 327) – 12, 19 GNR 985 (as amended by GN 324) – 14		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Entrance/ exit and 2 x weighbridges			**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Employees under cover waiting areas		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Employees turnstile access control and induction office		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Office complex	6.61 ha	X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Temporal change house and office	0.47 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Clinic		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Canteen		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Fire control facility		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Solid waste sorting facility		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Gas store		X	**GNR 327 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Temporal workshop	0.23 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 324 – 14**		
Chemical store		X	**GNR 983 (amended by GN 327)– 14, 19** **GNR 984 (as amended by GN 325) – 4** **GNR 985 (as amended by GN 324) – 10**		
Flammable store		X	**GNR 983 (amended by GN 327)– 14, 19** **GNR 984 (as amended by GN 325) – 4** **GNR 985 (as amended by GN 324) – 10**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Hazardous material store		X	**GNR 983 (amended by GN 327) – 14, 19** **GNR 984 (as amended by GN 325) – 4** **GNR 985 (as amended by GN 324) – 10**		
Electrical workshop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Instrumentation workshop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Welding shop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Combined stores		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
LDV/ HDV workshop	2.57 ha	X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
LDV/ HDV wash bay		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
LDV/HDV fuel storage and refuelling		X	**GNR 983 (amended by GN 327)– 12, 14, 19** **GNR 984 (as amended by GN 325) – 4** **GNR 985 (as amended by GN 324) – 10, 14**		
Used oil storage tanks		X	**GNR 983 (amended by GN 327) – 12, 14, 19** **GNR 324 – 14**		
Under crane warehouse		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
HDV tyre storage		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
HDV tyre change assembly station		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
HDV tyre change hard stand		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Beneficiation Plant Complex					
The beneficiation plant will be situated within the Mine Infrastructure area					
Leslie 1A					
Coal wash plant including -	1.52 ha	X	**GNR 983 (amended by GN 327) – 19** **GNR 984 (as amended by GN 325) – 17, 27**		
Primary crusher		X	**GNR 983 (amended by GN 327) – 19** **GNR 984 (as amended by GN 325) – 17**		
Plant MCC control room					
Transformer bays					
Plant workshop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 324 – 14**		
Plant coal lab		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Plant geology grade control					

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Plant office building		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Processed coal storage (Product stockpile)	1.78 ha	X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		X
Leslie 1C					
Coal wash plant including -	3.12 ha	X	**GNR 983 (amended by GN 327)– 19** **GNR 984 (as amended by GN 325) – 17, 27**		
Primary crusher		X	**GNR 984 (as amended by GN 325) – 17**		
Plant MCC control room					
Transformer bays					
Plant workshop		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 324 – 14**		
Plant coal lab		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Plant geology grade control					

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Plant office building		X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Processed coal storage (product stockpile)	3.16	X	**GNR 983 (amended by GN 327)– 12, 19** **GNR 985 (as amended by GN 324) – 14**		X
Roads and Access					
Leslie 1A roads (access roads) Heavy Vehicles Light Vehicles	 1141.58 m 977.53 m	X	**GNR 983 (amended by GN 327) – 19, 24**		X
Leslie 1B roads (access roads) *8 m wide		X	**GNR 983 (amended by GN 327) – 19, 24**		X
Leslie 1C roads (access roads) Heavy Vehicles Light Vehicles	 1 286.17m 1 248.59	X	**GNR 983 (amended by GN 327) – 19, 24**		X
Leslie 1D roads (access roads) *8 m wide		X	**GNR 983 (amended by GN 327) – 19, 24**		X
Leslie 1E roads (access roads) *8 m wide		X	**GNR 983 (amended by GN 327) – 19, 24**		X
Conveyor belt					
Leslie 1A	4 104.12	X	**GNR 984 (as amended by GN 325) – 17**		X
Leslie 1C	615.58 m	X	**GNR 984 (as amended by GN 325) – 17**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Waste and Water					
Leslie 1A					
Waste water treatment works		X	**GNR 983 (amended by GN 327) – 12, 19, 25** **GNR 984 (as amended by GN 325) – 6, 25** **GNR 985 (as amended by GN 324) – 14**		X
Pollution control dams Return Water Dam	1.36ha 0.38 ha 1.01 ha	X	**GNR 983 (amended by GN 327) – 12, 13, 19, 27** **GNR 984 (as amended by GN 325) – 6, 16** **GNR 985 (as amended by GN 324)– 14**		X
Pipelines	777.66m	X	**GNR 983 (amended by GN 327)– 9, 10, 12, 19** **GNR 984 (as amended by GN 325) 7** **GNR 985 (as amended by GN 324) – 14**		
Pump stations		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Storage tanks		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Leslie 1C					
Waste water treatment works		X	**GNR 983 (amended by GN 327) – 12, 19, 25** **GNR 984 (as amended by GN 325) – 6, 25** **GNR 985 (as amended by GN 324) – 14**		X
Pollution control dams Return Water Dam	0.91 ha 2.81 ha	X	**GNR 983 (amended by GN 327) – 12, 13, 19, 27** **GNR 984 (as amended by GN 325) – 6, 16** **GNR 985 (as amended by GN 324)– 14**		X
Pipelines	1085.36m	X	**GNR 983 (amended by GN 327)– 9, 10, 12, 19** **GNR 984 (as amended by GN 325) 7** **GNR 985 (as amended by GN 324) – 14**		
Pump stations		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Storage tanks		X	**GNR 983 (amended by GN 327) – 12, 19** **GNR 985 (as amended by GN 324) – 14**		
Electrical					

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Leslie 1A					
Substation and miniature substations (11kV)		X	**GNR 983 (amended by GN 327) – 11, 12, 19 GNR 984 (as amended by GN 325) – 9 GNR 985 (as amended by GN 324) – 14**		
UPS generators		X	**GNR 983 – 2**		
11/ 33kV switching station		X	**GNR 983 (amended by GN 327)– 11, 12, 19 GNR 984 (as amended by GN 325) – 9 GNR 985 (as amended by GN 324) – 14**		
33kV power line		X	**GNR 983 (amended by GN 327) – 11, 12, 19 GNR 984 (as amended by GN 325) – 9 GNR 985 (as amended by GN 324) – 14**		
Leslie 1B					
Substation and miniature substations (11kV)		X	**GNR 983 (amended by GN 327) – 11, 12, 19 GNR 984 (as amended by GN 325) – 9 GNR 985 (as amended by GN 324) – 14**		
UPS generators		X	**GNR 983 – 2**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
11/ 33kV switching station		X	**GNR 983 (amended by GN 327)– 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
33kV power line		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
Leslie 1C					
Substation and miniature substations (11kV)		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
UPS generators		X	**GNR 983 – 2**		
11/ 33kV switching station		X	**GNR 983 (amended by GN 327)– 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
33kV power line		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
Leslie 1D					
Substation and miniature substations (11kV)		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
UPS generators		X	**GNR 983 amended by GN 327) – 2, 19**		
11/ 33kV switching station		X	**GNR 983 (amended by GN 327)– 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
33kV power line		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		

Name of activity	Aerial extent of the activity (ha)[3]	Listed activity	Applicable listing notice as amended	Waste management authorisation	Water use licence authorisation[4]
Leslie 1E					
Substation and miniature substations (11kV)		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
UPS generators		X	**GNR 983 (as amended by GN 327) – 2, 19**		
11/ 33kV switching station		X	**GNR 983 (amended by GN 327)– 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		
33kV power line		X	**GNR 983 (amended by GN 327) – 11, 12, 19** **GNR 984 (as amended by GN 325) – 9** **GNR 985 (as amended by GN 324) – 14**		

4.6 Summary of the Activities and Infrastructure per Mining Area

The mining areas have been delineated and listed as per the order in which each Mine Area will be exploited:

- Leslie 1A – Surface infrastructure and access to underground mining;
- Leslie 1C – Surface infrastructure and access to underground mining;
- Leslie 1D – Portal and underground mining;
- Leslie 1E – Portal and underground mining;
- Leslie 1B – Portal and underground mining;

Table 4-4 describes the general activities to be undertaken and the infrastructure to be developed on site for the Leslie 1 Project, typically during the construction phase. It should be noted that each mining area will operate independently and is not synonymous with the next. As a result, infrastructure requirements may differ, however, in terms of the MRA for the Leslie 1 Project, all infrastructure has been applied for. Details specific to each mining area will be discussed in this subchapter.

Table 4-4: Infrastructure required for the Leslie 1 Project

Phase	Project Activity	Project Structure
Construction	Site Clearance	❖ Portal ❖ Topsoil and overburden stockpiles ❖ Infrastructure areas ❖ Roads
	Roads	❖ Internal roads, berms and surfaced parking areas ❖ Haul roads
	Surface Infrastructure establishment	❖ Crushing and screening plant ❖ Mine offices ❖ Change house ❖ Clinic and canteen ❖ All workshops ❖ Overburden and product stockpiles ❖ Site fencing ❖ Access and service roads (with weighbridge) ❖ Overland conveyor ❖ Hydrocarbon storage tanks ❖ Ventilation and incline shaft per mining area
	Processing Plant	❖ Washing, crushing and screening plant
	Blasting and excavation	❖ Portal, shafts
	Water Related Infrastructure establishment	❖ Reticulation infrastructure ❖ Pollution control dams ❖ Process water pipeline. ❖ Stormwater channels and pollution control dams ❖ Water treatment and purification plants ❖ Process water and return water dam ❖ Boreholes ❖ Sewage treatment plant

Phase	Project Activity	Project Structure
		❖ Silt traps ❖ Washing bays ❖ River diversions / crossings ❖ Raw water storage dam
	Co-disposal facility establishment	❖ Co-disposal facility
Operation	Underground mining	❖ Bord and pillar mining
	Processing Plant	❖ Washing, crushing and screening plant
Decommissioning	Removal of Surface Infrastructure	❖ Crushing and screening plant ❖ Mine offices ❖ Change house ❖ Clinic and canteen ❖ All workshops ❖ Overburden and Product Stockpiles ❖ Site fencing ❖ Access and service roads (with weighbridge) ❖ Overland conveyor ❖ Hydrocarbon storage tanks ❖ Ventilation and incline shaft per mining area
	Maintenance and Monitoring	Maintenance and monitoring will be undertaken in accordance with the approved EMPr for the Leslie 1 Project. Specialist Reports have structured the framework for maintenance and monitoring. Maintenance and monitoring will include some of the following key activities8: ❖ Fertilisation of rehabilitated areas ❖ Surface water quality monitoring ❖ Groundwater quality monitoring ❖ Fauna and flora monitoring ❖ Alien and invasive plant species monitoring and control ❖ General maintenance, including rehabilitation of cracks and subsidence ❖ Annual environmental performance assessment report development ❖ Environmental closure report development ❖ Annual environmental aspect reporting ❖ Final closure application development and motivation

5 Policy and Legislative Context

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

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

"*Everyone has the right –*

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

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

Table 5-1: Applicable National Legislation and Guidelines

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
The Constitution of South Africa, 1996 (Act 108 of 1996) Section 24 of the Act states that everyone has the right to an environment that is not harmful to their health or well-being; to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecological sustainable development and use of natural resources while promoting justifiable economic and social development. Section 32 of the Act states that every person has a right to information held by the State and to information held by other people that is required in the exercise or protection of a right. Lastly, Section 33 of the Act states that everyone has a right to just and procedurally fair administrative action.	As per the Requirements of NEMA and the NEMA EIA 2014 Regulations, alternative activities that are less taxing on the environment and resources must be investigated where possible. The DSR & Draft EIA Report were made available for public review as per the PPP section of this report. The Appeal Process will be described to all Interested and Affected Parties (I&APs) through the EA notification described in the Public Participation Process (PPP) section of this report.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) The MRA must be made in accordance with the provisions of Section 22 of the MPRDA, read together with the EIA 2014 Regulations, as amended, promulgated in accordance with Section 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). The critical components of a MRA are a Mining Work Programme (MWP) and a Social and Labour Plan (SLP). The content of both of these is prescribed by the DMR. The applicant is also required to demonstrate that the mineral can be mined optimally in accordance with the MWP; that it has access to financial resources and the technical ability to conduct the proposed mining operation optimally; there is a financing plan compatible with the intended mining operation and its duration; the mining will not result in unacceptable pollution, ecological degradation or damage to the environment; the applicant has the ability to comply with the relevant provisions of the Mine Health and Safety Act, Act No. 29 of 1996 (MHSA); that it is not in contravention of any provision of this Act; and importantly, that the granting of a mining right will further the broad empowerment objects of the MPRDA and the SLP. The assessment of impacts relating to soil pollution and erosion control, where appropriate, must form part of the EMPr.	A separate MRA, MWP and SLP has been submitted to the DMR for review and approval.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
The MRA requires the preparation of an Application for EA in terms of the EIA 2014 Regulations, as amended, which must be set out on the template prescribed by the DMR. Similarly, details relating to financial and technical competence and Broad-Based Black Economic Empowerment (BBBEE) status need to be set out on a prescribed template. Various supporting documents, such as a covering letter and corporate details, the Certificate of Incorporation, Certificate to Commence Business, Certificate of Change of Name (if relevant), Board Resolution and authorising signature, must be collated. In terms of the One Environmental System established by the NEMLAA, an EA in respect of a MRA must be issued within 300 days of the application being submitted.	
Mine Health and Safety Act (MHSA), Act 29 of 1996 (as amended): The mine will operate in accordance to the MHSA and associated regulations. This includes creating a safe and healthy work environment and providing the necessary protection and training to staff to ensure their health and safety is not compromised. Hazardous substances will be adequately stored and labelled. All regulations pertaining to safe use, handling, processing, storage, transport and disposal of hazardous substances; explosives and mixing substances to make explosives; protection of equipment, structures and water sources and the surface of land; the making safe of undermined ground and dangerous excavations, dumps and structures connected to mining operations; the monitoring and control of those environmental aspects which may affect the health and safety of persons will be applied on site. Regulations pertaining to provision of water, ablution facilities and staff health and safety will be applied on site.	Although not strictly addressed in the Scoping Report or EMPr, protecting the environment contributes to a safe working environment. MHSA regulations will be worked into the mine's Code of Practice (COP) and Standard Operating Procedures (SOPs).
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) The overarching principle of the NEMA is sustainable development. It defines sustainability as meaning the integration of social, economic and environmental factors into planning, implementation and decision making to ensure the development serves present and future generations. Section 2 of NEMA provides for the NEMA principle which apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and in conjunction with other appropriate and relevant considerations. The NEMA principles serve as the general framework within which environmental management and implementation plans must be formulated and serve as a guideline by reference to which any organ of state must exercise any function when taking any decision in terms of the NEMA or any statutory provision concerning the protection of the environment. In this regard the MPRDA specifically states that the NEMA principles apply to all prospecting and mining operations and any matter or activity relating to such	The NEMA is the overarching Act governing sustainable development and the NEMA principles apply to all prospecting and mining operations and any matter or activity relating to such operation. Listed activities as per the EIA 2014 Regulations, as amended, have been identified (refer to Chapter 3, subsection 3.5).

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
operation and serve as guidelines for the interpretation, administration and implementation of the environmental requirements of the MPRDA. NEMA authorises the Minister of the Department of Environmental Affairs (DEA) to issue Regulations relating to the administration of the Act[7], which has been done with the publication of the EIA 2014 Regulations, as amended. Section 24(2) allows the Minister to identify activities which may not commence without environmental authorisation from the competent authority. This identification has been done in accordance with listing notices referred to as Listing Notice 1, Listing Notice 2 and Listing Notice 3. The NEMA also allows the Minister to determine which authority will be the competent authority to receive and evaluate applications for EAs. Listing Notice 1 identifies activities of limited scale and effect, which need to be assessed by a fairly simple process referred to as a BA, where after a Basic Assessment Report (BAR) is submitted to the competent authority. Listing Notice 2 identifies activities of significantly greater magnitude, which require evaluation through an initial Scoping Phase followed by an EIA and an EMPr. This process is generally referred to as the S&EIR process. Listing Notice 3 relates to activities limited to specified geographical areas and matters of concern to the various provinces which require a BAR process to be dealt with by the provincial authority concerned. Activity 17 of Listing Notice 2 relates to any activity including the operation of that activity which requires a mining right as contemplated in Section 22 of the MPRDA, including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource or the primary processing of a mineral resource including winning, extraction, classifying, concentrating, crushing, screening or washing. Accordingly, the application for EA will require the undertaking of a full S&EIR process. All other identified activities will need to be dealt with in accordance with the S&EIR process. Regulation 16(1) prescribes the general application requirements and states that an application for an EA must be made on the official application form obtainable from the DMR (the competent authority) and must, amongst others, include proof of payment of the prescribed application fee. Regulation 21 provides for the submission of the Scoping Report to the DMR (the CA) for consideration and states that the scoping report must contain all the information set out in Appendix 2 to the EIA 2014 Regulations, as amended. In terms of regulation 22, the DMR must, after considering the Scoping Report, either accept the report, with or without conditions and advise the applicant to proceed with the plan of study for EIA or refuse the EA. Once the	

[7] Sections 24(5) and Section 44

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
Scoping Report is accepted by the DMR, the applicant must submit the EIA Report inclusive of specialist reports and an EMPr which have been subjected to a Public Participation Process (PPP). The timeframes for submission of the Scoping Report and the EIA Report inclusive of the timeframes within which the DMR must consider the reports and approve the EA are prescribed in regulations 21 to 24 of the EIA 2014 Regulations. Once a decision on the EA application has been reached, the DMR (the competent authority) must notify the applicant in writing of the decision and give reasons for the decision.	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA) As part of the waste management matters dealt with in the NEM: WA, waste activities have been identified in GN 921 of 29 November 2013[8]: List of Waste Management Activities that have, or are likely to have, a Detrimental Effect on the Environment. GN R921 provides that the waste management activities listed in Category A and B thereof may not commence, be undertaken or conducted without a Waste Management Licence (WML). Activities listed in Category C of GN 921 may only be commenced with, undertaken or conducted in accordance with the National Norms and Standards published in terms of the NEM: WA.[9] Category A activities require a BAR process while Category B Activities require a S&EIR process. It should be noted that previously residue deposits and residue stockpiles were regulated in terms of the MPRDA Regulations[10] and in particular Regulation 73. However, with the commencement of the NEMLAA section 4(b) of the NEM:WA has been deleted and as such the NEM:WA now regulates residue stockpiles and residue deposits. In line with the aforesaid amendment, GN 921 was amended by GN 632 of 24 July 2015 by including Activity B 4(11) which provides for *"the establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA"*. Accordingly, the establishment of a residue stockpile (as defined in Schedule 3 of the NEM:WA) requires a WML authorising activity 4(11) in Category B of GN 921. In addition to the requirement for a WML for the mine discard dump (residue stockpile), the mine is likely to trigger the following waste activities, all of which require a Category B WML: 1) The disposal of any quantity of hazardous waste to land;	Listed activities as per the NEM: WA regulations have been identified (refer to Chapter 3, subsection 3.5).

[8] Published in Government Gazette 37083
[9] The following National Norms and Standards have been published: Norms and Standards for Storage of Waste, 2013 (GN 926 of 29 November 2013); Standards for Extraction, Flaring or Recovery of Landfill Gas, 2013 (GN 924 of 29 November 2013); and Standards for Scrapping or Recovery of Motor Vehicles, 2013 (GN 925 of 29 November 2013
[10] GN R527 of 2004

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
2) The disposal of inert waste to land in excess of 25 000 tons, excluding the disposal of such waste for the purposes of levelling and building which has been authorised by or under other legislation; 3) 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); and 4) The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA. The Proposed Project will also need to comply with GN R632 of 24 July 2015. These Regulations prescribe the assessment of impacts and analyses of risks relating to the management of residue stockpiles and residue deposits, the characterisation of residue stockpiles and residue deposits, the classification of residue stockpiles and residue deposits, the investigation and selection of site for residue stockpiling, the design of the residue stockpiles and residue deposits, impact management, the duties of the holder of right/ permit, the monitoring and reporting system for residue stockpiles and residue deposits, dust management and control, decommissioning, closure and post closure management of residue stockpiles and residue deposits. The EA and WML are being dealt with as integrated application.	
National Water Act, 1998 (Act No. 36 of 1998) (NWA) In terms of the NWA, the national government, acting through the Minister of Water and Sanitation, is the public trustee of South Africa's water resources, and must ensure that water is protected, used, development, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons (section 3(1)). In terms of the NWA a person may only use water without a license if such water use is permissible under Schedule 1 (generally domestic type use) if that water use constitutes a continuation of an existing lawful water use (water uses being undertaken prior to the commencement of the NWA, generally in terms of the Water Act of 1956), or if that water use is permissible in terms of a general authorisation issued under section 39 (general authorisations allow for the use of certain section 21 uses provided that the criteria and thresholds described in the general authorisation is met). Permissible water use furthermore includes water use authorised by a license issued in terms of the NWA. Section 21 of the NWA defines water uses which are governed in terms of the Act and for which a WUL is required. In terms of section 40(1) of the NWA "a person who is required or wishes to obtain a licence to use water must apply to the relevant responsible authority for a licence." These water uses, in terms of Section 21, are as follows: (a) taking water from a water resource; (b) storing water;	An IWULA and IWWMP will be required for the Proposed Project and will be submitted to the DWS.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
(c) impeding or diverting the flow of water in a watercourse; (d) engaging in a stream flow reduction activity contemplated in Section 36; (e) engaging in a controlled activity identified as such in Section 37(1) or declared under Section 38(1); (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) disposing of waste in a manner which may detrimentally impact on a water resource; (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; (i) altering the bed, banks, course or characteristic of a watercourse; (j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and (k) using water for recreational purposes. It is not likely that sub-sections **(d), (e), (h), or (k)** will apply to the Proposed Project. Water uses associated with the mining activities, may include the development of PCDs, placement of material on a waste rock dump (WRD), construction and operation of a tailings storage facility (TSF), pumping of water from the underground workings, dust suppression and the storage and use of process and potable water. These water uses will require an IWUL and will be reassessed once final placement and conceptual designs have been completed. The IWULA must be prepared and submitted in accordance with the Water Use Licence Application and Appeals Regulations 2017 published in GNR 267 on 24 March 2017 and must generally be supported by a Technical Report and Integrated Water and Waste Management Plan (IWWMP) with conceptual design drawing of all water related infrastructure including infrastructures that could potentially contaminate the receiving environment.	
National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEM:BA) The NEM:BA provides for the management and conservation of South Africa's biodiversity within the framework of NEMA, as well as the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources. SANBI website and GIS tools were utilised to determine whether any nationally protected and threatened ecosystems occur on site. Therefore, NEMA Listing Notice 3 activities have been included in the EA application.	NEM:BA was used to inform the activities triggered by Listing Notice 3 (refer to Chapter 2, subsection 2.6).

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
The Proposed Project falls within the Mpumalanga Province, which has a provincial Biodiversity Assessment Protected Area Expansion Strategy. This strategy has been incorporated and considered throughout the compilation of this report.	
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) The NEM: AQA came into effect in April 2010 and is applied in accordance with the principals stipulated in NEMA. The Act outlines norms and standards with regards to air quality management planning, monitoring, compliance and management measures to protect and enhance the quality of air and reduce risks to human health. NEM: AQA also promotes sustainable development. An Air Emissions Licence (AEL) may be required for this project, and the mine must investigate, assess and evaluate the impact of dust fall out on the environment. Atmospheric emissions particularly in the form of dust must be adequately maintained to prevent dust pollution. The National Ambient Air Quality Standards were published on 24 December 2009 and provide *inter alia* for national ambient air quality standards for PM_{10}. In addition to these standards, the National Ambient Air Quality Standards for $PM_{2.5}$ came into effect on 29 June 2012. The Standards do not provide for the reporting of exceedances. The National Dust Control Regulations, 2013 (GNR 827 of 1 November 2013) provide acceptable dust fall rates at and beyond the boundary of the premises where dust originates. The dust fall-out rates are measured using the American Standard for Testing Materials method D1739 (ASTM D1739:1970) which provides that dust fall out at the boundary or beyond the boundary of the premises where it originates cannot exceed - 600 mg/m^2/day averaged over 30 days in residential areas; or 1200 mg/m^2/day averaged over 30 days in non-residential areas. Permitted exceedances are provided for.	An Air Quality Impact Assessment (AQIA) has been completed as part of the EIA Phase to investigate, assess and evaluate the impact of dust fall out on the environment.
National Environmental Management: Protected Areas Act (NEM:PAA), Act 57 of 2003 as amended The National Environmental Management Protected Areas Act (No. 57 of 2003) (NEM:PAA) concerns the protection and conservation of ecologically viable areas representative of South Africa's diversity and its natural landscapes and seascapes, and includes *inter alia*: ❖ The establishment of a national register of all national, provincial and local protected areas; ❖ The management of those areas in accordance with national standards; and ❖ Inter-governmental co-operation and public consultation in matters concerning protected areas. Sections 48 to 53 of the NEM:PAA lists restricted activities that may not be conducted in a protected area. Section 48 states that no person may conduct commercial prospecting or mining activities in a:	SANBI website and GIS tools were utilised to determine if the project area overlaps with CBAs. Some sections of the project were rated as irreplaceable. Therefore, it is anticipated that some restrictions will apply to the mining in terms of protected areas. The Regulations were utilised to determine the need for any additional listed scheduled activities under GNR 985.

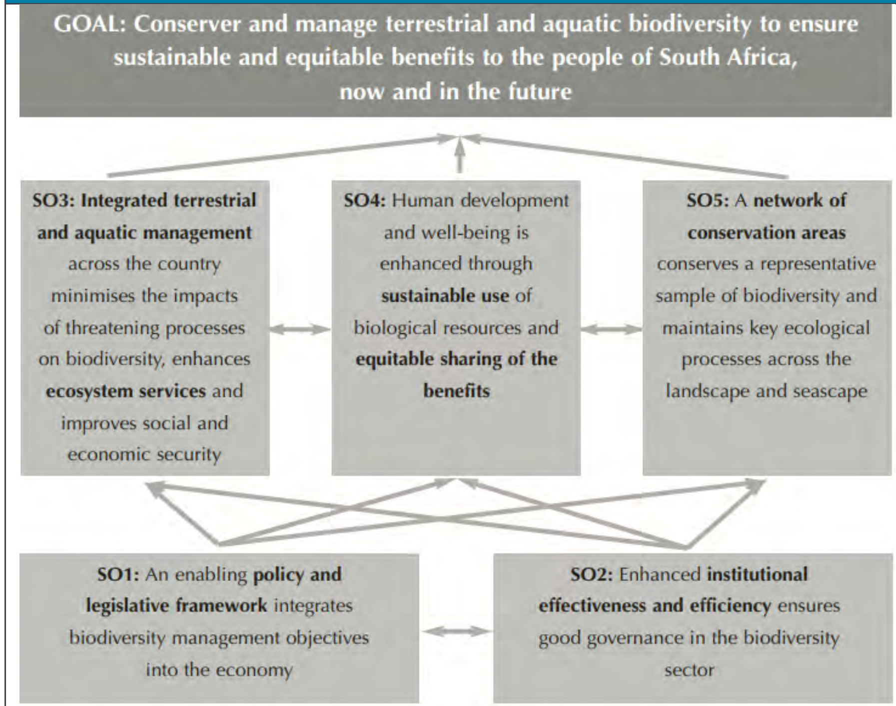
Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
❖ Special nature reserve or nature reserve; ❖ Protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs; and Protected area referred to in Section 9: ❖ (b) world heritage sites; and ❖ (d) specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act (No. 84 of 1998);	
National Forest Act, 1998 (Act No 84 of 1998) The purposes of National Forest Act, 1998 (Act No. 84 of 1998) (NFA) includes *inter alia:* *(c) provide special measures for the protection of certain forests and trees:* *(d) promote the sustainable use of forests for environmental, economic, educational, recreational, cultural, health and spiritual purposes.*	A Terrestrial Biodiversity Study has been done to determine the tree species in the project area and specify if there are any endangered species. A permit for the removal / destruction of protected trees will be applied for with the relevant department in terms of Section 15 of the NFA.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) The NHRA aims to promote good management of cultural heritage resources and encourages the nurturing and conservation of cultural legacy so that it may be bestowed to future generations. The Act requires all developers (including mines) to undertake cultural heritage studies for any development exceeding 0.5 ha. It also provides guidelines for impact assessment studies to be undertaken where cultural resources may be disturbed by development activities. The South African Heritage Resources Agency (SAHRA) will need to approve the heritage assessment undertaken as part of the impact assessment process.	A Heritage Impact Assessment has been undertaken as part of the EIA Phase and the assessment will be uploaded on the SAHRA web site along with the EIA Report.
Conservation of Agricultural Resources Act (No. 43 of 1983) The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) includes the use and protection of land, soil, wetlands and vegetation and the control of weeds and invader plants. This is the only legislation that is directly aimed at conservation of wetlands in agriculture. The Act contains a comprehensive list of species that are declared weeds and invader plants dividing them into three categories. These categories are as follows: ❖ Category 1: Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled, or eradicated where possible;	The protection of land, soil, wetlands and vegetation and the control of weeds and invader plants is contained within the EIA Report and well as in the Rehabilitation and Closure Plan.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
❖ Category 2: Declared invader species that are only allowed in demarcated areas under controlled conditions and prohibited within 30m of the 1:50 year floodline of any watercourse or wetland; and ❖ Category 3: Declared invader species that may remain but must be prevented from spreading. No further planting of these species is allowed. In terms of the Act, landowners are legally responsible for the control of alien species on their properties. Failure to comply with the Act may result in various infringement consequences and in some instances imprisonment and other penalties for contravening the law.	
The South African National Roads Agency Limited (SANRAL) and National Roads Act, 1998 (Act No. 7 of 1998) The National Road Traffic Regulations, 2000 places specific duties on the consignor and consignee of dangerous goods. A consignor means the person who offers dangerous goods for transport (i.e. hazardous waste) and a consignee is the person who accepts dangerous goods, which have been transported in a vehicle. Both consignor and consignee must comply with the requirements of several SANS standard specifications and codes of practice relevant to dangerous goods which have been incorporated into the regulations. The mine owner is responsible for: ❖ Offloading of the dangerous goods; ❖ Providing the dangerous goods offloading supervisor; and ❖ Ensuring that the loading and offloading are carried out by qualified employees trained in the relevant procedures. The mine must, in line with Section 54 of the Act and GN R225, provide evidence that the company has appointed responsible personnel to oversee the off-loading of dangerous goods at its operations. A driver of a vehicle transporting dangerous goods is required to undergo training at an approved training body.	The requirements of the Act and Regulations has been considered when assessing the project impacts and developing the associated mitigation measures in the EIA Phase.
Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA) The SPLUMA was promulgated in May 2015. SPLUMA is a framework act for all spatial planning and land use management legislation in South Africa. It seeks to promote consistency and uniformity in procedures and decision-making in this field. SPLUMA will also assist municipalities to address historical spatial imbalances and the integration of the principles of sustainable development into land use and planning regulatory tools and legislative instruments.	The applicant will apply for rezoning from agricultural use to mining. This is a separate application and will be submitted to the GMLM.
Explosives Act, 1956 (Act No. 26 of 1956) A licence will be required for any explosive magazines on the premises used for the storage of explosives. The licence is issued by the Chief Inspector of Explosives or his delegate.	The applicant will apply for a permit. This is a separate application and will be submitted to the South African Police Service.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
Hazardous Substances Act, 1973 (Act No. 15 of 1973) The Regulations for Hazardous Chemical Substances apply to an employer or a self-employed person who carries out work at a workplace which may expose any person to the intake of hazardous chemical substances at that workplace. Regulations 14 and 15 provide for the labelling, packaging, transportation and storage and the disposal of hazardous chemical substances respectively. These regulations set out specific requirements which form part of an employer's duty to provide and maintain, as far as reasonably practicable, a working environment that is safe and without risk to the health of his or her employees.	The requirements of the Act and Regulations has been considered when assessing the project impacts and developing the associated mitigation measures in the EIA Phase.
Fencing Act, 1963 (Act No. 31 of 1963) The Fencing Act was promulgated with the aim of consolidating laws relating to fencing and the fencing of farms and other small holdings. When a landowner erects a fence in a designated area, he / she may insist that the adjacent owner contribute towards the erection or maintenance costs. In areas where contributions are not mandatory / have not been published in the Government Gazette, a contribution can be claimed from the adjacent owner if the fence offers beneficial use for such a person. The Act also makes provision for a mechanism to deal with disputes between adjacent owners regarding a contribution towards erecting or repairing a fence. In terms of the Act, Section 17 requires that any individual erecting a boundary fence may clear any bush along the line of the fence up to 1.5 metres on each side thereof and may remove any tree species that may stand in the immediate line of the fence. It must be noted here that this legislation must be read in conjunction with the applicability of the NEM:BA, the MTPA and any other environmental legal provisions relevant to the protection of flora.	The Proposed Project will require the erection of new, or the upgrading of existing fences to prevent unauthorised access to the proposed mining activities.
Applicable International and National Guidelines and Standards	
International Guidelines To the extent demanded by possible international funding institutions, or as required by the project proponent to meet best practice, international guidelines will be applied, namely: The International Finance Corporation Performance Standards - ❖ Environmental and Social Assessment and Management System; ❖ Labour and Working Conditions; ❖ Pollution Prevention and Abatement; ❖ Community Health, Safety and Security; ❖ Land Acquisition and Involuntary Resettlement;	The IFC requirements will guide and inform the EIA Phase activities.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
❖ Biodiversity Conservation; and ❖ Sustainable Natural Resource Management–Protection of Indigenous Peoples; and Cultural Heritage	
<u>The Equator Principles</u> The Equator Principles (EP) are a risk management framework, adopted by financial institutions, for determining, assessing and managing environmental and social risk in projects and are primarily intended to provide a minimum standard for due diligence and monitoring to support responsible risk decision-making. Aspects of the EP include: Project Review and Categorisation; Environmental and Social Assessment, including greenhouse gas emissions; Applicable Environmental and Social Standards; Environmental and Social Management System and Equator Principles Action Plan; Stakeholder Engagement; Grievance Mechanism; Independent Review Project Finance; Financing Covenants; Independent Monitoring and Reporting; and Reporting and Transparency Client Reporting Requirements	The EP requirements will guide and inform the EIA Phase activities.
<u>Action Plan of the Environmental Initiative of the New Partnership of Africa's Development, 2003.</u> This Action Plan was established with the aim of encouraging sustainable development, conservation and acceptable use of biodiversity in Africa. It has been recognised that a healthy and productive environment is a prerequisite for the success of New Partnership of Africa's Development (NEPAD), together with the need to systematically address and sustain ecosystems, biodiversity and wildlife. Six areas have been identified: ❖ Combating land degradation, drought and desertification; ❖ Conserving Africa's wetlands; ❖ Preventing and controlling invasive alien species; ❖ Conservation and sustainable use of coastal and marine resources; ❖ Combating climate change in Africa; and ❖ Cross-border conservation and management of natural resources.	As the Proposed Project may affect the local biodiversity, this action plan will be considered.
<u>Mining and Biodiversity Guideline, 2013.</u> This guideline is founded on six fundamental principles: ❖ Apply the law; ❖ Use the best available biodiversity information; ❖ Engage relevant stakeholders thoroughly; ❖ Use best practice in EIA to identify, assess and evaluate impacts on biodiversity; ❖ Apply the mitigation hierarchy when planning any mining-related activities and develop robust EMPrs; and	As the Proposed Project may affect the local biodiversity, this guideline document has been used to inform the impact assessment process as completed as part of the EIA Phase.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
❖ Ensure effective implementation of EMPrs, including adaptive management. The guideline stipulates the requirements for both utilising and integrating biodiversity information and informants into the assessment of impacts (i.e. this S&EIA process) of mining on biodiversity and ecosystem services and recommends good practice throughout the mining life cycle.	
South Africa's National Biodiversity Strategy and Action Plan The National Biodiversity Strategy and Action Plan (NBSAP) sets out a framework and a plan of action for the conservation and sustainable use of South Africa's biological diversity and the equitable sharing of benefits derived from this use. The NBSAP was prepared by the former Department of Environmental Affairs and Tourism (DEAT), during the period May 2003 to May 2005. The goal of the NBSAP is to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa, now and in the future. In support of this goal, five key strategic objectives (SOs) have been identified, each with a number of outcomes and activities. The schematic below represents the objectives and their interconnection in achieving the NBSAP "Goal":	The Proposed Project is cognisant of the obligation to protect and preserve the integrity of the environment as well as its biodiversity. Principles of this plan have been taken into consideration during the EIA Phase.

<table>
<tr><th>Applicable Legislation and Guidelines used to compile the report.</th><th>Reference where Applied</th></tr>
<tr><td>

Through the NSBA, it is recognised that biodiversity cannot be conserved through protected area networks only. All stakeholders, from private landowners and communities to business and industry must get involved in biodiversity management. NBSAP further identified mining as one of the activities that causes habitat transformation and degradation, and seriously threatens aquatic and terrestrial biodiversity. The strategy therefore promotes the inclusion of biodiversity considerations in mining regulations, guidelines and best practice codes to mitigate negative impacts and encourage sustainable mining practices through partnerships</td><td></td></tr>
<tr><td><u>Best Practice Guideline Series</u>
The Department of Water and Sanitation has developed a number of best practice guidelines for water resource protection in the South African mining industry. The best practice guidelines include international principles and approaches towards sustainability. There best practice guidelines include viz.:
❖ A water management hierarchy;</td><td>The guidelines define and document best practices for water and waste management associated with mining and have been considered throughout the S&EIA process and reporting.</td></tr>
</table>

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
❖ General water management strategies, techniques and tools; and ❖ Guidelines for mining related activities and aspects.	

Table 5-2: Applicable Provincial and Local Policies, Guidelines and By-Laws

Policies, Guidelines and By-Laws	
Mpumalanga Parks Board Act, 1995 (No. 6 of 1995) The Act was amended in 2005, and contains the following objectives: ❖ To provide effective conservation management of natural resources of the Mpumalanga Province; ❖ To promote the creation of economic and employment opportunities in pursuit of nature conservation and biodiversity; ❖ To ensure that natural systems, biodiversity and ecological functions and processes in the Mpumalanga Province are maintained; ❖ To determine and enforce limits to sustainable utilization of natural resources; ❖ To contribute to the advancement of scientific knowledge, and facilitate technology transfer in respect of conservation; and ❖ Provide information and extension services to the public on conservation management, problem species, legal aspects of conservation and other conservation matters.	Aspects of this Act are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
Mpumalanga Conservation Act, 1998 (No. 10 of 1998) This Act was established with an aim to consolidate and amend the laws relating to nature conservation within the Mpumalanga Province and to provide for matters connected therewith. Aspects included in the Act include, but are not limited to, administration of wild animals, administration of fisheries, administration of indigenous plants, endangered and rare species of fauna and flora (including protected ecosystems, plants and unique communities).	Aspects of this Act are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
Mpumalanga Conservation Plan Mpumalanga Conservation Plan Version 2 (C-Plan 2) database (MPB, 2006), is intended to guide conservation and land-use decisions in support of sustainable development at a strategic level. These have been identified and cognisance has been taken to recognise these within this FSR. The C-Plan 2 maps the distribution of the Provinces known biodiversity into categories according to ecological and biodiversity importance and their contribution to meeting the quantitative targets set for each individual biodiversity feature.	Aspects of this Act are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.

Policies, Guidelines and By-Laws	
Mpumalanga Parks and Tourism Agency Act, 2005 (No. 5 of 2005) This Act provides for the establishment of the Mpumalanga Tourism and Parks Agency (MTPA) and for the management thereof by a Board; to provide for the sustainable development and improvement of the tourism industry in Mpumalanga; to provide for conservation management of the natural resources of Mpumalanga; to confer powers and functions upon the Agency; to provide for the registration of certain persons and entities directly involved in tourism; to provide for transitional arrangements; and to provide for matters incidental thereto.	Aspects of this Act are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
Mpumalanga Parks and Tourism Agency Guidelines for Biodiversity Management To promote national uniform standards in Environmental Management Programmes the Mpumalanga Tourism and Parks Agency (MTPA) have set minimum standards that need to be conformed to in terms of Biodiversity Assessments for development applications. These guidelines cover flora, fauna, aquatic and wetland systems.	Aspects of this Act are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
Mpumalanga Economic Growth and Development Path, 2011. One of the primary aims of the Mpumalanga Economic Growth and Development Path (MEGDP) is to improve labour absorption within the economy. The path modelled two scenarios to qualify what rate of Economic Growth is desired to significantly reduce unemployment in the Province in the foreseeable future. It was identified that an achievement of 15% would be desired by 2025, this will be done through: ❖ Creating 70 600 net jobs annually for the next 15 years, and ❖ By achieving an accelerated and sustained economic growth of about 4.6% annually.	The Proposed Project will contribute towards employment creation within the Province and will also contribute positively towards economic growth within the region through both its development and operation.
Gert Sibande District Municipality Final Integrated Development Plan (IDP) (2016/17) Economic Development and job creation is one of the key issues identified by the GSDM in the 2016/2017 IDP. Mining is one of the leading industries in terms of employment in the District. Natural resources make a significant and direct contribution to the District economy in the mining and energy generation sectors, however socio-economic challenges and unemployment still persist.	The Proposed Project will contribute towards employment creation within the District. This contribution would contribute to reducing unemployment and poverty within the District.
Govan Mbeki Local Municipality Integrated Development Plan (IDP) (2017 – 2022) The primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) is to foster economic growth that creates jobs, reduce poverty and inequality in the province. The mining sector is one of the main contributors to the Province's Gross Value Added (GVA) with the major concentration within GMLM.	The Proposed Project seeks to fulfil the objectives of the GMLM IDP by contributing to economic upliftment, creating jobs and reducing poverty. The proposed project is committed to BBBEEE entrepreneurial enhancement.

Policies, Guidelines and By-Laws	
In terms of alignment with the NDP, the ELM seeks to focus on creating jobs in infrastructure development, agriculture, mining and beneficiation, manufacturing, the green economy and tourism.	Specialist studied have been undertaken which assess the impacts of the Proposed Project on the surrounding environment. The findings of the specialist reports have been included as part of the EIA Phase. All mitigation measures are presented in the EIA/EMPr.
The Centre for Environmental Rights - Mining and your Community: Know your Environmental Rights To exploit a mineral, mining companies must get permission to mine from the government. This is known as EA. To get permission, the mining company is required to assess the environment and learn about the community and consult with everyone who will be affected by the proposed mining. The Guide published in 2014 by the CER discusses what rights communities and individuals who are affected by mining have, and what laws and processes must be followed by a mining company before it can start mining.	This Final EIA/EMPr incorporates the recommendations and guidelines listed in the guide when undertaking Public Participation (PP). All PP is implemented according to the requirements listed in the NEMA EIA Regulations of 2017. Refer to Chapter 7 for an overview of PP undertaken.

6 Need and Desirability of the Proposed Activities

Coal as an energy source faces several challenges, not least among them the fact that, as a contributor to Greenhouse Gas (GHG) emissions, coal is responsible for environmental degradation. At an international level, governments have developed and rectified legislation to cut down the use of coal in electricity generation. As a result, environmentally-friendly technologies are subsidised with the hope that soon they will replace coal in the process of generating electricity. The South African government has ratified the Paris Agreement, which entered into force on 4 November 2016, signalling that government is committed to addressing the challenge of climate change. Government through the Department of Energy (DoE) intends reducing the share of coal generated power in the country's electricity mix from 82% in 2016 to 31% in 2050 as outlined in the Integrated Resource Plan (IRP) 2016. However, coal and nuclear power will continue to play an important and immediate role in the economy as the IRP 2016 adds an additional 6.3GW of electricity to existing generation consumption levels which will have come from coal-fired power plants (Chamber of Mines, 2018).

There are traditional trade-offs that exist between economic-social-environmental systems such as represented in Figure 6-1. These systems are inextricably bound. The health of the ecological systems and associated natural capital underpins social and economic growth. These trade-offs have different meanings for different stakeholders. In terms of the Proposed Project, the greatest trade-off that exists is that between Agriculture and Mining. The loss of arable land, the loss of revenue for farmers and the unemployment of farm workers needs to be taken into consideration.

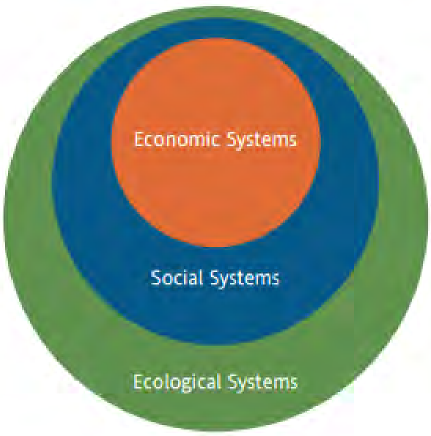


Figure 6-1: The Economic, Social and Environmental systems that are inextricably bound

6.1 National and Regional Perspective

Currently, the 16 coal-fired power stations that exist, produce approximately 82% of the electricity generated in South Africa (Chamber of Mines, 2018), and until such time as alternative energy generation can be implemented successfully, Eskom is largely dependent on coal mining.

In 2016, the coal industry employed 77 506 people, representing 17% of total employment in the mining sector. These employees earned R21 billion in wages and salaries. In the same year, the coal industry spent R60 billion on the procurement of goods and services, most of it locally. This contributed to creating and maintaining jobs in other industries. Indirectly, the coal industry created 173 093 jobs mainly in the transport and storage sector where almost 120 000 jobs were created representing 69% of all indirect jobs created by the coal industry.

The following needs and desirability of the Proposed Project are discussed below:

Need and Desirability #1: Cheap input costs are necessary to ensure efficient production resulting in economic growth and development. Electricity is a major input in the production process and improves society's welfare if it is accessible and affordable. Affordable, reliable and easily accessible energy is at the core of economic growth and development. For that reason, the drive to develop new electricity technologies should be based on these three pillars, which can be fundamentally summed up as the 'least cost options'.

Currently, coal power is among the cheapest baseload options, a fact that is acknowledged by the IRP 2016. Not only does coal present the cheapest baseload option, it does so even at the inclusion of CO_2 curbing technologies such as Carbon Capture Storage (CCS), fluidised bed combustion (FBC) and integrated gasification combined cycle (IGCC).

The growth in peak electricity demand in South Africa is increasing. Coal at present provides 82% of the power generated by state-owned power utility Eskom (Chamber of Mines, 2018).

Need and Desirability #2: Coal remains strategically critical to the South African economy with 253.1 million tonnes per annum (Mtpa) produced in 2016 (Chamber of Mines, 2018), of which 181.4Mt were sold internally with a value of R61.5 billion while 68.9Mt, worth R50.5 billion, were exported. South Africa is the world's 6th largest coal exporter at 77 Mtpa (Table 6-1).

Table 6-1: Top 10 coal exporters in the world in 2017[11]

Rank	Exporter	2017 Coal Exports	% World Total
1	Australia	US$40.6 billion	36.6%
2	Indonesia	$17.9 billion	16.1%
3	Russia	$13.5 billion	12.2%
4	United States	$9.9 billion	8.9%
5	Colombia	$6.8 billion	6.2%
6	South Africa	$5.7 billion	5.2%
7	Canada	$5.1 billion	4.6%

[11] http://www.worldstopexports.com/coal-exports-country/

Rank	Exporter	2017 Coal Exports	% World Total
8	Netherlands	$4.1 billion	3.7%
9	Mongolia	$2.2 billion	2%
10	China	$1.1 billion	1%

The domestic demand for coal in the country is depicted in Figure 6-2. Local coal is mainly of the bituminous type and about 4% of coal demand is satisfied by coking coal imports worth an estimated R4 billion. The largest share of demand in terms of value originates from electricity (53%), then the basic iron and steel sector (20%), followed by the synthetic fuel and chemical industries (10%).

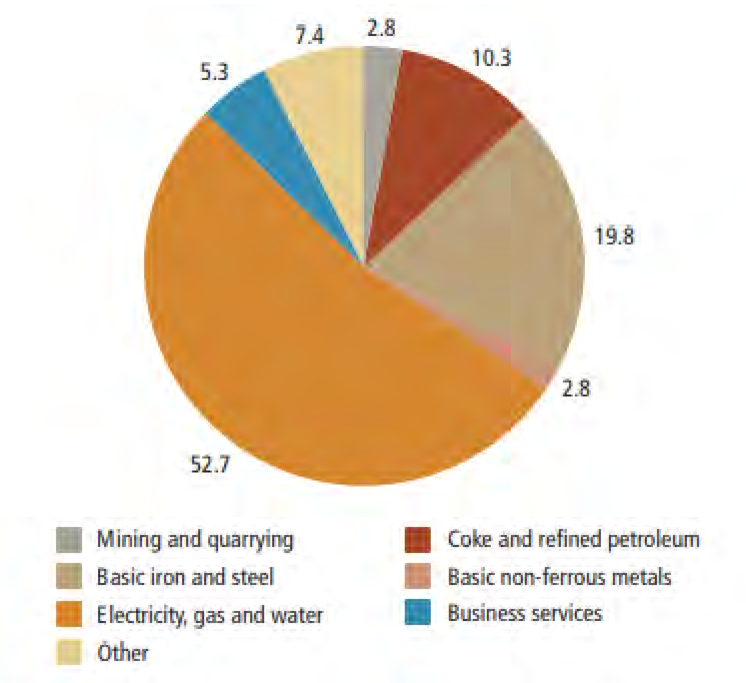


Figure 6-2: South African coal intermediary demand from industries 2015

Need and Desirability #3: In terms of implementing the National Development Plan (NDP), the Government of South Africa intends to provide policy certainty to encourage long-term investment in mining. The NDP aims to reduce the costs of living and of doing business, resulting in improved consumer and business confidence, rising levels of private investment, and higher growth and employment. A key implement and area of focus for National Policy is to "*Create jobs in infrastructure development, agriculture, mining and beneficiation, manufacturing, the green economy and tourism*". The Proposed Project will contribute to achieving this objective.

As stated in the GSDM IDP (2016/2017), the primary objective of the Mpumalanga Economic Growth and Development Path (MEGDP) is to foster economic growth that creates jobs, reduces poverty and inequality in the province. The following are the main economic sectors (all of which occur in the Gert Sibande District) that have been identified as pivotal in spurring economic growth and employment creation:

- Agriculture and forestry;
- Mining and energy;
- Tourism and cultural industries;
- The green economy and information and communication technology; and
- Manufacturing and beneficiation.

Key areas for intervention to facilitate growth and job creation in the agricultural sector include:

- Massive drive on infrastructure development;
- Massive drive in skills development;
- Comprehensive support to small-scale farmers and agri-businesses;
- Fast-track the settlement of the outstanding land claims;
- Optimal utilisation of resituated and distributed land;
- Increase acquisition of agricultural land for the previously disadvantaged;
- Revisit current legislation to create balanced development in areas of competition between mining and farming; and
- Assistance (technical, material and finance) to identified Agricultural co-operatives in traditional areas as well as the establishment of the fresh produce market in the District.

Key areas for intervention to facilitate growth and job creation in the mining industry are as follow:

- Upgrading and maintenance of the coal haulage network;
- Increase the level of higher skilled graduates;
- Expand the water network and increase reliance on water transfer schemes;
- Increase South Africa's load and improve alternate energy supply;
- Establishment of a mining supplier park to enhance enterprise development in the province;
- Resolve land claims to release land for development;
- Comprehensive support to small-scale mining enterprises to exploit opportunities presented by corporate social investment initiatives, retreatment of sub-economic deposits and dumps, and dimension stones; and
- Improving rail haulage of minerals to reduce shipping costs(currently done by road).

Leading industries in terms of employment in the district are trade (18.8%), community services (17.0%), mining (14.5%) and agriculture (13.9%). There has been a decrease in the role of agriculture & trade as employer and an increase in the role of community services & mining as employer. One of the GSDM's Strategic Development Initiatives is the implementation of Mining Beneficiation Master Plan.

The coal-mining activities enable electricity generation by the coal-fired power stations in the District. The processing of the mined products either for electricity generation or petrochemicals contributes immensely to the economy of the country. These sectors have not been fully exploited to their maximum capacity to benefit the economy of the District. It is envisaged that through intersectoral collaborations with relevant stakeholders more initiatives focusing on the second economy can still be examined, thus creating an enabling environment for more jobs to be created, and thus lessening dependency ratios (IDP, 2016-2017).

The GSDM Development Principle 10 states that the District Municipality aims to "*Facilitate and accommodate mining in the District in a sustainable manner in order to support local energy generation and industrial development*".

6.2 Local Perspective

Need and Desirability #4: The mining sector within the GMLM is the dominant supplier of employment opportunities in the area, providing 28% of all employment in the area. When comparing employment to Gross Domestic Product (GDP) contribution for the same sector, the sector has a 39% share in the GDP contribution to the local economy and acts as a main driving force to long term development. When considering that, GDP contribution is higher than the contribution made to employment, the conclusion can be deduced that the mining industry may be providing higher paying employment to fewer employees than various other sectors (GMLM IDP, 2017-2022).

In addition, a Spatial Development Framework (SDF), which creates guidelines for consideration of spatial and potential development areas, is included in the GSDM IDP. These areas are designated to ensure sustainable growth of already established communities through the development of the municipality into a mining, industrial and energy producing region. The Proposed Project is located in an area ear-marked predominantly for mining and agriculture (Figure 6-3).

To foster economic growth and create jobs, Leslie 1 will employ approximately up to 685 people during the LOM at full capacity, with most of the labour coming from the GSDM and the surrounding areas.

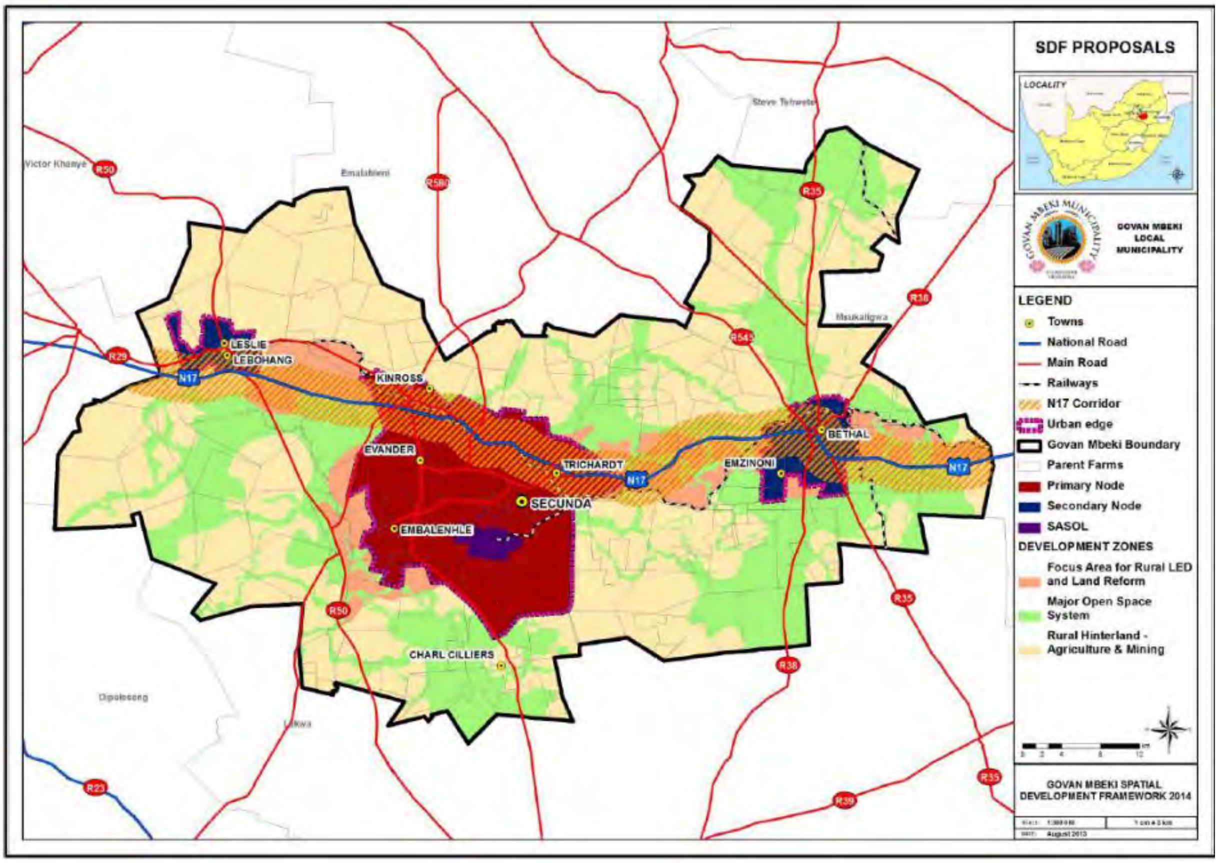


Figure 6-3: Govan Mbeki Local Municipality Spatial Development Framework 2014

Need and Desirability #5: South Africa has only 1.5% high potential arable soils, of which 46.4% is situated in Mpumalanga. A Pilot Study undertaken by the Bureau for Food and Agricultural Policy (BFAP, 2012) in the Leandra region, shows that the area contains 5.3% of this total high-arable land. At the current rate of coal mining in Mpumalanga, the study calculated that approximately 12% of South Africa's total High Potential arable land will be transformed.

The potential loss of maize production in the area from current mining activities and activities in the near future, amounts to 284 844 tons per annum (tpa). Over the long run, the reduction of 447 581 tpa of maize might result in average annual price increases of R300/ton, and projected values of R 2 090/ton, thereby increasing maize prices to increase by 14%, which in turn would cause maize meal prices to rise by approximately 5%.

Mining, agriculture and tourism are in constant conflict over the use of land. More often, this results in the loss of high value agricultural land, land featuring high biodiversity or eco-tourism areas. The Leslie 1 project is an underground project, which will result in minimal land use loss, compared to open-cast mining operations.

7 Preferred Site Selection

7.1 The Project Site based on a Sensitivity Analysis

The five mining areas have been selected by the AOL technical project team. The mining areas were selected based on the following criteria:

- The measured, indicated and inferred coal resources belonging to AOL within the landscape;
- The practical and least invasive requirements for gaining access to the coal seams from the surface;
- The initial findings of the prospecting activities;
- Existing infrastructure within the landscape to be utilised by the project (access roads, railways, existing collieries); and
- Existing land-uses of the immediate and broader regional setting.

The full project site was evaluated as part of the EIA process, and a site sensitivity assessment was carried out at each mining area. The assessment was conducted using desktop and mapping data to ensure that the mining areas were suitably positioned within the MR area, and that areas of environmental sensitivity were avoided as far as practically possible.

Following the completion of the specialist studies during the EIA Phase of the project, the infrastructure Plans were significantly revised, based on specialist recommendations, to minimise negative environmental impacts.

7.2 The Consideration of Alternatives

In accordance with the requirements outlined in Appendix 2 of the EIA 2014 Regulations (as amended), a consideration of reasonable and feasible alternatives, including site and technology alternatives and the "do-nothing" alternative must be undertaken. Each alternative is to be accompanied by a description and comparative assessment of the advantages and disadvantages that such development and activities will pose on the environment and socio-economy. When no feasible and/ or reasonable alternatives can be identified and investigated in terms of a comparative assessment during the Scoping Phase, the EIA/EMPr will then not contain a section with alternatives.

The EIA 2014 Regulations (as amended) define alternatives as the different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

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

Although a collection of alternatives may exist for the Leslie 1 Project, only feasible alternatives have been considered and are discussed in greater detail below. Kongiwe strived to seek alternatives that maximise efficient and sustainable resource utilisation and minimise negative environmental impacts.

7.3 The Property or location where it is Proposed to Undertake the Activity

No alternatives have been investigated in terms of location of the Leslie 1 Project. AOL currently holds the PR to the areas under investigation and will not consider any other properties that are not contained within the PR area. Moreover, the geological formation of the area is controlled by the current weathering surface. The ROM coal expected to be extracted has been deposited as 'multiple Seams' with the development of five major Seam horizons, which may in places be composite Seams. The geological structure has been interpreted based on borehole intersections, both historical and from AOL's phased drilling programme, and with reference to the published surface geological map. There are therefore no alternative property or location areas.

7.4 The Type of activity to be Undertaken

7.4.1 Alternative means of Power Generation in Mpumalanga Province[12]

Coal mining is a form of energy generation and forms part of the Energy Sector. In terms of alternatives investigated for energy generation, no viable alternatives have been identified. Only one option exists for the Generation of Energy for the Leslie 1 Project and that is Coal Mining.

Although the area considered for coal mining may be viable for renewable energy generation, AOL does not operate within the Renewable Energy Sector and has a long-standing history within the coal mining sector. Lastly, the development of a renewable energy project would result in the sterilisation of the existing coal resource.

The table below describes the advantages and disadvantages of coal mining in the context of the Leslie 1 Project.

Table 7-1: Advantages and Disadvantages of Coal Mining

Option	Advantages	Disadvantages
Energy Generated from Coal Mining (Current Option)	❖ Continuous, predictable, reliable source of power ❖ Lower capital investment ❖ Low cost/inexpensive energy source ❖ High load factor ❖ Large established industrial base	❖ Greenhouse gas emissions and emissions of harmful substances ❖ Contribution to Climate Change ❖ Health and safety impacts ❖ Direct and indirect environmental degradation

[12] Information extracted from City Press: Fin24. Written by Sizwe Yende. Available online at: http://www.fin24.com/Economy/mpumalanga-aimsto-go-green-by-2030-20161125

Option	Advantages	Disadvantages
	❖ **Large amounts of jobs are created, with the potential for "own business" opportunities**	❖ **Medium length project duration.**
Energy Generated from Renewable Energy	❖ Low direct and indirect environmental degradation. ❖ Low contribution to greenhouse gases. ❖ Long-term project duration. ❖ Renewable resource. ❖ Requires less maintenance than traditional generators. ❖ Lower costs of operation.	❖ Sterilisation of coal resources ❖ Low job creation. ❖ Difficult to generate the quantities of electricity that are as large as those produced by traditional fossil fuel generators. ❖ Current cost of renewable energy technology is also far in excess of traditional fossil fuel generation.

7.5 The Design and Layout of the Activity

The normal objective of any design is to ensure that the size of the project is economically viable within the given constraints of reserve size, Capital Expenditure (Capex) requirements, payback period and transport constraints. The initial aim of the Leslie 1 Project was to determine the best possible size for the whole operation from the mine areas to the market, and an important driver during mine design and layout was to make optimal use of the reserve, i.e. to get maximum mine life out of the reserve.

7.5.1 Leslie 1A

The alternative plant layouts for Leslie 1A are:

- Option 1: The initial layout proposed by the client.
- Option 2: This option looks at changing from a boxcut to an access portal, reducing the size of the required infrastructure and shifting the layout to avoid sensitive features.
- Option 3. This option looks at accessing the underground seams from the open pit areas of the approved adjacent Springboklaagte mine and to partially make use of Springboklaagte mine's plant infrastructure. This option would require an agreement between Leslie 1 and Springboklaagte Mine. In addition, the surface infrastructure area would be reduced in size and shifted to avoid sensitive features.

The table below describes the advantages and disadvantages of the various layout options for Leslie 1A.

Table 7-2: Advantages and Disadvantages of Leslie 1A site layout options

Option	Advantages	Disadvantages
Option 1 ❖ Original Proposed Layout	❖ Infrastructure close to box-cut. ❖ 5 seam coal available for production.	❖ Soils with high agricultural potential and high yields.

Option	Advantages	Disadvantages
		❖ Proximity to highly sensitive biodiversity areas. ❖ High air quality impacts
Option 2: (preferred option) ❖ **Portal access rather than box-cut** ❖ **Reduced infrastructure footprint** ❖ **Relocation of infrastructure** ❖ **Removal of east access road**	❖ **Reduced mine footprint to avoid sensitive features.** ❖ **Reduced cumulative air quality impacts from having a smaller plant.** ❖ **Conveyor belts used to transport material resulting in reduced air quality impact.** ❖ **Shorter, tarred access roads to the plants reducing air quality impacts.**	❖ **Soils with high agricultural potential and high yields.** ❖ **Proximity to highly sensitive biodiversity areas.**
Option 3: ❖ Accessing the eastern underground seams from the open pit areas of the approved Springboklaagte Mine ❖ Partial use of Springboklaagte Mine's plant infrastructure ❖ Reduced infrastructure footprint ❖ Relocation of infrastructure ❖ Removal of east access road	❖ Reduced mine footprint to avoid sensitive features. ❖ Reduced cumulative air quality impacts from having a smaller plant.	❖ Soils with high agricultural potential and high yields. ❖ Proximity to highly sensitive biodiversity areas. ❖ Requires agreement between both mines.

Figure 7-1 illustrates the initial layout which informed the specialist studies. During the specialist reporting period of the EIA Phase, specialist investigations critically, and objectively, assessed the direct, indirect and cumulative impacts of the mining activities and infrastructure at each mine area. Their reports identified areas of environmental sensitivity, which have been incorporated to produce alternative infrastructure layout (Figure 7-2).

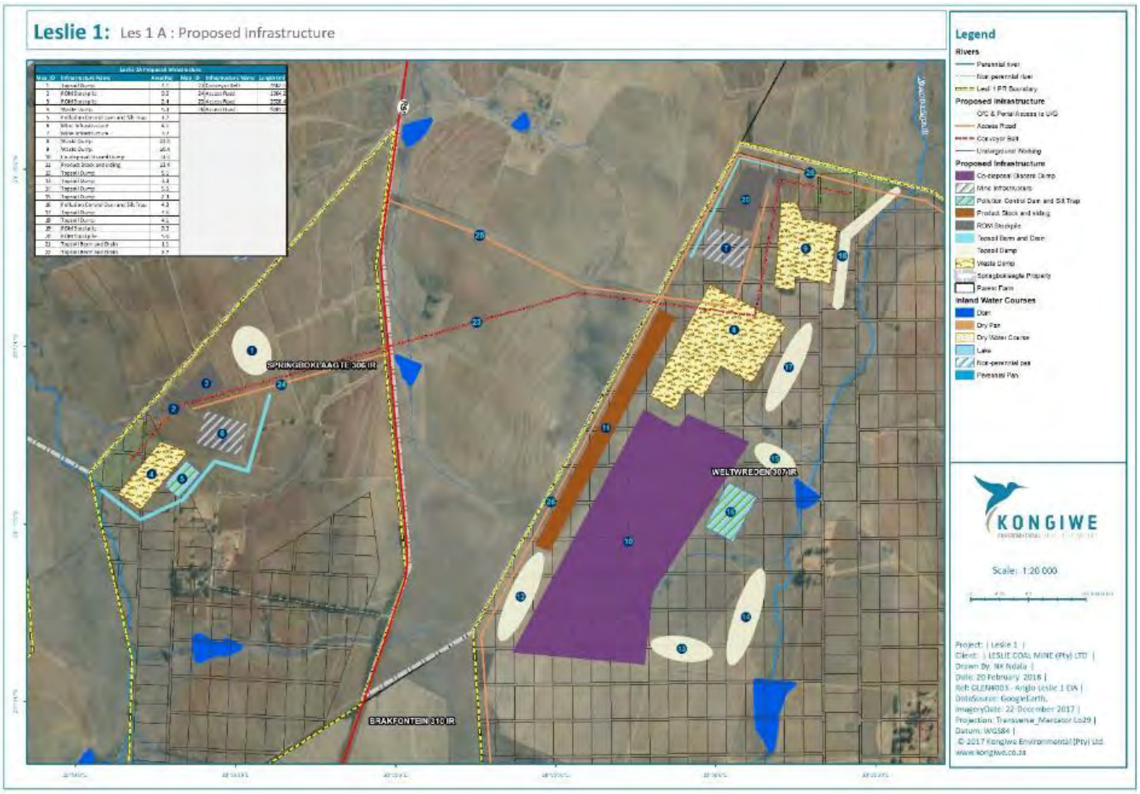


Figure 7-1: Initial layout plan for Leslie 1A (Option 1)

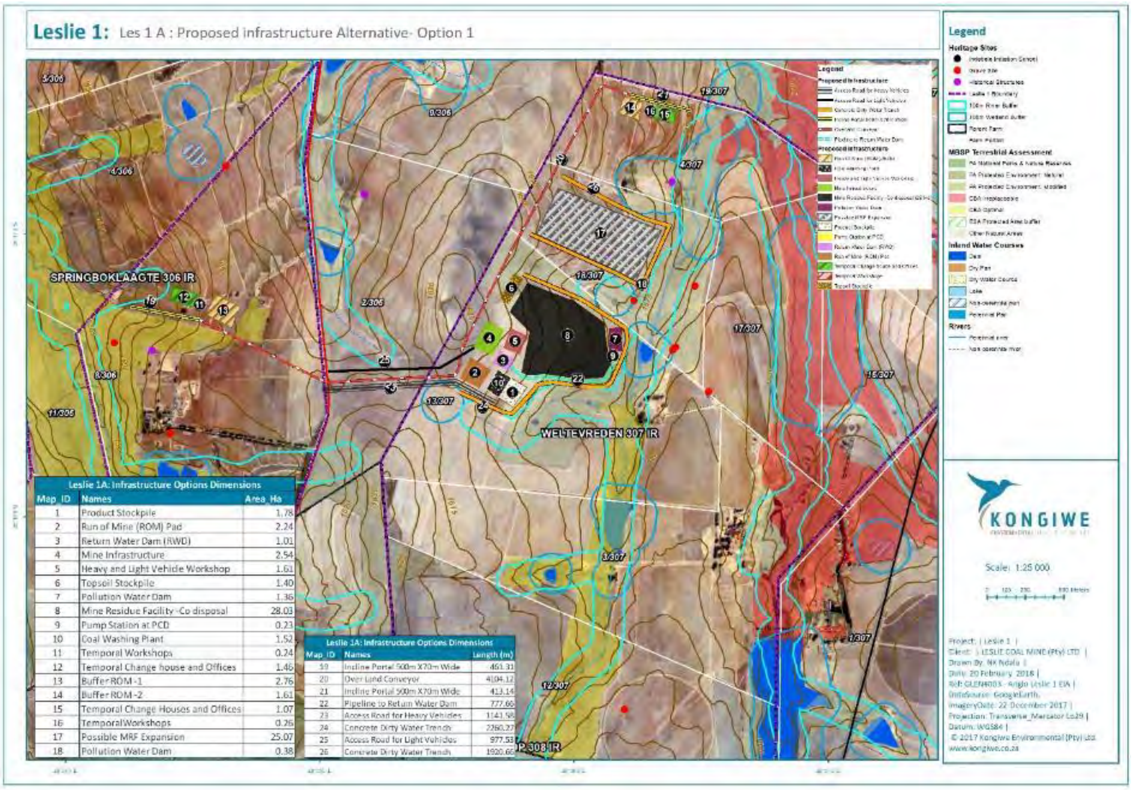


Figure 7-2: Layout plan for Leslie 1A (Option 2)

7.5.2 Leslie 1C

The alternative plant layouts for Leslie 1C are:

- Option 1. The initial layout proposed by the client;
- Option 2: The option of reducing the area required for the existing infrastructure and placing all infrastructure south of the dams.
- Option 3: This option looks at not having a plant at 1C and trucking the ore to the Leslie 1A plant.

The table below describes the advantages and disadvantages of the various layout options for Leslie 1C.

Table 7-3: Advantages and Disadvantages of site layout options

Option	Advantages	Disadvantages
Option 1: ❖ Original Proposed Layout	❖ Low agricultural potential soil ❖ Soils that can compact easily and which rehabilitate well	❖ High air quality impacts ❖ Blasting impacts on SANRAL structures
Option 2 (Preferred option) ❖ **Reducing the area required for the existing infrastructure and placing all infrastructure south of the dams** ❖ **Access via a portal rather than a box cut** ❖ **Using conveyor belts to transport material from portal to the plant**	❖ **Reduced area disturbance** ❖ **Reduce blasting impacts on SANRAL structures** ❖ **Low agricultural potential soil** ❖ **Soils that can compact easily and which rehabilitate well** ❖ **Reduced air quality impacts**	❖ **Air quality impacts**
Option 3 ❖ Not having a plant at 1C and trucking the ore to Leslie 1A	❖ Minimal area disturbance ❖ Reduced air quality impacts	❖ Increased traffic through Leandra ❖ Need for second Co-disposal facility at Leslie 1A.

Figure 7-3 illustrates the initial layout which informed the specialist studies. During the specialist reporting period of the EIA Phase, specialist investigations critically, and objectively, assessed the direct, indirect and cumulative impacts of the mining activities and infrastructure at each mine area. Their reports identified areas of environmental sensitivity, which have been incorporated to produce alternative infrastructure layouts.

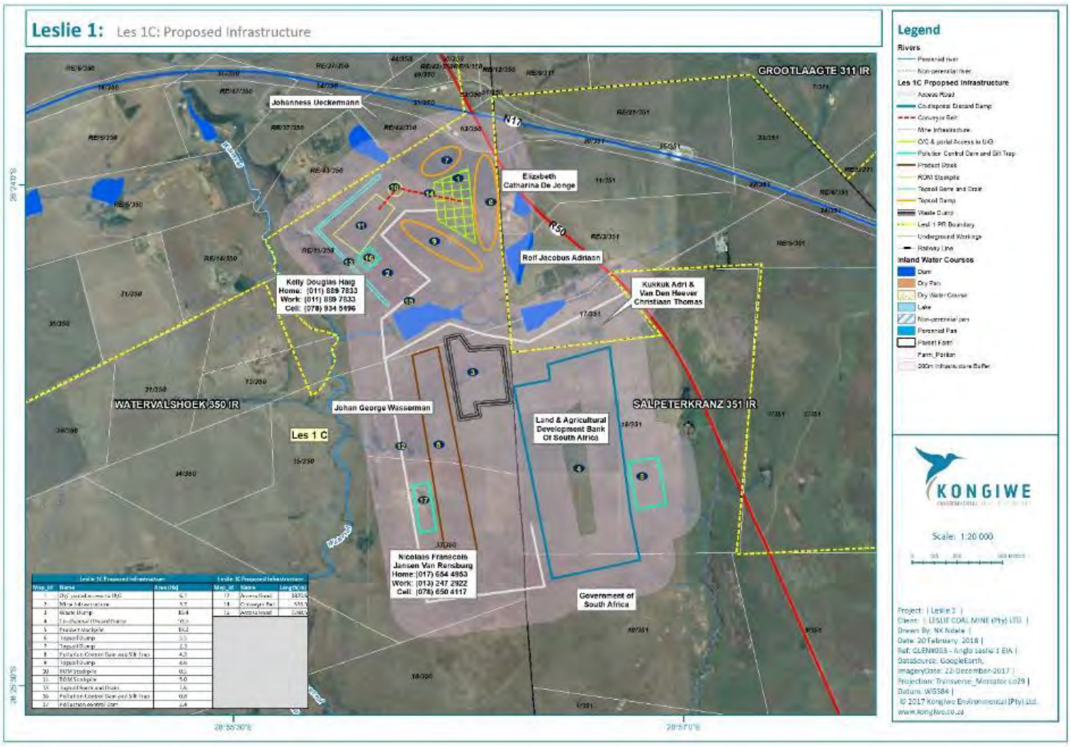


Figure 7-3: Initial layout Plan for Leslie 1C (Option 1).

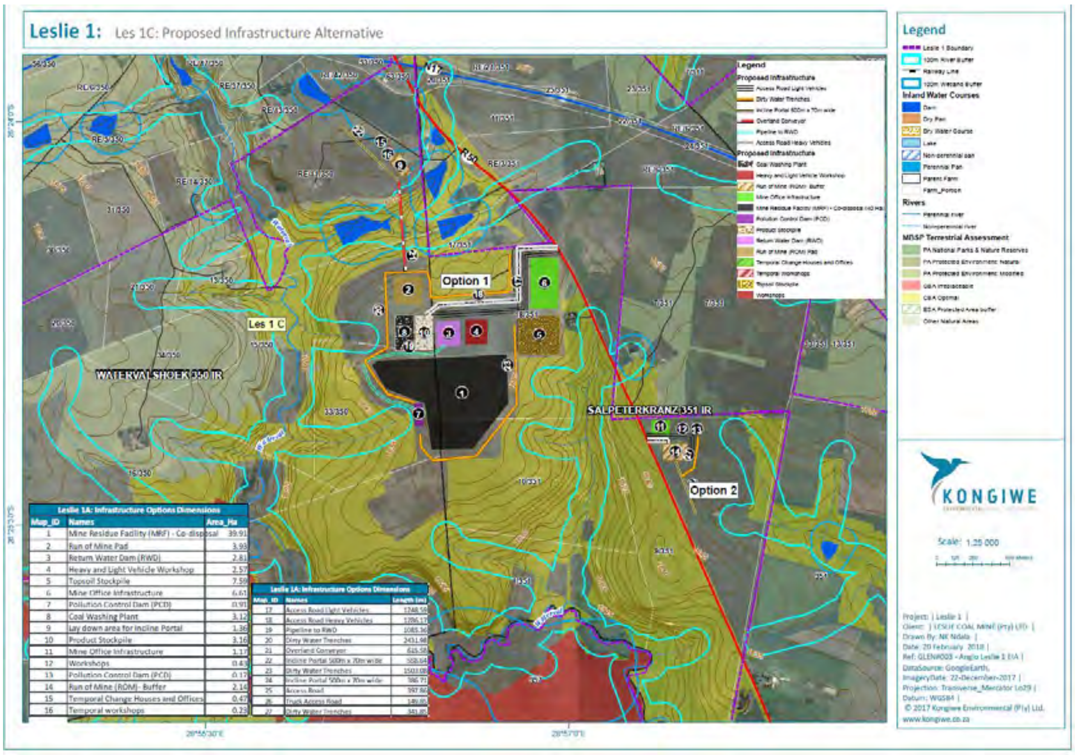


Figure 7-4: Layout Plan for Leslie 1C (Option 2).

7.6 The Technology to be used in the Activity

7.6.1 Coal Extraction Methods

The nature of the coal seams determines the preferred mining method. The location of the feasible coal determines the location of the mining operation. These two factors limit mining alternatives that are available. The depth of coal within the five Mine Areas allows for underground mining to take place. The No. 2 seam is considered the most economical seam, and at certain mine areas can be extracted as ROM without processing. The tonnage of the resource and the LOM indicates the optimal mining rate and this in turn determines the mining method.

The alternative extraction methods that exist are:

- Open Pit Mining:
  - Truck and Shovel
  - Dragline
- Underground Mining:
  - Bord and Pillar by continuous miner (**Preferred Option**)
  - Longwall

Table 7-4: The advantages and disadvantages of alternative mining extraction technology options

Option	Advantages	Disadvantages
Truck and Shovel	❖ Most appropriate for bulk extraction of variable coal seams. ❖ Commonly used in South Africa coal mining. ❖ Employment opportunities. ❖ Lower operating costs ❖ Can exploit small and remote coal reserves economically ❖ Reduced working area per ton of capacity ❖ Less technical support needed ❖ Ease of linking the mining system to new transportation or extraction technologies	❖ Destruction of natural vegetation and faming land. ❖ Increase in soil erosion resulting from the removal of vegetation. ❖ Increased dust generation due to open pit blasting and operations. ❖ Increased noise generation due to construction and operational vehicles. ❖ Increased rehabilitation costs. ❖ Decrease in surface water runoff due to open pit capturing rain water. ❖ Potential formation of groundwater cone of depression. ❖ Potential for acid mine drainage to due contamination of groundwater and surface water.
Dragline	❖ Employment Opportunities ❖ Productivity increases ❖ Higher extraction rates	❖ Capital cost ❖ Burden units not thick enough to warrant usage. ❖ Increase in soil erosion ❖ Destruction of natural vegetation and faming land. ❖ Increase in soil erosion resulting from the removal of vegetation. ❖ Increased dust generation due to open pit blasting and operations.

Option	Advantages	Disadvantages
		❖ Increased noise generation due to construction and operational vehicles. ❖ Increased rehabilitation costs. ❖ Decrease in surface water runoff due to open pit capturing rain water. ❖ Potential formation of groundwater cone of depression. ❖ Potential for acid mine drainage to due contamination of groundwater and surface water.
Bord and Pillar by continuous miner (preferred option)	❖ **Reduced surface area disturbance, thereby preserving farming areas and natural land.** ❖ **Fast initiation of mining activities** ❖ **Lower cost** ❖ **High degree of flexibility (allows variable thickness in the ore);** ❖ **Method easily modifiable; may operate simultaneously on multiple levels** ❖ **Employment opportunities.**	❖ **Requires ongoing maintenance of the roof and eventually the pillars. The tension in the open spaces increases with depth.** ❖ **Significant capital investment for extensive mechanization.** ❖ **Loss of ore in pillars.** ❖ **May be difficult to achieve good ventilation to dilute contaminants in due to low air velocity panel in large open spaces.** ❖ **Requires good technical and engineering support.** ❖ **Potential formation of groundwater cone of depression.** ❖ **Potential for acid mine drainage to due contamination of groundwater and surface water.**
Longwall	❖ Reduced surface area disturbance, thereby preserving farming areas and natural land. ❖ Employment opportunities ❖ Productivity increases ❖ Higher extraction rates	❖ Capital cost ❖ Not appropriate for small underground deposits ❖ Surface subsidence, which may considerably alter the landscape above the mine which can damage natural or man-made structures or features, ❖ Deterioration in groundwater quality, as it can become more brackish with increased sulphate levels. ❖ Potential formation of groundwater cone of depression.

Option	Advantages	Disadvantages
		❖ Potential for acid mine drainage to due contamination of groundwater and surface water.

7.6.2 The Type of Beneficiation

Processing coal improves the quality thereof, which in turn improves the efficiency of power plants. The properties of raw and washed coal can differ significantly, and the beneficiation of the raw coal can improve its quality, thereby influencing the performance of power stations. The following alternatives were identified with regard to the options for the type of beneficiation to be utilised.

- De-Stoning
- Dry Separation
- Single Stage Wash
- Multiple Stage Wash **(Preferred Option)**

Table 7-5: Advantages and Disadvantages of Alternative Types of Beneficiation

Option	Advantages	Disadvantages
De-Stoning	❖ None	❖ Sulphur content too high and Net CV too low. ❖ Increased dust and noise impacts.
Dry Separation	❖ Reduced water consumption	❖ Comparatively inefficient ❖ Increased dust and noise impacts.
Single Stage Wash	❖ Provides a reliable product ❖ Reduced dust and noise impacts	❖ Higher cost ❖ Increased water consumption
Multiple Stage Wash (Preferred Option)	❖ **Provided a reliable product** ❖ **Reduced dust and noise impacts**	❖ **Higher cost** ❖ **Products may not be obtainable due to size** ❖ **Increased water consumption comparatively**

7.6.3 Processing Plant Options

The following alternatives were identified with regard to the options for the processing plant to be utilised.

- Option 1: Onsite mobile screening and crushing plant
- Onsite stationary process plant (**Preferred Option**)

Table 7-6: Advantages and Disadvantages of Alternative Processing Plant Options

Option	Advantages	Disadvantages
Onsite mobile processing plant	❖ Lower Environmental Impacts ❖ Can service more than one Mine Area ❖ More jobs are created as transportation would be required	❖ Higher capital costs
Onsite stationary process plant (Preferred Option)	❖ **Coal beneficiation would be more efficient as less transportation would be required.**	❖ **More equipment is required** ❖ **The plant might require a larger footprint** ❖ **Greater environmental impacts**

7.6.4 Coal Transportation Options

The following alternatives were identified with regards to the options for the transportation of coal:

- ❖ Via haul truck to the final destination (**Preferred Option**);
- ❖ Via overland conveyor to the final destination; and
- ❖ Via railway.

Table 7-7: Advantages and Disadvantages of Alternative Transport Options

Option	Advantages	Disadvantages
Via Haul Truck (Preferred Option)	❖ **Opportunities for haul truck drivers to own and operate their own trucks.** ❖ **Job stimulation, upskilling.** ❖ **More financially viable in the initial stages of mining.**	❖ **Traffic impacts.** ❖ **Emissions impacts.** ❖ **Greater maintenance requirements.**
Via Overland Conveyor	❖ Larger quantities of coal can be transported. ❖ Less negative environmental and road impacts.	❖ Less job stimulation and potential for entrepreneurship. ❖ Costlier in the long term as the quantity of coal to be transported is not large enough to substantiate the costs involved.
Via Railway	❖ Less negative environmental and road impacts. ❖ Support from Transnet.	❖ Costlier in the long term as the quantity of coal to be transported is not large enough to substantiate the costs involved. ❖ Servitude requirements for railway line.

Option	Advantages	Disadvantages
		❖ Road transport still required for Eskom coal.

7.7 The "No-Go" Option

The option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. As such, negative impacts on biodiversity, water resources, air quality land use etc. would not transpire, but also that the positive impacts such as economic development, employment creation, skills development and poverty alleviation would not occur. The "No-Go" Option also assumes the continuation of the current land use of the proposed mining area, implying the absence of any mining and associated infrastructures.

Table 7-8: Advantages and Disadvantages of "No-Go" Option

Option	Advantages	Disadvantages
"No-Go" Option Continued agriculture	❖ Continuation of land use and food safety ❖ Lower environmental impacts	❖ Lower job creation
Underground Mining	❖ Job creation ❖ Economic stimulation ❖ Farming can continue above the underground mining areas	❖ Environmental impacts ❖ Smaller disturbance area ❖ Sterilisation of agricultural land on infrastructure area
Open cast mining	❖ Job creation ❖ Economic stimulation ❖ Lower capex	❖ Large environmental impacts ❖ Large areas disturbed ❖ Sterilisation of agricultural land on infrastructure area and mining footprint

7.8 Project Motivations

7.8.1 Motivation for the Alternative Development Location for the Leslie 1 Project

No alternatives have been investigated in terms of location of the Leslie 1 Project. AOL currently holds the PR to the areas under investigation and will not consider any other properties that are not contained within the PR area. Moreover, the geological formation of the area is controlled by the current weathering surface. The ROM coal expected to be extracted has been deposited as 'multiple Seams' with the development of five major Seam horizons, which may in places be composite Seams. The geological structure has been interpreted based on borehole intersections, both historical and from AOL's phased drilling programme, and with reference to the published surface geological map. There are therefore no alternative mining areas.

7.8.2 Motivation for the Final Proposed Facility Alternative

The factors below have been used to determine the final preferred alternatives for the Leslie 1 Project:

❖ Financial feasibility;

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

Although mining is an inevitable consequence of the compounding demand for fossil fuels, these requirements can be met by planning mining in such a way that sensitive areas are, as far as possible, preserved. Underground mining activities have a far lower surface impact than open cast mining and allow existing farming activities to continue on the surface. Leslie Coal Mine will follow the rehabilitation, monitoring programmes and EMPr strictly to ensure that these resources are managed in a sustainable way whilst meeting the needs of the growing South African economy. In saying, the following layouts are the final preferred mine layouts and facility designs for the Leslie 1 Project.

Note that the preferred facility designs for the Leslie 1 Project have been provided in Appendix B – A3 Maps.

7.8.3 Motivation where No Alternatives have been considered

Motivations where no alternatives have been assessed have been addressed throughout Chapter 6.

8 Public Participation

This PPP was developed to ensure compliance with all environmental regulatory requirements and to provide I&APs with an opportunity to evaluate the Leslie 1 Project, provide their inputs, and receive feedback from the project team, specialists and applicant.

This chapter will discuss the following 9 aspects with regard to undertaking the necessary PPP:

1. The objective of the PPP;
2. The process of identifying stakeholders and capturing them on the project database;
3. The status of identifying land claims relevant to the Leslie 1 Project;
4. Materials for undertaking the PPP;
5. The Draft Scoping consultation process;
6. The Final Scoping consultation process;
7. A summary of activities, which were undertaken as part of the FSR; and
8. A summary of activities to be undertaken as part of the EIA Phase; and
9. PP during the decision-making phase.

8.1 Objectives of the Public Participation Process:

The PPP objectives are to:

- Ensure that I&APs are informed about the Leslie 1 Project;
- Provide I&APs the opportunity to engage and provide comment;
- Draw on local knowledge by identifying environmental and social concerns associated with the Leslie 1 Project;
- Involve I&APs in identifying ways in which concerns can be addressed;
- Verify that stakeholder comments have been recorded; and
- Comply with the legal requirements.

The PPP has four phases of consultation with I&APs during the environmental regulatory process. These are presented in Table 8-1 below:

Table 8-1: PPP Activities

Project Phase	Activities Undertaken
Pre-scoping Phase	❖ Identification of stakeholders; ❖ Providing project information to I&APs; ❖ Consultation with I&APs; and ❖ Obtaining comments, suggestions and concerns from I&APs.
Scoping Phase	❖ Distribution and placement of project announcement materials; ❖ Updating of the stakeholder database; ❖ Making the Scoping Report available for public comment; ❖ Providing I&APs with further details of the Proposed Project and associated specialist studies;

Project Phase	Activities Undertaken
	❖ Consultation with I&APs; ❖ Obtaining further comments, suggestions and concerns from I&APs; and ❖ Informing specialists and the proponent of I&AP comments.
EIA Phase	❖ Provide feedback about the specialist studies conducted and mitigation measures proposed by means of consultation with I&APs; ❖ Make the relevant environmental reports available for public comment; ❖ Consult with I&APs; ❖ Provide opportunity for I&APs to comment on specialist findings, impacts assessments and recommendations; ❖ Verify that comments raised by I&APs have been accurately recorded; and ❖ Inform specialists and the proponent of I&AP comments.
Decision Making Phase	❖ Once the competent authority has come to a decision regarding the authorisation of the project, all registered I&APs will be notified of the decision made and the appeal process will be explained.

8.2 Identification of Stakeholders

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

- WinDeed searches were undertaken for farm portions in and around the project site to verify land ownership and obtain contact details;
- Desktop and online research;
- Stakeholder networking and discussions to source additional stakeholder details:
  - This entailed telephonic consultation and meetings with landowners, Local and Provincial Government and community representatives; and
- Site visits were also undertaken to identify I&APs for which no contact details could be obtained.

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

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

A stakeholder database has been compiled and will be updated throughout the environmental regulatory process (refer to Appendix C1).

8.3 Land Claims

A formal enquiry, which contained a list of all the directly and indirectly affected land portions for the project, was submitted via letter to Mr Sam Nkosi, Chief Director: Land Restitution Support from the Mpumalanga Department Rural development and Land Reform (DRDLR), Land Claims Commission, on Friday, 23 February 2018 (refer to Appendix C2). Feedback was received by means of a letter dated 23 March 2018 (refer to Appendix C2) which indicated that there are land claims on some of the directly affected properties. The properties/farms listed below have land claims submitted, please note that none of these land claims have been finalised.

- Watervalshoek 350 IR, Portions 4, 13, 15 (RE), 16-21, 27, 28, 33, 34, 51, 52, 63, Re/11, Re/12 and Re/9;
- Brakfontein 310 IR, Portions 3, 12, 13, 15, 18, 19, 20 and 21; and
- Weltevreden 307 IR, Portions 3,4/RE, 5, 7-9, 12,13,15-18 and RE.

8.4 Public Participation Materials

Considering the legislative requirements and good practice, the following documents have been developed and distributed to stakeholders. The various PPP materials which were used during the Pre-Scoping and Scoping Phases are included as appendices to this report.

Background Information Document: The BID (Appendix C3) provides a detailed description of the full project area, regional setting map, EIA process, specialist studies to be undertaken, PPP and relevant contact details. The BID has also been translated into Afrikaans and isiZulu.

Newspaper advertisements: A newspaper advert (Appendix C4) was placed in the Daily Sun, which is a local newspaper in the project area, on Tuesday, 13 March 2018. The advert included a brief project description, information about the required legislation, the competent authorities and details of the appointed EAP. The advertisement set out the details of the Public Meeting. The venues where the DSR could be reviewed was provided in the advertisement. In addition to the above, the advertisement invited stakeholders to register formally as I&APs.

Site notice: Similar to the advertisement, the site notice provided an overview of the Proposed Project and highlighted the applicable legislation for the EIA process. It stipulated the competent authority, PPP and where relevant information could be obtained from. Stakeholders were invited to register formally as I&APs. Site notices were placed at prominent places in and around the project area. See Appendix C5 for the site notice, and site notice report.

Notification Letter with a Comment and Registration Form: A process notification letter was sent which contained information about the proposed Leslie 1 project, applicable legislation and competent authorities. The letter also shared details of the Public Meeting to be held at the Tholulwazi Thusong

Service Centre Boardroom, 307 Norda Street Leandra / Leslie on Wednesday, 18 April 2018 and invited stakeholders to register formally as I&APs. A Comment and Registration Form was also provided for stakeholders to use to formally register as I&APs or to submit comments. A second announcement letter was emailed on Wednesday 28 March 2018, to remind stakeholders of the availability of the Draft Scoping Report public review period and the public meeting (Appendix C6).

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

Pre-scoping consultation: Pre-scoping consultation was aimed at providing stakeholders with an overview of the proposed Leslie 1 Project and to obtain initial comments which informed specialist studies and for project planning. This was done by means of a BID and a map showing the properties. Consultation with stakeholders was focused on one-on-one meetings and Focus Group meetings which were held with authorities and landowners along with telephonic consultation. Refer to Appendix C7 for a list of meetings and consultations that were under taken. All comments raised by stakeholders during these meetings are captured in the Comments and Responses Report (CRR) (Appendix C9). Responses to comments will be provided in line with the overall project scope and available information.

8.5 Scoping Phase Consultation

8.5.1 Draft Scoping Consultation

The aim of consultation during the Scoping Phase is focused on the formal EIA process, specialist impact studies terms of reference and addressing stakeholder comments already submitted. A Public Meeting was held on Wednesday, 18 April 2018 at the Tholulwazi Thusong Service Centre Boardroom, 307 Norda Street Leandra / Leslie. The purpose of the meeting was to facilitate stakeholder dialogue between the project team and landowners, authorities, NGOs and communities. The minutes of the public meeting are included in Appendix C8.

Figure 8-1: Public meeting held at the Tholulwazi Thusong Service Centre Boardroom, Leandra / Leslie

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

A separate Landowners meeting was held on Thursday, 10 May 2018 held at 10H00 at Moedverloren Lapa, with the directly affected and adjacent landowners/occupiers, the same format as the Public Meeting was followed. The purpose of the meeting was to discuss the Proposed Project, contents of the Scoping Report and also to provide I&APs with an opportunity to raise their concerns/comments. The landowners were invited to the meeting by means of a notification letter which was sent by email, telephone calls and SMS were made to remind landowners to attend the meeting. All comments raised by landowners have been captured into the CRR (Appendix C9).

Figure 8-2: Landowners meeting held at the at Moedverloren Lapa, Farm Moedverloren, Leslie

Presentations: A Power Point presentation was used at the Public Meeting as well as at the landowners meeting to present the project. CDs containing the DSR and comment sheets were made available at the Public Meeting. The minutes of the meeting and the presentation are included in Appendix C8.

The presentations at the meeting covered the following aspects:

- Project Description;
- The Environmental Authorisation process;
- Specialist Studies to be conducted;
- Questions & answers

Consultation meetings with farm workers and farm occupiers were held during May 2018. The purpose of these meetings was to inform farm workers within the project area about the Proposed Project and also to provide them with an opportunity to raise their comments/concerns regarding the proposed project. Comments raised include the following:

- Concerns about loss of livelihood;
- Relocation;
- Impacts on their graves;

- Limited/restricted access to land (ie) land used for spiritual/cultural purposes and grazing land.

All issues/comments raised during the consultation meetings with the abovementioned stakeholders have been in included in the CRR.

The DSR was made available to stakeholders on the Kongiwe Environmental website and in public places for a 30-day comment period from 28 March 2018 to 02 May 2018. Notification of the availability of the documentation for review was distributed on 22 March 2018 and a second announcement was published on Wednesday, 28 March 2018. With the submission of the Final Scoping Report (FSR), Stakeholders had the opportunity to verify that their comments were captured during the DSR phase and to review responses provided by the project team as the FSR was placed on the Kongiwe website.

Table 8-2 below provides details of the activities that formed part of the Draft Scoping Phase.

Table 8-2: Summary of PP activities during the Draft Scoping Phase

Activity	Details	Reference in report
Identification of stakeholders	Stakeholders, with associated details, were identified by means of WinDeed searches, stakeholder networking and research for the compilation of a stakeholder database.	Appendix C1 Stakeholder database
Identification of land claims	A formal enquiry, which contained a list of all the directly and indirectly affected land portions for the project, was submitted via letter to Mr Sam Nkosi, Chief Director: Land Restitution Support from the Mpumalanga Department Rural development and Land Reform (DRDLR), Land Claims Commission, on Friday, 23 February 2018 (refer to **Appendix C2**). Feedback was received by means of a letter dated 23 March 2018 (refer to **Appendix C2**) which indicated that there are land claims on some of the directly affected properties. The properties/farms listed below have land claims, please note that none of these land claims have been finalised. ❖ Watervalshoek 350 IR, Portions 4, 13, 15 (RE), 16-21, 27, 28, 33, 34, 51, 52, 63, Re/11, Re/12 and Re/9 ❖ Brakfontein 310 IR, Portions 3, 12, 13, 15, 18, 19, 20 and 21 ❖ Weltevreden 307 IR, Portions 3,4/RE, 5, 7-9, 12,13,15-18 and RE	Appendix C2 Land claims letters
Development of the Background Information Document	The BID was developed and was mailed to the stakeholder database and distributed at stakeholder meetings.	Appendix C3 BID
Placing of media advertisements	An advertisement was placed in the Daily Sun on Tuesday, 13 March 2018.	Appendix C4 Advertisements

Activity	Details	Reference in report
Placing of site notices	Site notices were put up within the Proposed Project site and at publicly accessible venues within proximity to the project area, these were placed on Monday, 19 March 2018. A copy of the site notice was also placed at the ❖ Leandra Public Library ❖ Lebohang Public Library ❖ Devon Public Library A site notice placement report and map have been developed, indicating the exact locations where site notices were placed, with photos and GPS coordinates.	Appendix C5 Site notice report and placement map
Announcement of the project and Draft Scoping Report	The announcement letter was emailed to the full database on 22 March 2018 and then a second announcement to remind stakeholders on Wednesday, 28 March 2018. The DSR and the BID were made available on Kongiwe's website. http://www.kongiwe.co.za/publications-view/public-documents/	Appendix C6 Announcement Letter Appendix C3 BID
Stakeholder meetings	One-on-one meetings and Focus Group meetings took place with directly and indirectly affected landowners and key authorities. A high-level overview of the Proposed Project was discussed, and stakeholder inputs captured. All stakeholder comments were captured and responded to in the CRR.	Appendix C7 List of meetings & Meeting Minutes Appendix C9 Comment and Response Report
Public Meeting	A Public Meeting was held with stakeholders from 10:00 -13:00 at the Tholulwazi Thusong Service Centre Boardroom, 307 Norda Street Leandra / Leslie on Wednesday, 18 April 2018. Minutes of this meeting have been distributed to everyone who attended the meeting.	Appendix C8 Minutes from meeting
Landowners Meeting	A Landowners meeting was held with directly and adjacent landowners on 10 May 2018.	Appendix C8 Minutes from meeting

8.5.2 Consultation Undertaken as Part of the Final Scoping Phase

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

Notification of the availability of the documentation for review was distributed on 09 May 2018 (Appendix C6). In the submission of the FSR, stakeholders had the opportunity to verify that their comments were captured during the draft Scoping Phase and to review responses provided by the project team.

Table 8-3 below illustrates the PPP activities that were undertaken as part of the Final Scoping Phase of the project:

Table 8-3: Summary of PPP activities that was undertaken during the Final Scoping Phase

Activity	Details
Update of stakeholder information	The stakeholder database was updated with new I&APs who formally registered, attended stakeholder meetings or submitted comments.
Placement of the FSR	The FSR was made available on the Kongiwe Environmental website http://www.kongiwe.co.za/publications-view/public-documents/ from 09 May 2018.
Announcement of the FSR	A notification letter announcing the availability of the FSR for comment was emailed to the full stakeholder database on 09 May 2018.

8.6 EIA Phase Consultation

Consultation with stakeholders during the IEIA Phase was undertaken to provide feedback on findings, impacts and proposed mitigation measures provided by various specialists and to obtain additional comments from stakeholders. All comments raised to date were captured in the CRR (Appendix C9). The PowerPoint presentation was used during the various stakeholder meetings. Details of the Public Meeting are indicated below (Table 8-5).

Table 8-4: Details of the Public Meeting

Date	Venue	Time
18 August 2018	Difa Nkosi Community Hall, Stand no 1095 Lebohang Ext 9, Butana Nkambule Street.	10H00

8.6.1 Public Participation Materials

Notification Letter: A letter (Appendix C6) which indicated availability of the Draft EIA/ EMPr for public comment and an invitation to the Public Meeting was sent to the full stakeholder database on 18 July 2018. Emails were also sent to the relevant stakeholder groups to extend an invitation to attend the public meeting and the landowners' meeting.

Newspaper advertisements: A newspaper advert (Appendix C4) was placed in The Daily Sun on 20 July 2018 and a second media advert was placed in the Ridge Times on 27 July 2018. The advertisement provided the review period for the Draft EIA/ EMPr and how the public could access the draft reports for their review and comment. The media advert also provided details regarding the public meeting.

Telephonic Discussions: Stakeholders were invited to the stakeholder meetings by means of telephonic discussions, to confirm their attendance.

Maps: Various maps of the EIA were on display throughout the stakeholder meetings. These included maps of the various specialist study findings and the landownership maps.

PowerPoint Presentation: A presentation was compiled and used at the Public Meeting and the Landowners meetings. The following aspects were covered in the presentation below:

- Project overview will be given;
- EIA process and legislation timeframes;
- Specialist study findings, impacts and proposed mitigations; and
- PPP to date and next steps.

8.6.2 Stakeholder Meetings

The following sections below outline the stakeholder meetings that were conducted as part of this EIA process.

8.6.2.1 Landowner Meeting

A Landowners Meeting with the directly affected or indirectly affected landowners, was held on Wednesday, 15 August 2018 at 10H00 at the at the at Moedverloren Lapa, Farm Moedverloren, Leslie. The landowners were invited to the meeting by means of a notification letter which was sent by email/post. The purpose of this meeting was to provide feedback on the findings from the specialist studies undertaken.

The minutes of the landowner's meeting are included as (Appendix C8). The updated infrastructure maps of the proposed mine were made available to stakeholder to view and comment on. Comments received at this meeting has been captured into the CRR and responded to (Appendix C9).

Figure 8-3: Landowners meeting held on Wednesday, 15 August 2018 at the Moedverloren Lapa, Farm Moedverloren, Leslie

8.6.2.2 Public Meeting

A Public Meeting was held on 18 August 2018 at the Difa Nkosi Community Hall for all stakeholders who are affected by or interested in the Proposed Project. Key specialists attended the meeting to address technical comments. The objective of this meeting was to provide feedback to stakeholders on specialist studies undertaken and to obtain further comments.

The minutes of the public meeting are included as (Appendix C8). Comments received at this meeting has been captured into the CRR and responded to.

Figure 8-4: Public meeting held on Saturday, 18 August 2018 at the Difa Nkosi Community Hall, Lebohang

8.6.3 Summary of the PPP activities to be undertaken as part of the EIA Phase

Table 8-5: Summary of PPP activities that were undertaken during the Draft Environment Impact Assessment Phase

Activity	Details	Reference in report
Announcement of Draft EIA/ EMPr	A Notification letter announcing the availability of the Draft EIA/EMPr for public review and comment was emailed to the full database on 18 July 2018. Stakeholders were informed about the updated surface infrastructure layout plans. SMSs to notify stakeholders about the Draft EIA/EMPr were sent to the full database on Wednesday, 18 July 2018. (Public comment period: 03 August – 03 September 2018.	Appendix C6 Announcement of the Draft EIA/EMP Report
Placement of Draft EIA/EMPr	The Draft EIA/EMPr was available to stakeholders at the following public places: ❖ Leandra Public Library ❖ Lebohang Public Library ❖ Devon Public Library A copy of the Draft EIA/EMPr was also made available at the public meeting and the landowners' meeting. The Draft EIA/EMPr was made available on Kongiwe's website. http://www.kongiwe.co.za/publications-view/public-documents/	N/A
Public Meeting	A Public Meeting was held in Leslie with all stakeholders on Saturday, 18 August 2018 at the Difa Nkosi Community Hall. All comments provided at this meeting will be captured in the Comment and Response Report	Appendix C9 Comment and Response Report

Activity	Details	Reference in report
Landowners Meeting	A Landowner Meeting with the directly affected or indirectly affected landowners, was held on Wednesday, 15 August 2018 at 10H00 at the at the at Moedverloren Lapa, Farm Moedverloren, Leslie.	Appendix C9 Comment and Response Report Appendix C8 PowerPoint Presentation

Table 8-6: PPP activities to be undertaken during the Final Environment Impact Assessment Phase

Activity	Details
Announcement of the Final EIA/EMPr	A notification letter announcing the availability of the Final EIA/ EMPr will be emailed to the full database. The Final EIA/ EMPr will be made available on Kongiwe's website.
Submission to the Authorities	The Final EIA/EMPr will be submitted to the DMR, who is the competent authority for the Proposed Project

8.7 Public Participation During the Decision-Making Phase

Once the CA has come to a decision regarding the authorisation of the project, all registered I&APs will be notified of the decision made and the appeal process will be explained.

9 The Baseline Environment and Specialist Findings

All specialist studies were initiated on the basis of the conceptual layout plans (Appendix B) indicating mine infrastructure associated with the proposed mining areas, provided by AOL. A more detailed mine infrastructure plan (Appendix B) was drawn up by Kongiwe based on the outcome and sensitivity findings provided by specialists.

Apart for the Climate, Topography and Geology of the Leslie 1 Project, the remaining environmental aspects will be discussed in terms of their (1) *Status Quo*, (2) specialist methodology of assessment, (3) findings per mine area and (4) conclusions.

9.1 Climate

Ambient air quality in the Highveld region of South Africa is strongly influenced by regional atmospheric movements, together with local climatic and meteorological conditions. The most important of the regional atmospheric movement routes is the direct transport towards the Indian Ocean and the recirculation over the sub-continent around a continental high-pressure system (Scholes, 2002). The seasonal shifts of this regional upper-air high pressure system, northwards during winter and southwards during summer, have a pronounced influence on the airflow and atmospheric stability of the area. During summer, the southward extension of troughs and low-pressure systems enables the tropical easterlies to bring moisture into the region from the east. During winter, the high-pressure belt moves northwards, allowing circumpolar westerlies to displace the tropical easterlies.

In summer, solar radiation and unstable atmospheric conditions result in mixing of the atmosphere and rapid dispersion of pollutants. Summer rainfall also aids in removing pollutants through wet deposition. In contrast, winter is characterised by atmospheric stability caused by the persistent high-pressure system over South Africa. This dominant high-pressure system results in subsidence, causing clear skies and a pronounced temperature inversion over the central plateau region. This inversion layer traps the pollutants in the lower atmosphere, which results in reduced dispersion and a poorer ambient air quality. Preston-Whyte and Tyson (Preston-Whyte & Tyson, 1998) describe the atmospheric conditions in the winter months as highly unfavourable for the dispersion of atmospheric pollutants.

9.1.1 Rainfall

Rainfall data from the South African Weather Services (SAWS) weather station 0477772 W was adopted for the Project, as it was the closest station and contained the longest and most complete record. Daily patched rainfall for this station was extracted from the Lynch (2003) database using the Daily Rainfall Extraction Utility programme for the period 1920/1/1 to 2000/8/31 (79 years and 8 months of rainfall data). The rainfall characteristics are summarised in Table 9-1 and Table 9-2.

The adopted monthly rainfall totals and Mean Annual Precipitation (MAP) of 713 mm, is indicated in Table 9-1. Rainfall in the area is highly seasonal, with majority of the rain falling in the summer months of October to April. January is the wettest month (124 mm), with an average of 9 rain days occurring (a rain day is classified as a day where more than 1 mm of precipitation occurs). The driest month is July, where on average only 6 mm of rainfall is received. Rainfall is mostly in the form of convective thunderstorms, which are often brief, but regularly high in intensity. Tropical and frontal rainfall systems also occur in the region, but are not as common.

Table 9-1: Monthly rainfall and average number of rain days per month

Month	Rainfall (mm)	Average No. of Rain Days
January	124	9
February	102	6
March	85	5
April	40	3
May	19	1
June	7	1
July	6	1
August	7	1
September	24	2
October	73	6
November	117	8
December	108	8
Total	**713**	**51**

Table 9-2 indicates the highest rainfall totals received over consecutive days. The highest rainfall received in one day is 152 mm, which occurred on 28 November 1940. The wettest period for 2 to 30 consecutive days, occurred between 8 February and 5 March 2000. This coincides with the February 2000 floods, which resulted in disastrous flooding, loss of hundreds of lives and severe damage to infrastructure (Dyson, 2000). The extreme rainfall was concentrated in two periods, namely, 5 to 10 February and 22 to 25 February 2000, and was caused by tropical weather systems that moved from West to East over the subcontinent (Dyson, 2000). The combination of the two systems and high levels of antecedent soil moisture from an already wet December resulted in the excessive flooding (Van Biljon, 2000).

Table 9-2: Highest rainfall totals recorded over consecutive days

Number of Consecutive Days	Highest Total Rainfall (mm)	Date/Period
1	152	1940/12/28
2	202	2000/02/08 - 2000/02/09
3	288	2000/02/08 - 2000/02/10
4	318	2000/02/07 - 2000/02/10
5	318	2000/02/06 - 2000/02/10
6	351	2000/02/05 - 2000/02/10
7	396	2000/02/08 - 2000/02/14
10	460	2000/02/05 - 2000/02/14
15	460	2000/02/05 - 2000/02/19
30	566	2000/02/05 - 2000/03/05

9.1.1.1 Storm Rainfall Depths

The storm rainfall depths for Leandra (approximate centre position between the proposed MRAs) were extracted from the Design Rainfall Estimation in South Africa programme (Smithers and Schulze, 2002). The programme uses the six closest rainfall stations to a user specified position, to calculate the storm rainfall depths. The six closest rainfall stations used to calculate the storm rainfall depths for the Project are indicated in Table 9-3.

Table 9-3: Six closest rainfall stations used to calculate the storm rainfall depths

Station Name	Station No.	Distance from Leandra (km)	Record (Years)	Latitude	Longitude	MAP (mm)	Altitude (mamsl)
Leslie (Mun)	0477772 W	0	93	26°22'S	28°55'E	688	1670
Devon (Pol)	0477501 W	14.5	92	26°21'S	28°47'E	655	1660
Strehla	0477762 W	14.5	79	26°14'S	28°56'E	666	1560
Vlakplaas	0477494 W	20.4	26	26°14'S	28°47'E	662	1578
Bombardie Estate	0478039 W	25	40	26°10'S	29°2'E	665	1594
Rasrant	0440637 W	26.2	44	26°36'S	28°51'E	691	1706

The adopted storm rainfall depths for the Project are indicated in Table 9-4 for various storm durations and return periods. A 1:50 year storm event would mean that there is a 1/50 or 0.02 (2 %) chance of that storm occurring in the vicinity of the Project. Similarly, a 1:100 year storm event would mean that there is a 1/100 or 0.01 (1 %) chance of that storm occurring. The highest rainfall of 152 mm recorded at station 0477772 W, would be very close to a 1:100 year 24 hour storm event.

Table 9-4: Storm rainfall depths for the Project

Storm Duration	Return Period / Storm Rainfall Depth (mm)						
min / hr / day	**1:2 yr**	**1:5 yr**	**1:10 yr**	**1:20 yr**	**1:50 yr**	**1:100 yr**	**1:200 yr**
5 min	9	12.1	14.3	16.6	19.7	22.2	24.8
10 min	13	17.4	20.6	23.8	28.3	31.9	35.7
15 min	16.1	21.5	25.5	29.5	35	39.5	44.2
30 min	20.6	27.6	32.6	37.8	44.9	50.6	56.6
45 min	23.8	32	37.8	43.7	51.9	58.5	65.5
1 hr	26.4	35.4	41.9	48.5	57.6	64.9	72.6
1.5 hr	30.5	41	48.4	56.1	66.6	75.1	84
2 hr	33.9	45.4	53.7	62.2	73.8	83.2	93.1
4 hr	40.6	54.5	64.4	74.6	88.6	99.8	111.7
6 hr	45.2	60.6	71.6	82.9	98.5	111	124.2
8 hr	48.7	65.4	77.2	89.4	106.2	119.7	134
10 hr	51.7	69.3	81.9	94.8	112.7	127	142.1
12 hr	54.2	72.7	85.9	99.5	118.2	133.2	149
16 hr	58.4	78.4	92.7	107.3	127.4	143.6	160.7
20 hr	62	83.2	98.2	113.7	135.1	152.3	170.4

Storm Duration	Return Period / Storm Rainfall Depth (mm)						
24 hr	65	87.2	103.1	119.3	141.8	159.8	178.8
1 day	56.3	75.6	89.3	103.4	122.8	138.4	154.9
2 day	69.6	93.3	110.3	127.7	151.7	170.9	191.3
3 day	78.7	105.6	124.8	144.4	171.6	193.4	216.4
4 day	85.6	114.9	135.7	157.1	186.6	210.3	235.4
5 day	91.3	122.6	144.8	167.7	199.2	224.5	251.2
6 day	96.3	129.3	152.7	176.8	210.1	236.8	264.9
7 day	100.8	135.2	159.8	185	219.8	247.7	277.1

9.1.2 Evaporation

The closest weather station to the Project that measures evaporation is the DWS station B1E004, located 30 km east of Leandra. Monthly Symon's Pan evaporation from this station was available from January 1981 to September 2003 and was downloaded from the DWS Hydrological Services website. Symon's Pan evaporation measurements are not a true reflection of open water evaporation, as the pan is located below the ground surface and painted black, which results in the temperature of the water being higher than that of a natural open water body. To convert Symon's Pan measurements to open water evaporation, a monthly open water evaporation factor is used, which was obtained from the WR2012 study. The adopted monthly evaporation for the Project is indicated in Table 9-5. Evaporation is highest over the summer months of September to April, and lowest over the winter months of June and July.

Table 9-5: Symon's Pan and open water evaporation for the Project

Month	Symon's Pan Evaporation (mm)	Open Water Evaporation Factor	Open Water Evaporation (mm)
January	207	0.84	174
February	178	0.88	157
March	166	0.88	146
April	136	0.88	119
May	122	0.87	106
June	92	0.85	78
July	105	0.83	87
August	141	0.81	114
September	183	0.81	148
October	198	0.81	161
November	202	0.82	166
December	205	0.83	170
Total	**1935**	**N/A**	**1626**

Monthly evaporation and rainfall for the Project are graphically depicted in Figure 9-1. As can be observed, evaporation far exceeds rainfall in this region.

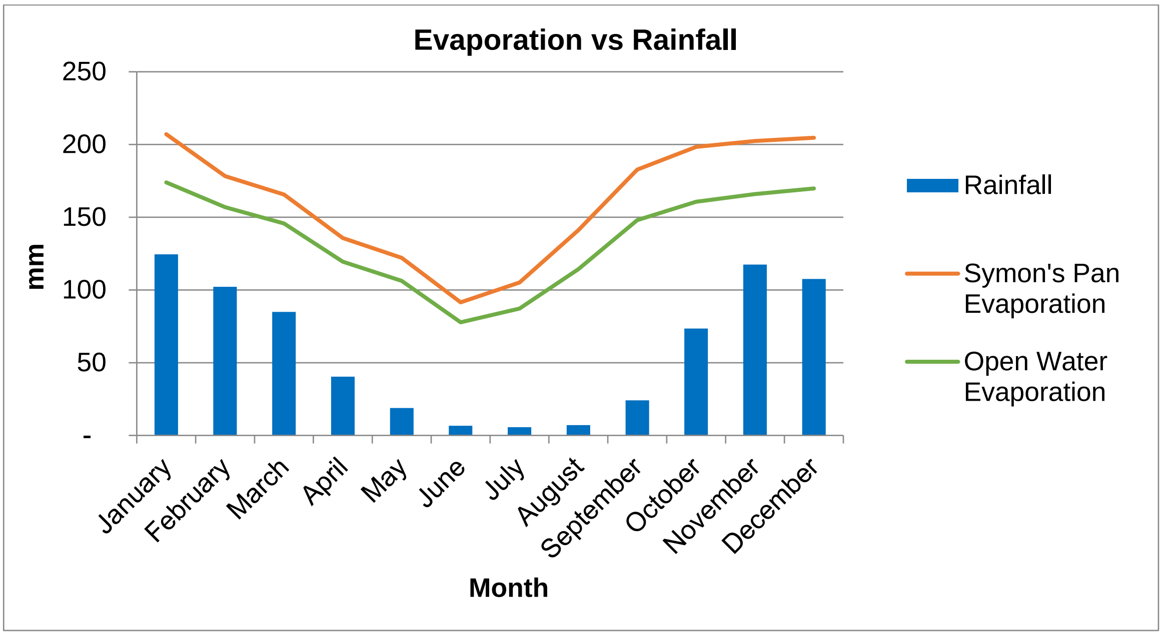


Figure 9-1: Monthly evaporation vs monthly rainfall for the Project

9.1.3 Temperature

Minimum and maximum daily patched temperature data for a 51 year period (1950/1/1 to 2000/12/31) was extracted from the Schulze and Maharaj (2003) database for the closest temperature station in the database to the Project. This was the Secunda weather station (0478330 W) located 30 km south-east of Leandra. The minimum, average and maximum monthly temperatures are summarised in Table 9-6. The warmest months in the region are November to March, with the hottest month being February. The coldest months are June and July. The lowest temperature recorded over this period was -7°C on 26 June 1992. The highest temperature recorded was 35°C on 27 February 1983.

Table 9-6: Minimum, average and maximum monthly temperatures

Month	Average Minimum Temperatures (°C)	Average Temperatures (°C)	Average Maximum Temperatures (°C)
January	13.9	20.0	26.1
February	14.0	20.3	26.5
March	12.5	18.7	25.0
April	9.3	16.1	22.9
May	5.3	12.9	20.4
June	2.4	10.0	17.6
July	2.1	10.0	17.9
August	4.1	12.2	20.4
September	8.1	15.9	23.7
October	10.5	17.5	24.4
November	11.9	18.4	24.9
December	13.0	19.3	25.6

9.1.4 Wind

The predominant wind direction (as measured at the Eskom monitoring station in Leandra) is from the north-north-westerly direction (approximately 14% of the time) (Figure 9-2a). The predominant wind directions (as given by the WRF data for the years 2015-2017 for the project area) are from the north-north-westerly and northerly directions (each for approximately 12% of the time) (Figure 9-2b**).** The average hourly wind speed measured by the Eskom station is 2.19 m/s. The average hourly wind speed predicted by the WRF model is approximately 4.48 m/s. Calm conditions (wind speeds below 0.5 m/s) are experienced approximately 6.45% of the time. The WRF data generally predicts higher wind speeds for the mining site than those measured by Eskom in Leandra.

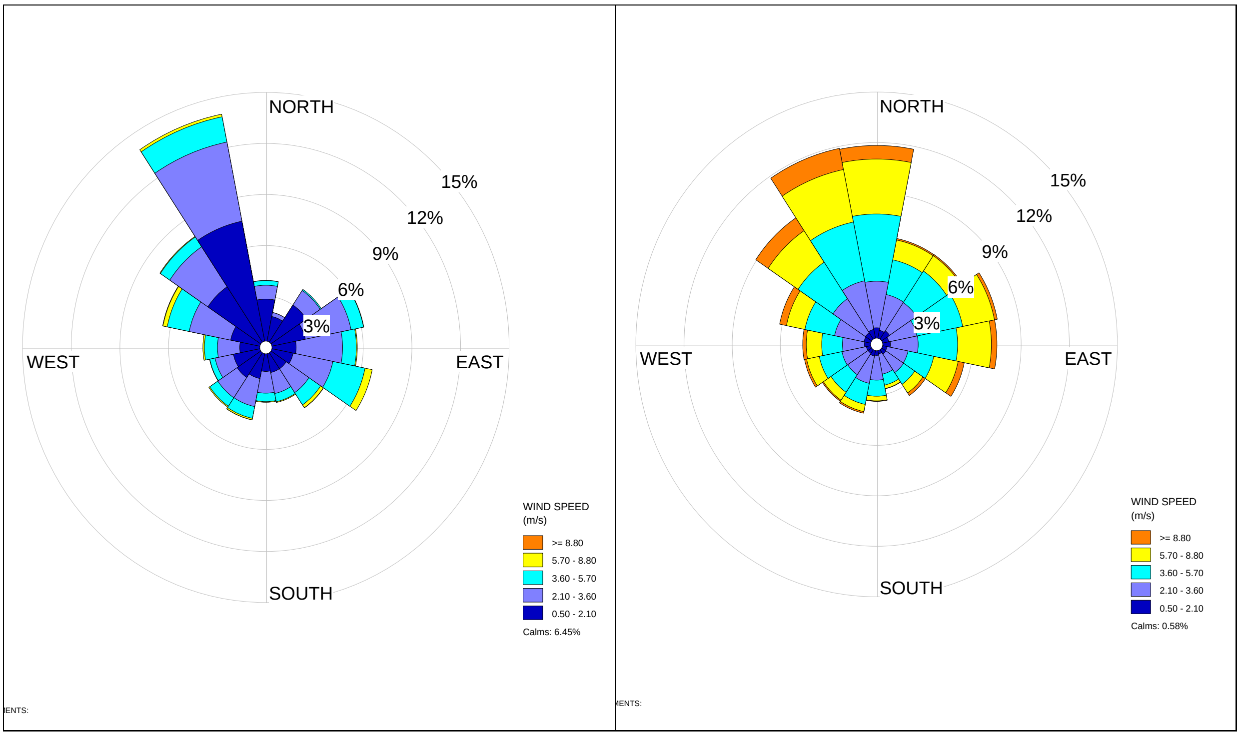


Figure 9-2: Wind roses of the average winds, a) measured at the Eskom weather station in Leandra for the years 2012-2014 and b) produced by the WRF model for the proposed Leslie 1 Project area, for the years 2015-2017.

Minimal seasonal variations in wind direction are observed (Figure 9-3). The highest frequency of wind speeds of greater than 5.7 m/s is experienced in September to October. The lowest frequency of calm conditions (wind speeds less than 0.5 m/s) is also experienced from September to October. The lowest average wind speeds are experienced from March to April. The dominant north-north-westerly wind direction does not change with season (Figure 9-3).

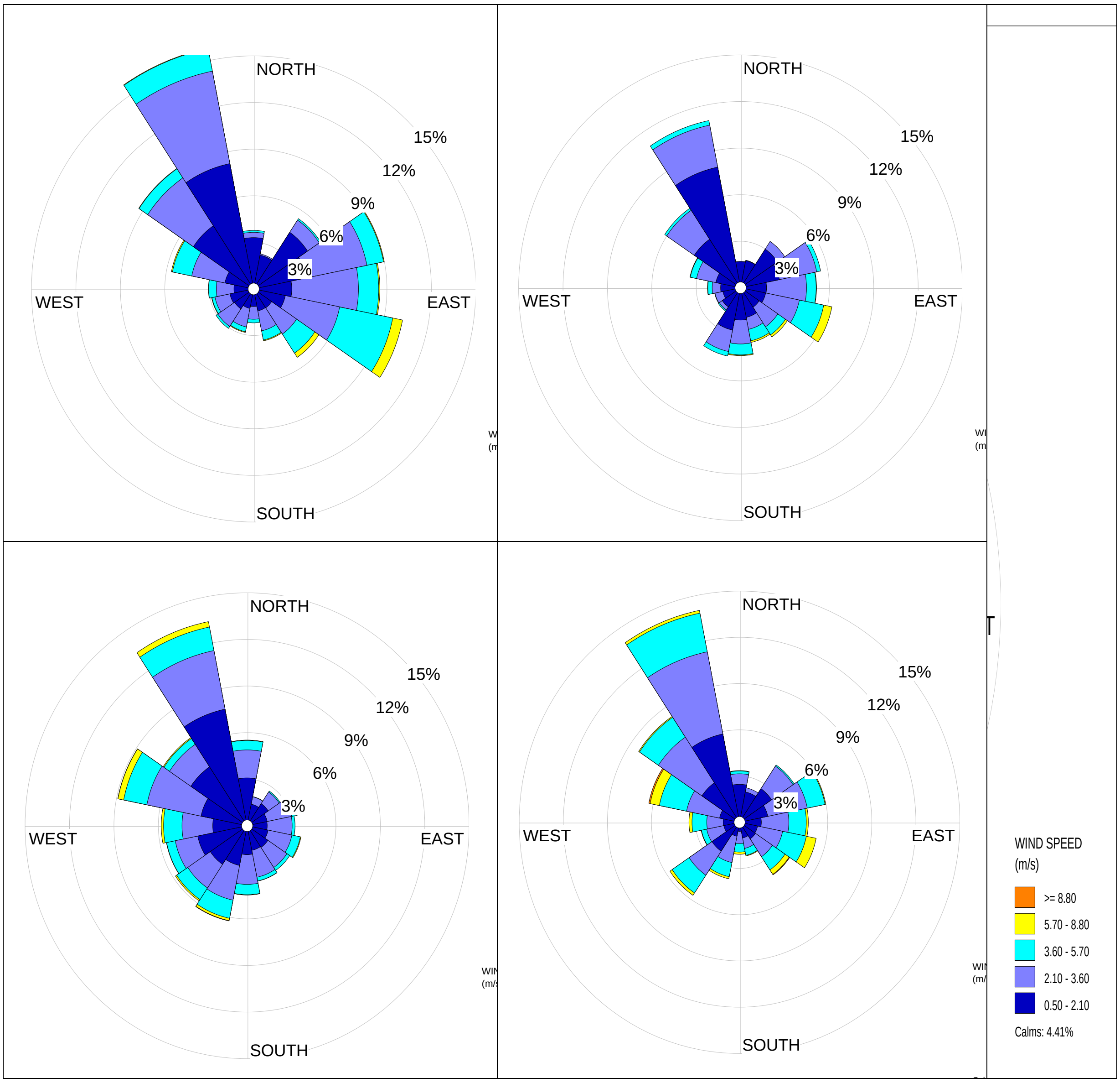


Figure 9-3: Seasonal wind roses of winds measured by the Eskom weather station in Leandra for the years 2012-2014.

The diurnal variation in hourly winds also shows a dominance of winds from the north-north-westerly direction during both the day and night (Figure 9-4Figure 9-4**).** The highest number of calm conditions are observed during the night with the average wind speeds during the day recorded as 2.47 m/s and the average wind speeds at night recorded as 1.9 m/s at the Eskom monitoring station in Leandra.

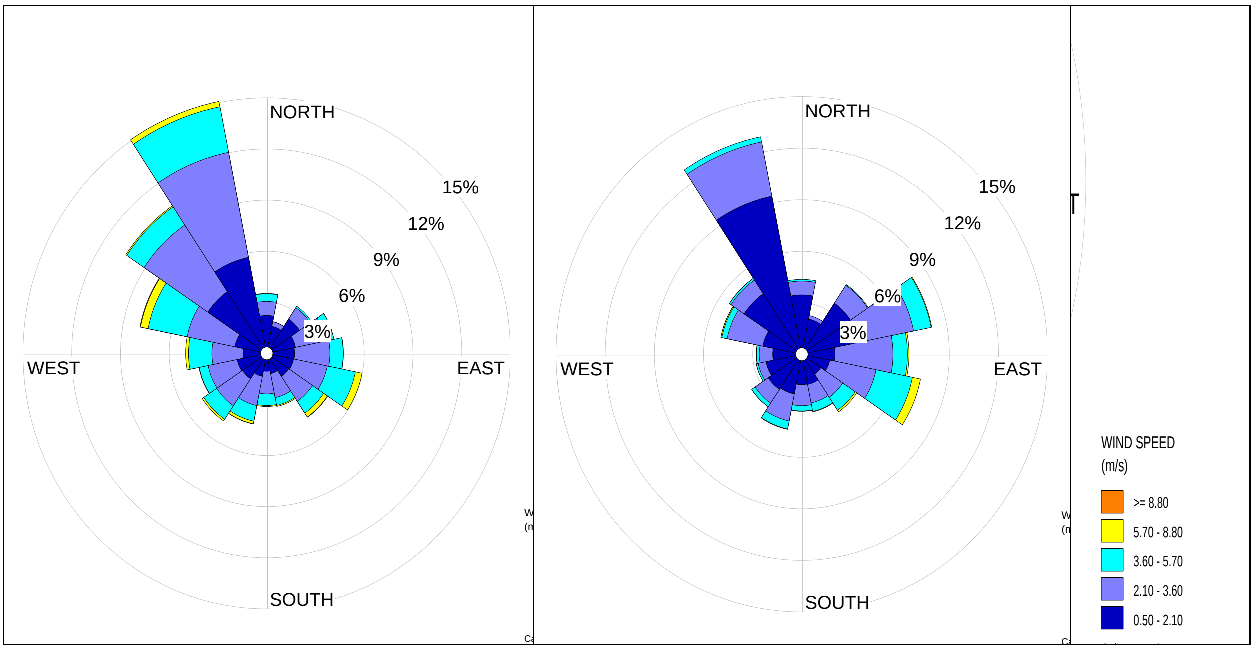


Figure 9-4: Diurnal wind roses of winds measured by the Eskom weather station in Leandra for the years 2012-2014.

9.2 Topography

The terrain characteristic, as described by the Land Type Memoirs, is represented in Table 9-7 below and presented on a topographical map (Figure 9-5).

Table 9-7: Description of the terrain features according to the Land Type Memoir data for the Leslie 1 Project.

Attribute	Leslie 1A	Leslie 1C	Portal 1B	Portal 1D	portal 1E
Terrain Type	A2 - More than 80% of the area has slopes less than 8%				
Slope	Level plains or plateaus with a local relief between 30m – 90m.				
Shape	Concave in a north facing direction	Concave in a south facing direction	Flat	Flat	Slightly down sloping
Land Type	Ab9, Bb4, Ea20	Ea17, Ea20	Bb4	Ea17, Ea20	Ea20

The project is located between 1540 m and 1700 m above sea level, with the lowest point located in the north of the Leslie 1A project site. The town of Leandra and the northern section of Leslie 1C are at the highest relief (approximately 1700 m above sea level). As a result, the landscape is highly variable with extensive sloping plains and a series of ridges slightly elevated over undulating surrounding plains.

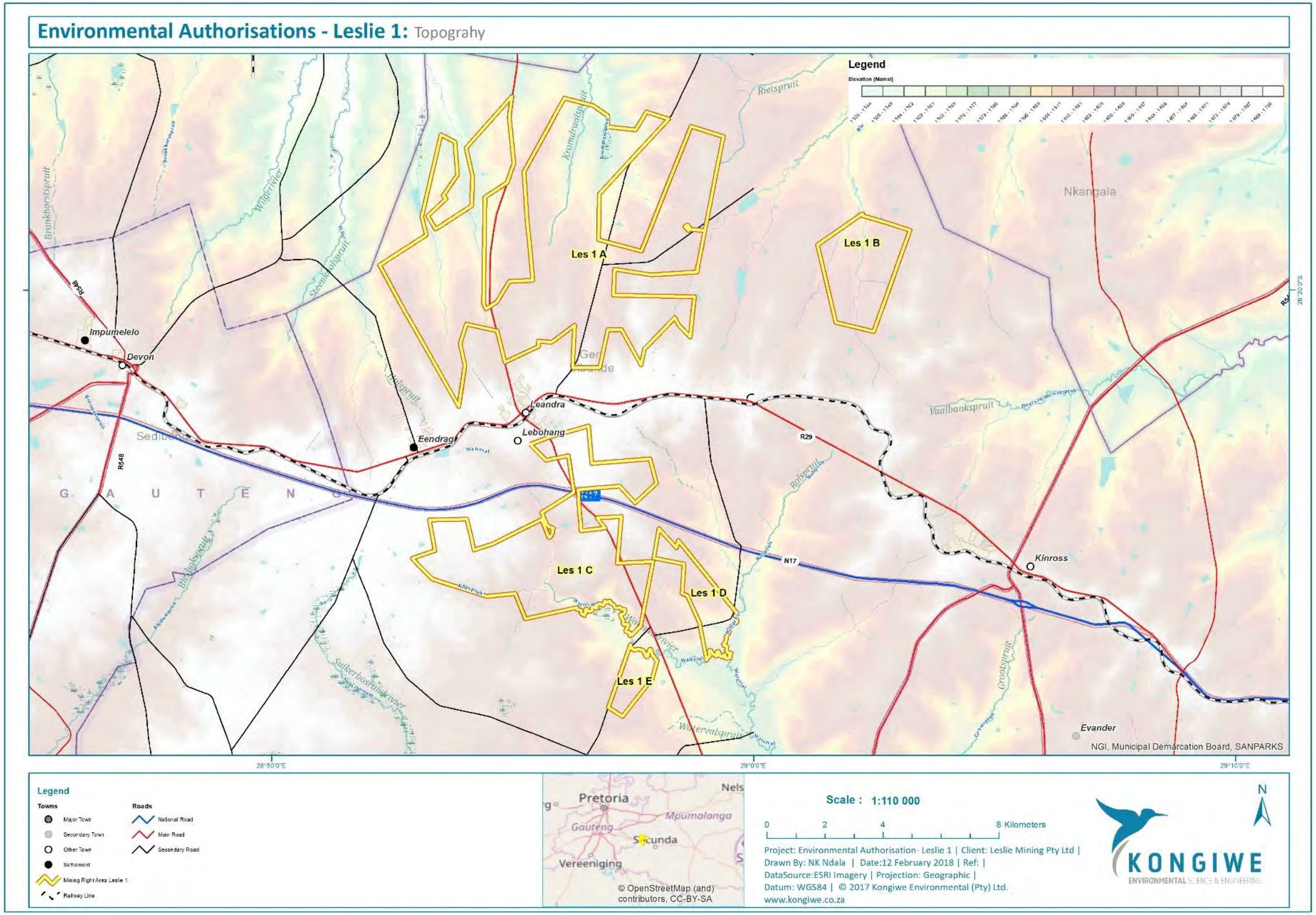


Figure 9-5: Topography

9.3 Geology

All of the known coal deposits in South Africa are hosted in sedimentary rocks of the Karoo Basin, a large retroforeland basin which developed on the Kaapvaal Craton and filled between the Late Carboniferous and Middle Jurassic periods.

The Karoo Supergroup is lithostratigraphically subdivided into the Dwyka, Ecca, and Beaufort Groups, succeeded by the Molteno, Elliot, and Clarens Formations, and the Drakensburg Formation (S.A.C.S., 1980). The coal ranges in age from Early Permian (Ecca Group) through to Late Triassic (Molteno Formation) and is predominantly bituminous to anthracite in rank. This is a classification in terms of metamorphism under the influence of temperature and pressure.

Based on variations in sedimentation, origin, formation, distribution, and quality of the coal seams, 19 coalfields are defined within the Karoo Basin. These variations are in turn attributed to specific conditions of deposition and the local tectonic history characteristic of each area.

The coal bearing Ecca Group has been divided into three subunits: the Pietermaritzburg, Vryheid, and Volksrust Formations. Within the main Karoo Basin of South Africa, the primary economically important coal seams occur in the Vryheid Formation of the Ecca Group.

The Vryheid Formation rests nonconformably on sedimentary rocks of the Dwyka Group, which are interpreted to be the products of glacial, fluvioglacial, and glaciolacustrine depositional environments. Documenting and understanding these glacial deposits is important for understanding coal seam thicknesses and qualities, particularly for the 1 Seam and the 2 Seam. The Dwyka Group in the Witbank and Highveld coalfield areas is mainly represented by glacially deposited diamictites and varved shales.

9.3.1 Highveld Coalfield Geology

The Leslie 1 project area is situated in the Highveld Coalfield of the Karoo Basin. The Highveld and Witbank coalfields are regarded as one morphological province, because of a marked consistency in the coal succession stratigraphy. The two coalfields are separated from each other by an east to west felsite ridge of Pre Karoo age. The coal seams occur in the Vryheid Formation of the Ecca Group.

The strata in which the coal seams occur consist predominantly of fine, medium, and coarse-grained sandstone with subordinate mudstone, shale, siltstone, and carbonaceous shale.

Seven coal seams, with varying degrees of persistence, occur in the Coalfield. They are numbered from the bottom upward, namely 1 Seam, 2 Seam, 3 Seam, Lower 4 Seam, Upper 4 Seam, 4A Seam, and 5 Seam.

Coal deposition was largely controlled by the glacial Pre Karoo topography. This undulating floor strongly influenced the sedimentation patterns and extent of the different coal seams. Lower stratigraphic units lie against highs of Dwyka Tillite and Pre Karoo Bushveld Complex felsites. Thick coal deposits were formed in the deeper parts of the basin, while the coal seams thinned rapidly and petered out against the major palaeo high areas.

9.3.2 Local Project Deposit Geology

The Leslie 1 project area (which forms part of the Highveld Coalfield), has a stratigraphic sequence that is broadly similar to that of the Witbank Coalfield. It is located around the town of Leandra. All of the major seams of the Highveld Coalfield are present, including the 5 Seam, 4A Seam, 4 Seam, 3 Seam, 2 Seam, and 1 Seam. The 4A Seam, 3 Seam, and 1 Seam may not be present throughout the Coalfield and are too thin to mine.

9.4 Soils, Land Use, and Land Capability

A Soil Impact Assessment was undertaken by Kongiwe for the Leslie 1 Project. The sections included herewith are extracted from this report and the full report is provided in Appendix D1.

9.4.1 Environmental Status Quo

9.4.1.1 Land Type

The land type data illustrates typical terrain cross sections with dominant soil types within each of them, spatially presented at a scale of 1:250 000. Spatial representation of the data showed that the region comprises of 4 land types, namely Land Types Ab9, Bb4, Ea17 and Ea20. The location of each of these land types is shown in Figure 9-6 below. A summary of the features of each of the land types is also given in Table 9-8 below.

From Table 9-8 it should be noted that the site is split between an area with more agricultural soils dominant versus an area with vertic clay soils dominant. In terms of land capability, the northern land types (Leslie 1A and 1B) are rated a land capability class 2, which is arable. The soils in the south (Leslie 1C, 1D and 1E) are rated as a land capability class 3 and 4. The restrictions in these areas are limited rooting depth due to the vertic clays found in the Arcadia soils resulting in some areas that can be arable while others can only support grazing.

The vertic dominant soils in the southern portion of the Leslie 1 Project are of a smectitic nature (2:1 clay), with consequent shrinking and swelling properties (Fey et.al., 2010). These soils have a narrower moisture range for cultivation than most other agricultural soils. When wet, these soils saturate easily and drain slowly, causing anaerobic conditions (especially under irrigation) and a deficit of oxygen in the root zone. If allowed to dry out, however, these soils can crack, damaging roots and causing what is known as root pruning.

Surface crusting is also a potential problem, due to the swelling and sealing nature of the soils, which can lead to decreased infiltration rates. However, these black clay soils are naturally fertile, with high cation exchange capacities and moderately high organic carbon contents. Due to the ability of these soils to retain water for prolonged periods of time, cognisance of the potential flood related damage to infrastructure should be taken into account. Lastly, the dispersive nature of smectite clays lends to potential erosion pressures once plant cover is removed or compromised.

Table 9-8: A summary of the Land Type data, interpreted from the land type memoirs, for the Leslie 1 Project

Criteria	Aa9	Bb4	Ea17	Ea20
	Leslie 1A	Leslie 1A and 1B	Leslie 1C and 1D	Leslie 1A, 1C, 1D and 1E
Area	45 022 Ha	234 720 Ha	240 663 Ha	349 249 Ha
Arable Area	500 Ha	15 000 Ha	5 000 Ha	7 000 Ha
Position in the landscape	Mainly Crest and midslope	Mainly Crest and midslope	Mainly Crest, midslope and parts of the footslope	Mainly crest and midslope positions
Slope	Shallow slopes between 1% and 8%.	Shallow slopes between 1% and 5%	Slopes between 2% and 8%	Shallow slopes between 1% and 5%
Effective rooting depth (ED)	Dominant soils with an ED greater 900 mm.	Dominant soils with an ED greater than 800 mm	Dominant soils with and ED of less than 500 mm. Arcadia soils are an exception with an ED between 300 mm and 900 mm.	Dominant soils with an ED less than 400 mm. Arcadia soils are an exception with an ED between 300 mm and 600 mm.
Clay content	Between 20% and 35%. Ideal for agricultural purposes	Between 15% and 30%. Ideal for agricultural purposes	Above 30%. Can be up to 70%.	Above 30%. Can be up to 70%.
Geology	Dolerite; shale, sandstone, clay, conglomerate, limestone and marl of the Ecca Group, Karoo Sequence	Shale, sandstone, clay and conglomerate of the Ecca Group, Karoo Sequence; dolerite; occasional felsitic lava of the Rooiberg Group, Transvaal Sequence	Dolerite; sandstone, grit and shale of the Ecca Group, Karoo Sequence	Dolerite; sandstone, grit and shale of the Ecca Group, Karoo Sequence
Dominant Soil	Hutton – deep red apedal soil	Avalon – yellow brown apedal soil over a soft plinthic horizon	Arcadia – well-structured clay soils, black vertic soils	Arcadia – well-structured clay soils, black vertic soils
Land Capability	Class II – Soils with a good agricultural potential	Class II – Intense Cultivation. Soils with a good agricultural potential	Class III – Moderate Cultivation	Class IV – Light Cultivation/Intense Grazing Potential

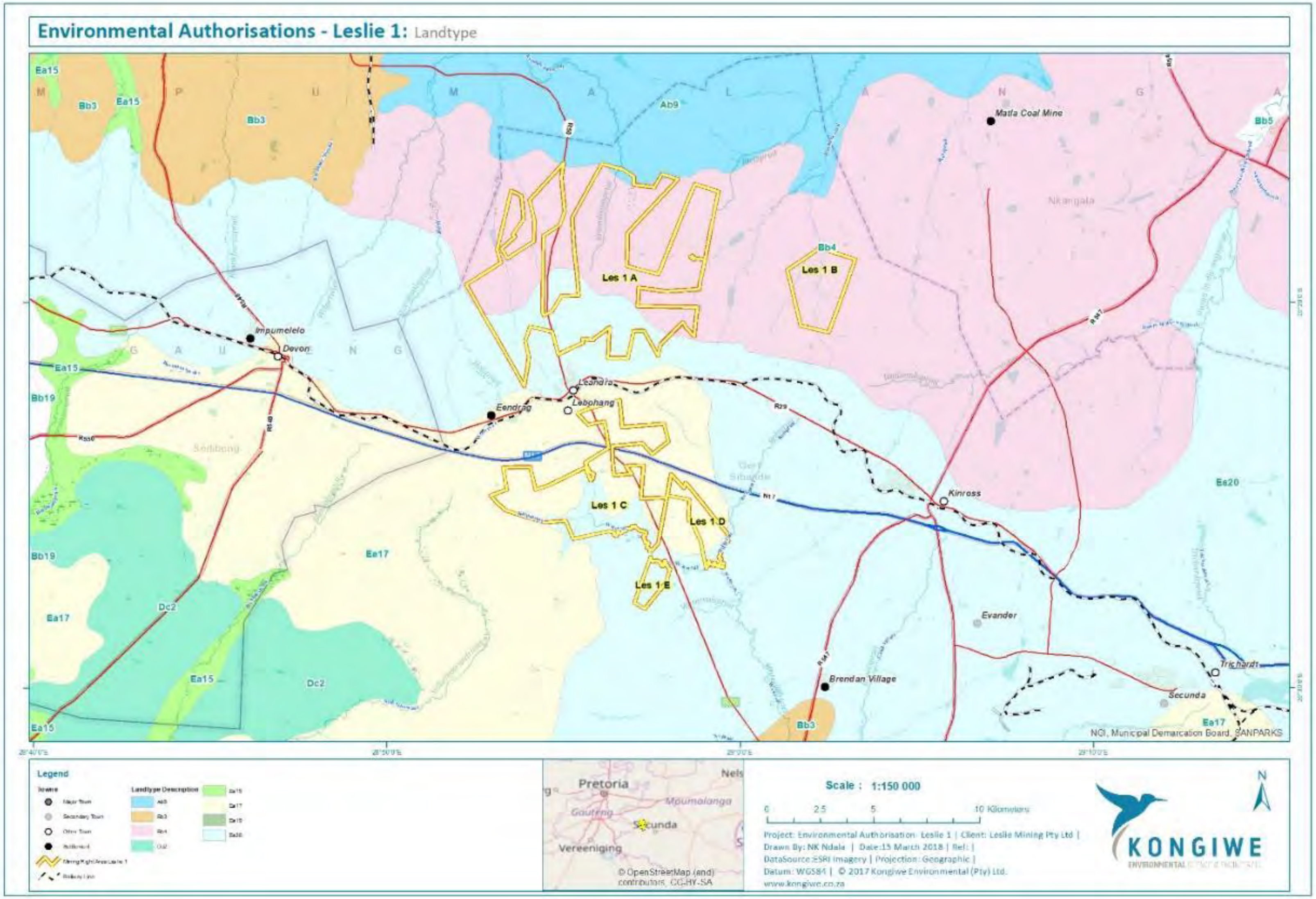


Figure 9-6: Land Type map for the Leslie 1 Project Area

9.4.1.2 Land Use

The impacts of mining on high potential soil, is receiving more and more attention by I&APs. This increased attention is brought about by increasing numbers of mining right applications, where the present dominant land uses are agriculture. Two main agricultural activities are normally at stake, these are arable areas and grazing areas.

Current land use activities within the Leslie 1 Project area is largely dominated by natural grasslands, constituting 4178.271 ha of the MRA (9 750 ha). A fairly large portion of the study area comprises of agricultural activities; dominated by livestock farming and some cultivated crops and pastures. Cultivated lands collectively constitutes approximately 4502.417 ha, amounting to 46% of the MRA.

From an agricultural perspective, there is little evidence of misuse, given that around 42% of the area is defined as arable. The clear majority of the wetlands and pans observed on site were delineated prior to the establishment of the agricultural lands. The land under consideration for the Leslie 1 Project is well maintained and man-made features within the MRA refer to agricultural infrastructure and housing. Below are a few photographs of the site indicating the main land uses.

Figure 9-7: Vast grazing lands of Leslie 1C

Figure 9-8: Cattle Handling Facility at Leslie 1A with Anthropogenic Soils

Figure 9-9: Soybean rows at Leslie 1A

Figure 9-10: Maize cultivation at all sites

Figure 9-11: Vast grazing lands of Leslie 1C

Soil forms have been defined on the basis of the super-imposition of defined diagnostic topsoil and subsoil horizons and other defined materials. On this basis a total of 28 different soil forms were classified for the Leslie 1 Project. Each form (and associated abbreviation) has been assessed in terms of the total area in hectares that it occupies for the Leslie 1 Project, as well as the percentage area in relation to the project area as a whole where the MRA is 9 750 Ha.

As stated above, land capability of an area is the combination of the inherent soil properties and the climatic conditions. In addition, it is influenced by other landscape properties such as slope and drainage patterns that may inhibit agricultural land use or result in the development of specific land functionality such as wetlands. It is thus necessary to represent each soil form in terms of their ability to influence the land capability potential for the Leslie 1 Project site.

Table 9-9 represents a summary of the soils forms identified for the Leslie 1 Project. The soils vary significantly in physical and chemical composition over the different areas. They are strongly influenced by the underlying rocks (geology) from which they were derived, as well as by their position in the landscape and the origin of the parent material *(in-situ* versus colluvium/alluvium derived).

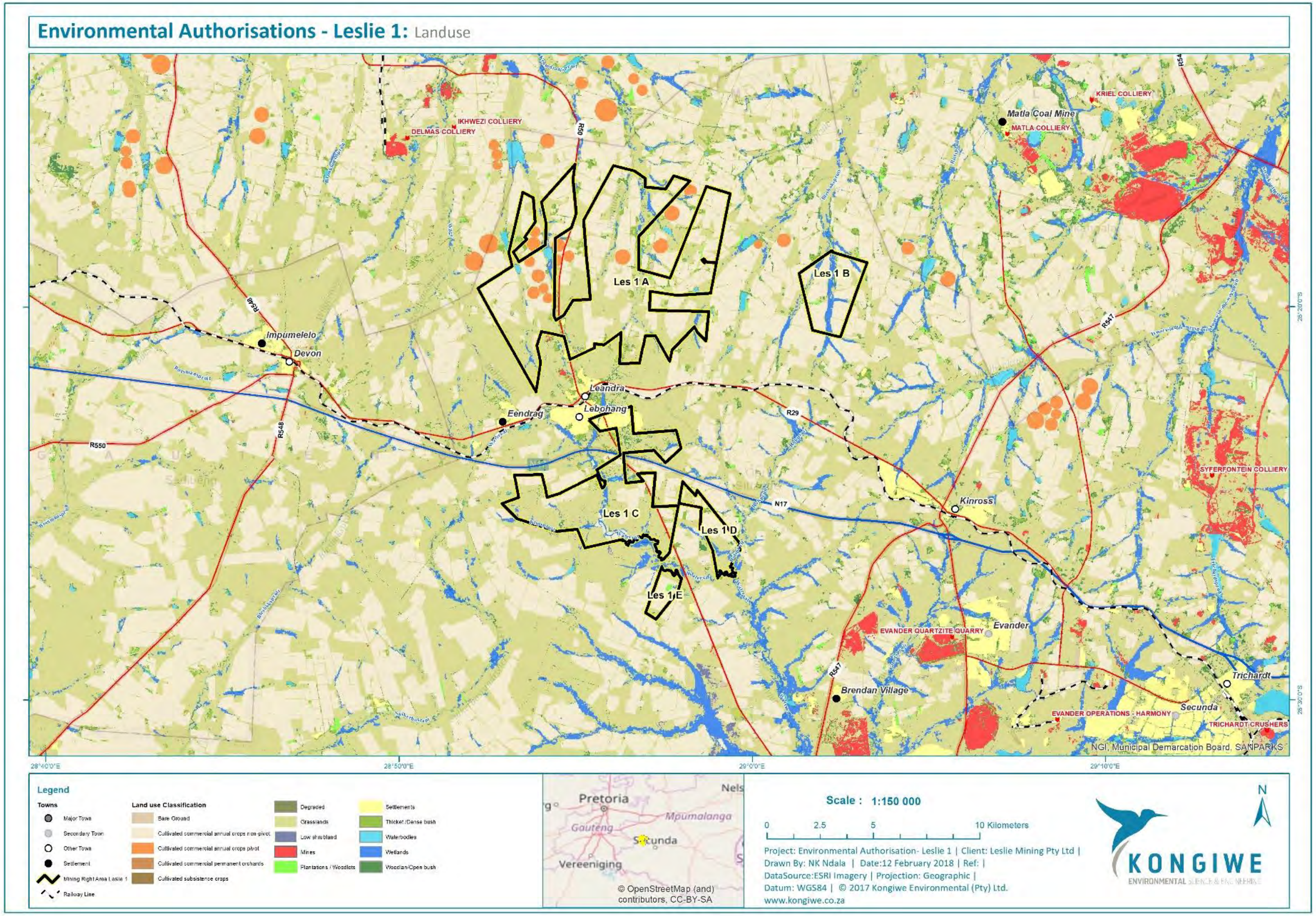
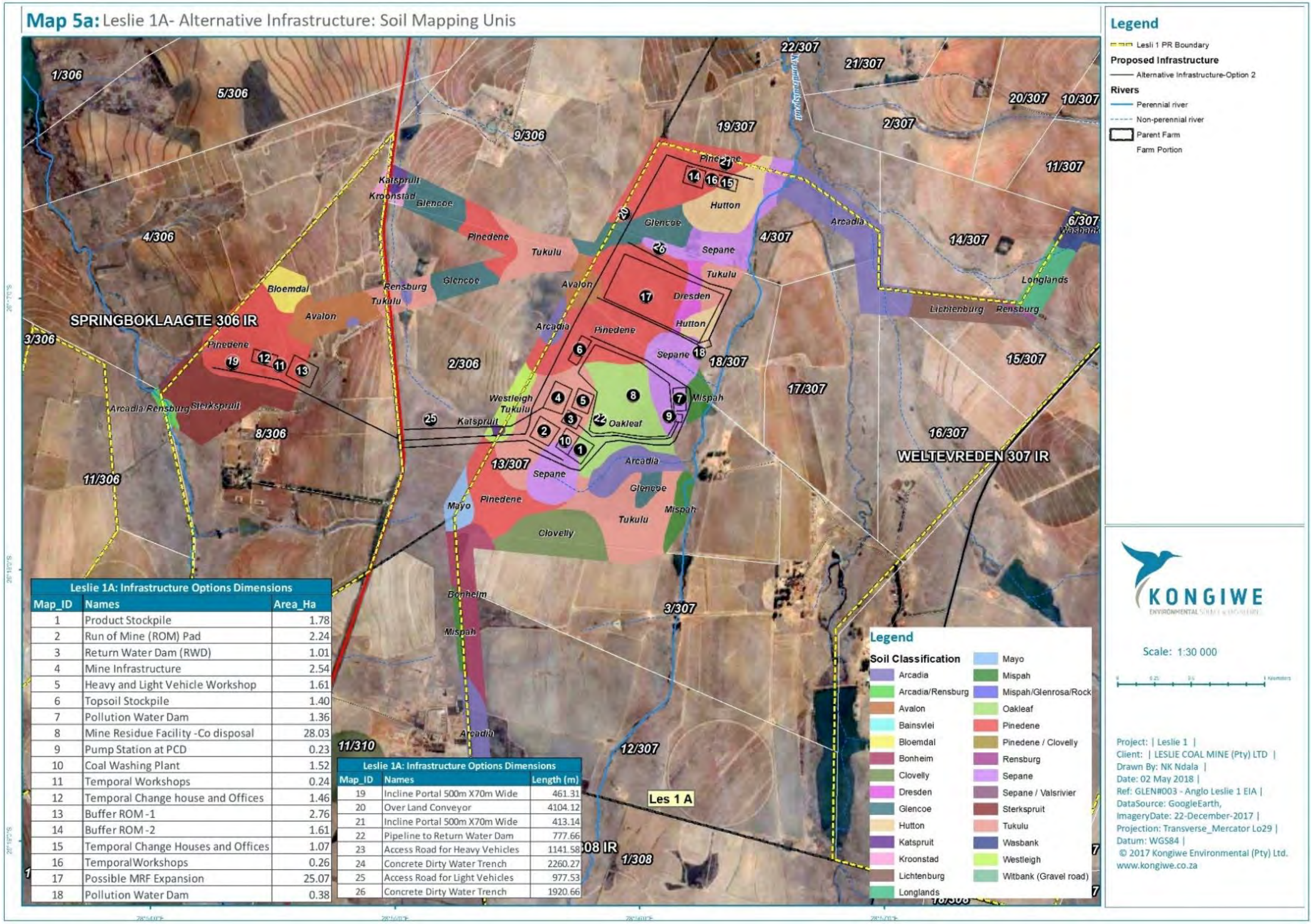


Figure 9-12: Pre-Mining land use of the Leslie 1 Project Area



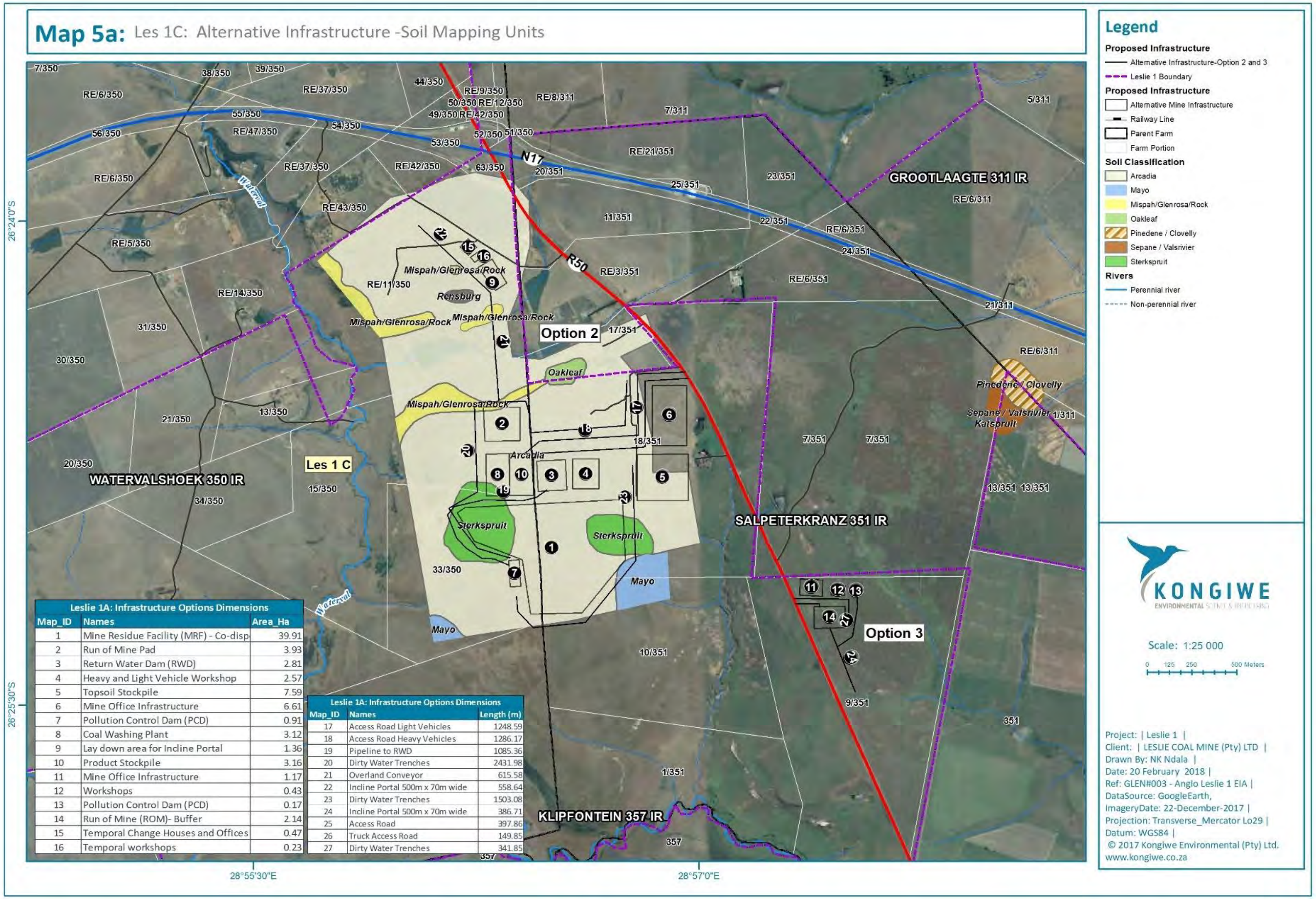
Leslie 1A: Infrastructure Options Dimensions

Map_ID	Names	Area_Ha
1	Product Stockpile	1.78
2	Run of Mine (ROM) Pad	2.24
3	Return Water Dam (RWD)	1.01
4	Mine Infrastructure	2.54
5	Heavy and Light Vehicle Workshop	1.61
6	Topsoil Stockpile	1.40
7	Pollution Water Dam	1.36
8	Mine Residue Facility -Co disposal	28.03
9	Pump Station at PCD	0.23
10	Coal Washing Plant	1.52
11	Temporal Workshops	0.24
12	Temporal Change house and Offices	1.46
13	Buffer ROM -1	2.76
14	Buffer ROM -2	1.61
15	Temporal Change Houses and Offices	1.07
16	TemporalWorkshops	0.26
17	Possible MRF Expansion	25.07
18	Pollution Water Dam	0.38

Leslie 1A: Infrastructure Options Dimensions

Map_ID	Names	Length (m)
19	Incline Portal 500m X70m Wide	461.31
20	Over Land Conveyor	4104.12
21	Incline Portal 500m X70m Wide	413.14
22	Pipeline to Return Water Dam	777.66
23	Access Road for Heavy Vehicles	1141.58
24	Concrete Dirty Water Trench	2260.27
25	Access Road for Light Vehicles	977.53
26	Concrete Dirty Water Trench	1920.66

Figure 9-13: Soil forms identified for Leslie 1A based on the revised surface infrastructure layout.



Leslie 1A: Infrastructure Options Dimensions

Map_ID	Names	Area_Ha
1	Mine Residue Facility (MRF) - Co-disp	39.91
2	Run of Mine Pad	3.93
3	Return Water Dam (RWD)	2.81
4	Heavy and Light Vehicle Workshop	2.57
5	Topsoil Stockpile	7.59
6	Mine Office Infrastructure	6.61
7	Pollution Control Dam (PCD)	0.91
8	Coal Washing Plant	3.12
9	Lay down area for Incline Portal	1.36
10	Product Stockpile	3.16
11	Mine Office Infrastructure	1.17
12	Workshops	0.43
13	Pollution Control Dam (PCD)	0.17
14	Run of Mine (ROM)- Buffer	2.14
15	Temporal Change Houses and Offices	0.47
16	Temporal workshops	0.23

Leslie 1A: Infrastructure Options Dimensions

Map_ID	Names	Length (m)
17	Access Road Light Vehicles	1248.59
18	Access Road Heavy Vehicles	1286.17
19	Pipeline to RWD	1085.36
20	Dirty Water Trenches	2431.98
21	Overland Conveyor	615.58
22	Incline Portal 500m x 70m wide	558.64
23	Dirty Water Trenches	1503.08
24	Incline Portal 500m x 70m wide	386.71
25	Access Road	397.86
26	Truck Access Road	149.85
27	Dirty Water Trenches	341.85

Figure 9-14: Soil forms identified for Leslie 1C based on the revised surface infrastructure layout

Table 9-9: Consolidated results of the soil forms occurring at the surface infrastructure site of the Leslie 1 Project.

Soil Form	Areas of Soil Forms Surveyed(Ha)					Total Area Surveyed (Ha)	Total Area Surveyed (%)
	Leslie 1A	Leslie 1C	Portal 1B	Portal 1D	Portal 1E		
Clovelly (Cv)	19,66					19,66	2,11%
Hutton (Hu)	21,27					21,27	2,29%
Bainsvlei (Bv)			3,11			3,11	0,33%
Pinedene/Clovelly (Pn/Cv)				5,61		5,61	0,60%
Bloemdal (Bd)	6,49					6,49	0,70%
Avalon (Av)	19,65					19,65	2,11%
Oakleaf (Oa)	30,77	2,44				33,21	3,57%
Pinedene (Pn)	144,79			5.60		144,79	15,56%
Glencoe (Gc)	37,74		1,07			38,81	4,17%
Lichtenburg (Li)	13,78					13,78	1,48%
Tukulu (Tu)	83,58					83,58	8,98%
Wasbank (Wa)	16,14				0,32	16,46	1,77%
Longlands(Lo)	9,16					9,16	0,98%
Sepane/Valsrivier (Se/Va)				4,44		4,44	0,48%
Katspruit (Ka)	2,47			0,18	0,47	3,12	0,34%
Sterkspruit (Ss)	28,82	21,45				50,27	5,40%
Sepane (Se)	47,85					47,85	5,14%
Westleigh (We)	6,72					6,72	0,72%
Arcadia (Ar)	56,73	267,65			3,99	328,37	35,29%
Bonheim (Bo)	17,11					17,11	1,84%
Arcadia/Rensburg (Ar/Rg)	2,05					2,05	0,22%
Dresden (Dr)	5,16		0,94			6,1	0,66%
Rensburg (Rg)	1,03	1				2,03	0,22%

Soil Form	Areas of Soil Forms Surveyed(Ha)					Total Area Surveyed (Ha)	Total Area Surveyed (%)
	Leslie 1A	Leslie 1C	Portal 1B	Portal 1D	Portal 1E		
Kroonstad (Kd)	2,78					2,78	0,30%
Mayo (My)	5,65	9,98				15,63	1,68%
Mispah/Glenrosa/Rock (Ms/Gs/R)		15,98				15,98	1,72%
Mispah (Ms)	12,25					12,25	1,32%
Witbank (Wb)					0,32	0,32	0,03%
TOTALS	591,65	318,5	5,12	10,23	5,1	930,6	100%

Land Capability (DAFF, 2017)	Class and Colour
High to Very High	**13 and 12**
High	**11**
Moderate to High	**10 and 9**
Moderate	**8**
Low to Moderate	**7 and 6**
Low	**5**
Very Low	**2**

9.4.1.3 Soil Delineation

The major soil forms that generally have similar characteristics were grouped together in management units to simplify the data for interpretation purposes (Table 9-10). Management units for the Leslie 1 Project include:

- Agricultural soils;
- Structured and Swelling Soils;
- Soils with Dense clay layers in the subsoils;
- Shallow and Rocky soils;
- Transitional and Poor Transitional soils; and
- Wetland Soils.

Table 9-10: Delineation of the different soil forms within their management units as well as their corresponding land capability

Management Unit	Land Capability (Chamber of Mines)	Land Capability (DAFF, 2017)	Soil Forms	Area (Ha and %)
Agricultural soils	Arable	Classes 9, 10, 11, 12 and 13	Clovelly, Hutton, Bloemdal, Avalon, Oakleaf, Pinedene, Glencoe, Lichtenburg, Tukulu, Pinedene/Clovelly, Wasbank and Bainsvlei.	406,42Ha 43.6%
Swell/Shrink Soils	Grazing	Classes 5 and 6	Mayo and Arcadia	344Ha 36.97%
Soils with Dense clay layers in the subsoils		Classes 6, 7 and 8	Sepane, Bonheim, Sterkspruit, , and Sepane/Valsrivier	119,67Ha 12.86%
Shallow and Rocky soils	Wilderness	Class 2 and 5	Mispah and Mispah/Glenrosa/Rock	28,23Ha 3%
Anthropic Soils			Witbank	0,32Ha 0,03%
Transitional and Poor Transitional soils	Wetland	Class 6, 7 and 8	Longlands, Dresden and Westleigh	21,98Ha 2,4%
Wetland Soils		Classes 5, 6 and 7	Katspruit, Kroonstad and Rensburg Arcadia/Rensburg	10Ha 1.1%

12 soil forms have been identified as having a <u>high agricultural potential</u> for the Leslie 1 Project. 43.6% of the Leslie 1 Project site is comprised of these soil forms, of which Pinedene is the most dominant (specifically at Leslie 1A).

2 soil forms have been identified as having <u>shrinking and swelling properties</u>. 37% of the Leslie 1 Project site is comprised of these soil forms, of which Arcadia is the most dominant (particularly at Leslie 1C and Portal 1E).

9.4.1.4 Land Capability

The pre-mining land capability for the Leslie 1 Project area is given in Table 9-10. It was concluded that 43.6% of the entire project area demarcated for surface infrastructure or portals is **Arable** land. It is the agricultural soils with good internal drainage and a deep effective rooting depth that make up the majority of this land capability class. Where the effective depth is less than 30 cm and soils have greater chemical and physical limitations, the land is better suited to annual and non-perennial sweetveld grasses. These lands are ideal **Grazing** lands and constitute 51.5% of the project area. Soils which indicate zones of seasonal or permanent wetness are classified as **Wetland** soils. Wetlands play an important role in sustaining various ecosystem functions, and it is thus prevalent that these are protected. 3.4% of the land on the Leslie 1 project site consist of wetlands. The remaining 1.3% of land is only suited to that of **Wilderness**. Here land has either been significantly altered or disturbed that no longer serves a functional role in the landscape.

Table 9-11: Pre-Mining Land Capability for each surface infrastructure or portal area

Land Capability	Leslie 1A	Leslie 1C	Portal 1B	Portal 1D	Portal 1E
Arable	66.5%	0.77%	81.6%	54.8%	6.3%
Grazing	26.5%	98.9%	0%	43.4%	78.1%
Wetland	5%	0.3%	18.3%	1.7%	9.2%
Wilderness	2%	0%	0%	0%	6.3%

Map 5b: Pre-Mining Land Capability- Alternative Infrastructure

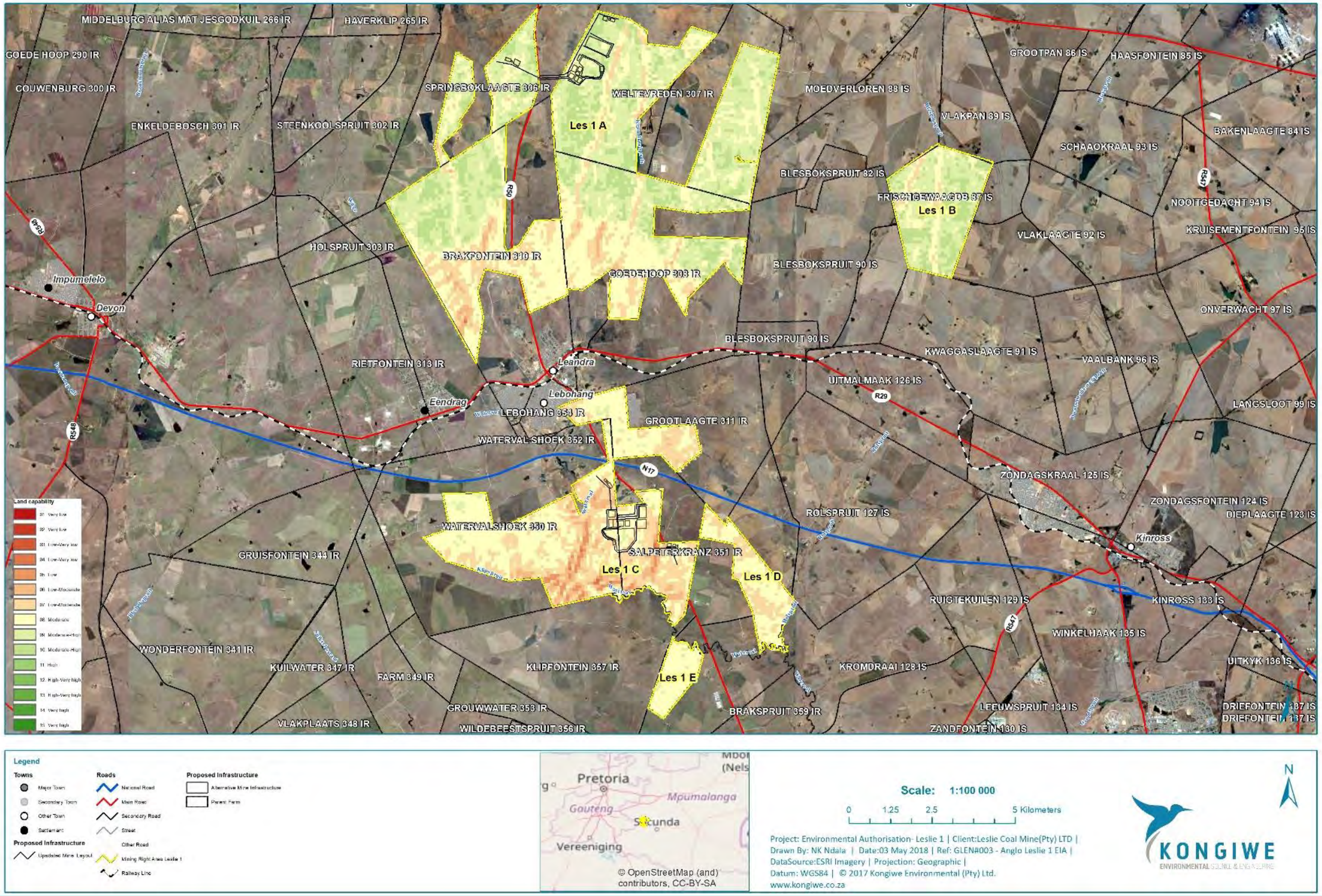


Figure 9-15: Land Capability for the Leslie 1 Project as described by the DAFF (2017) Raster Projections and Land Capability Model.

9.4.1.5 Agricultural Potential

The summer field crops observed on the farms visited during the field investigation included Maize, Soybean and Oats. Summer perennial pasture grasses observed were *Eragrostosis curvula*, *Panicum maximum*, *Digitaria eriantha* and *Cynodon dactylon*. The agricultural potential of the site varies due variation of soil forms and soil conditions on site. Large areas are covered by deep agricultural soils that are of high potential. These soils have, for the most part, already been tilled and are currently being used for dryland and irrigated agriculture. The agricultural potential of the Leslie 1 project varies from moderate to high due to a range of soil conditions. In many cases these soils are structured and of high clay content but of limited depth. The main land use then is grazing, and it is also this land use that is considered to be the most viable for the bulk of the area.

In addition to soil characteristics, climatic characteristics need to be assessed to determine the agricultural potential of a site. The site falls within a climate capability class of 4 (moderately limiting), which has a moderately restricted growing season due to low temperatures and severe frost. The climate has a good yield potential for a moderate range of adapted crops, but planting date options more limiting than C3. The rainfall characteristics are of primary importance and to provide an adequate baseline for the viable production of crops rainfall quantities and distribution need to be sufficient and optimal. The combination of the above-mentioned factors will be used to assess the agricultural potential of the soils on the site.

Table 9-12: Agricultural Potential for the Leslie 1 Project site according to Land Capability for each soil management unit

Management Unit	Land Capability (Chamber of Mines)	Agricultural Potential Key-note Determinates	Agricultural Potential
Agricultural soils	Arable	Deep sandy soils with good drainage. Adequate distribution of soils and size of high potential soil area to constitute a viable economic management unit.	High Potential Arable Land
Swell/Shrink Soils	Grazing	Plant available water is low, but the soils are nutrient rich. Root pruning may occur during dry spells, especially when the crops are young.	High Potential Grazing Low to Medium Potential Arable Land
Soils with Dense clay layers in the subsoils		Structure is very strong and may impede roots.	High Potential Grazing Low to Medium Potential Arable Land
Shallow and Rocky soils	Wilderness	Shallow depth for root development, contains rocks in the matrix and are susceptible to erosion. Internal drainage is often hampered.	Low to Medium Potential Grazing Land Drainage Complex
Anthropic Soils		Completely altered and disturbed	Low Grazing Potential No Arable Land Potential

Management Unit	Land Capability (Chamber of Mines)	Agricultural Potential Key-note Determinates	Agricultural Potential
Transitional and Poor Transitional soils	Wetland	Imperfectly or poorly drained soils.	Low Arable Potential Moderate to low Grazing potential
Wetland Soils		Poorly drained soils, prone to waterlogging.	Very Low Arable Potential Low Grazing potential

Dryland Production

The largest part of the Leslie 1A and Portal 1B study site is currently used for crop production. All the soil forms encountered at the site are suitable or highly suitable for crop production with the exception of the Katspruit, Kroonstad and Sterkspruit soil forms. The annual precipitation of 650 to 900 mm is sufficient for successful maize production. The plinthic soils such as Longlands, Avalon, Glencoe and Lichtenburg are prized by maize farmers on the Highveld because the plinthic layer dams water in the lower profile which can be used by maize roots during periods of drought. The Hutton, Clovelly and Oakleaf soil forms are suitable for crop production. Signs of old crop fields in these areas have been observed during the site visit. However, these sections are fragmented now as a result of the mine infrastructure and has not been used for several years for crop cultivation.

Leslie 1C and Portal 1D and 1E are currently used for grazing capacity lands (with some agriculture) as discussed below.

Irrigated Production

Irrigation infrastructure is currently used on Leslie 1A, Portions of 1C and Portal 1B. All sites had large dams with irrigation potential. All the agricultural soils identified on site are suitable for irrigated crop production. The soil forms at Leslie 1C and Portal 1D and 1E identified on the site have low suitability for irrigated crop production as the presence of phreatic water in transitional, wetland and strongly structures soil forms. The poor or imperfect drainage of these soils may prove problematic during high rainfall years when dry land production methods will suffice. Portions of Leslie 1C and 1E do have some potential for this production method should it ever become a future land use possibility.

Grazing Capacity

The grazing capacity of a specified area for domestic herbivores is given either in large animal units per hectare or in hectares per large animal unit. One large animal unit is regarded as a steer of 450kg whose weight increases by 500g per day on veld with a mean energy digestibility of 55%. The grazing capacity of the veld for the study area is 7 – 10 hectares per large animal unit or large stock unit (Morgenthal et al., 2005). These large stock units can further be converted to include small grazers and browsers such as some goat and/or sheep species.

Areas where the wetland soils are dominant (Katspruit, Kroonstad and Rensburg soil form) and highly erodible soils shallow and/or rocky soils and duplex (Sterkspruit, Sepane and Valsvivier) are more suitable for cattle farming than crop production. Cattle farming is a viable long-term land use of certain parts of the site as long as the field quality is maintained by never exceeding the grazing capacity. Land use after decommissioning of the Leslie 1 Project should aim to re-establish the cattle farming potential of the land.

9.4.2 Specialist Assessment Methods

This study was conducted in three phases according to the objectives as indicated by the Applicant and the EAP. This included:

- Phase 1: Desktop investigation and field preparation
  - Historic climatic conditions;
  - The terrain features using 5m contours;
  - The base soils information from the land type database (Land Type Survey Staff, 1972 - 2006);
  - The new land capability raster data as obtained from Department of Agriculture, Forestry and Fisheries that was released in 2017; and
  - The geology for the proposed mining site.
- Phase 2: Soil Survey and Analysis
  - Field Investigation;
  - Site conclusions;
  - Laboratory analysis; and
  - Soil and land capability mapping.
- Phase 3: Soil impact assessment, recommendations and management requirements

9.4.3 Specialist Findings

The overall impacts on the soils of the site due to the proposed mining activities are significant. Several sensitive areas have been identified. Each of the sensitive features will be discussed separately below.

9.4.3.1 Natural Wetland Soils

Wetlands and their associated riparian areas are generally regarded as especially sensitive landscapes under statutory protection, and as such must not be disturbed, polluted, cultivated or overgrazed without a license. Such areas have a high significance from a preservation point of view, since they perform important hydrological functions, and are major contributors to the biodiversity of an area. It is typically recommended that a 500m buffer be placed around these wetland features as to preserve their functionality and integrity.

9.4.3.2 Natural Wetland Drainage Features

A limited number of short disconnected slightly concave ephemeral drainage features exist within the Leslie 1 Project site. These would have been identified in the Surface Water Study. Typically, these features are occupied by the aforementioned natural wetland soils and are thus considered sensitive. The free (uninterrupted) flow of water (surface and sub-surface) must be promoted in all areas. It is typically recommended that a 500m buffer be placed around these wetland features as to preserve their functionality and integrity.

9.4.3.3 Wetland/Riparian Vegetation

Riparian vegetation (as identified in the Biodiversity/Surface Water Studies) must ideally be preserved for the following reasons: represents a major contributor to the bio-diversity in any area; stabilizes drainage areas; limits and slows runoff; traps sediments; and promotes evapotranspiration. Recommendations made within the Biodiversity study, which specifically relate to wetland/riparian vegetation, should be adhered to.

9.4.3.4 Erodible Soils

In-situ soil erosion of sheet and gully erosion was observed on the Leslie 1 Project site. The vast majority of the erosion appears to have occurred in the relatively recent past, the result of the introduction of cattle (mostly now gone), over-grazing, burning, cycles of consecutive years of drought, consequent relatively bare surfaces at the commencement of the rainy season, and then rain drop and sheet erosion during heavy thunderstorms. Soil fertility and nutrient cycling will have been severely affected by the loss on average of over half of the A-horizon, where organic matter (now mostly lost) is mostly concentrated.

The soils in the study area that are likely to be more sensitive to erosion than others include the following:

- Pedocutanic soils, due to a slow-moderate subsoil permeability; and
- Shallow soils, due to a relatively impermeable (to water) depth limiting horizon within 10 - 30cm below the soil surface, the aforementioned being either hard plinthite (Dresden form) or hard rock (Mispah form and the Mispah/Glenrosa/Rock complex).

Figure 9-16: Typical erosion of soil seen on site. Here the profile has been subjected to erosion is a result of water movement over the land.

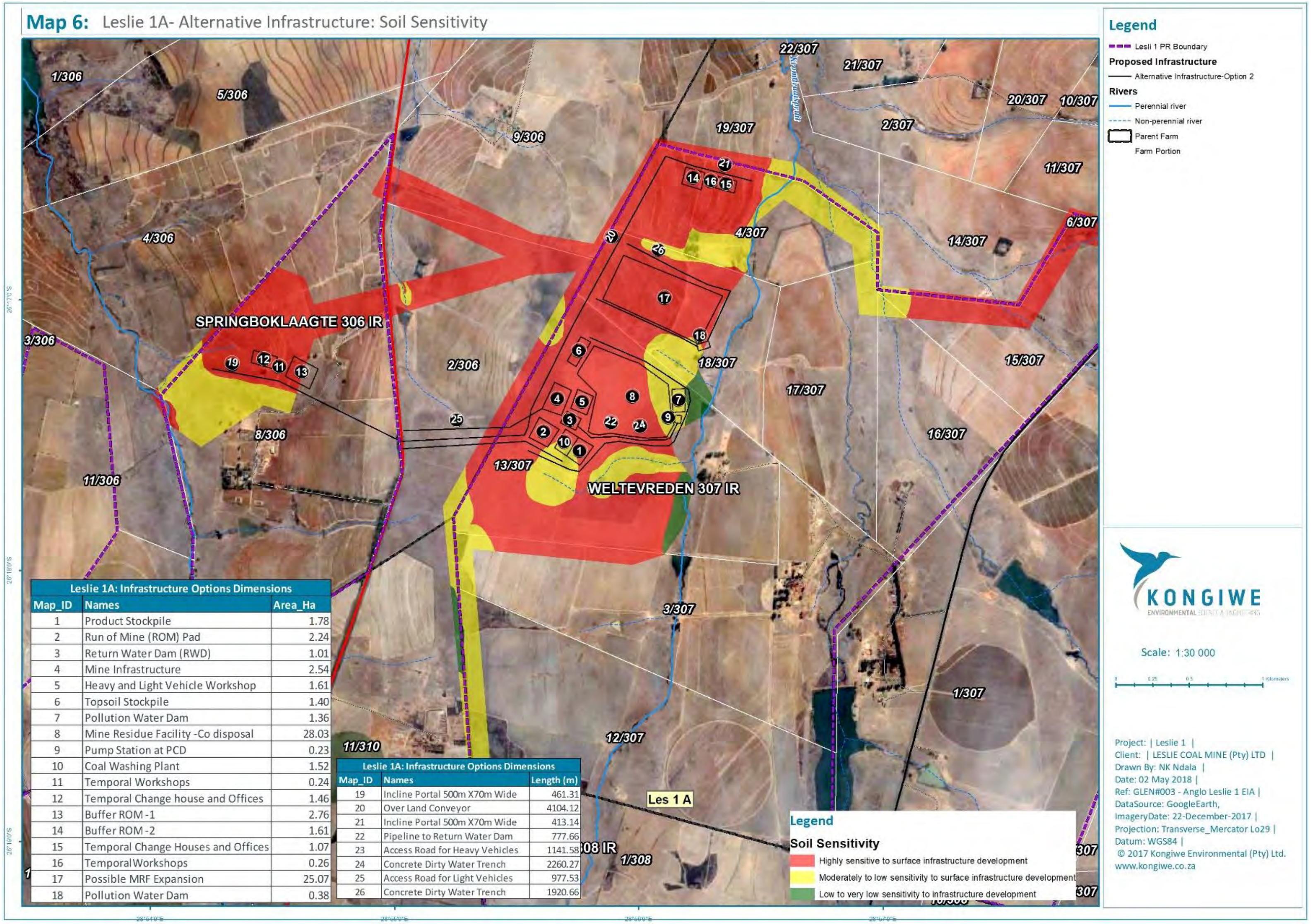
9.4.3.5 Areas below the 1:50 Year Flood Line

These areas are included to protect naturally sensitive areas such as streams, wetlands (wetland soils, vleis and pans), flood plains and riparian vegetation, where development would result in the destruction of the soils/land capability/land use in these areas, while water pollution could [potentially] also result. Furthermore, this is also to prevent the flooding and resultant instability of man-made features. In the absence of delineated flood lines, only the water courses, pans, and wetlands (without the buffer) were delineated.

Due to the specific properties of the soils on the site a number of aspects have to be noted and incorporated into the mining procedures and planning for post mining rehabilitation.

9.4.3.6 Sensitivity analysis

A sensitivity analysis was conducted, and the results are indicated on Figure 9-17 and Figure 9-18.



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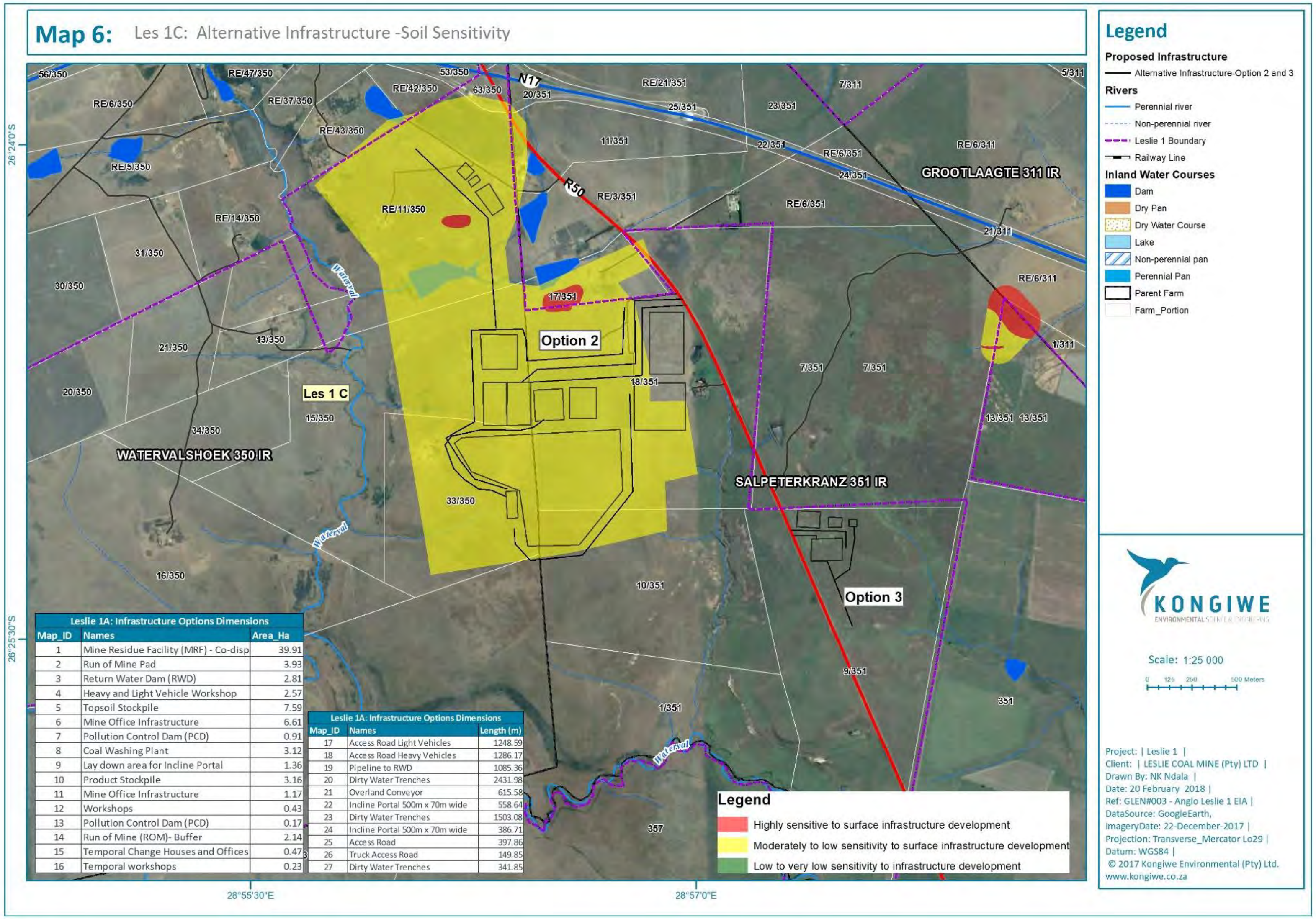
15	Temporal Change Houses and Offices	1.07
16	TemporalWorkshops	0.26
17	Possible MRF Expansion	25.07
18	Pollution Water Dam	0.38

Leslie 1A: Infrastructure Options Dimensions

Map_ID	Names	Length (m)
19	Incline Portal 500m X70m Wide	461.31
20	Over Land Conveyor	4104.12
21	Incline Portal 500m X70m Wide	413.14
22	Pipeline to Return Water Dam	777.66
23	Access Road for Heavy Vehicles	1141.58
24	Concrete Dirty Water Trench	2260.27
25	Access Road for Light Vehicles	977.53
26	Concrete Dirty Water Trench	1920.66

Figure 9-17: Sensitivity of the soil to surface infrastructure development at Leslie 1A.



Leslie 1A: Infrastructure Options Dimensions		
Map_ID	Names	Area_Ha
1	Mine Residue Facility (MRF) - Co-disp	39.91
2	Run of Mine Pad	3.93
3	Return Water Dam (RWD)	2.81
4	Heavy and Light Vehicle Workshop	2.57
5	Topsoil Stockpile	7.59
6	Mine Office Infrastructure	6.61
7	Pollution Control Dam (PCD)	0.91
8	Coal Washing Plant	3.12
9	Lay down area for Incline Portal	1.36
10	Product Stockpile	3.16
11	Mine Office Infrastructure	1.17
12	Workshops	0.43
13	Pollution Control Dam (PCD)	0.17
14	Run of Mine (ROM)- Buffer	2.14
15	Temporal Change Houses and Offices	0.47
16	Temporal workshops	0.23

Leslie 1A: Infrastructure Options Dimensions		
Map_ID	Names	Length (m)
17	Access Road Light Vehicles	1248.59
18	Access Road Heavy Vehicles	1286.17
19	Pipeline to RWD	1085.36
20	Dirty Water Trenches	2431.98
21	Overland Conveyor	615.58
22	Incline Portal 500m x 70m wide	558.64
23	Dirty Water Trenches	1503.08
24	Incline Portal 500m x 70m wide	386.71
25	Access Road	397.86
26	Truck Access Road	149.85
27	Dirty Water Trenches	341.85

Figure 9-18: Sensitivity of the soil to surface infrastructure development at Leslie 1C.

9.4.4 Specialist Conclusions

Good quality soils underpin a range of ecosystem services (such as food production and habitats for animals and plants) which are critical for the viability and sustainability of agricultural activity. In South Africa, the availability of moderate to high potential soils is limited (comprising just 10.3% of the country's soils) and therefore, the sensible use and management of these soils is exceptionally important for food security (BFAP, 2015).

Leslie 1A surface infrastructure and Portal 1B are proposed to be located on prime agricultural land that is currently very productive, with infrastructure in place such as centre pivots and/or irrigation schemes. The soil and land capability of the cultivated areas are classified as arable Class II with some portions supporting grazing of Class IV. The land use is dominated by agriculture, mixed arable and grazing but arable is dominating the land use. The affected farms have been cultivated for generations and are producing higher than average maize yields, with 2017 experiencing a 'boom' in maize production. Not only is maize produced on site, but the production of soybeans and a small percentage of sorghum and sunflower are also produced in the area. In addition, natural pans and watercourses were observed on site. Surface infrastructure on, or around these areas (and within the 1:50 year floodline) will result in impacts that are considered high and irreversible.

It is well known and documented that the rehabilitation of mined soils is often never fully achieved. There are cases where 6t to 8t maize/ ha were achieved pre-mining, and only 1t/ha to 1,2t/ ha could be harvested after mining and rehabilitation. This study concluded that the loss of agricultural land, the loss of arable land, the disturbance to the *in-situ* soil horizons and the change in land use will be long term and permanent – an impact that is high in significance, which has thus led to the revision of the surface infrastructure to significantly reduce the surface area and impact on highly productive soils.

9.5 Surface Water

A Surface Water Impact Assessment was undertaken by Hydrospatial for the Leslie 1 Project. The sections included herewith are extracted from the report and the full report is provided in Appendix D2.

9.5.1 Environmental Status Quo

9.5.1.1 Regional Catchments

The DWS and the Surface Water Resources of South Africa studies (WR90, WR2005 and WR2012) have divided South Africa into primary, secondary, tertiary and quaternary catchments. Primary catchments are the largest defined catchments for South Africa, of which there are 22, and are assigned a letter ranging from A – X (excluding O). Secondary catchments are subdivisions of the primary catchments, and are the second largest catchments in South Africa, and are assigned the primary catchment letter within which they fall, and a number e.g. A5 (secondary catchment 5 located within primary catchment A). Similarly, tertiary catchments are subdivisions of secondary catchments, and are represented for example by A53 (tertiary catchment 3 located within secondary catchment A5). Lastly, quaternary catchments are the smallest defined catchments and are assigned the tertiary catchment number, along with a quaternary catchment letter e.g. A53D (quaternary catchment D located within tertiary catchment A53).

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

The Project is located on a major catchment divide between the Olifants and Vaal River systems. The Leslie 1A and 1B MRAs are located in quaternary catchments B20E and B11E, within the Olifants WMA (Figure 9-19). The Leslie 1C, 1D and 1E MRAs are located in quaternary catchment C12D, within the Vaal WMA.

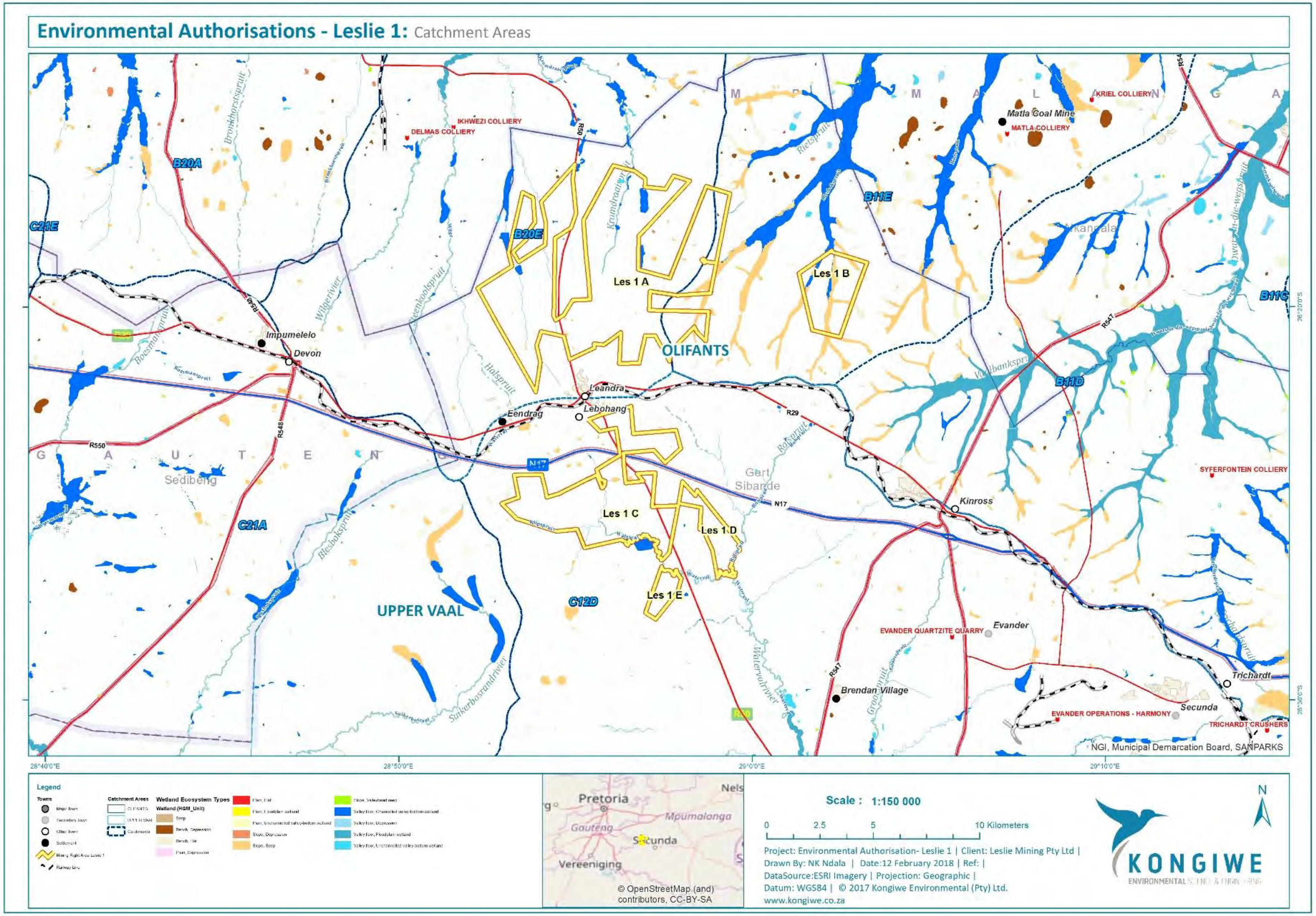


Figure 9-19: Project catchment area and surface water bodies.

9.5.1.2 Drainage

The topography of the area associated with the Project can be described as undulating. The undulating topography is largely associated with outcroppings of a dolerite sill, which is more resistant to weathering compared to the adjacent sandstone (Ecca Group). Where the dolerite and the sandstones intersect, springs and streams often develop. A gentle broad ridge running in a south-west to north-east direction, on which the town of Leandra and the N17 national road are located, separates the northern Leslie 1A and 1B MRAs, from the southern 1C, 1D and 1E MRAs (Figure 9-20). This ridge forms a major catchment divide between the Olifants WMA towards the north, and the Vaal WMA towards the south. The average elevation along this ridge is approximately 1 680 metres above mean sea level (mamsl), and drops off gently towards the north, where an elevation of 1 565 mamsl is reached along the Kromdraaispruit, near the northernmost point of the Leslie 1A MRA. Similarly, the elevation reduces gradually towards the south, to an elevation of 1 580 mamsl at the confluence of the Waterval River and Rolspruit, at the southernmost point of the Leslie 1D MRA.

The western and central areas of the Leslie 1A MRA are drained by a number of northerly flowing tributaries of the Wilge River. These include the Steenkoolspruit that drains the far western extent, two unnamed tributaries that drain the western central areas including the Leslie 1A western infrastructure, and the Kromdraaispruit that drains the central and eastern areas as well as the Leslie 1A eastern infrastructure (Figure 9-20). The Wilge River flows in a northerly direction downstream of Leslie 1A, until it is joined by the Bronkhorstspruit, after which it flows in a north-easterly direction until it forms a confluence with the Olifants River, approximately 30 km upstream of the Loskop Dam.

The far western extent of Leslie 1A is drained by the Rietspruit and Blesbokspruit, while Leslie 1B is drained by an unnamed tributary of the Rietspruit (Figure 9-20). These streams are tributaries of the Steenkoolspruit, which joins the Olifants River approximately 20 km upstream of the Witbank Dam.

The Leslie 1C and 1E MRAs as well as the Leslie 1C infrastructure area, are drained by a number of tributaries of the Waterval River, which has its source near the town of Leandra (Figure 9-20). The Leslie 1D MRA is drained by tributaries of the Rolspruit, which forms a confluence with the Waterval River at its southernmost point. Downstream of Leslie 1D. The Waterval River continues to flow in a southerly direction, until it is met by the Boesmanspruit, after which it flows in south-westerly direction where it forms a confluence with the Vaal River, approximately 30 km upstream of the town of Villiers.

The smaller non-perennial drainage lines within the MRAs are only likely to flow in wet season. A number of small and large farm dams occur throughout the area.

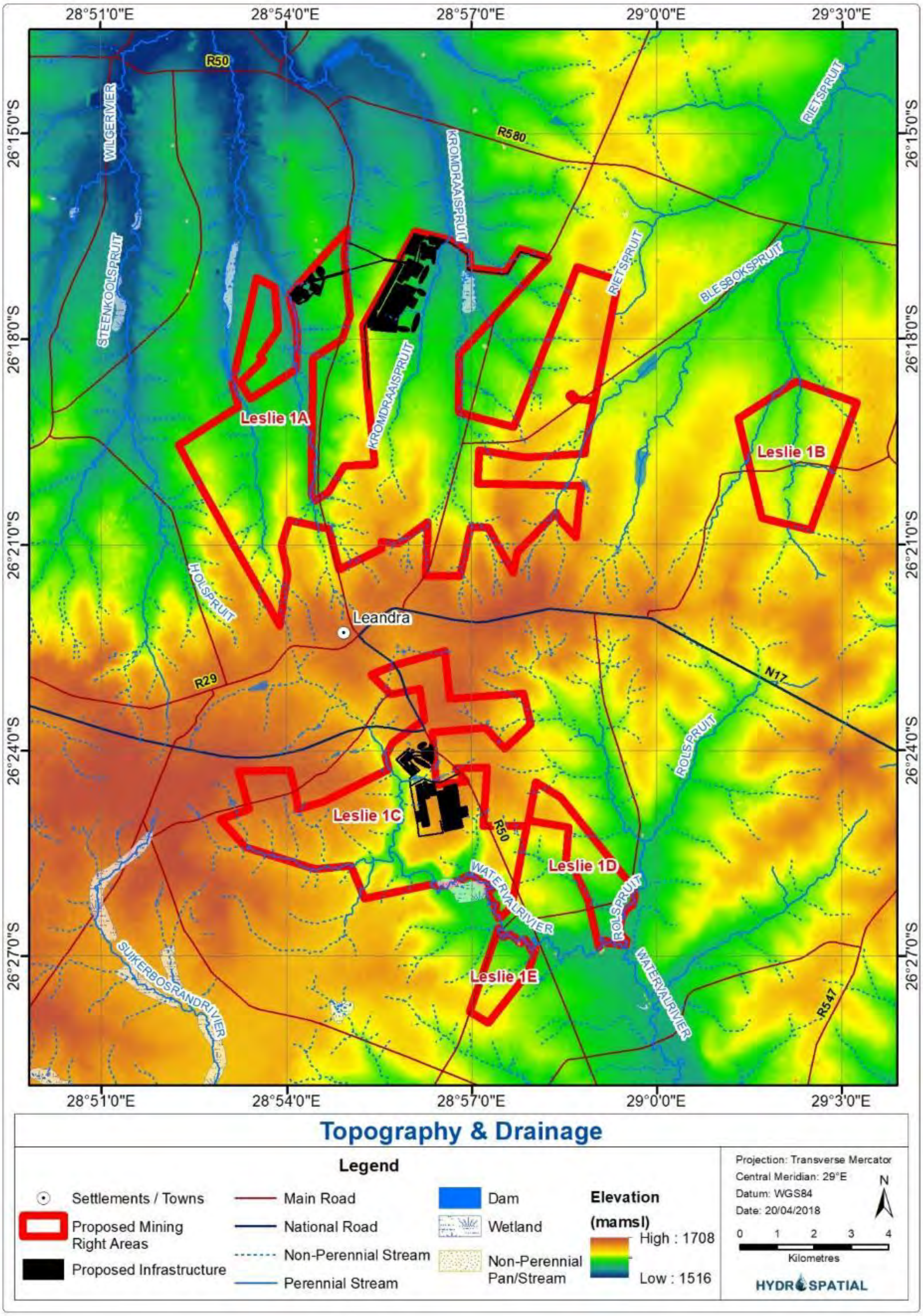


Figure 9-20: Topography and drainage of the Project area

9.5.1.3 Surface Water Use

Surface water in the region is mostly used for livestock watering and crop irrigation.

9.5.1.4 Surface Water Runoff

Surface water runoff volumes were obtained from the WR2012 study for the quaternary catchments in which the MRAs are located. Table 9-13 below provides a summary of the Mean Annual Runoff (MAR) obtained from the WR2012 study for the quaternary catchments in which the Project falls.

Table 9-13: Mean Annual Runoff (MAR) for the quaternary catchments in which the Project is located

Quaternary Catchment	MRAs	Gross* Catchment Area (km^2)	Effective* Catchment Area (km^2)	MAR (million m^3/annum)
B20E	Most of Leslie 1A	620	611.9	22.3
B11E	Eastern extent of Leslie 1A & whole of Leslie 1B	467	402.3	22.3
C12D	Leslie 1C, 1D & 1E	899	899	70.6

*The gross catchment area is the entire area of the quaternary catchment, while the effective catchment area is the area of the quaternary catchment that contributes to runoff

During the site investigation, sewage affected water was observed in the Waterval River, and within an unnamed stream flowing in a northerly direction directly west of the proposed Leslie 1A west infrastructure. It is likely that releases from the Leandra Waste Water Treatment Works (WWTW) located in the upper reach of the abovementioned unnamed stream, is likely to influence the flows.

The Environmental Water Requirements (EWR) can be broadly described as the quantity (volume) of water required to sustain aquatic life in a river. The following legislated Resource Quality Objectives (RQOs) are applicable to the Project for the Olifants WMA and are indicated in Table 9-14.

Table 9-14: RQO flow volumes applicable to the Project

Biophysical Node	Quaternary Catchment/s	Location	Natural MAR (million m^3/annum)	EWR as a % of the Natural MAR
HN27	B20E and B20F	Wilge River confluence with Bronkhorstspruit	45.8	13.42
HN5	B11E	Blesbokspruit confluence with Rietspruit	-	-
UE.2	C12D and C12F		80.37	-

9.5.1.5 Surface Water Quality

The surface water sampling focused mostly around the Leslie 1A and 1C surface infrastructure areas, at accessible locations (as far as possible), upstream and downstream of the proposed infrastructure. The reason for this is that the surface infrastructure is the most likely source to contaminate surface water, while decant from the underground is only likely to occur at a much later stage (should the groundwater modelling indicate this). The points upstream of the infrastructure will provide an indication of the un-impacted water quality, while the downstream locations will provide an indication of whether water contamination is occurring. Details of the sampling points are provided in Table 9-15, and a graphical depiction of the sampling points in relation to the Project is shown in Figure 9-21.

Table 9-15: Details of the surface water sampling points

Sampling Point & Coordinates*	Description	Photograph of Sampling Point
SW1 26°24'15.268"S 28°56'45.823"E	Located upstream of the Leslie 1C infrastructure above a culvert on an unnamed non-perennial drainage line. The stream was flowing gently at the time of sampling.	
SW2 26°25'13.105"S 28°55'43.453"E	Located on the Waterval River downstream of the area draining the following proposed Leslie 1C infrastructure – product stockpile, north and south-west PCD, waste dump, western extent of the co-disposal discard dump, mine infrastructure, topsoil dumps, ROM stockpile and shaft. The river was flowing firmly at the time of sampling.	

Sampling Point & Coordinates*	Description	Photograph of Sampling Point
SW3 26°26'39.869"S 28°57'27.832"E	Located below a bridge on the Waterval River. The entire Leslie 1C infrastructure area drains to this point. The stream was flowing gradually at the time of sampling, although evidence of recent high flows was evident.	
SW4 26°23'40.783"S 28°55'18.901"E	Located above the Leslie 1C infrastructure on tributary of the Waterval River. Sampling was conducted at a culvert below the N17 national road. This tributary drains the settlement of Lebohang. The stream was noted to have a milky appearance with a bad odour, and was flowing firmly at the time of sampling.	
SW5 26°18'48.186"S 28°55'50.218"E	Located upstream of the Leslie 1A east infrastructure area on the Kromdraaispruit. The stream was not flowing at the time of sampling, but provided the uppermost accessible point on the Kromdraaispruit to take a sample.	
SW6 26°16'18.232"S 28°56'38.224"E	Located below the Leslie 1A east infrastructure area on the Kromdraaispruit. All surface water from the Leslie 1A east infrastructure drains to this point. The stream was flowing gradually at	

Sampling Point & Coordinates*	Description	Photograph of Sampling Point
	the time of sampling. This area was noted to be very marshy.	
SW7 26°20'43.393"S 28°54'29.614"E	Located upstream of the Leslie 1A west infrastructure on an unnamed stream. The Leandra Waste Water Treatment Works (WWTW) is located approximately 600 m upstream of this point. The stream was flowing firmly at the time of sampling.	
SW8 26°16'56.636"S 28°53'46.507"E	Located downstream of the Leslie 1A west infrastructure area on an unnamed stream. All surface water from the Leslie 1A west infrastructure area drains to this point. The stream was flowing gradually at the time of sampling.	
SW9 26°16'22.051"S 29°2'23.932"E	Located downstream of the Leslie 1A and 1B MRAs at a bridge on the Rietspruit. The river is fairly wide at this point and was flowing gradually at the time of sampling.	
SW10 26°14'5.273"S 28°53'6.684"E	Located downstream of the area draining the western extent of the Leslie 1A MRA on an unnamed stream. The stream was flowing gradually at the time of sampling.	

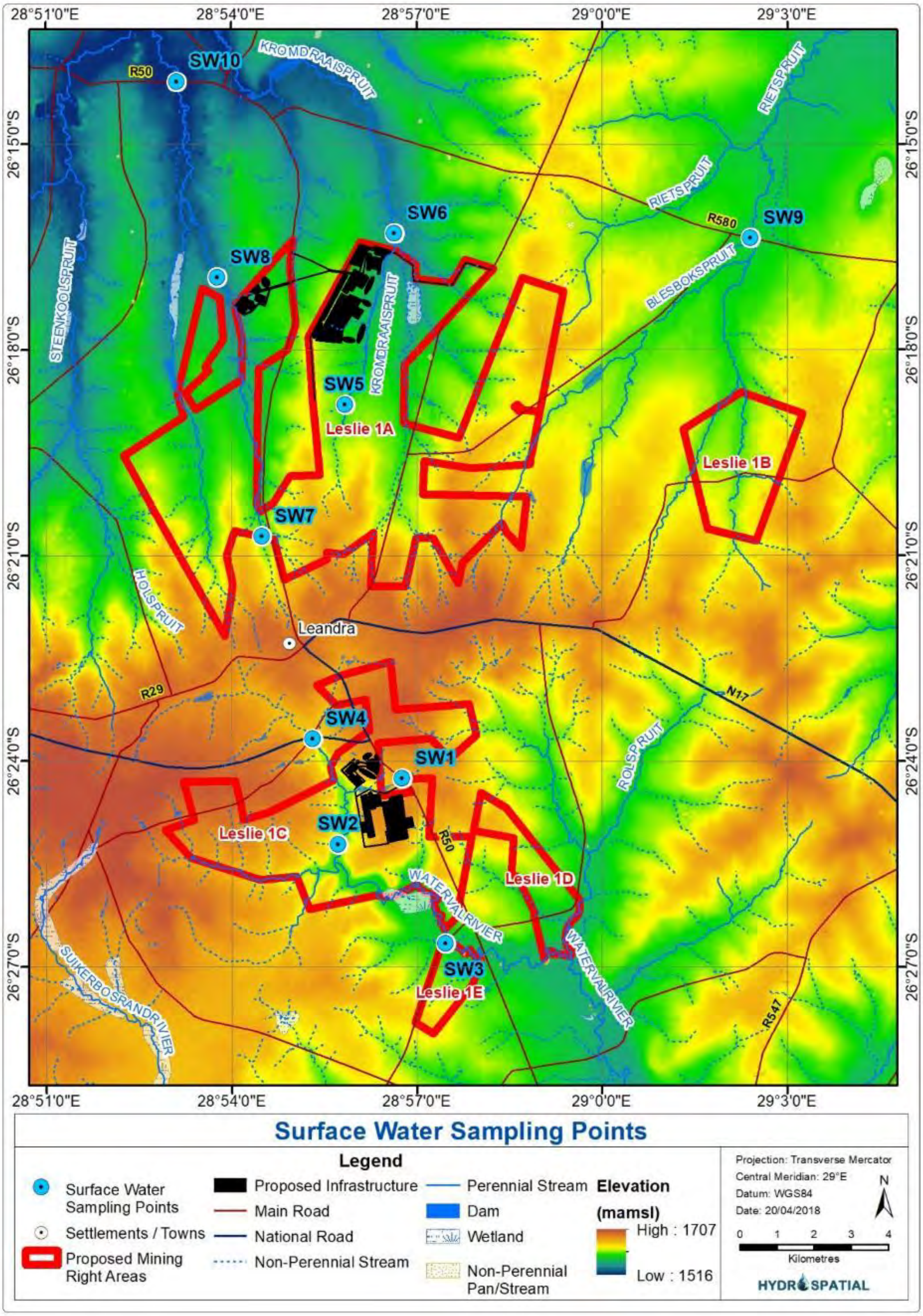


Figure 9-21: Surface water sampling points

The surface water quality is summarised below:

- The surface water in the area can be considered to be more alkaline (pH > 7) than acidic. The pH at all sampling points was above 7, with an average pH of 8.1. All sampling points were within the specified pH limits;
- Dissolved salts were at moderate levels for most of the sampling points. Electrical Conductivity (EC) and Total Dissolved Solids (TDS), which provides an indication of the dissolved salts in water, were within the SANS 241:2015, RQO and livestock watering limits, but exceeded the irrigation limits at all sampling points except SW6 and SW9. The EC guideline limit of ≤ 40 mS/m specified for irrigation, is primarily for crops with low salinity thresholds. For un-impacted streams in the area, an EC in the vicinity of 10 mS/m would be expected, indicating that most of the streams have been modified to some extent. The highest EC and TDS values occurred along the Waterval River, specifically at SW4. SW4 is located immediately below the settlement of Lebohang, and all runoff from this settlement drains to this sampling point. The high TDS values are likely to be from uncontrolled sewage from this settlement, which was witnessed on the site investigation. A high TDS value also occurs at SW7, which is located approximately 600 m below the Leandra WWTW;
- Turbidity exceeded the SANS 241:2015 limits at all sampling points. Turbidity is the measure of the light-scattering ability of water (e.g. murky water will have high turbidity and clear water will have low turbidity). Turbidity is largely related to Total Suspended Solids (TSS), which is the measure of suspended material in water. The highest turbidity and TSS measurements occurred at SW4 and SW8. The high levels at SW4 are most likely from runoff and sewage from the settlement of Lebohang. SW8 is located at a stream crossing. The turbidity and TSS measurements at this point are likely to be influenced by the movement of vehicles and livestock through the crossing. Turbidity and TSS were expected to be slightly elevated, as high rainfall had occurred in the area on the days preceding the site visit;
- Faecal coliforms exceeded the guideline limit for irrigation at all sampling points, as well as the guideline limit for livestock watering at all sampling points except SW1 and SW5. Faecal coliforms are bacterial indicators of faecal pollution from humans and warm blooded animals. They are primarily used to indicate the presence of bacterial pathogens such as *Salmonella* spp., *Shigella* spp. *Vibrio cholerae*, *Campylobacter jejuni*, *Campylobacter coli*, *Yersinia enterocolitica* and pathogenic *E. coli*. The highest faecal coliform counts occurred at the sampling points located along the Waterval River, with excessively high counts in excess of 100 000 occurring at SW4 and SW2. High counts also occurred at SW8 and SW10, downstream of the Leandra WWTW;
- Orthophosphate exceeded the Resource Quality Objectives (RQO) limits at SW2, SW3 and SW4 along the Waterval River. This is also likely to be from sewage from the settlement of Lebohang, as discussed previously. Orthophosphate was also high at SW7, located directly downstream of the Leandra WWTW. Similarly, the exceedance of sodium at SW4, as well as the elevated levels at SW2, SW3 and SW7, are also likely to be as a result of the abovementioned sources;
- Aluminium slightly exceeded the RQO limit at SW6, and is not of any concern, unless future monitoring indicates regular exceedance; and
- Manganese was within the RQO limits, but exceeded the guideline limits for irrigation at SW1, SW2, SW3 and SW8. Manganese was highest at SW2 and SW4, suggesting that once again, runoff and sewage from Lebohang may be the cause; and

- Metal concentrations at all sampling points were generally well within limits.

From the above, it is apparent that the Waterval River that drains the Leslie 1C, 1D and 1E MRA, is heavily impacted on by runoff from the settlement of Lebohang. Sewage appears to be a major contributor to this. The unnamed stream draining the central western area of Leslie 1A, near to which the Leslie 1A west infrastructure is located, is being impacted on by the Leandra WWTW. Agricultural runoff is also likely to be contributing to the elevated parameter levels in the area.

9.5.2 Specialist Assessment Methods

Methods undertaken to assess the surface water surrounding Leslie 1 Project and the impacts that the mining activities will have on this resource were as follows:

Description of the baseline (current) surface water hydrology in terms of water quality and quantity:

- Development of a conceptual Stormwater Management Plan (SWMP) in accordance with the DWS Best Practice Guideline G1: Storm Water Management and GN704 Regulations;
- Determination of the 1:50 and 1:100 year floodlines;
- Development of a water balance according to the DWS Best Practice Guideline G2: Water and Salt Balances;
- An assessment of the potential surface water impacts and possible mitigation measures; and
- Development of monitoring plans that can be used to monitor potential impacts resulting from the proposed Mine.

For a full description and overview of the methods undertaken during the Surface Water Impact Assessment, please refer to the specialist report in Appendix D2.

9.5.3 Specialist Findings

9.5.3.1 Floodlines and 100 m Watercourse Buffer

The 1:50 and 1:100 year floodlines, as well as the 100 m watercourse buffer are indicated on Figure 9-22 and Figure 9-23. Table 9-16 indicates the proposed infrastructure that is located within the 1:100 year floodlines or 100 m watercourse buffer, whichever is the greatest.

Table 9-16: Infrastructure located within the 1:100 year floodlines and 100 m watercourse buffer

Leslie 1A West Infrastructure	Leslie 1A East Infrastructure	Leslie 1C Infrastructure
Incline Shaft	Concrete Dirty Water Trench	Mine Office Infrastructure
-	Access Road	Overland Conveyor

The following is recommended:

- Proposed infrastructure located within the 1:100 year floodlines and 100 m watercourse buffer are relocated outside of these areas. Should this not be possible, then an exemption from Regulation 4 (a) and (b) of GN704 should be obtained, prior to construction; and

❖ The floodlines are remodelled at a later stage using detailed survey elevation data.

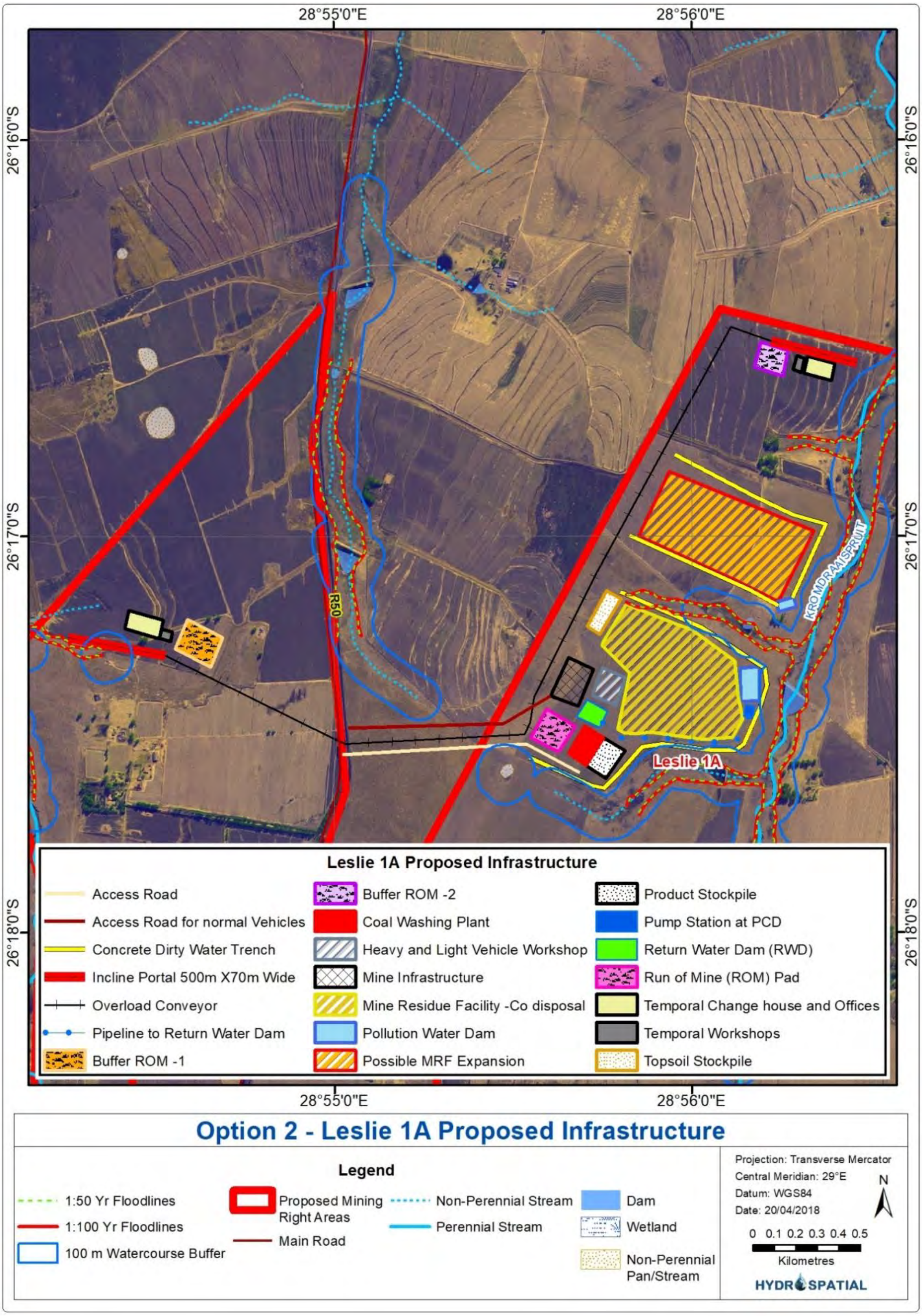


Figure 9-22: Floodlines and 100 m watercourse buffer at the Leslie 1A proposed infrastructure

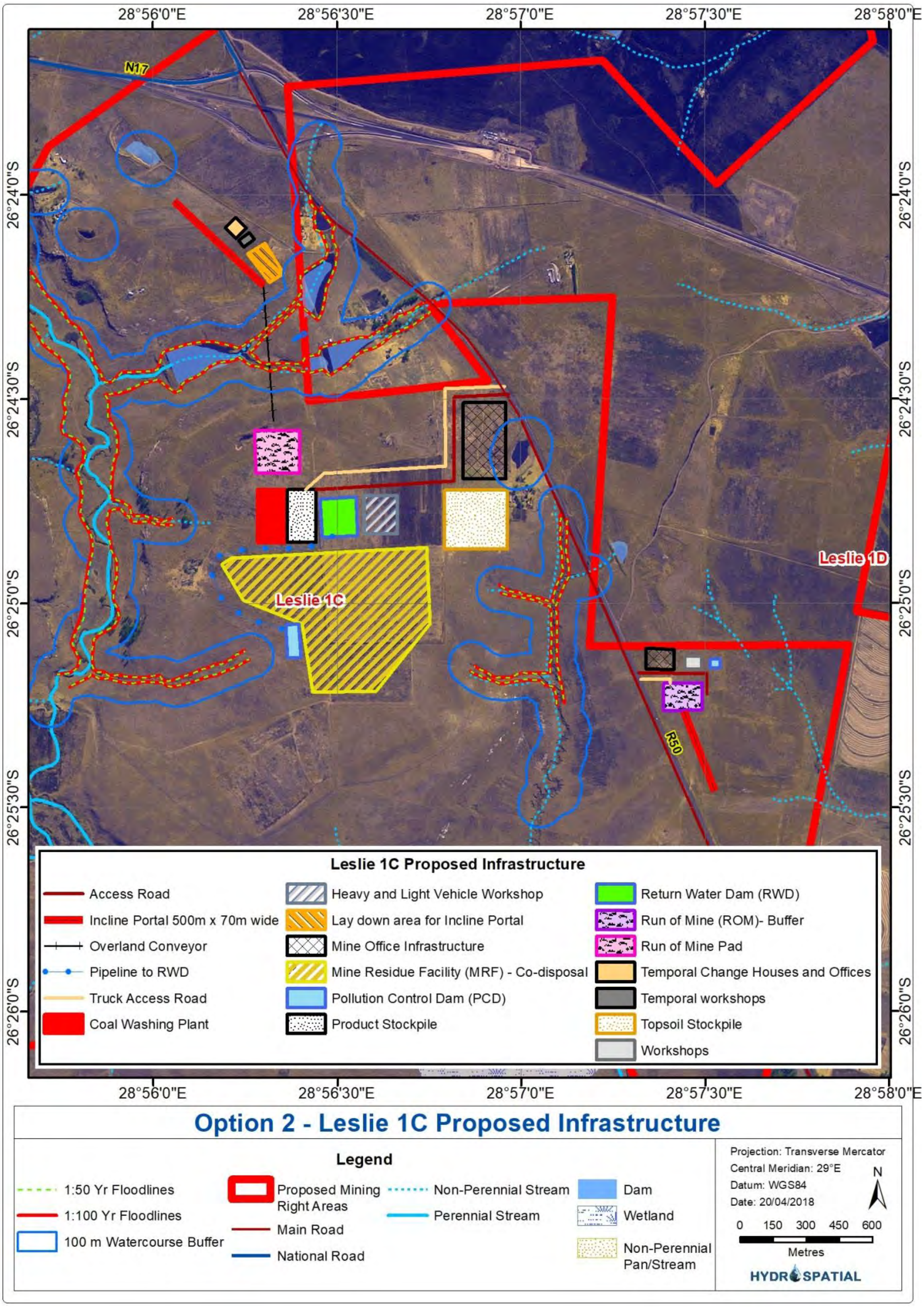


Figure 9-23: Floodlines and 100 m watercourse buffer at the Leslie 1C proposed infrastructure

9.5.3.2 Impacts on Surface Water

Construction Phase

The activities and impacts that are likely to occur during the construction phase are summarised in Table 9-17.

Table 9-17: Summary of activities and impacts for the construction phase

Activity	Impact Description
Removal of vegetation and exposure of soils	**Impact 1:** Erosion and consequent increase in TSS of surface water resources leading to deteriorated water quality
Lay down of impermeable surfaces such as concrete	**Impact 2:** Increased velocity in surface water runoff leading to erosion and consequent increase in TSS of surface water resources
Alteration to the natural topography (excavations, shaft portal, dumps, etc.)	**Impact 3:** Alteration in surface water drainage patterns leading to erosion and consequent increase in TSS of surface water resources

Operational Phase

The only definite foreseen impact during the operational phase is the loss of surface water quantity as a result of the removal of contributing catchment area. Rainfall falling on the shaft portals and surface infrastructure areas (runoff captured by a closed SWMP) will not contribute to surrounding stream flows. Table 9-18 indicates the area weighted loss in quaternary catchment MAR, and the remaining MAR.

Table 9-18: Loss in quaternary catchment MAR as a result of the Project

Quaternary Catchment	Effective Quaternary Catchment Area (km^2)	Quaternary Catchment MAR (million m^3/annum)	Infrastructure Area (km^2)	% Loss in Area	Loss in Quaternary Catchment MAR (million m^3/annum)	Remaining Quaternary Catchment MAR (million m^3/annum)
B20E	611.9	22.3	2.61	0.4	0.1	22.2
C12D	899	70.6	2.5	0.3	0.2	70.4

The activities and impacts that are likely to occur during the operational phase are summarised in Table 9-19.

Table 9-19: Summary of activities and impacts for the operational phase

Activity	Impact Description
Excavation of the shaft portals and implementation of a SWMP (closed system) around the plant area and dumps	**Impact 1:** Loss of contributing catchment area to stream flows

Closure Phase

The activities and impacts that are likely to occur during the mine closure phase are summarised in Table 9-20.

Table 9-20: Summary of activities and impacts for the closure phase

Activity	Impact Description
Loosening of soil during demolition of infrastructure and rehabilitation processes	**Impact 1:** Erosion and consequent increase in TSS of surface water resources leading to deteriorated water quality

Post Closure Phase

The groundwater model indicated that the mine will decant in excess of 100 years.

Seepage and runoff from the waste dumps and co-disposal facilities could potentially occur for many years after mine closure, if not managed.

Subsidence of the undermined areas may occur if a pillar safety factor is not applied, or if high extraction mining takes place, whereby the pillars that support the roof are mined.

Cumulative Impacts

Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

The five MRAs for the proposed Leslie 1 Coal Mine are located at the top of the Olifants and Vaal WMAs. Only one small scale mine is present higher up in the catchment directly to the north of Leandra. Coal mining does occur downstream of all proposed MRAs. This includes near Argent downstream of Leslie 1A, at Rietspruit and Coalville below Leslie 1B, and near Secunda on tributaries of the Waterval River below Leslie 1C, 1D and 1E. Two other proposed coal mines have received mining rights in the direct vicinity of the Project, namely, Springboklaagte (opencast and underground mining) located directly north of Leslie 1A, as well as Leslie 2 (underground mining), located directly west of Leandra.

The surface water quality draining Leslie 1A as well as the Leslie 1C, 1D and 1E MRAs, was shown to be impacted on mostly by sewage, but also runoff from agricultural areas. In general, the water quality of the area was summarised as having an alkaline pH (average pH of 8.1), moderate TDS levels (salt levels), elevated bacterial levels (faecal coliforms) and low metal concentrations. The establishment of the Leslie 1 Coal Mine, as well as the other two proposed mines in the direct vicinity, is likely to cumulatively impact on the current surface water quality, particularly in lowering the pH, and increasing the salt loads and metal concentrations. This is also likely to cumulatively add to the deteriorated downstream water qualities, where coal mining is more concentrated, and provide less dilution potential to these areas.

In terms of surface water quantity, underground mining has the potential to dewater streams (depending on the mining depth and water table) and result in subsidence. Should this occur within Leslie 1A MRA, as well as directly downstream at the proposed Springboklaagte mine, then there exists a potential cumulative impact on the water quantity of the Kroomdraaispruit. T

Unplanned Events and Risks

Unplanned events and risks are unexpected incidents that may occur and are not planned for, resulting in an impact e.g. an extreme flood (1:200 year flood). These are indicated in Table 9-21.

Table 9-21: Unplanned events, risks and management measures

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
Hydrocarbon spills from vehicles and heavy machinery or hazardous materials or waste storage facilities.	Hydrocarbon contamination of surrounding surface water resources through surface water runoff.	▪ Hydrocarbons and hazardous materials must be stored in bunded areas that are sized according to legislated requirements; ▪ Refuelling must take place on lined and contained areas; ▪ Ensure that silt, oil traps and sumps are in good working condition and are serviced regularly; and ▪ Vehicles and heavy machinery should be serviced and checked on a regularly basis to prevent leakages and spills.
Spill/leaks from the slurry pipeline between the plant and co-disposal dump.	Contamination of surrounding surface water resources.	▪ Regular inspections of the pipeline for any leaks; and ▪ Ensure that stormwater management structures are put in place to capture all spills and to convey to the PCD or other areas where spills can be captured.
Pipelines and conveyors constructed below the 1:100 year floodline and potentially being washed away.	Pollution of surface water resources	▪ Ensure that the pipeline is constructed above the 1:100 year floodline.
Blockage of storm water management structures.	Overflow of dirty water into clean areas.	▪ Inspect storm water management structures after large storm events.

Potential Project Risk (Unplanned Occurrences)	Aspect Potentially Impacted	Mitigation / Management / Monitoring
Mined out void flooding after cessation of dewatering and potential decant into to the surface environment	Mine flooding has the potential to decant into the surface environment and contaminate surrounding surface water resources but is a low possibility.	▪ Regular monitoring of surface water resources as per the monitoring programme; ▪ Monitoring groundwater levels to pre-empt date of decant; and ▪ Water pumping and treatment as a final solution.
Subsidence	Alteration of natural surface water drainage patterns, loss in wetlands, pans, dams and streams and unnatural ponding of water.	▪ Apply a suitable safety factor to underground mining; ▪ Yearly subsidence monitoring; and ▪ If possible, repair the topography of subsided areas to a pre-mining state by infilling to allow surface water to drain freely.

9.5.4 Specialist Conclusions

The surface water impact assessment indicated no major impacts, provided that the mitigation measures provided are adhered to.

9.6 Groundwater Hydrology

A Groundwater Impact Assessment was undertaken by iLEH for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D3.

9.6.1 Environmental Status Quo

9.6.1.1 Hydrocensus

The groundwater level below surface varied between a maximum depth of 19.49 metres below ground level (mbgl) on the farm Goedehoop and close to the water divide, and artesian on the farm Brakfontein (Brak24) (excluding the springs where the water table is at surface). If the groundwater levels are viewed as elevation above sea level, then the highest water elevations can be found along the water divide between the Olifants and the Upper Vaal WMAs, and the lowest water table elevations along valley embankments and closer to the streams, especially in the Leslie 1A area. The proposed mining areas are located along the boundary of the Olifants and Upper Vaal WMA and therefor the regional groundwater flow will be in a southerly direction or in a northerly direction.

The correlation between topography and groundwater elevation is approximately 96%. This means that the depth to groundwater correlates well with the surface elevations (topography), indicating that on a local scale groundwater flow follows topography.

Based on communication with the land owners the springs in the area are perennial. The springs serve as water supply to livestock in the area. Seasonal spring flow rates are also not available.

Detailed information in terms of borehole construction and yields are not available for the identified private boreholes. The information provided by the land owners or farm workers indicated low borehole yields for most of the Leslie 1 project area. Five boreholes were identified with high or good yields by the landowners. These boreholes are in the Goedehoop and Weltevreden areas and mainly along the Kromdraaispruit.

9.6.1.2 Groundwater Quality

Table 9-22 shows the groundwater quality across the Leslie 1 project area.

Table 9-22: Hydro-chemical results

Parameter	Unit	SANS241 Standard Limits		DWS Drinking Standards	Brak 01	Land 01	Brak 26	Sal 04	Fris 01	Wat 07	Goed 12	Wat Spring 2	Goed 16	Well 11
Ammonium	mg N/ℓ	Aesthetic ≤1.5			0,032	0,685	0,065	0,034	0,041	0,031	0,036	0,086	0,032	0,057
Chloride	mg Cl/ℓ	Aesthetic ≤300			80,80	90,40	77,10	7,59	20,30	5,61	9,59	6,67	69,10	68,60
Aluminium	mg Al/ℓ	≤0.3			-0,002	-0,002	-0,002	-0,002	0,032	-0,002	0,039	0,036	-0,002	-0,002
Cadmium	mg Cd/ℓ		Chronic health ≤0.003		-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
Calcium	mg Ca/ℓ			No health. Scaling intensifies from 32mg/L	153,0	21,5	107,0	46,3	42,5	49,2	19,0	72,3	102,0	98,7
Chromium	mg Cr/ℓ		Chronic health ≤0.05		-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003	-0,003
Copper	mg Cu/ℓ		Chronic health ≤2		0,004	0,011	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
Iron	mg Fe/ℓ	Aesthetic ≤0.3	Chronic health ≤2		-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
Lead	mg Pb/ℓ		Chronic health ≤0.01		-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004	-0,004
Magnesium	mg Mg/ℓ			Diarrhoea and scaling issues from 70mg/L	99,3	25,5	23,0	30,2	16,0	28,8	7,6	47,7	36,6	41,5
Manganese	mg Mn/ℓ	Aesthetic ≤0.1	Chronic health ≤0.4		-0,001	-0,001	-0,001	0,021	-0,001	-0,001	-0,001	-0,001	-0,001	-0,001
Nickel	mg Ni/ℓ		Chronic health ≤0.07		-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002	-0,002
Zinc	mg Zn/ℓ	Aesthetic ≤5			-0,002	-0,002	-0,002	-0,002	0,04	-0,002	-0,002	-0,002	0,472	0,218
Electrical Conductivity at 25°C	mS/m	Aesthetic ≤170			119,0	86,6	75,6	56,3	45,0	48,3	17,7	62,9	77,9	74,2
Fluoride	mg/ℓ		Chronic health ≤1.5		0,269	0,532	-0,263	-0,263	0,324	0,278	-0,263	0,466	0,351	0,380
Nitrate	mg/ℓ		Acute health ≤11		2,16	0,68	26,5	0,47	1,49	0,90	0,71	0,82	28	0,52
pH at 25°C		≥5 - ≤9.7			7,29	8,47	7,47	7,81	8,02	7,92	8,21	7,87	7,69	7,34
Potassium	mg K/ℓ			No aesthetic or health effects below 50mg/L	2,78	2,13	12,40	2,23	1,42	1,20	4,10	0,57	6,08	2,63
Sodium	mg Na/ℓ	Aesthetic ≤200			83,9	200,0	31,2	73,7	57,8	54,1	10,4	34,5	59,0	62,6
Sulphate	mg SO_4/ℓ	Aesthetic ≤250	Acute health ≤500		279,0	48,8	85,8	38,2	11,1	39,2	12,7	93,2	82,4	54,1
Total Alkalinity	mg $CaCO_3$/ℓ				485	361	129	319	227	275	69,8	302	230	352
Total Dissolved Solids	mg/ℓ	Aesthetic ≤1200			1005	613	532	395	295	350	109	443	621	545
Total Hardness	mg $CaCO_3$/ℓ	60–120 mg/l, moderately hard	120–180 mg/l, hard	more than 180 mg/l, very hard	791	158	361	240	172	241	79	377	406	417
Total Organic Carbon	mg C/ℓ		Chronic health ≤10		4,96	3,09	2,60	1,88	1,85	1,63	4,30	2,89	2,05	2,79

Based on Piper and Stiff Diagrams the dominant cation in the groundwater samples are sodium (Na), although most of the samples do not show a dominant cation; they are thus well mixed. The dominant anion is bicarbonate (HCO_3). The ion distribution is clear in the Stiff diagrams, with the general water type of the Leslie 1 project area predominantly represented by Ca- and Na-HCO_3 water. This is typical of recent recharged water. The diagrams show that all the samples are enriched in alkalinity and depleted in sulphates. This suggests that no mine-related contamination has taken place, as mine water is typically distinguished by enriched sulphate and depleted alkalinity.

The samples can be classified into two sources based on their cation content: those that are Ca and Mg-dominated and those that are Na and K-dominated. The Ca/$MgHCO_3$ type boreholes are typically encountered in recently recharged groundwater. This means that the groundwater does not have significant residence time and is relatively freshly recharged. The $NaHCO_3$ type water could be a result of mixing of recently recharged water from the weathered aquifer and water of the deep aquifer that are enriched with Na. The groundwater in the Leslie 1C area seem to be more enriched with sodium.

Based on the water quality results (Table 9-22), the following conclusions were drawn:

- Acute Health effects (SANS Drinking water standards):
  - Nitrate – Boreholes Brak26 and Goed16 yielded high nitrate concentrations (26 to 28 mg/L); potentially because of human and irrigation activity in the area. Mineral deposits of nitrate are rare due to the high water-solubility of nitrate, but it is abundant in soils, particularly in association with the breakdown of organic matter and eutrophic conditions. A source of nitrate in natural water results from the oxidation of plant and animal debris and of animal and human excrement. Brak26 is a submersible pump in a centre pivot and could possibly draw water from the nearby stream that is fed by discharged treated waste water. The other borehole is located close to a house and surrounded by irrigated lands. All samples with high nitrate concentrations should be checked for bacteriological contamination.
- Aesthetic effects:
  - Sodium – One borehole has an elevated sodium concentration (Land01). Elevated sodium concentrations are synonymous with the Karoo sandstone and shale formations and could indicate older type water.
  - Sulphate – One borehole (Brak01) has an elevated sulphate concentration. The borehole is located outside Leandra at a filling station, but also downstream from the town's landfill site. It is unknown whether the borehole intercepted coal seams as this could potentially be the cause of the elevated sulphate concentration.
- Magnesium – an elevated magnesium concentration was observed for borehole Brak01. Magnesium is an alkaline earth metal which reacts with oxygen and water to form magnesium oxide and magnesium hydroxide, respectively. Magnesium is a common constituent of water. Magnesium, together with calcium, is responsible for the hardness of water.
- Total hardness – elevated calcium concentrations were measured in all boreholes except Land01 and Goed12. Very high total hardness values were measured in 7 of the 10 boreholes. Scaling is

likely to occur in water heating appliances such as kettles and geysers, and results in low efficiencies and the partial obstruction of pipes. High concentrations of calcium also impair the lathering of soap.

- Boreholes Land01 and Fris01 are classified as hard water.
- Borehole Goed12 is classified as moderately hard water.

The chemicals of concern (CoC) for the Leslie I Project area are nitrate and potentially sulphate and sodium. Most of these are however only elevated in one or two sampling points. Most of the salts, including sulphate were present in concentrations below the SANS241 guideline limits. Based on the SANS241 drinking water guideline and on the sampled borehole water results, the groundwater sampled from only borehole Brak26 is not fit for human consumption (unless treated).

The only borehole where multiple elements (3 or more) are present in elevated concentrations is:

- Brak01 – calcium, magnesium, sulphate and total hardness. This borehole is located at a filling station north of Leandra on the R50 road.

The groundwater in the area presents a low sodium hazard and a low to medium salinity hazard to soil, if used for irrigation.

Groundwater quality in an area can be defined by the groundwater flow rate (residence time), the geological formations, the redox potential and human activities. Good quality groundwater can be expected in the Leslie 1 area due to the locality at a major water divide, rainfall of approximately 682 mm/a, and active groundwater flow. Stagnant groundwater zones are not expected in the area.

The discharged waste water from the two water treatment facilities in Leandra can be potential contamination sources to the local aquifers. Both plants discharge water on a continuous basis. The water flowing from the northern plant seems to be of better quality compared to the water flowing south and into the Watervalspruit. The water in the Watervalspruit has a distinct sewerage smell and could contaminate groundwater resources in the area.

9.6.1.3 Aquifers

Regional hydrogeological Conditions

Two main aquifers are typically formed in the Karoo sediments of the Highveld Coalfield. These include a shallow weathered aquifer and a deeper fractured rock aquifer.

The shallow weathered aquifer forms within the limit of weathering (LOW), which is around 11 m. The soil profile in the region vary between 1 and 3.82 m, with an average depth of 3 m. (JCK, 2014). In low-lying areas, the groundwater table is shallow, recorded at 1.2 m below surface. In comparison, in higher-lying areas, the average depth to groundwater in the shallow weathered aquifer is 3.7 m. The depth to groundwater in the weathered aquifer varies between 1,45 and 10,13 m, with an average depth of 4.5 m (JKC, 2014). The aquifer is unconfined and is replenished through the infiltration of rainwater (recharge) from the soil horizon.

The rate of recharge to this aquifer is typically assumed to be around 3% of the MAP. G^2 (2013) reports a rate of recharge of 2% of MAP (i.e. 14 mm/a or 3.8E-5m/d). The permeability of weathered aquifer is variable, but groundwater occurrence is most often associated with the transition between weathered and fresh rock. In this area, the dolerite sill will form a barrier between the upper weathered and deeper fractured rock aquifers.

Fractured rock aquifers form in faults, fractures, joints and bedding planes of the sediments and rock formations. Groundwater occurrence in the deeper fractured rock aquifer may be associated with the contact zones of the dolerite sills. These aquifers are typically narrow and linear along the strike of the intrusion. Groundwater occurrence may also be associated with the coal seams. Where present, zones of increased permeability allow groundwater flow through otherwise tight rock matrices. Shangoni (2017) reports that this aquifer extends from depths of 20 to 150 m below surface.

The permeability of these aquifers is highly variable as it is dependents on the nature and extent of the secondary features mentioned. Measurements by Hodgson and Kranz (1998) suggests that the permeabilities of the Ecca Group sediments vary between 0.0007 and 0.5 m/d, with an average permeability of 0,07 m/d. It is noted that the permeability of the rock formations decreases with depth. In contrast, the permeability of the Dwyka measured during the same study varies between 0.0002 and 0.0148 m/d, with an average of 0.015 m/d.

The depth to groundwater in the deeper fractured rock aquifer varies between 1.71 and 71.65 m, (JKC, 2014). The deeper groundwater levels are thought to reflect poor aquifer conditions and had probably not recovered to the regional rest water level at the time of measurement. One borehole (BH-2D) intersected a groundwater strike between the S2L an S2 coal seams. The rest water level in this borehole was recorded at 27.84 m. If the outliers in groundwater level measurements are disregarded, the depth to groundwater in the deeper fractured rock aquifer is reported to be between 27.84 m and 38.72 m (JKC, 2014).

The 2526 Hydrogeological Map of Johannesburg indicates that the project area falls in a d2 aquifer class region. The groundwater yield potential for this class is 0.5 to 2 litres per second (L/s). Shangoni (2017) completed an assessment of aquifer vulnerability. The results suggested that the aquifers have a medium to high susceptibility to pollution. A medium to high level of aquifer protection is therefore required.

Local Hydrogeological Conditions

Figure 9-24 shows the underground water levels and flow directions for the Leslie 1 project.

The northern part of the application area, groundwater flow is in a generally in a north-westerly direction. Drainage in this area takes place towards the Wilge River and towards the Kromdraaispruit. This is especially prominent over the Springboklaagte mining area, where groundwater flow is in a westerly and easterly direction from the mining area. The average groundwater flow gradient in the northern part of the application area is 0.02 (1:50).

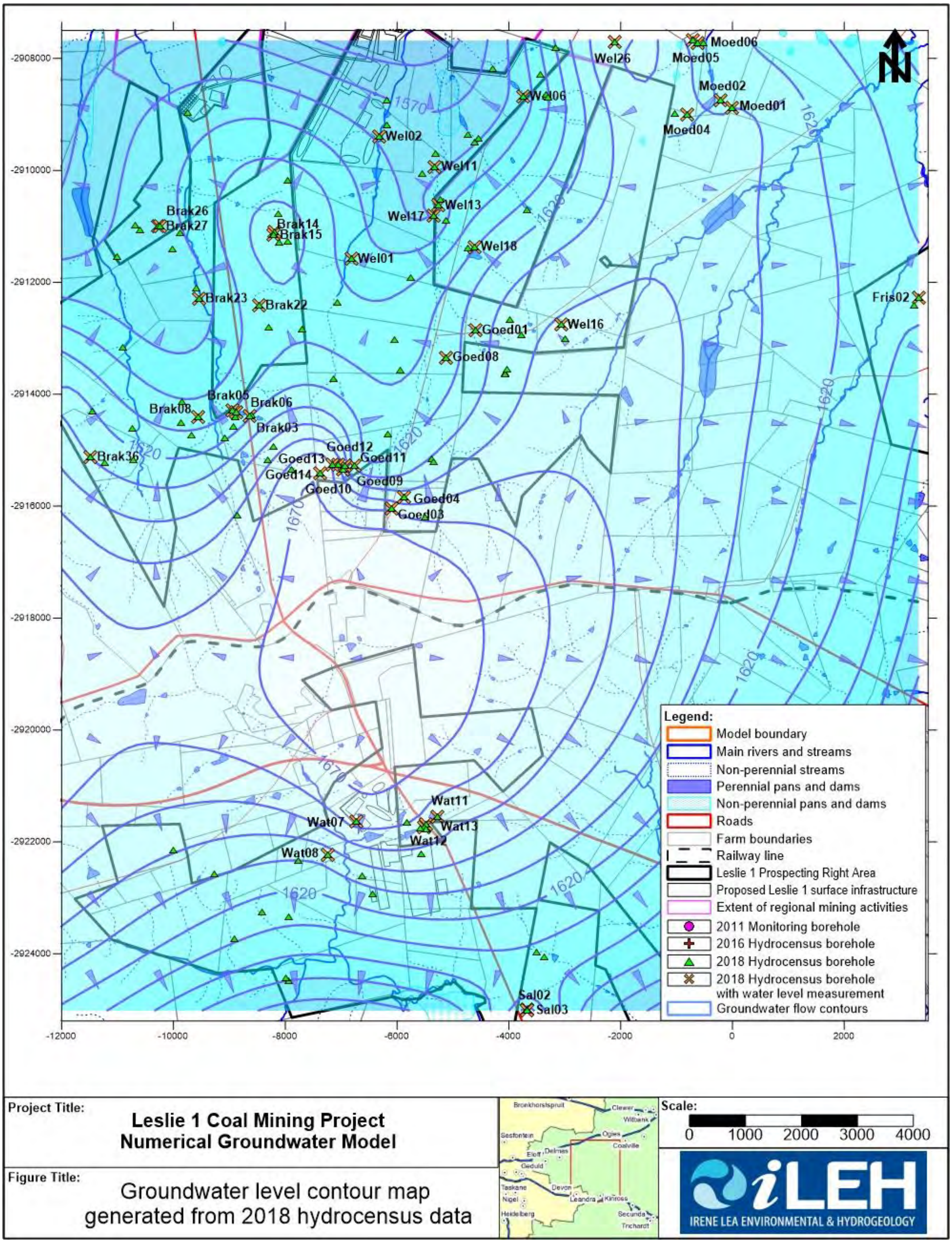


Figure 9-24: 2018 Hydrocensus data groundwater level contour map

In the southern part of the application area, groundwater flow takes place in a south-easterly direction. In this area, the presence of perennial rivers and streams also control localised groundwater flow patterns. Limited groundwater level measurements are available for this area, but the contours suggest flow towards the Klipriver in a south-westerly direction, as well as towards the Rolspruit in a south-easterly direction. The average groundwater flow gradient in the southern part of the application area is 0.016 (1:63).

The groundwater flow patterns suggest that groundwater discharges as baseflow to the local rivers and streams, which is typical of the area.

9.6.2 Specialist Assessment Methods

The geohydrological impact assessment was completed with information contained in existing specialist reports and documentation available for the Leslie 2 Project. In addition, a hydrocensus was completed as part of this study to identify and quantify existing private groundwater use in the area.

AOL made the Mining Work Programme (MWP) and prospecting borehole data available to complete the geohydrological study for the project. The prospecting borehole information was used to conceptualise the depth of weathering, as well as the coal floor and roof conditions. The mine plan and mining schedule used during the impact assessment was obtained from the MWP.

No site-specific groundwater monitoring boreholes were drilled or tested as part of this assessment. Aquifer parameters used as part of the assessment were inferred from a geohydrological study completed for the Springboklaagte Mine during 2013 (G^2, 2013).

The geohydrological impact assessment was completed based on the outcome of simulations with a numerical groundwater flow and contaminant transport model.

The impact assessment was completed at the hand of Kongiwe Impact Assessment Methodology.

9.6.3 Specialist Findings

9.6.3.1 Wetlands

The wetlands are often associated with areas of shallow groundwater table conditions, as well as with the pans and streams present. As such, the impact of mining on the shallow weathered aquifer is of importance to the sustainability of wetlands during and after mining. A lowering in groundwater levels would dry the wetlands up. The impact of mine dewatering is therefore of importance when evaluating the impact on wetlands.

It is thought that any permanent lowering of the groundwater table will reduce the groundwater that feeds many of the wetlands in the area, on which the wetland fauna and flora are dependent for survival. This could result in a loss of riparian vegetation and wildlife habitat. The depth of groundwater fluctuation that would negatively affect wetland sustainability will depend on the root depth of the plants. For the simulations discussed below, it is assumed that wetlands that fall in zones of impact where the groundwater level is lowered by more than 1 m, would be negatively affected by the mining activities. This assumption needs to be confirmed and re-assessed, if necessary. It is however a conservative approach, as a 1 m drawdown in groundwater level would be closely associated with the edge of the zone of influence delineated by the 0 m drawdown contour.

In addition to the impact of fluctuations in groundwater levels, contaminated groundwater that infiltrate from the mining areas will also have adverse impacts on wetland flora and fauna. Any changes in the geochemical character of the soil and/or water is expected to have a negative impact on biological communities in the wetlands. This is especially true if the pH of water drops because of acid mine drainage or if the salt and metal concentrations increase to toxic levels in the groundwater discharging to the wetlands.

9.6.3.2 Impact prediction: Zone of influence on groundwater levels

The rate of groundwater seepage to the mining areas was calculated with the model. The model assumes average permeabilities for the rock formations intersected during mining. The aquifers are however heterogenous and variable groundwater seepage rates will be experienced. For example, if a water-bearing feature is intersected, the rate of groundwater seepage will increase.

The rate of groundwater seepage is also influenced by the depth and method of mining. Mining that takes place at shallow depths that intersects the shallow weathered aquifer may experience increased groundwater seepage rates, as these formations are expected to have higher permeabilities. Increased groundwater seepage rates are especially anticipated along the zone of transition from weathered to fresh rock in the incline shafts.

Underground mining in the fractured rock aquifer is expected to experience groundwater seepage at lower rates, especially for mining depths greater than 70 m, as the average permeability with depth is expected to decrease as the rock formations become tighter. Higher seepage rates will however occur if a water-bearing structure is intersected. It is not possible to predict when and where zones of higher permeability would be intersected during mining. For this reason, the model was used to simulate average, minimum and maximum seepage rates, based on the permeabilities presented in G^2 (2013) for the Springboklaagte mine.

The information presented below must be re-evaluated once groundwater monitoring boreholes have been drilled for the Leslie 1 mining areas.

Rate of groundwater seepage during the construction phase

During construction of the incline shafts to reach the required mining depths, groundwater seepage will be experienced as the regional groundwater table is intersected. This is expected at an average depth of 5 m below ground level. Local variations will occur and the depth to groundwater can vary between depths of less than 1 m to 10 m below surface.

Current mine layout information indicates two incline shafts for the Leslie 1A mining area. These will be constructed during Year 1 and Year 6 of mining. Another incline shaft is indicated for Year 10 in the Leslie 1C mining area. The groundwater seepage rates calculated for these areas are presented inTable 9-23. It is shown that the rate of groundwater seepage to the portals may vary from around 1 to 75 m^3/d.

Table 9-23: Groundwater seepage rates expected during the construction phase (m^3/d)

Timing	Leslie 1A (m^3/d)			Leslie 1C (m^3/d)		
	Min	Avg	Max	Min	Avg	Max
Year 1	1	3	28			
Year 6	0,4	2	16			
Year 10				2	7	75

During simulations, mine dewatering at the Springboklaagte mine was taken into consideration to facilitate cumulative impacts. The Springboklaagte zone of impact is expected to have an impact at the Leslie 1A mining area. The rate of groundwater seepage to the box cut and incline shafts constructed in the Leslie 1A area is expected to be lower compared that for the Leslie 1C area.

The cone of depression that may develop around the incline shafts is not expected to extend more than 200 m from the edge of the mining area. This is due to the shallow depth of mining in the incline shaft at the time of construction and the perceived low permeabilities of the rock formations that will be intersected. No private boreholes are in the immediate vicinity of the Leslie 1A West incline shaft. Private borehole Spr01 is however situated in the anticipated zone of influence delineated for the construction phase of the incline shaft, at the Leslie 1A East incline shaft, as indicated in Table 9-24. This borehole is the only source of water to this farm.

Private borehole Wat7 is situated within the anticipated zone of influence at the Leslie 1C incline shaft. This borehole is the only source of water to this property.

Table 9-24: Private boreholes within the zone of influence during the construction phase

Leslie 1A East Incline Shaft	Leslie 1C Incline Shaft
Spr01	Wat7

<u>Rate of groundwater seepage during the operational phase</u>

The rate of groundwater seepage to the underground working during the construction phase of mining was calculated for each coal seam to be mined. The results are presented in Table 9-25, Table 9-26 and Table 9-27, as well as Figure 9-25, Figure 9-26 and Figure 9-27. The seepage rates presented are cumulative (total) volumes as mining progresses.

The rate at which groundwater is expected to flow into the underground workings is influenced by the following factors:

- ❖ The extent of mining: groundwater seepage rates will increase for larger mining areas. For example, when the mining schedule increases to 5-year blocks, the cumulative seepage rates will be higher compared to that for the 1-year mining blocks.

- Depth of mining: groundwater seepage rates to shallower mining areas are expected to be higher compared to deeper mining areas where the water-bearing fractures are expected to be tighter.
- The intersection of water-bearing features: the extent, location and depth of such fractures or faults are not known at present. Simulations were undertaken with average aquifer parameters. A range of seepage rates are however presented, based on the aquifer parameters described in G2 (2013) for the Springboklaagte mine.
- Cumulative impact of mine dewatering: groundwater levels will already be lowered around the Springboklaagte mine, which will affect groundwater flow gradients towards the Leslie 1A mining area. Lower flow gradients will result in a lower groundwater seepage rate. Similarly, as mining progresses in a specific block, the rate of groundwater seepage may be high when new ground is broken initially. With time, as the aquifers in the immediate vicinity of the mining area are progressively dewatered, the rate of groundwater seepage is expected to reduce. The exception to this will be the intersection of water-bearing features that is fed from areas extending outside the zone of influence of mine dewatering. Such fractures and/or faults may yield groundwater at a relatively constant rate over the life of the mine. As mentioned above, it is not possible to predict where mining would intersect such features at present.

Table 9-25 Cumulative groundwater seepage volumes to mining areas: 5 Seam Workings (Unit: m3/d)

Timing	Leslie 1A			Leslie 1B			Leslie 1C			Leslie 1D			Leslie 1E		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Year 1															
Year 2															
Year 3															
Year 4															
Year 5															
Year 6															
Year 7															
Year 8															
Year 9															
Year 10															
Year 11-15															
Year 16-20	283	1130	1978												
Year 21-25	596	2382	4169												
Year 26-30	272	1089	1906												
Year 31-35	142	569	996												
Year 36-40	84	336	588												

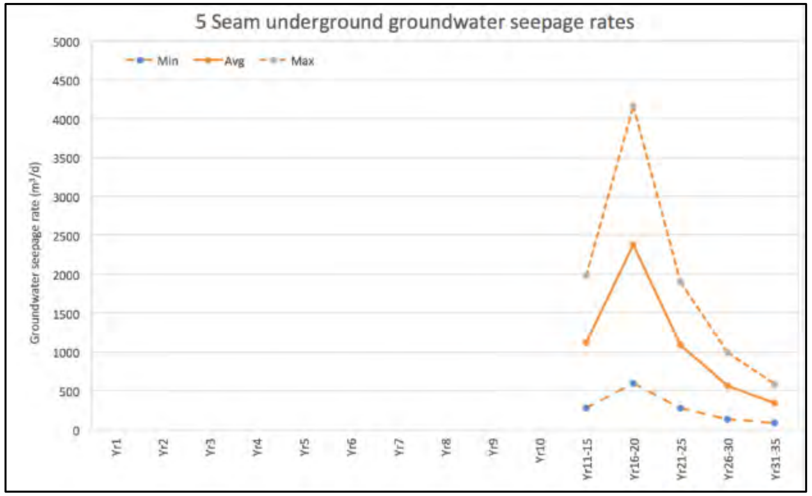


Figure 9-25: Cumulative underground seepage rates: 5 Seam Workings

The rate of groundwater seepage to the No 5 seam workings is expected to reduce from an initial volume of 1 130m^3/d during the initial stages of mining to around 340m^3/d towards the end of mining in this area. It is possible that these rates may be as low as ¼ of the average values or 1¾ times higher, depending on the aquifer conditions intersected.

Table 9-26 Cumulative groundwater seepage volumes to mining areas: 4 Seam Workings (Unit: m^3/d)

Timing	Leslie 1A			Leslie 1B			Leslie 1C			Leslie 1D			Leslie 1E		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Year 1															
Year 2	868	3470	6073												
Year 3	417	1666	2916												
Year 4	458	1830	3203												
Year 5	375	1498	2622												
Year 6	313	1252	2191												
Year 7	557	2226	3896												
Year 8	614	2456	4298												
Year 9	631	2522	4414												
Year 10	703	2812	4921												
Year 11-15	1331	5324	9317				136	542	949						
Year 16-20	868	3470	6073				1002	4006	7011						
Year 21-25	619	2477	4335				2389	9557	16725						
Year 26-30	468	1870	3273				3284	13135	22986						
Year 31-35	375	1498	2622	653	2611	4569	1937	7747	13557	773	3092	5411	434	1735	3036
Year 36-40	313	1252	2191	1740	6961	12182	1230	4919	8608	547	2188	3829	329	1316	2303

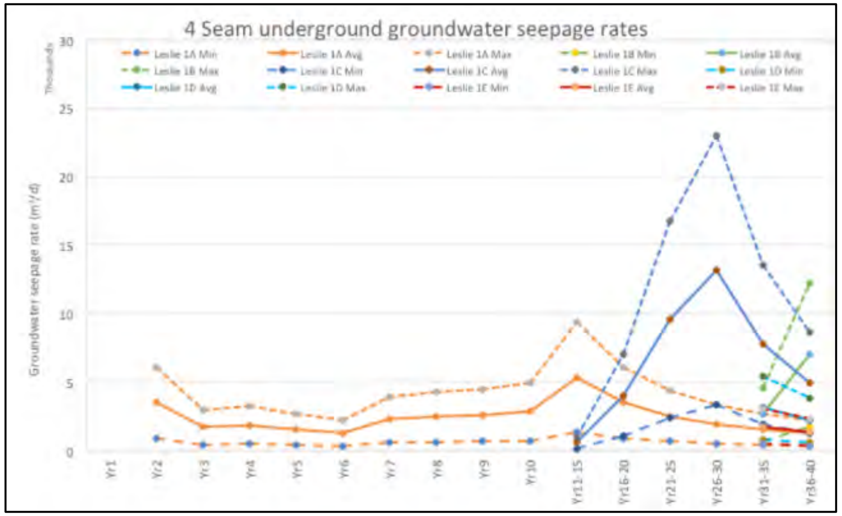


Figure 9-26: Cumulative underground seepage rates: 4 Seam Workings

In the Leslie 1A area, groundwater seepage rates may be as high as 3 500m^3/d during the initial stages of mining. These volumes may however be as low as 870m^3/d and as high as 6 100m^3/d, depending on aquifer conditions. In the absence of site-specific aquifer information, it is not possible to predict seepage rates with a high level of confidence. Towards the end of mining in the Leslie 1A area, the seepage rates may reduce to around 1 250m^3/d (minimum 320m^3/d; maximum 2 200m^3/d).

In the Leslie 1B mining area, seepage rates may vary between 2 600 and 7 000m^3/d (minimum: 650 m^3/d; maximum 12 200m^3/d). In the Leslie 1C mining area, seepage rates may vary between 540 and 4 900m^3/d (minimum: 140m^3/d; maximum 23 000m^3/d). In the Leslie 1D and E mining areas, seepage rates may vary between 1 300 and 3 000m^3/d (minimum: 330m^3/d; maximum 5 400m^3/d).

Table 9-27 Cumulative groundwater seepage volumes to mining areas: 2 Seam Workings (Unit: m^3/d)

Timing	Leslie 1A			Leslie 1B			Leslie 1C			Leslie 1D			Leslie 1E		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Year 1															
Year 2	41	162	284												
Year 3	57	226	396												
Year 4	71	285	499												
Year 5	89	354	620												
Year 6	96	385	674												
Year 7	115	460	805												
Year 8	122	487	852												
Year 9	134	534	935	197	787	1377									
Year 10	153	610	1068	235	941	1647									
Year 11-15	160	640	1120	139	554	970	2	8	14						
Year 16-20	131	523	915	110	440	770	75	298	522						
Year 21-25	108	433	758	97	387	677	386	1545	2704						
Year 26-30	92	368	644	89	356	623	436	1744	3052						
Year 31-35	80	318	557	84	336	588	182	726	1271	146	584	1022	36	145	254
Year 36-40	74	294	515	75	301	527	75	301	527	43	172	301	51	203	355

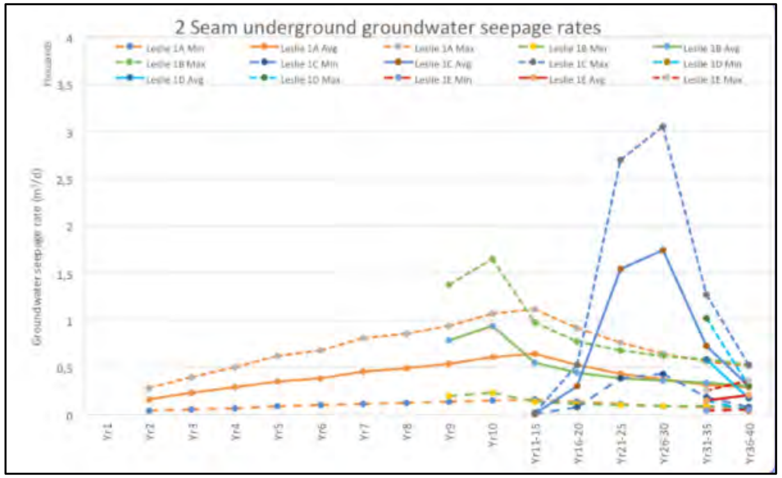


Figure 9-27: Cumulative underground seepage rates: 2 Seam Workings

As discussed for the 4 Seam workings, the predicted range of groundwater seepage volumes to the 2 Seam workings is presented as a wide range due to the uncertainty in site-specific aquifer conditions. The rate of seepage at this depth is however expected to be lower compared to the shallower mining areas, due to lower anticipated permeabilities of the aquifers intersected.

In the Leslie 1A mining area, seepage rates may vary between 160 and 640 m^3/d (minimum: $40m^3/d$; maximum 1 $120m^3/d$). In the Leslie 1B mining area, seepage rates may vary between 780 and $940m^3/d$ (minimum: $200m^3/d$; maximum 1 $640m^3/d$). In the Leslie 1C mining area, seepage rates may vary between 10 and 1 $740m^3/d$ (minimum: $2m^3/d$; maximum 3 050 m^3/d). In the Leslie 1D and E mining areas, seepage rates may vary between 150 and $580m^3/d$ (minimum: $40m^3/d$; maximum 1 $020m^3/d$).

Zone of influence due to mine dewatering during the operational phase

The groundwater that will seep into the underground workings, as discussed above, will be pumped from the mining areas to surface. This is referred to as mine dewatering. The removal of this groundwater will result in a regional lowering in groundwater levels. A lowering in groundwater because of mine dewatering may therefore result in a lowering of groundwater levels in private boreholes, if they are in the zone of influence of mine dewatering.

The cumulative impact of mine dewatering at the adjacent Springboklaagte mine was taken into consideration during this assessment. Model results indicate that underground mine dewatering will most probably not impact on groundwater levels in the shallow weathered aquifer. This is due to the presence of the dolerite sill at shallow depths. The assumed low permeability of the sill will act as a barrier between the weathered aquifer and the deeper underground mining activities. Groundwater levels will most probably only be lowered around the incline shafts in the weathered aquifer.

This zone was calculated with the numerical model as is presented in Figure 9-28. The figure represents the impact of mine dewatering at the No 4 seam mining depth (65 to 70 m below surface), as it is assumed that most private boreholes are drilled to this depth. The zone of influence is divided into four categories according to the anticipated significance of the drawdown in groundwater levels:

- 0 to 1 m drawdown in groundwater levels: Within the context of the simulations, this zone represents an area where there is uncertainty whether groundwater levels would be impacted during mining. The possibility exists that boreholes falling in this zone may or may not be impacted by mine dewatering. A lowering in groundwater level of between 0 and 1 m is however not expected to alter the status or use of a borehole.
- 1 to 5 m drawdown in groundwater levels: Boreholes that fall in this zone will probably be affected by mine dewatering. A lowering in groundwater levels by up to 5 m may affect borehole performance, depending on the borehole depth and construction. Seasonal effects on groundwater levels may be more noticeable in boreholes falling in this zone, especially during the dry season. It is however thought that groundwater abstraction will continue, but possibly in a modified way.
- 5 to 10 m drawdown in groundwater levels: Boreholes that fall in this zone are likely to be affected. Groundwater abstraction is likely to reduce under these circumstances. The extent to which groundwater abstraction will be affected for boreholes in this zone will depend on the depth and construction of the boreholes, as well as the nature of the water-bearing fractures/faults intersected. In the absence of this information, it is assumed that abstraction would be negatively affected and that these boreholes may run dry from time to time.
- More than 10 m drawdown in groundwater levels: Boreholes that fall in this zone are directly above the underground workings and are therefore likely to run dry because of mine dewatering. As stated above, the risk and timing of this impact occurring will depend on their depth and construction, as well as the nature of the water-bearing fractures/faults intersected. If these fractures/faults also intersect the underground workings, the boreholes are highly likely to run dry. In the absence of this information, a conservative approach is taken, and it is assumed that

groundwater abstraction would be negatively affected and that these boreholes will probably run dry during the operational phase of mining.

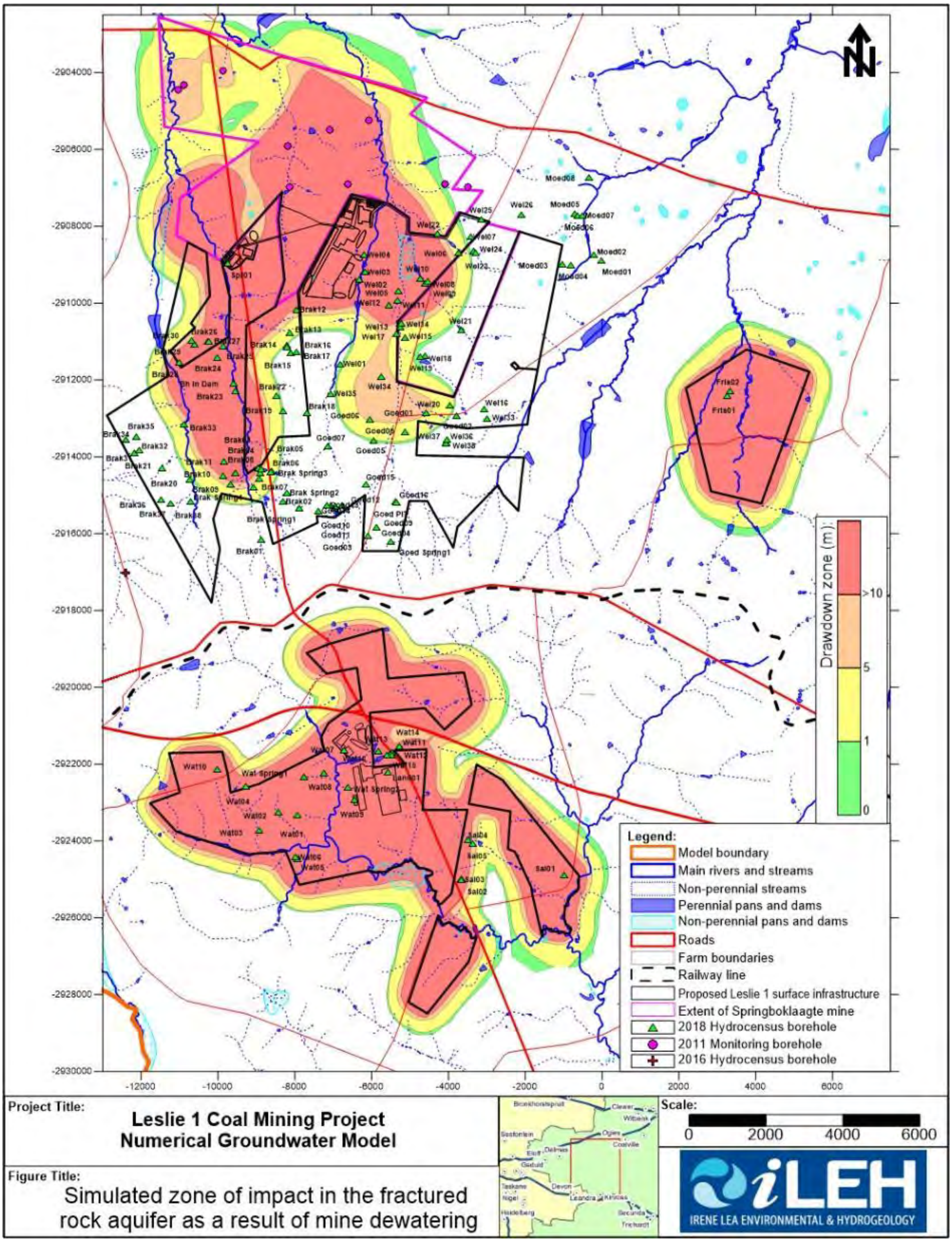


Figure 9-28: Zone of impact on groundwater levels because of mine dewatering

Table 9-28: List of private boreholes that may be affected by mine dewatering

Leslie 1A area	Leslie 1B area	Leslie 1C area	Leslie 1D area	Leslie 1E area
0 – 1 m drawdown zone				
Brak10				
Brak19				
Brak15				
Brak15				
Wel01				
Wel35				
Goed05				
Wel18				
Wel19				
Wel23				
Wel24				
1 – 5 m drawdown zone				
Brak07				
Brak05				
Brak06				
Brak22				
Brak13				
Goed03				
Wel37				
Goed01				
Wel20				
Wel15				
Wel17				
Wel06				
5 – 10 m drawdown zone				
Brak10		Sal05		
Brak09				
Brak03				
Brak04				
Brak08				
Brak12				
Wel34				
Wel13				
Wel14				
Wel22				
>10 m drawdown zone				
Wel04	Fris01	Wat10	Sal01	
Wel03	Fris02	Wat04		
Wel02		Wat03		
Wel05		Wat02		
Wel12		Wat01		
Spr01		Wat06		
Brak26		Wat05		

Leslie 1A area	Leslie 1B area	Leslie 1C area	Leslie 1D area	Leslie 1E area
Brak27		Wat08		
Brak25		Wat07		
Brak24		Wat16		
Bh In Dam		Wat09		
Brak23		Wat11		
Brak06		Wat12		
Brak04		Wat13		
Brak08		Wat14		
		Land01		
		Sal04		
		Sal03		
		Sal02		

Because water levels in the shallow weathered aquifer are not expected to be lowered because of mine dewatering, it is unlikely that any of the springs will be affected by mine dewatering. It will however be prudent to continue monitoring the springs to confirm this outcome.

The list of private boreholes that may be affected by mine dewatering, is presented in Table 9-28 It is strongly recommended that this impact assessment is updated once site-specific monitoring information is available for the Leslie 1 project area.

Private boreholes that extend into the underground workings will be destroyed during mining and will have to be replaced by AOL. It is not possible to say with certainty which boreholes will be affected in this manner with the available dataset. To do so, the depth and position of each private borehole must be compared to the depth of mining.

Impact on groundwater levels post closure

Once mining and dewatering of the underground workings ceases, groundwater levels will start to recover. The rate at which the groundwater levels will recover depends on the permeability of the aquifers, the depth and the extent of mining, as well as the level of interconnection between the three mining depths, in each mining area.

Dewatering at the adjacent Springboklaagte mine will most probably affect underground water levels recovery at the Leslie 1A mining area. The mine schedule for Springboklaagte is not available and for this reason it cannot be said with confidence to what extent dewatering at Springboklaagte would affect groundwater level recovery at Leslie 1A mine upon closure. For calculations, the impact of Springboklaagte was disregarded.

Another factor that may play a role is whether subsidence of ground above the underground workings will take place. This will increase the rate of recharge to the underground workings, thus affecting the rate of flooding. It is understood that no subsidence is expected and for this reason, average recharge rates were used during this assessment.

Based on the available dataset, the extent of mining over three coal seams and the assumptions discussed above, the estimated time of flooding of the underground workings for all five mining areas is expected to be more than 100 years, as indicated in Table 9-29.

The estimation provided should be updated once site-specific groundwater monitoring and aquifer characteristics information is available for the Leslie 1 project.

Table 9-29 Estimated time to flood underground workings

Mining area	Surface area (m^2)	Estimated total void volume (m^3)	Recharge volume (m^3/a)	Groundwater inflow (m^3/a)			Time to flood (years)		
				Minimum	Average	Maximum	Maximum	Average	Minimum
Leslie 1A East	9 071 416	2 4492 823	125 821	3 668	14 670	25 673	189	174	162
Leslie 1A West	3 315 441	8 951 691	45 985	2 341	9 364	16 386	185	162	144
Leslie 1B	7 874 173	1 7716 889	109 215	2 045	8 178	14 312	159	151	143
Leslie 1C	25 211 573	5 672 6039	349 685	7 045	28 181	49 317	159	150	142
Leslie 1D	3 423 694	7 703 312	47 487	2 088	8 352	14 616	155	138	124
Leslie 1E	2 463 961	5 543 912	34 175	1 194	4 776	8 357	157	142	130

9.6.3.3 Impact of groundwater abstraction for water supply to the mine

The Scoping Report states that the mine will require 3 Ml/d of water for use in the mine water balance. One option that is under consideration is the use of groundwater to supply the mine.

There is currently no information available to indicate where water supply boreholes can be drilled and how many boreholes will be required.

To identify optimal water supply borehole drilling sites, geophysical surveys must be undertaken to identify optimal targets; pumping tests must be completed to confirm the safe yield of each borehole; and the model must be updated and re-calibrated with this information to assess the impact of groundwater abstraction on existing private groundwater users. This cannot be completed until the information listed above are available.

It is strongly recommended that the mine evaluate the availability of groundwater for use at the operations prior to the commencement of mining during the planning phase for the project. This study must evaluate the cumulative impact of groundwater abstraction to determine whether or not groundwater abstracted for water supply to the mine will compete with existing groundwater use. If the outcome of this study indicates that groundwater abstraction for the mine will reduce groundwater available to existing users, alternative water resources must be identified as required. These may have to include a combination of groundwater, surface water or municipal water supply, depending on the availability of water in the area.

9.6.3.4 Risk of decant

Decant from mining areas refers to the daylighting of mine void or underground water on surface, most often in the long-term. At mine closure, active mine dewatering ceases and groundwater levels start to recover, as discussed above. The likelihood of whether decant will take place, depends on the volume of water that enters the mining area. Inflow to the mining areas post closure will take place from two main sources, namely the recharge of rainwater and natural groundwater throughflow. If this combined volume is higher than natural rates, it is likely that the mining area would decant. If the inflow volume is less than or equal to natural rates, it is unlikely that decant would take place.

The rate of groundwater inflow to the mining areas will be determined by the flow gradients, the permeability of the rock formations intersected and the area over which groundwater seepage will take place. Initially the inflow to the underground workings will be fast, post closure, due to steep flow gradients towards the mining area. As the mines start to flood, the gradients will become shallower as groundwater levels rise, which will reduce the volume of groundwater inflow to near natural conditions.

Comparatively, the volume that groundwater inflow contributes post closure is lower than the volume of water added through recharged of rainwater. The rate of recharge to the mining areas is therefore the main driving force behind decant.

With the available dataset and mine plan, it is concluded that the risk of decant from the underground workings is very low. If no subsidence takes place, the rate of recharge to the underground workings will remain close to natural rates. Under these conditions, underground water levels are not expected to rise above natural trends, thus eliminating the risk of decant.

9.6.3.5 Zone of influence on groundwater quality

The results of simulations are presented as sulphate plumes that indicate the extent of the zone of impact on groundwater quality in the weathered and fractured rock aquifers for both the operational and long-term scenarios, as discussed below. The sulphate plumes were delineated by the 250 mg/L concentration contour, which represents the SANS241:2015 aesthetic limit for potable water.

Impact on groundwater quality during the construction phase

Due to the short duration of the construction phase, no significant adverse impacts on groundwater quality is expected.

Impact on groundwater quality during the operational phase

During the operational phase of mining the spread of contamination from the mining areas will be controlled by the effect of mine dewatering. The lowering of groundwater levels in both aquifers will reverse groundwater flow gradients towards the mining areas, thus preventing potential pollution from spreading beyond the zone of influence of mine dewatering. The impact of underground mine dewatering is however not expected to have an impact on the weathered aquifer, as discussed earlier. Potential groundwater contamination originating from surface sources may therefore spread from these areas during the operational phase, as discussed below. Such areas include the plant areas, run of mine (ROM) stockpiles and the discard dumps. These facilities are located at the Leslie 1A and 1C operations. Please note that it was assumed that no contamination would originate from the PCDs, as these will be designed to contain all dirty water and not spills are therefore envisaged. The dams will also be lined with HDPE, thus not allowing any seepage to occur.

The extent of the zone of influence on groundwater quality in the weathered aquifer expected at the end of the operational phase of mining is presented in Figure 9-29. Three zones of impact are delineated:

- Sulphate concentrations of 250 to 500 mg/L: boreholes that fall in this zone may experience sulphate concentration increases above the SANS241:2015 aesthetic limit. The groundwater may therefore be tainted with respect to taste or colour but will not pose and unacceptable health risk.
- Sulphate concentrations 500 to 1 000 mg/L: boreholes in this zone may experience sulphate concentration increases above the SANS241:2015 acute health limit and may therefore pose an unacceptable health risk. The water is expected to have a salty or bitter taste and may result in diarrhoea if consumed.
- Sulphate concentrations higher than 1 000 mg/L: groundwater in this zone will cause diarrhoea and have a very strong salty and bitter taste.

At the Leslie 1A East mining area, the plume from the discard dump is expected to migrate a distance of 400 m in a westerly and easterly direction from the site. By the end of the operational phase, sulphate concentrations exceeding 1,000 mg/L may reach the Kromdraaispruit over a distance of 1 km along the flow of the stream, as shown on Figure 9-29. Contamination associated with the incline shaft is not expected to significantly impact on groundwater quality at the end of the operational phase. Private boreholes Wel02, Wel03 and Wel04 may be affected at this stage.

Contamination from the Leslie 1A West incline shaft is not expected to significantly impact on groundwater quality as shown on Figure 9-29.

Sulphate contamination from the discard facility and associated infrastructure at the Leslie 1C mining area may also migrate up to 400 m from the facility during the operational phase. There is a small likelihood that the plume may reach the tributary of the Klipspruit over a distance of 150m along the stream during the operational phase, situated to the west of the site, during this time. Sulphate concentrations are not expected to increase significantly above 250 mg/L at this position.

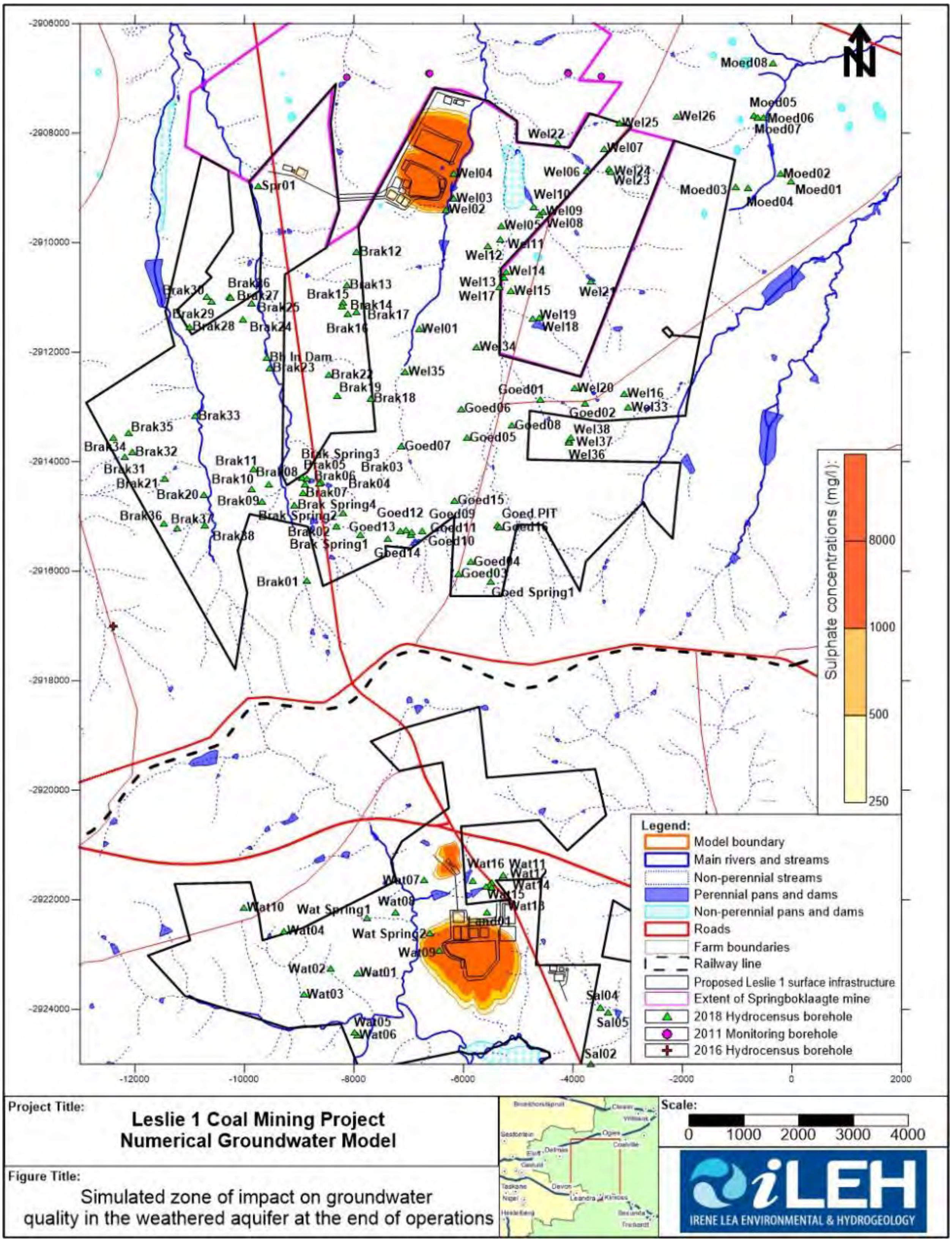


Figure 9-29: Weathered aquifer zone of influence on groundwater quality: Operational phase

Private boreholes that may be affected by potential contamination from the Leslie 1A and 1C mining areas, during the operational phase, are listed in Table 9-30.

Table 9-30: Boreholes within the zone of influence on groundwater quality: Operational Phase

Leslie 1A Mining Area	Leslie 1C Mining Area
250 – 500 mg/L SO_4 impact zone	
Wel02	
500 – 1,000 mg/L SO_4 impact zone	
	Wat Spring 2
>1,000 mg/L SO_4 impact zone	
Wel03	Wat09
Wel04	

The extent to which groundwater quality would be affected in these boreholes will depend on their depth and construction. In the absence of detailed information regarding borehole depth and construction, a cautionary approach is taken and all boreholes falling in the delineated zones are listed.

9.6.3.6 Impact on river water quality during the operational phase

The available dataset suggests that groundwater flow follows the topography and drains towards local rivers and streams. Groundwater is therefore expected to contribute to the baseflow of rivers and streams, most significantly to perennial streams during the dry season. It follows that if groundwater is contaminated through mining activities and the plumes emanating from the various sources reaches rivers and streams, that the contaminated groundwater would add to the salt load on the affected rivers and streams.

This impact will be most significant in the weathered aquifer, as groundwater flow in the deeper fractured rock aquifer is controlled by the overlying dolerite sill that confines the deeper aquifer.

During the operational phase, model simulations indicate that groundwater with sulphate concentrations more than 1,000 mg/L may reach the Kromdraaispruit in the Leslie 1A East mining area and a tributary of the Klipspruit at the Leslie 1C mining area. No impacts on rivers or streams are expected in the Leslie 1A West mining area. The estimated salt load because of this impact is presented in Table 9-31.

Table 9-31: Estimated salt load during the operational phase of mining

Mining Area	Estimated volume (m^3/a)	Average SO_4 concentration (mg/L)	Average salt load (t/a)
Leslie 1A East	2 000	1 000	2.0
Leslie 1C	800	250	0.2

9.6.3.7 Long-term impact on groundwater quality

<u>Potential contamination of the weathered aquifer</u>

The long-term movement of sulphate plumes expected in the shallow weathered aquifer are presented in Figure 9-30. The figures show the extent of sulphate contamination 100 years after mining ceases and rehabilitation is completed. During simulations, the sulphate concentration assigned to the discard dumps has the most significant impact. The concentrations and recharge rates reported in G^2 (2013) were used to approximate this impact. Groundwater level recovery in the underground workings is not expected to affect movement of contamination in the weathered aquifer post closure. This is because the fractured rock aquifer is confined by the dolerite sill present in the area, which is assumed to retard vertical flow between the weathered and fractured rock aquifer. For this reason, the spread of contamination in the weathered aquifer will most probably occur under natural groundwater flow conditions.

At the Leslie 1A East and West operations, the plumes from the incline shafts are not expected to significantly impact on groundwater quality due to its comparatively small size.

At the Leslie 1A East operations the plume from the discard dump will migrate in a westerly direction towards the tributary of the Kromdraaispruit. The plume from the discard dump is also expected to continue to spread in an easterly direction towards tributary of the Wilge River. Sulphate concentrations may increase to 3 500 mg/L in groundwater reaching this stream over the 100-year simulation period.

At the Leslie 1C mining area, the plume from the discard dump is expected to move in a southerly direction towards the Klipspruit and reach the stream in the 100-year simulation period. Sulphate concentrations exceeding 900 mg/L may be recorded at this position. The plume will also migrate towards the tributary of the Klipspruit to the west and sulphate concentrations are expected to increase to around 1 000 mg/L in this area.

Private boreholes that fall in the zone of impact on groundwater quality in the weathered aquifer are listed in Table 9-32.

Table 9-32 Boreholes within the zone of influence on groundwater quality: Post-Closure Phase

Leslie 1A Mining Area	Leslie 1C Mining Area
250 – 500 mg/L SO_4 impact zone	
500 – 1 000 mg/L SO_4 impact zone	
	Wat07
	Wat Spring 02
>1 000 mg/L SO_4 impact zone	
Wel04	WatSpring2
Wel03	Wat09

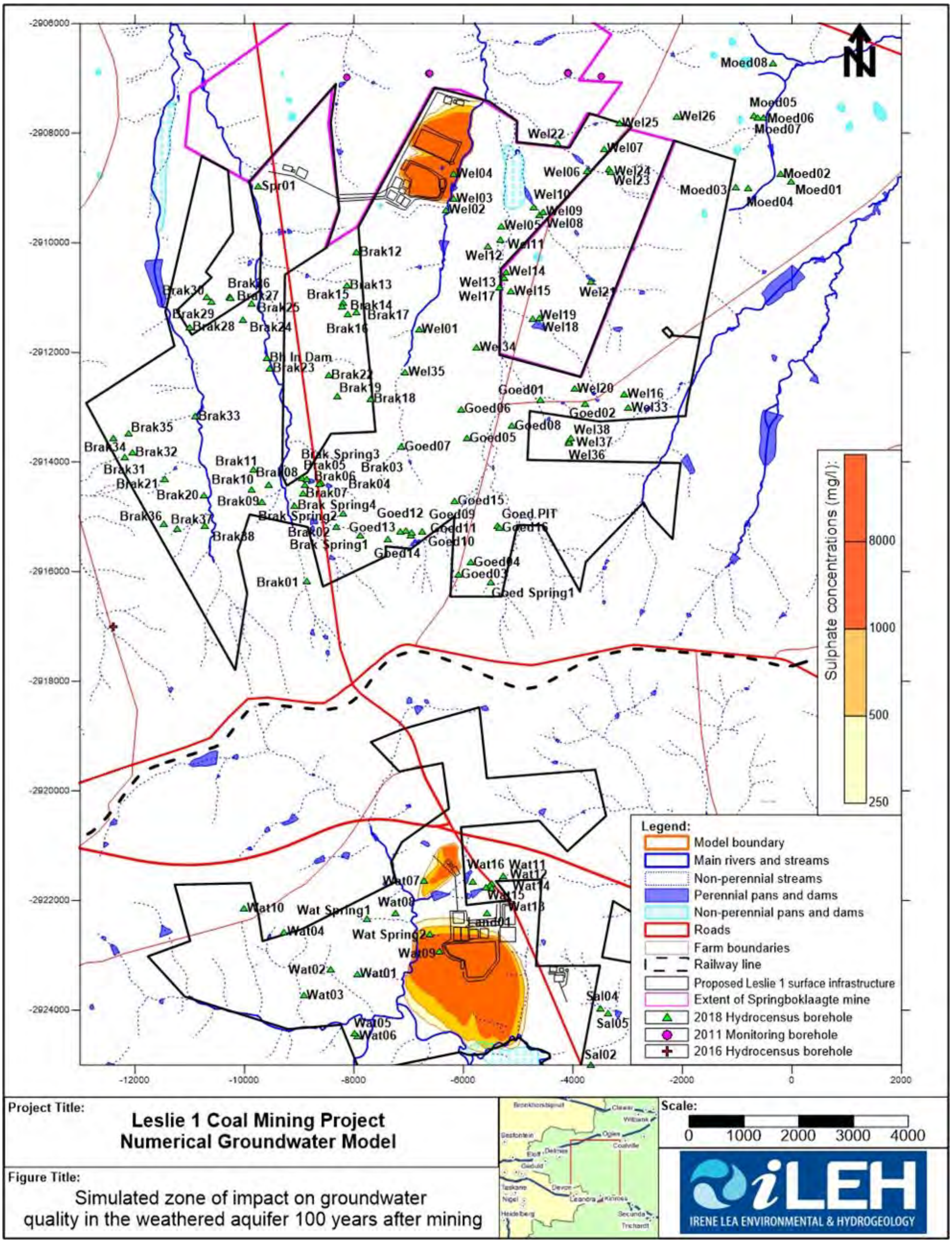


Figure 9-30: Weathered aquifer zone of influence on groundwater quality: Post closure phase

9.6.3.8 Potential impact on the fractured rock aquifer

The extent to which contamination could spread from the underground workings in the fractured rock aquifer post closure, over a period of 100 years, will be controlled by the rate of groundwater level recovery. It is shown in Table 9-29 that this is expected to take more than 100 years.

As a result, the spread of contamination post closure from the underground workings is not expected to significantly move outside the extent of mining. This is demonstrated in Figure 9-31, Figure 9-32 and Figure 9-33 for the three mining depths. The extent of sulphate contamination is presented in the impact zones discussed above. The contaminated water will most likely be contained in the underground workings and as such is not expected to impact on private borehole quality. Private boreholes that extend into the underground workings will most probably be destroyed during mining.

It is possible that the plume may move up to 200 m from the mining areas on the level of mining during the 100-year simulation period, mainly because of the way in which dispersion was included during modelling.

It is recommended that this conclusion be confirmed with additional simulations once site-specific monitoring borehole and aquifer information becomes available for the Leslie 1 mining areas.

9.6.3.9 Impact on river quality in the long-term

The estimated long-term impact of contaminated groundwater flowing into the local rivers and streams are presented in Table 9-33. As discussed earlier, the Kromdraaispruit will be affected at the Leslie 1A West operations; a tributary of the Wilge River at the Leslie 1A East operations; and a tributary of the Klipspruit at the Leslie 1C operations.

Table 9-33 Estimated salt load post closure

Mining Area	Estimated volume (m^3/a)	Average SO_4 concentration (mg/L)	Average salt load (t/a)
Leslie 1A East	2 700	3 500	9.5
Leslie 1C	3 000	1 000	3.0

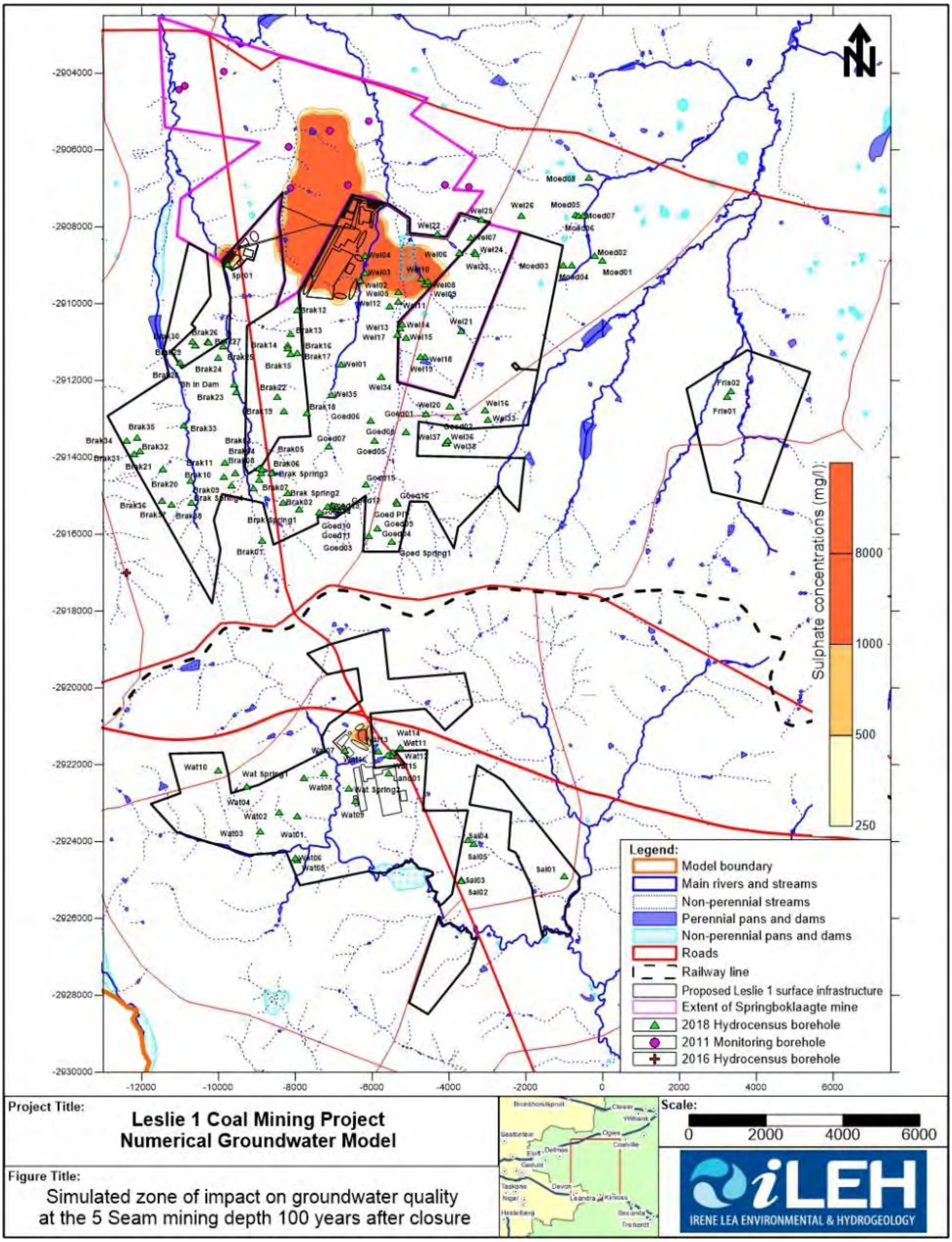


Figure 9-31 Long-term fractured aquifer zone of influence on groundwater quality on 5 Seam level

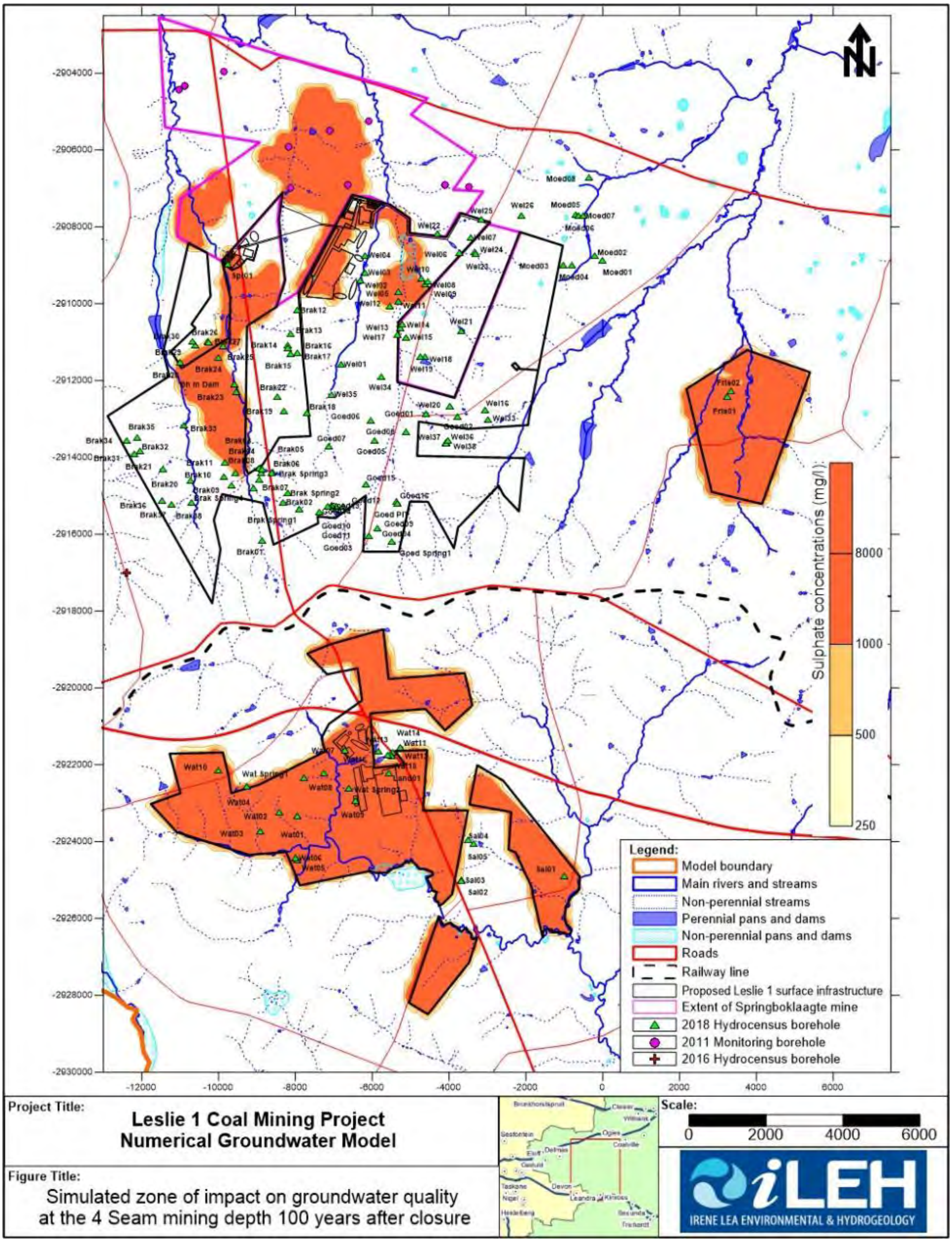


Figure 9-32 Long-term fractured aquifer zone of influence on groundwater quality on 4 Seam level

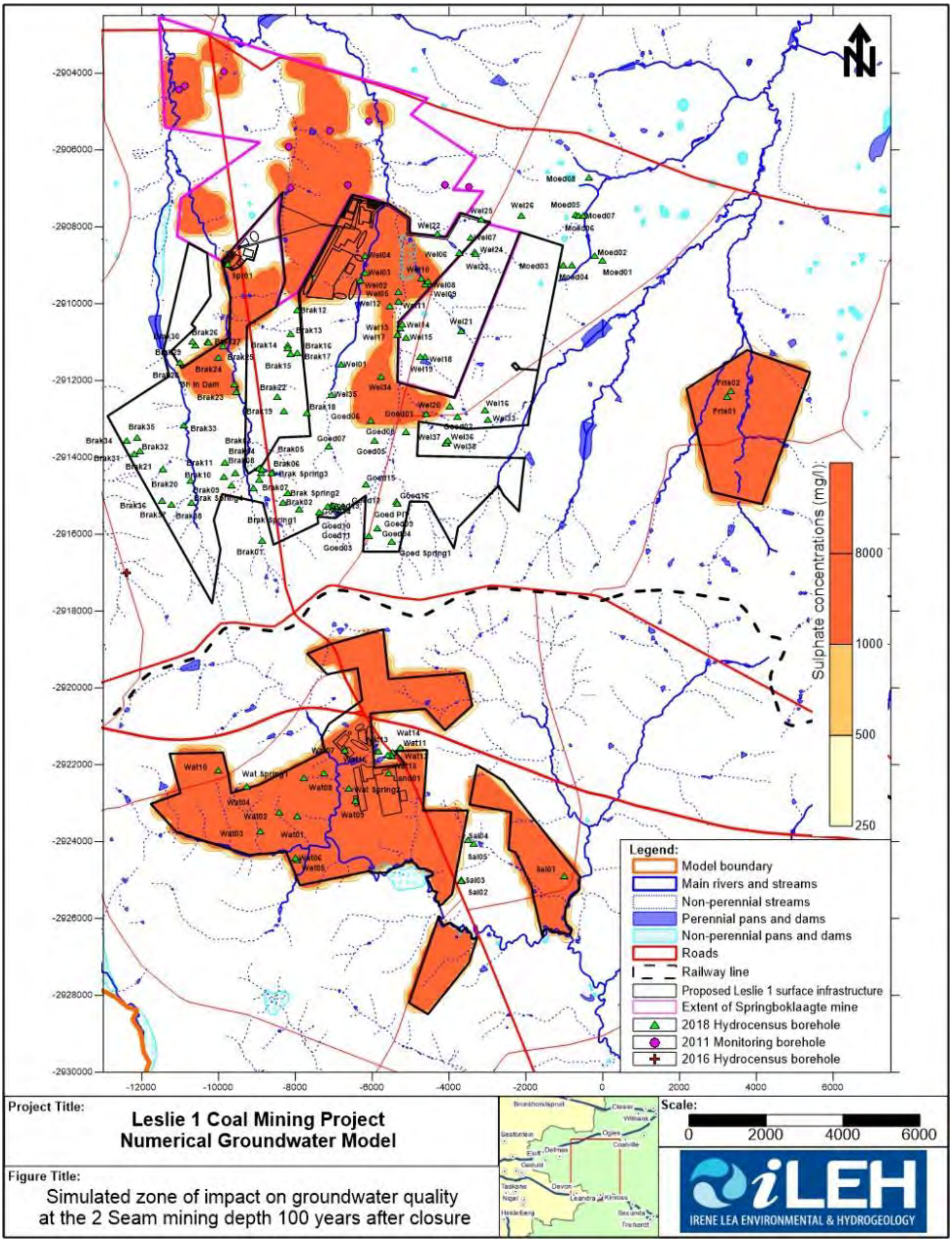


Figure 9-33 Long-term fractured aquifer zone of influence on groundwater quality on 2 Seam level

9.6.4 Specialist Conclusions

It is recommended that:

- The groundwater management plan discussed in the specialist report be implemented for all phases of mining.
- The groundwater monitoring programme presented in the report is implemented and maintained during the life of the project.
- The authors believe the project can proceed, but alternative water supply sources will have to be provided to several landowners, should monitoring results indicate that boreholes are negatively impacted due to mining. Several production farmers are in the project area and livestock and poultry operations rely heavily on local surface and groundwater resources.

9.7 Biodiversity

A Biodiversity Impact Assessment, Aquatic Impact Assessment and Wetland Impact Assessment were undertaken by The Biodiversity Company for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full reports are provided in Appendix D4, Appendix D5 and Appendix D6 respectively.

9.7.1 Environmental Status Quo

9.7.1.1 The Project Area in Relation to the Mpumalanga Biodiversity Sector Plan

Figure 9-34 shows the Leslie 1 Project area superimposed on the Mpumalanga Biodiversity Sector Plan (MBSP) Terrestrial Critical Biodiversity Areas (CBA) map. Based on this, the proposed mining areas will overlap with the following:

- Critical Biodiversity Areas (CBAs);
- Ecological Support Areas (ESAs);
- Heavily or Moderately Modified Areas (HMAs); and
- Other Natural Areas (ONAs).

Based on this desktop information, much of the Project area is identified as either HMAs or ONAs. However, various CBAs exist across both the northern and southern portions of the Project area.

Importantly, the proposed infrastructure portions on Leslie 1A overlap predominantly with ONAs, and a small portion intersects with an Irreplaceable CBAs. The proposed infrastructure development areas on Leslie 1C overlap predominantly with HMAs. However, Irreplaceable CBAs surround the proposed development area on all sides.

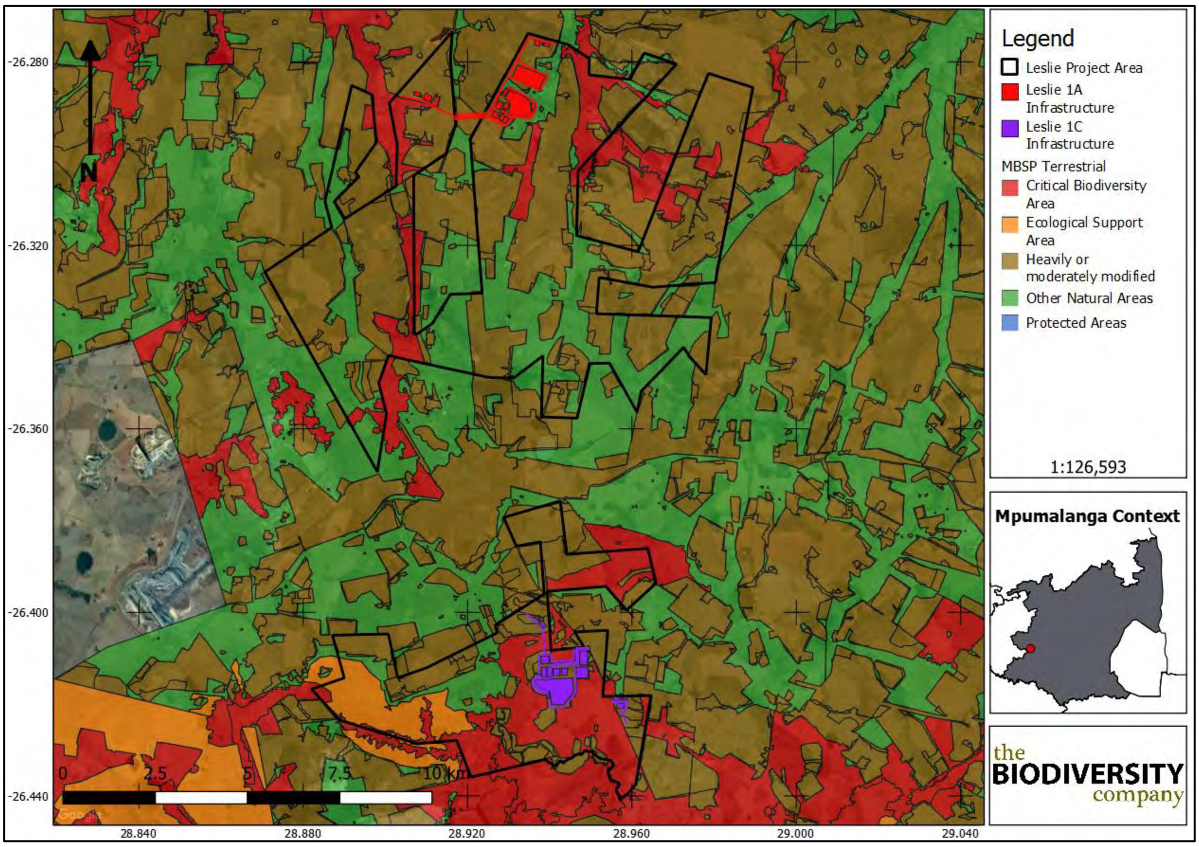


Figure 9-34: Leslie 1 Project area superimposed on the MBSP Terrestrial Critical Biodiversity Areas (CBA) map (MBSP, 2014)

9.7.1.2 Project Area in relation to Ecosystem Threat Status

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

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

The Project area was superimposed on the terrestrial ecosystem threat status (Figure 9-35). The infrastructure development portions, as well as the overall Project area, overlap entirely with ecosystems that are listed as Vulnerable (VU). A Critically Endangered (CR) ecosystem lies to the west of the Project area.

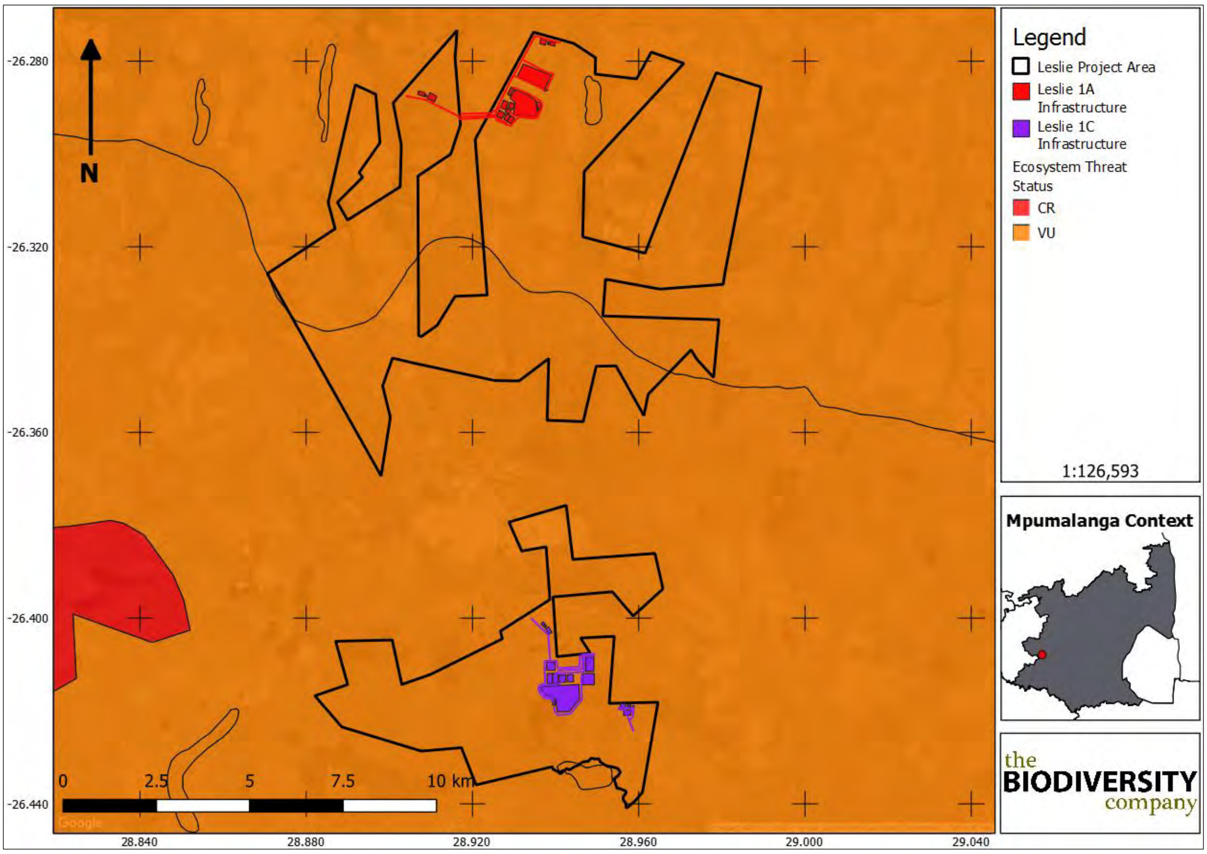


Figure 9-35: Leslie 1 Project area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2012)

9.7.1.3 Project Area in relation to Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver at al., 2012).

The Leslie 1 Project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 9-36). The majority of the terrestrial ecosystems associated with the development are rated as *not protected* and small pockets in both the northern and southern portions of the Project area are rated as *poorly protected*. Areas that are designated as *not protected* are ecosystems that are not adequately protected in formally protected areas, such as national parks.

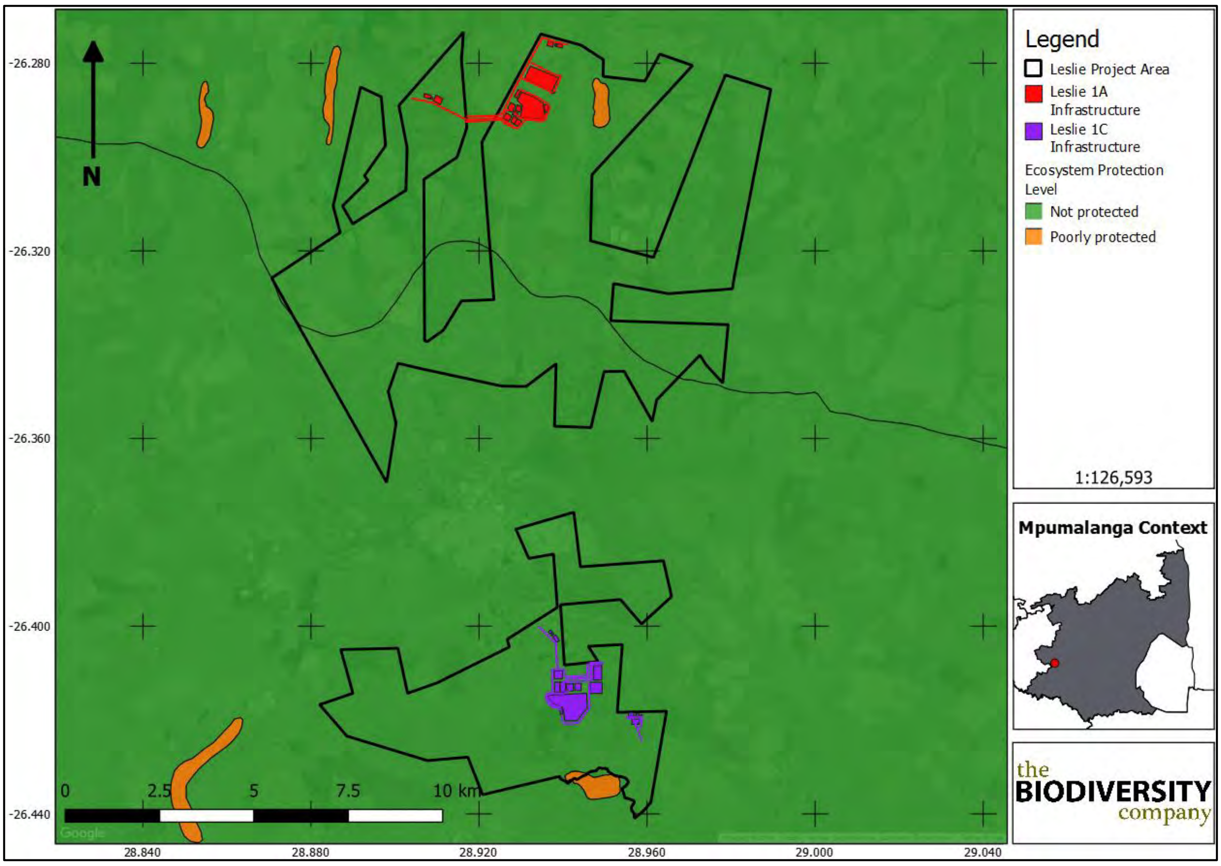


Figure 9-36: The Leslie 1 Project area showing the level of protection of terrestrial ecosystems (NBA, 2012)

9.7.1.4 Project Area in Relation to Protected Areas

Figure 9-37 shows the location of formally protected areas in relation to the Leslie 1 Project area. Formally protected areas refer to areas protected either by national or provincial legislation.

Based on the SANBI (2010) Protected Areas Map and the National Protected Areas Development Strategy (NPAES) the Project area does not overlap with any formally or informally protected area. The closest protected area is the Marievale Bird Sanctuary Provincial Nature Reserve which is situated approximately 42.6 km west of the Project area.

Based on the above information and the location of the proposed development, the Leslie Development project is not expected to have an impact on any formally or informally protected areas.

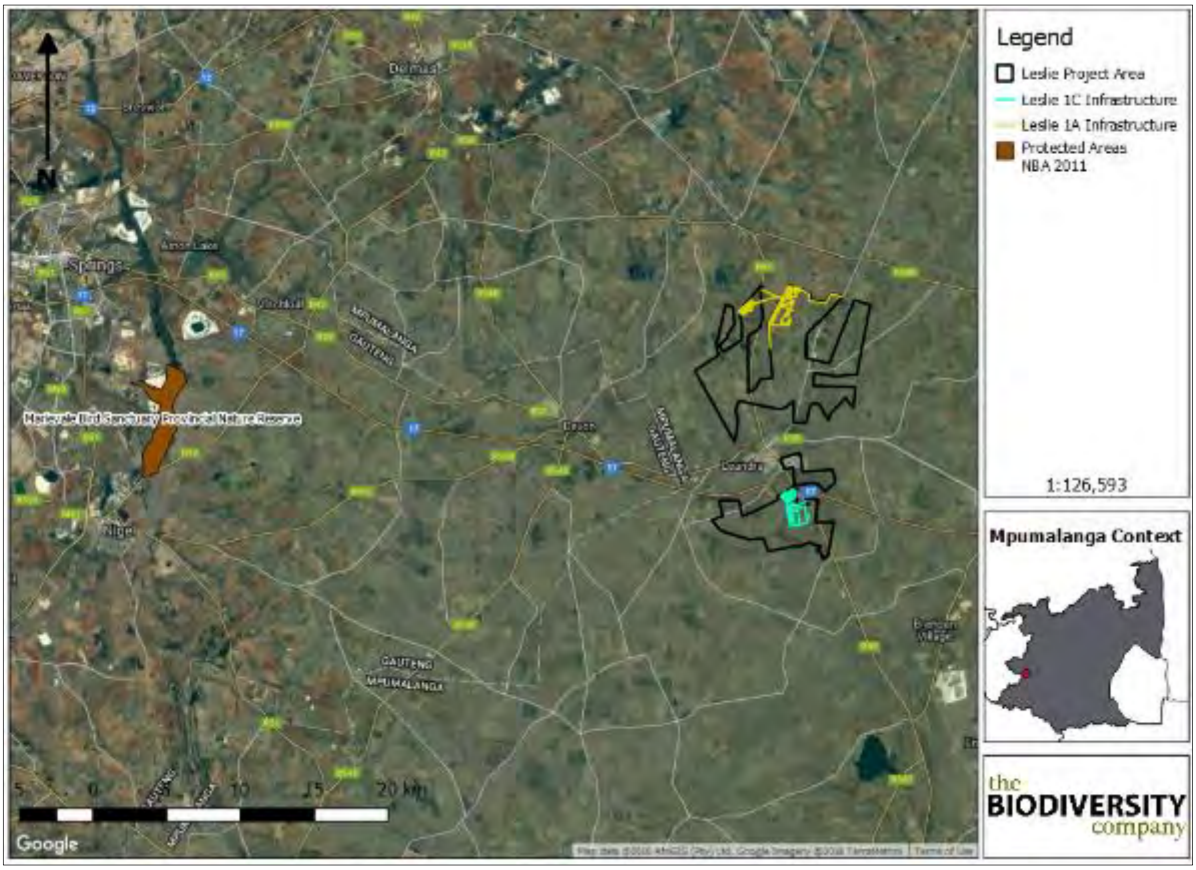


Figure 9-37: Formally protected areas in relation to the Project area (BGIS,2017)

9.7.1.5 National Freshwater Ecosystem Priority Area (NFEPA) Status

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

Figure 9-38 shows the location of the Project area in relation to wetland and river FEPAs. Based on this information, the Project area does overlap with certain wetland areas various perennial rivers.

The northern portion of the Leslie 1A Project area, and specifically the infrastructure footprint area, overlap with two perennial rivers. However, neither of these rivers are classified as NFEPA rivers. Project area 1A does not intersect and FEPA or Non-FEPA wetland areas. Various small Non-FEPA wetlands occur east of the infrastructure footprint area.

The southern portion of the Leslie 1C Project area intersects with a Class 1: Freshwater Ecosystem Priority Area. This Class 1 NFEPA river has the most sensitive classification. Project areas 1A does not intersect with any FEPA wetland areas.

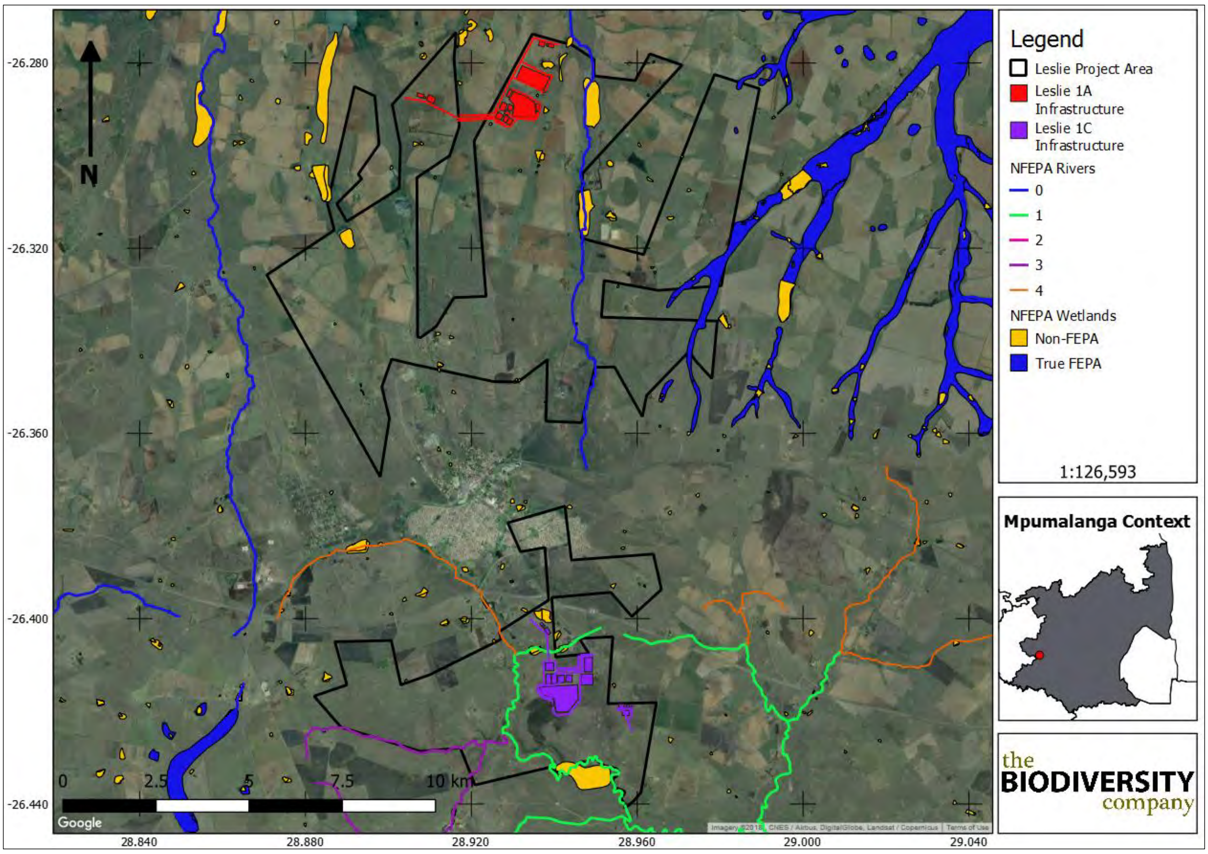


Figure 9-38: The Leslie 1 Project area in relation to the National Freshwater Ecosystem Priority Areas (2011)

9.7.1.6 The MBSP Freshwater Assessment

The MBSP Freshwater Assessment outlines priority areas for freshwater biodiversity in Mpumalanga. The resulting features are predominantly derived from the NFEPA products, layers include CBA Rivers (based on FEPA and free-flowing rivers), CBA Wetlands (based on FEPA wetlands), CBA Aquatic species (Odonata & crab taxa of conservation concern only), ESA Wetland Clusters (FEPA wetland clusters), and ESA Wetlands (all other non-FEPA wetlands).

The Leslie 1 Project area in relation to the MBSP Freshwater Assessment overlaps with the following areas: Critical Biodiversity Areas (CBAs), Ecological Support Areas (ESAs), Heavily Modified Areas (HMAs) and Other Natural Areas (ONAs) (Figure 9-39).

The northern portion of the Project area, specifically portion 1A, intersects with HMAs and ONAs. Portion 1A does not intersect with any CBAs but does intersect predominantly with HMAs and ONAs.

The southern section of the Project area, portion 1C, intersects predominantly with HMAs and ESAs. However, a small portion of the proposed infrastructure areas crosses a CBA.

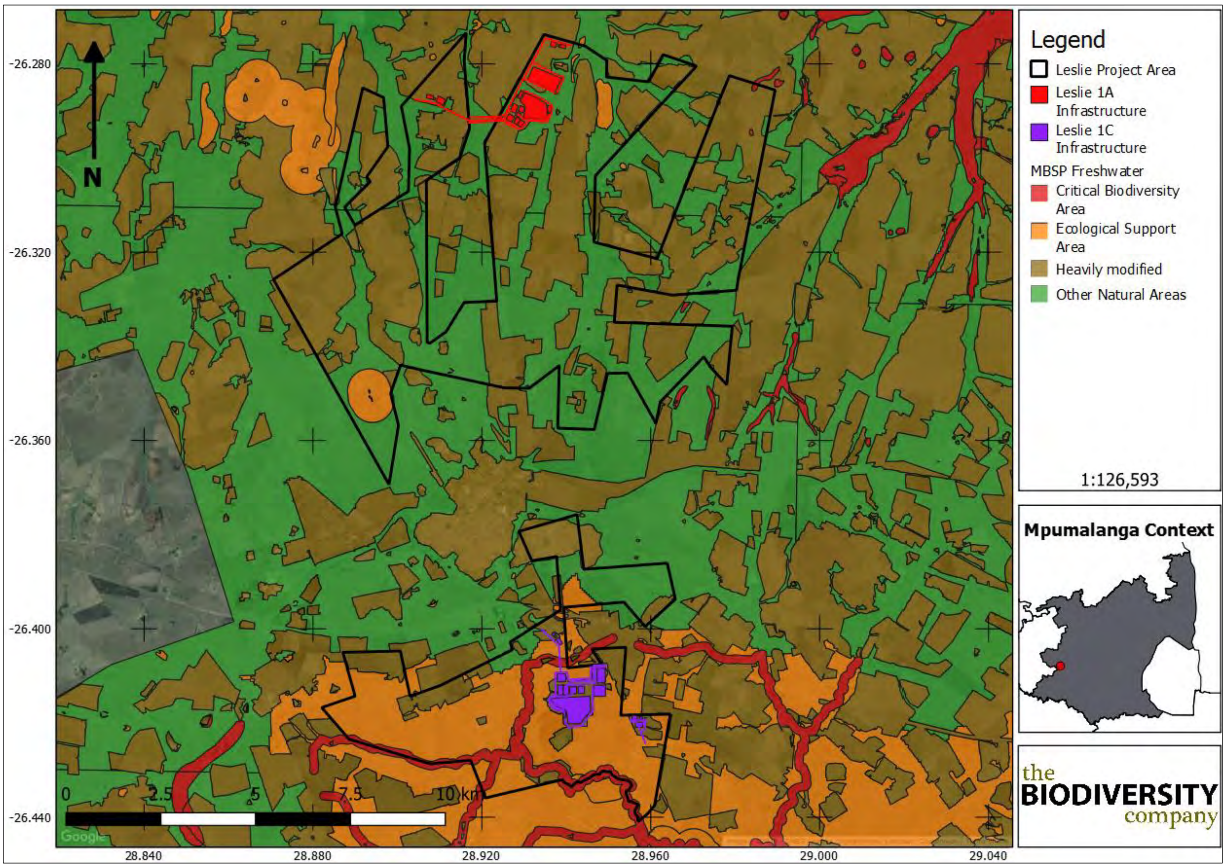


Figure 9-39: The Leslie Project area in relation to the MBSP Freshwater Assessment

9.7.1.7 Mpumalanga Highveld Wetlands

Figure 9-40 shows the Project area in relation to the Mpumalanga Highveld Wetlands data as provided by SANBI. Leslie 1A Project area intersects with wetland areas classified as AB, which means that these areas have been classified as mostly natural or good condition. Infrastructure footprint areas in the southern portions (Leslie 1C) of the Project area intersect with wetland areas classified as C and are adjacent to various dams and class AB wetlands to the west.

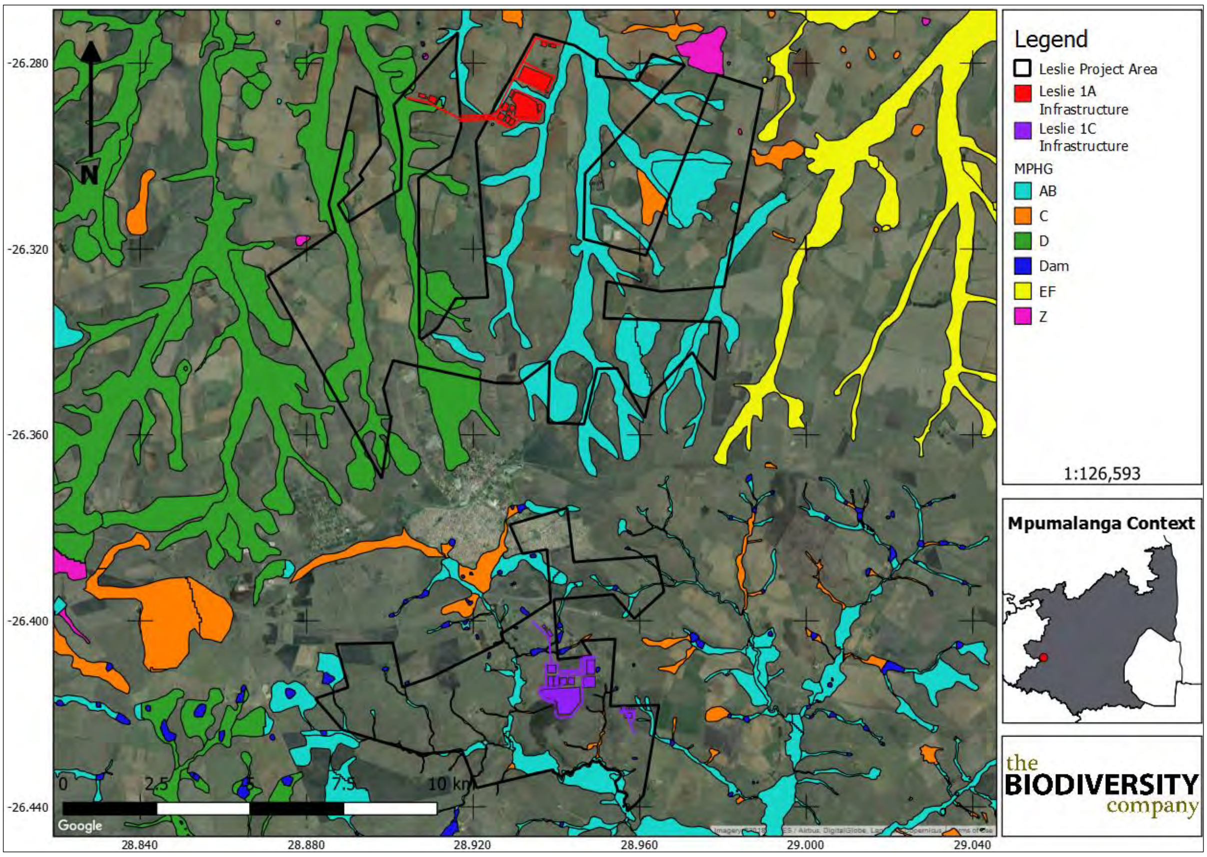


Figure 9-40: Shows the overall Project area in relation to the Mpumalanga Highveld Wetlands (SANBI, 2012)

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. The extent of the delineated wetland areas is presented in Figure 9-41 and Figure 9-42. These delineations illustrate isolated hillslope seeps (HGM 1 and HGM 3), unchanneled valley bottoms (HGM 2), seeps with channelled outflow (HGM 4) as well as floodplains (HGM 5) identified during the field survey.

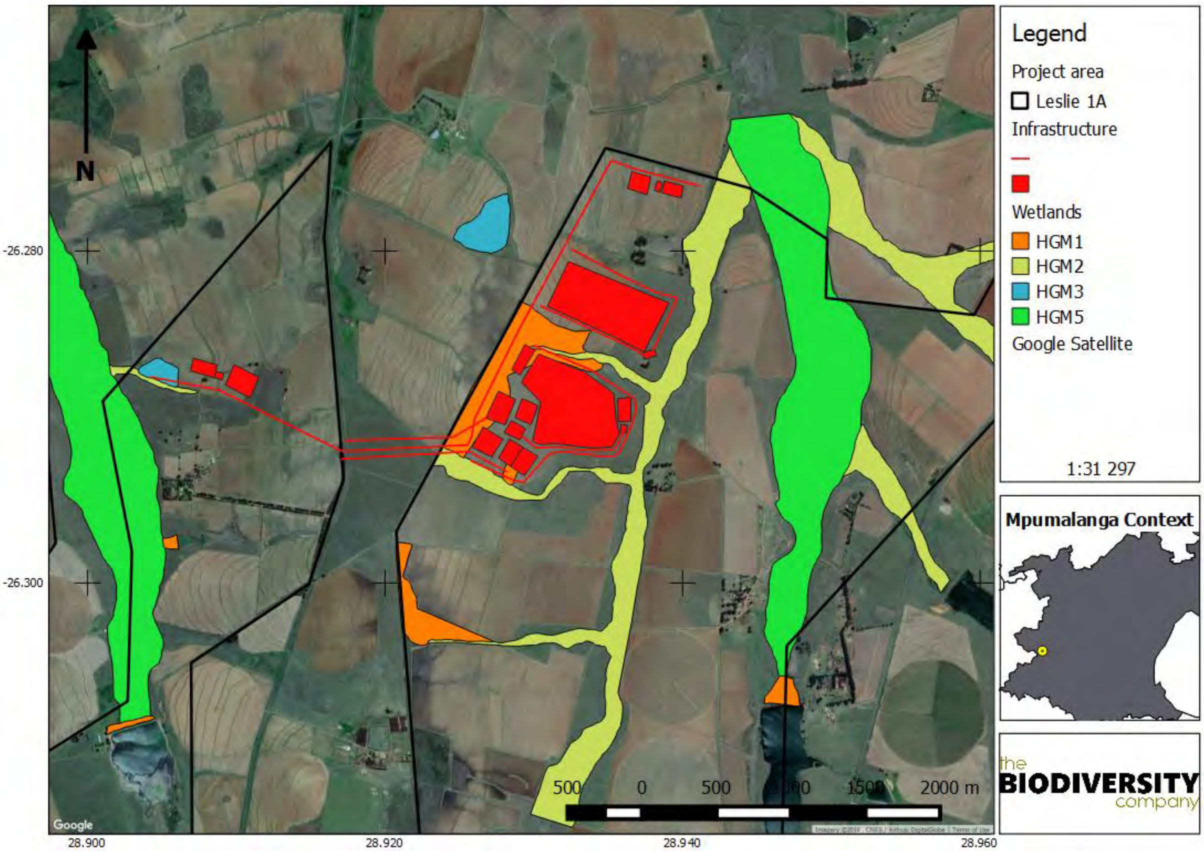


Figure 9-41: Delineation of wetlands within project area 1A

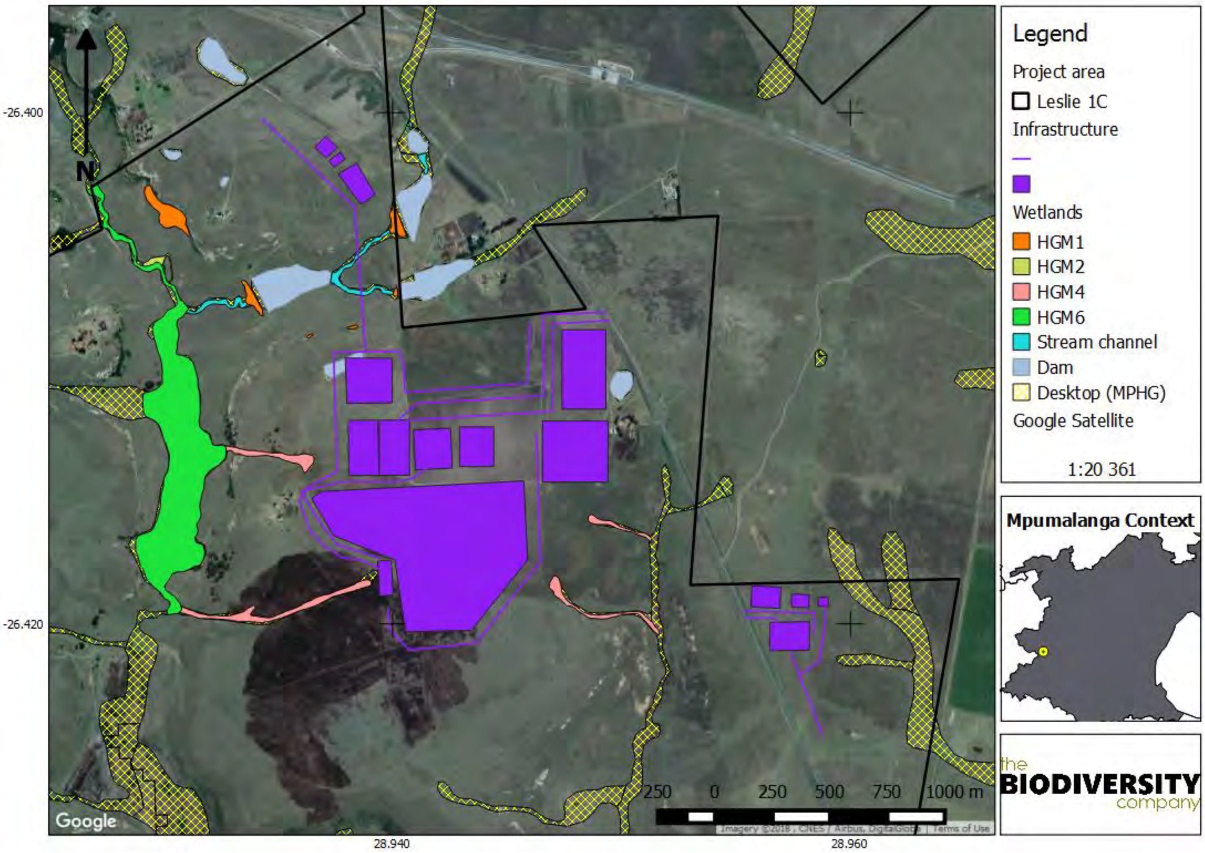


Figure 9-42: Delineation of wetlands within project area 1C

9.7.1.8 Important Bird Areas (IBA)

Important Bird Areas (IBAs) are the sites of international significance for the conservation of the world's birds and other nature as identified by BirdLife International. These sites are also all Key Biodiversity Areas; sites that contribute significantly to the global persistence of biodiversity (Birdlife, 2017).

According to Birdlife International (2017), the selection of Important Bird and Biodiversity Areas (IBAs) is achieved through the application of quantitative ornithological criteria, grounded in up-to-date knowledge of the sizes and trends of bird populations. The criteria ensure that the sites selected as IBAs have true significance for the international conservation of bird populations and provide a common currency that all IBAs adhere to, thus creating consistency among, and enabling comparability between, sites at national, continental and global levels.

The Leslie 1 Project area is adjacent to the Devon Grasslands IBA (Figure 9-43). This IBA was established in 2014 due to the presence of a number of species of conservation concern. The IBA extends from the town of Devon in the north to an area 7 km east of Balfour and 5 km north of Greylingstad.

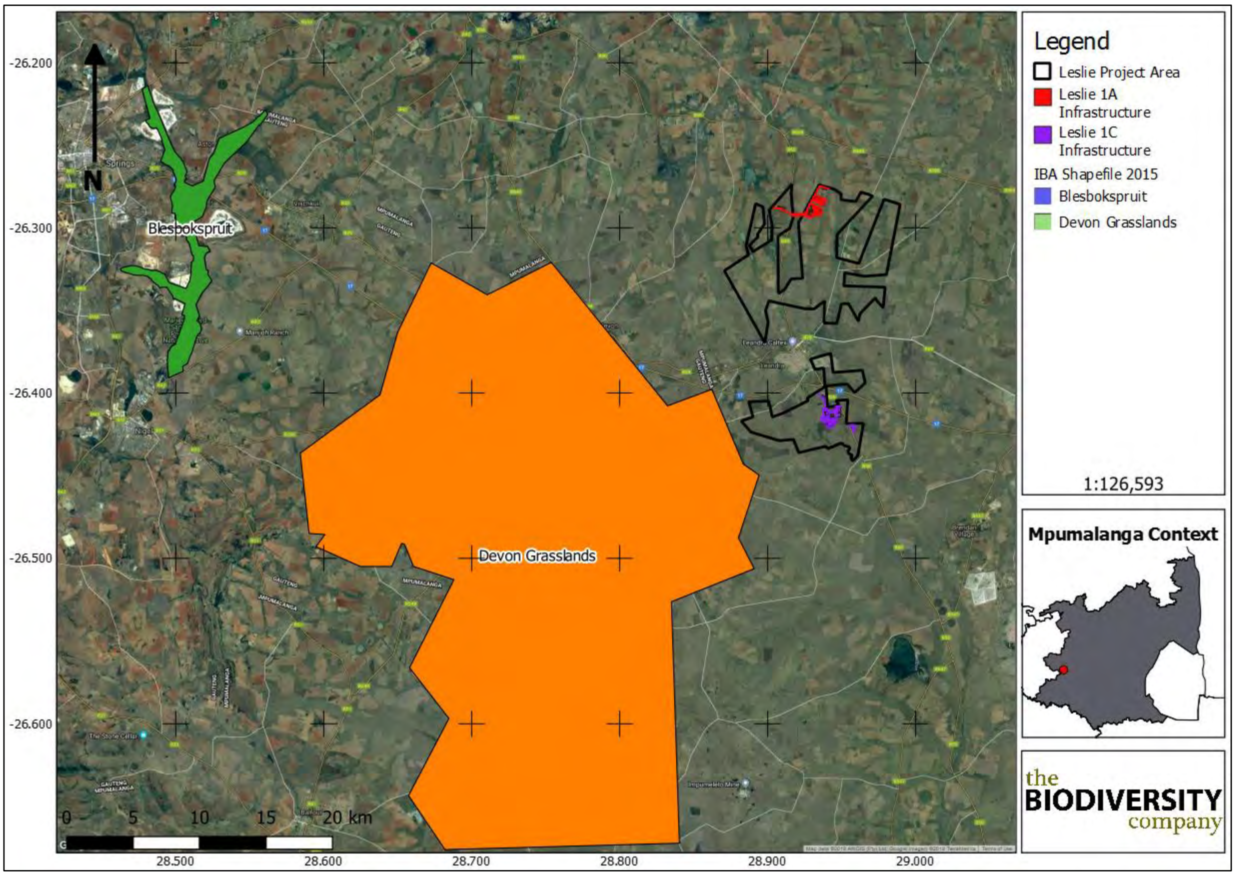


Figure 9-43: Proximity of the Leslie 1 Project area to the Devon Important Bird and Biodiversity Area

The Devon Grasslands IBA was declared for its importance in supporting globally threatened bird species. It is of global importance as it hosts various grassland and wetland bird species that are either globally or nationally threatened and have restricted ranges (Birdlife, 2017). The area is well known for Blue Crane (*Anthropoides paradiseus*) and flocks totalling 250–300 birds are recorded during most winters (Birdlife, 2017). Blue Korhaan (*Eupodotis caerulescens*) and Secretarybird (*Sagittarius serpentarius*) breed here and are commonly observed. Other regionally threatened bird species that occur here are African Grass Owl, Greater Flamingo and African Marsh Harrier.

Based on the initial desktop analysis there appears to be extensive habitat within the proposed Project area that may be important for some of these bird species. Even semi-disturbed areas can provide suitable foraging areas for many of the species that occur within and adjacent to this IBA.

9.7.1.9 The Mining and Biodiversity Guidelines

The Mining and Biodiversity Guidelines (2013) was developed by the Department of Mineral Resources, the Chamber of Mines, the South African National Biodiversity Institute and the South African Mining and Biodiversity Forum, with the intention to find a balance between economic growth and environmental sustainability. The Guideline is envisioned as a tool to "foster a strong relationship between biodiversity and mining which will eventually translate into best practice within the mining sector. In identifying biodiversity priority areas which have different levels of risk against mining, the Guideline categorises biodiversity priority areas into four categories of biodiversity priority areas in relation to their importance from a biodiversity and ecosystem service point of view as well as the implications for mining in these areas:

- ❖ Legally protected areas, where mining is prohibited;
- ❖ Areas of highest biodiversity importance, which are at the highest risk for mining;
- ❖ Areas of high biodiversity importance, which are at a high risk for mining; and
- ❖ Areas of moderate biodiversity importance, which are at a moderate risk for mining.

According to these guidelines, the proposed Project area Leslie 1C falls within an area which is considered the highest risk for mining and of high biodiversity importance (Figure 9-44). A buffer of 1 km is recommended around any FEPA rivers or wetlands situated in this category. Based on this information, the proposed mining areas at Leslie 1C overlaps with the recommended buffer. The Leslie 1A Project area does not overlap with any areas that represent a biodiversity risk to mining according to the Mining and Biodiversity Guidelines (2013).

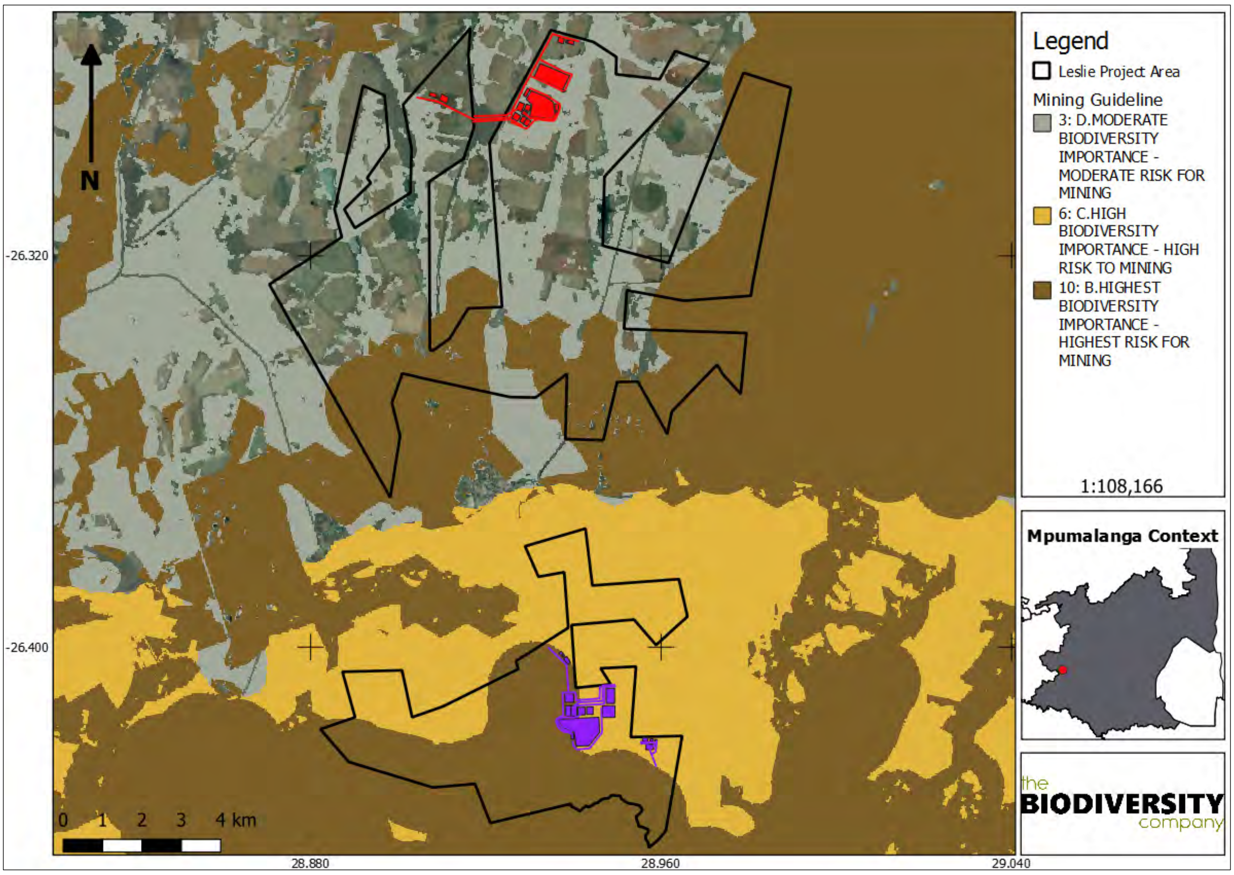


Figure 9-44: The project area superimposed on the Mining and Biodiversity Guidelines spatial dataset (2013)

9.7.1.10 Vegetation

Regional Vegetation

The Leslie 1 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 (Mucina & Rutherford, 2006). 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.

The Project area is situated across two different vegetation types; the Eastern Highveld Grassland (GM12) and the Soweto Highveld Grassland (GM8) vegetation types, according to Mucina & Rutherford (2006) (Figure 9-45). A third vegetation type, the Eastern Temperate Freshwater Wetlands (AZf3), occurs in a number of pockets within the Project area.

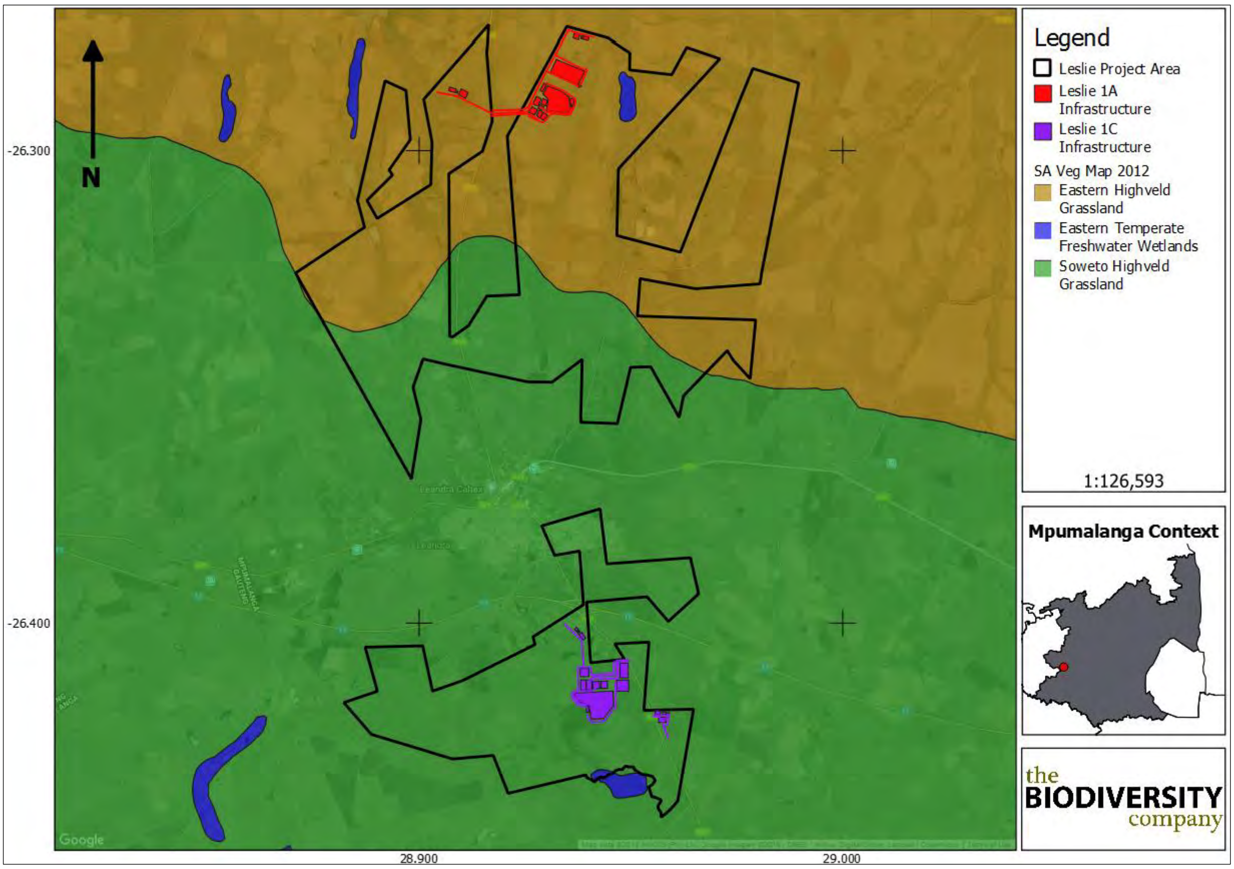


Figure 9-45: Project area showing the vegetation types based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS,2017)

- **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. Some 44% is transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. No serious alien invasions are reported (Mucina & Rutherford, 2006). This vegetation type is classified as Endangered. The national target for conservation protection for this vegetation type is 24%, but only a few patches are statutorily conserved.

- **Soweto Highveld Grassland**

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

This vegetation type is classified as Endangered. The national target for conservation protection for both this vegetation type is 24%, but only a few patches are statutorily conserved.

9.7.1.11 Terrestrial Fauna

Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database and records from the Animal Demography Unit (2018), 292 bird species are expected to occur in the vicinity of the Project area. Of the expected bird species, twenty-six species (9.1%) are listed as SCC either on a regional (23) or global scale (15) (Table 9-34).

Table 9-34: List of bird species of regional or global conservation importance that are expected to occur

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Alcedo semitorquata	Kingfisher, Half-collared	**NT**	LC	High
Anthropoides paradiseus	Crane, Blue	**NT**	**VU**	High
Bugeranus carunculatus	Crane, Wattled	**CR**	**VU**	High
Calidris ferruginea	Sandpiper, Curlew	LC	**NT**	High
Charadrius pallidus	Plover, Chestnut-banded	**NT**	**NT**	High
Ciconia abdimii	Stork, Abdim's	**NT**	LC	High
Circus macrourus	Harrier, Pallid	**NT**	**NT**	Moderate
Circus maurus	Harrier, Black	**EN**	**VU**	Moderate
Circus ranivorus	Marsh-harrier, African	**EN**	LC	High
Coracias garrulus	Roller, European	**NT**	LC	Moderate
Eupodotis caerulescens	Korhaan, Blue	LC	**NT**	High
Eupodotis senegalensis	Korhaan, White-bellied	**VU**	LC	High
Falco biarmicus	Falcon, Lanner	**VU**	LC	High
Falco vespertinus	Falcon, Red-footed	**NT**	**NT**	High
Geronticus calvus	Ibis, Southern Bald	**VU**	**VU**	High
Glareola nordmanni	Pratincole, Black-winged	**NT**	**NT**	Moderate
Mirafra cheniana	Lark, Melodious	LC	**NT**	High
Mycteria ibis	Stork, Yellow-billed	**EN**	LC	High
Neotis denhami	Bustard, Denham's	**VU**	**NT**	High
Oxyura maccoa	Duck, Maccoa	**NT**	**NT**	High
Phoeniconaias minor	Flamingo, Lesser	**NT**	**NT**	High
Phoenicopterus ruber	Flamingo, Greater	**NT**	LC	High
Podica senegalensis	Finfoot, African	**VU**	LC	High
Rostratula benghalensis	Painted-snipe, Greater	**NT**	LC	High

Species	Common Name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Sagittarius serpentarius	Secretarybird	**VU**	**VU**	High
Tyto capensis	Grass-owl, African	**VU**	LC	High

Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 84 mammal species that could be expected to occur within the project area. Of these species, 12 are medium to large conservation dependant species, such as *Ceratotherium simum* (Southern White Rhinoceros) and *Tragelaphus oryx* (Common Eland) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the Project area and are removed from the expected SCC list. Of the remaining 73 small to medium sized mammal species, 12 (16.8%) are listed as being of conservation concern on a regional or global basis.

Table 9-35: List of mammal species of conservation concern that may occur in the Project area

Species	Common name	Conservation Status		Likelihood of occurrence
		Regional (SANBI, 2016)	IUCN (2017)	
Aonyx capensis	Cape Clawless Otter	**NT**	**NT**	High
Atelerix frontalis	South Africa Hedgehog	**NT**	LC	High
Crocidura mariquensis	Swamp Musk Shrew	**NT**	LC	High
Dasymys incomtus	African Marsh Rat	**NT**	LC	High
Felis nigripes	Black-footed Cat	**VU**	**VU**	Moderate
Leptailurus serval	Serval	**NT**	LC	High
Mystromys albicaudatus	White-tailed Rat	**VU**	**EN**	Moderate
Ourebia ourebi	Oribi	**EN**	LC	Moderate
Panthera pardus	Leopard	**VU**	**VU**	Moderate
Pelea capreolus	Grey Rhebok	**NT**	LC	Moderate
Poecilogale albinucha	African Striped Weasel	**NT**	LC	High
Redunca fulvorufula	Mountain Reedbuck	**EN**	LC	High

Overall, mammal diversity in the project area was moderate to high, with 16 mammal species being recorded during the March and April 2018 surveys.

Four mammal SCC were recorded in the project area. There appear to be healthy populations of Cape Clawless Otters (*Aonyx capensis*) along the wetland areas and in the dams within the Project area and adjacent to it. Most importantly, this species was observed in the proposed infrastructure area at Leslie 1C. The South African Hedgehogs were recorded from the proposed infrastructure area at Leslie 1C. This was a species that was rated as being highly likely to occur in the Project area. The individuals seen were however being kept as pets by one of the tenants on the property. It was explained to the specialists that the South African Hedgehogs being kept were caught from the wild in the surrounding grassland. Multiple individuals of Swamp Musk Shrew were recorded within the wet areas within the proposed infrastructure development areas in Leslie 1C.

Herpetofauna (Reptiles & Amphibians)

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2018) 22 reptile species are expected to occur in the Project area.

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2018) 17 amphibian species are expected to occur in the project area. No amphibian species of conservation concern should be present in the Project area according to the above-mentioned sources.

Eight reptile species were recorded in the Project area during the March and April 2018 surveys. One near-endemic snake and two endemic snake species were recorded in the project area. Reptile diversity was notably high in the Project area considering the extent of existing agricultural activities which has already transformed some of the natural ecosystems.

Four amphibian species were recorded in the Project area during the March and April 2018 surveys based on visual observations as well as from calls made by various frog species. Due to the surveys being conducted towards the end of the wet season, it is expected that more species should occur in this area, especially considering the extent of the rivers and wet areas.

9.7.1.12 Aquatic Fauna

The Leslie 1A and 1B project areas are located in the B11E and B20E quaternary catchments. The watercourses draining the project area within the B11E quaternary catchment drain in a northern direction into the B11E-1373 Sub Quaternary Reach (SQR). The B11E-1373 SQR is a reach of the Blesbokspruit which is a tributary of the Rietspruit River system, an affluent of the Olifants River above the Witbank Dam. Watercourses in the project area within the B20E quaternary catchment drain into the B20E-1376 SQR in the centre of the project area and the B20E-1383 SQR to the east of the project area. The B20E-1376 and B20E-1383 SQR's are reaches of the Kromdraaispruit and Wilge Rivers respectively.

The Leslie 1C, 1D and 1E project areas are located in the C12D quaternary catchment. River systems draining these project areas drain into the several highly defined SQR's. The project area Leslie 1C will potentially directly affect the following SQR's: C12D-1508, C12D-01533, C12D-1528, C12D-01547, C12D-1535 and C12D-1560. The project area Leslie 1D will potentially affect the C12D-1532, C12D-1538. C12D-1560 and the C12D-1573 SQR's. The project area Leslie 1E will potentially affect the C12D-1560 SQR. To simplify this assessment, the river reaches will be separated into the formal names of the various SQR's. The western tributary in the overall study area is known as the Waterval River system. The watercourse draining the east of the study area is known as the Rolspruit which eventuates in the Waterval River system at the C12D-1573 SQR.

9.7.2 Specialist Assessment Methods

9.7.2.1 Biodiversity

The Terms of Reference (ToR) for the study included the following:

- Desktop description of the baseline receiving environment specific to the field of expertise (general surrounding as well as site specific environment);
- Identification and description of any sensitive receptors in terms of relevant specialist disciplines (biodiversity, wetlands and soils) that occur in the study area, and the manner in which these sensitive receptors may be affected by the activity;
- Site visit to verify desktop information;
- Screening to identify any critical issues (potential fatal flaws) that may result in project delays or rejection of the application;
- Provide a map identifying sensitive receptors in the study area, based on available maps, database information & site visit verification; and
- Compile summary specialist inputs to feed into the overall report, including the following:
  - Botany;
  - Fauna (mammals and avifauna); and
  - Herpetology (reptiles and amphibians).

9.7.3 Specialist Findings

The current impacts observed during surveys are listed below:

- Commercial crop production and plantations;
- Fences;
- Overgrazing and trampling of natural vegetation and wetlands by livestock;
- Farm roads and highways (and associated traffic and wildlife road mortalities);
- Artificial impoundments;
- Artificial drainage in agricultural fields;
- Farmsteads and houses;
- Exotic game;
- Erosion;
- Feral animals such as dogs and cats;
- Alien and/or Invasive Plants (AIP);
- Snaring of wildlife and poaching;
- Servitudes and infrastructure (powerlines)
- Water contamination; and
- Vegetation removal.

9.7.3.1 Vegetation

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 281 plant species are expected to occur in the area, of which seven (7) species are listed as being Species of Conservation Concern (SCC) (Table 9-36).

Table 9-36: Plant Species of Conservation Concern (SCC) expected to occur in the Project area (BODATSA-POSA, 2016)

Family	Taxon	Author	IUCN status	Habitat preference	Likelihood of Occurrence
Fabaceae	*Argyrolobium longifolium*	(Meisn.) Walp.	VU	Ngongoni and sandstone grassland. Small populations only exist.	Medium
Amaryllidaceae	*Nerine gracilis*	R.A. Dyer	VU	Undulating grasslands in damp areas	Medium
Fabaceae	*Argyrolobium campicola*	Harms	NT	Highveld grassland	Medium
Iridaceae	*Gladiolus robertsoniae*	F. Bolus	NT	Moist highveld grasslands, found in wet, rocky sites, mostly dolerite outcrops, wedged in rock crevices.	Medium
Asphodelaceae	*Kniphofia typhoides*	Codd	NT	Low lying wetlands and seasonally wet areas in climax Themeda triandra grasslands on heavy black clay soils, tends to disappear from degraded grasslands.	Medium
Apocynaceae	*Stenostelma umbelluliferum*	(Schltr.) Bester & Nicholas	NT	Savanna: Deep black turf in open woodland mainly in the vicinity of drainage lines	Low
Fabaceae	*Lessertia phillipsiana*	Burtt Davy	DD	Uncertain, possibly rocky hills or plains.	Medium

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 most of these species. The fieldwork did reveal the disturbed nature of most of the habitats on the Project area, largely due to overgrazing. Based on the field observations, the likelihood of occurrence of any of the Red and Orange List plant species is low to medium.

Local Vegetation

The habitats identified for Leslie 1A include (Figure 9-46):

- Agriculture;
- Moist grassland; and
- Transformed.

The habitats identified for Leslie 1C include (Figure 9-47):

- Agriculture;
- Moist rocky grassland;
- Moist grassland; and
- Transformed.

Each of the habitats identified are discussed in the sub-sections below.

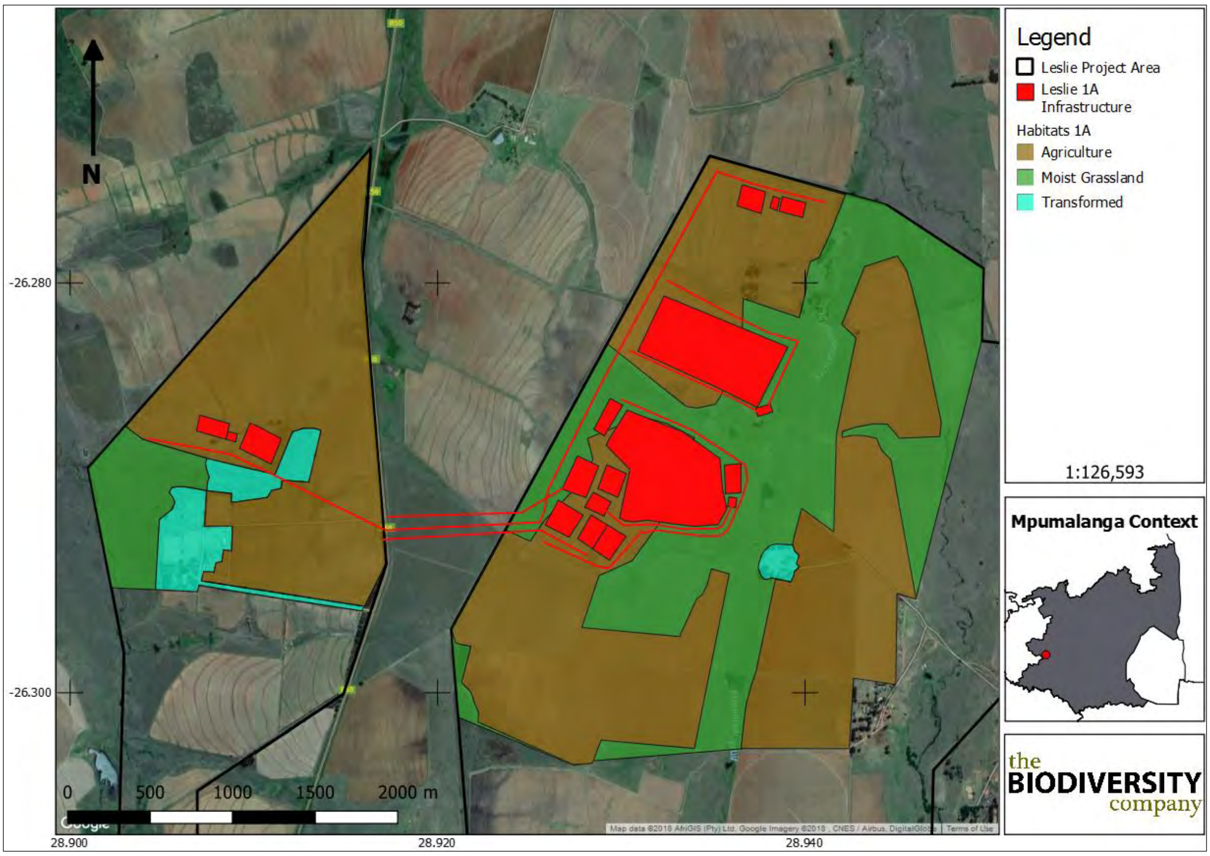


Figure 9-46: Habitat map for the Leslie 1A Project area

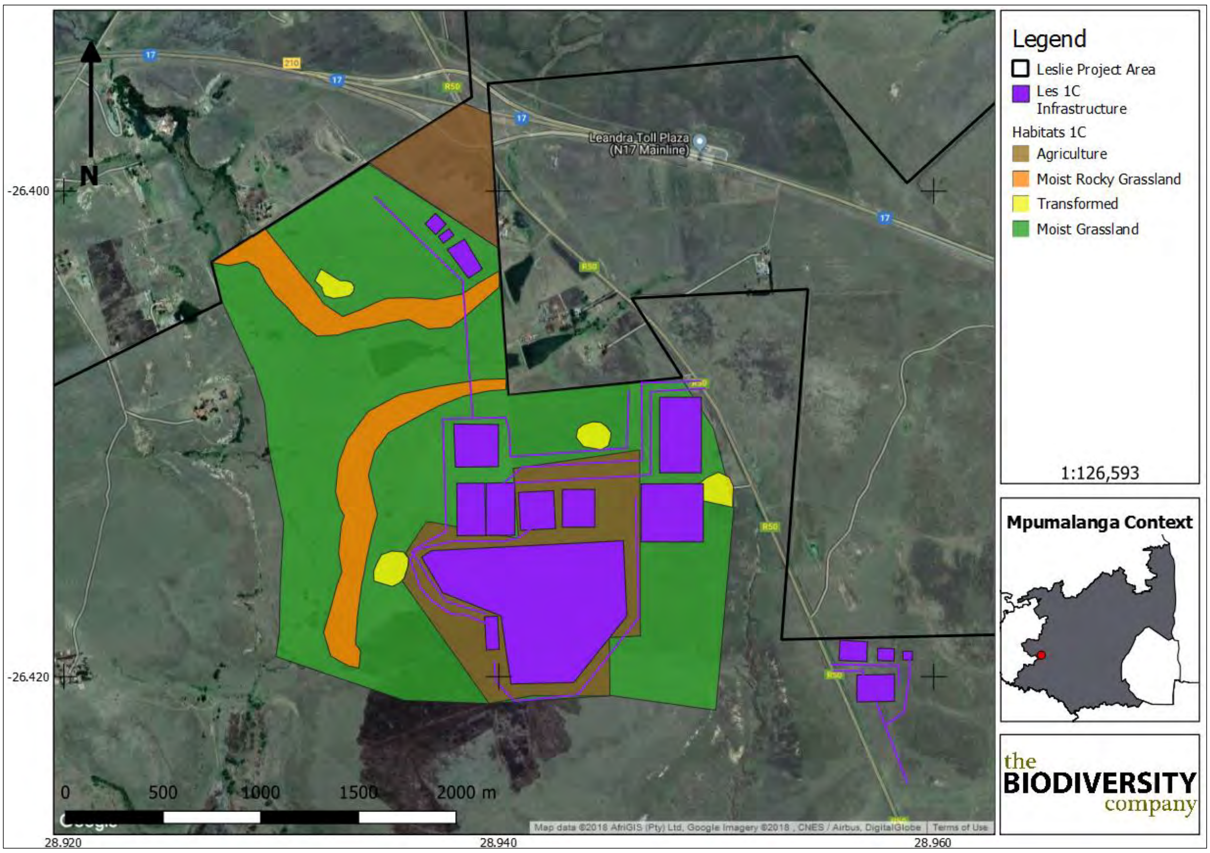


Figure 9-47: Habitat map for the Leslie 1C Project area

- **Moist Rocky Grassland**

This habitat type is found mostly at Leslie 1C and ranges between areas with large boulders to inconspicuous rocky ridges interspersed with grassy and rocky slopes. Typical flora species recorded within this habitat type are given in Table 9-37 and shown in Figure 9-48

Figure 9-48. This habitat type is regarded as primary grassland and therefore natural, but slightly disturbed due to grazing by livestock. 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 may have been dormant but is more likely due to the disturbance of this habitat due to grazing during the fieldwork. Despite this and due to its limited distribution in the landscape, this habitat is regarded as having a high sensitivity.

Table 9-37: Plant species recorded within Moist rocky grassland habitat

Growth form	Species
Shrubs	*Asparagus laricinus, Diospyros austro-africana, Diospyros lycioides, Felicia muricata, Gymnosporia buxifolia, Heteromorpha arborescens, Leonotis leonurus, Pyracantha angustifolia, Rhus magalismontana, Searsia rigida, Stoebe plumosa*
Dwarf shrubs	*Gnidia triplinervis, Polygala hottentotta*

Growth form	Species
Graminoids	*Andropogon eucomus, Aristida congesta, Aristida diffusa, Aristida meridionalis, Bewsia biflora, Brachiaria serrata, Bromus catharticus, Cymbopogon caesius, Diheteropogon amplectens, Elionurus muticus, Eragrostis capensis, Eragrostis, Eragrostis curvula, Eragrostis racemosa, Harpochloa falx, Hyparrhenia hirta, Hyperthelia dissoluta, Loudetia flavida, Melinis repens, Microchloa caffra, Setaria sphacelata, Themeda triandra, Trachypogon spicatus, Trichoneura grandiglumis, Tristachya leucothrix*
Herbs	*Agrimonia procera, Anthericum cooperi, Blepharis subvolubilis, Commelina africana, Hibiscus microcarpus, Ipomoea crassipes, Leucas martinicensis, Monsonia burkeana, Psammotropha myriantha, Sebaea grandis, Senecio inornatus, Ursinia nana, Wahlenbergia grandiflora, Zaluzianskya katharinae*
Geophytes	*Gladiolus elliotii, Haemanthus humilis subsp. humilis, Hypoxis multiceps Hypoxis rigidula Baker var. rigidula, Habenaria falcicornis subsp. falcicornis*
Lithophytes	*Pellaea calomelanos var. calomelanos*
Parasites	*Striga elegans*
Succulents	*Aloe boylei, Boophone disticha, Crassula alba var. alba*

Figure 9-48: Photographic evidence of a selection of plant species recorded within the Moist rocky grasslands habitat: A) *Crassula alba var. alba*; B) *Gnidia triplinervis*; C) *Haemanthus humilis subsp. Humilis*; and D) *Diospyros austro-africana*

- **Mesic Grassland**

The condition of these grasslands ranges from heavily disturbed (largely due to overgrazing) to disturbed grassland. Typical flora species recorded within this habitat type are given in Table 9-38 and shown in Figure 9-49. This habitat type is regarded as largely natural but disturbed primary grassland. This habitat is not limited in the landscape and is also linked to the aquatic habitats (i.e. wetlands and open water) found within the Project area.

Only one IUCN listed species was recorded, namely, the Critically Endangered *Aloe craibii*. The Identification is preliminary due to the fact that there was no inflorescence present during the time of the survey. Taking the ecosystem services of this habitat and its association with the aquatic habitats within the Project area into account, this habitat is regarded as having a high sensitivity.

Table 9-38: Plant species recorded within Mesic grassland habitat

Growth form	Species
Trees	*Eucalyptus sp., Salix mucronata, Vachellia karroo*
Shrubs	*Felicia filifolia, Felicia muricata, Solanum pseudocapsicum, Stoebe plumosa*
Suffrutex's	*Erythrina zeyheri, Nemesia fruticans,*
Dwarf shrubs	*Gnidia capitata, Polygala hottentotta*
Graminoids	*Andropogon eucomus, Aristida congesta, Aristida meridionalis, Brachiaria serrata, Bromus catharticus, Cymbopogon caesius, Digitaria eriantha, Diheteropogon amplectens, Elionurus muticus, Enneapogon scoparius, Eragrostis biflora, Eragrostis capensis, Eragrostis chloromelas, Eragrostis curvula, Eragrostis gummiflua, Eragrostis lehmanniana, Eragrostis racemosa, Eragrostis superba, Hyparrhenia hirta, Hyperthelia dissoluta, Imperata cylindrica, Loudetia flavida, Paspalum dilatatum, Pennisetum clandestinum, Setaria pumila, Setaria sphacelata, Sporobolus africanus, Themeda triandra*
Herbs	*Acalypha angustata, Anthericum cooperi, Anthericum fasciculatum, Berkheya echinacea, Berkheya pinnatifida, Berkheya radula, Berkheya setifera, Bidens bipinnata, Bidens pilosa, Campuloclinium macrocephalum, Cirsium vulgare, Commelina africana, Conyza bonariensis, Cosmos bipinnatus, Cotula anthemoides, Crabbea hirsuta, Dianthus mooiensis, Gazania krebsiana, Gerbera ambigua, Haplocarpha scaposa, Helichrysum cephaloideum, Helichrysum nudifolium, Helichrysum rugulosum, Hibiscus trionum, Jamesbrittenia aurantiaca, Leucas martinicensis, Macledium zeyheri, Monopsis decipiens, Nidorella podocephala, Ocimum obovatum, Oenothera rosea, Oenothera stricta, Oldenlandia herbacea, Physalis viscosa, Plantago longissima, Pollichia campestris, Scabiosa columbaria, Sebaea grandis, Senecio inornatus, Solanum panduriforme, Tephrosia capensis, Tephrosia rhodesica, Verbena bonariensis, Wahlenbergia grandiflora, Walafrida densiflora*
Geophytes	*Albuca setosa, Gladiolus elliotii, Gladiolus sericeovillosus, Habenaria falcicornis subsp. falcicornis Hypoxis hemerocallidea, Hypoxis iridifolia, Hypoxis multiceps, Hypoxis rigidula, Ledebouria ovatifolia*
Helophytes	*Persicaria lapathifolia*
Mesophytes	*Bulbostylis burchellii*
Parasites	*Striga elegans*
Succulents	*Aloe craibii, Boophone disticha, Erythrina zeyheri, Opuntia imbricata, Xysmalobium undulatum*

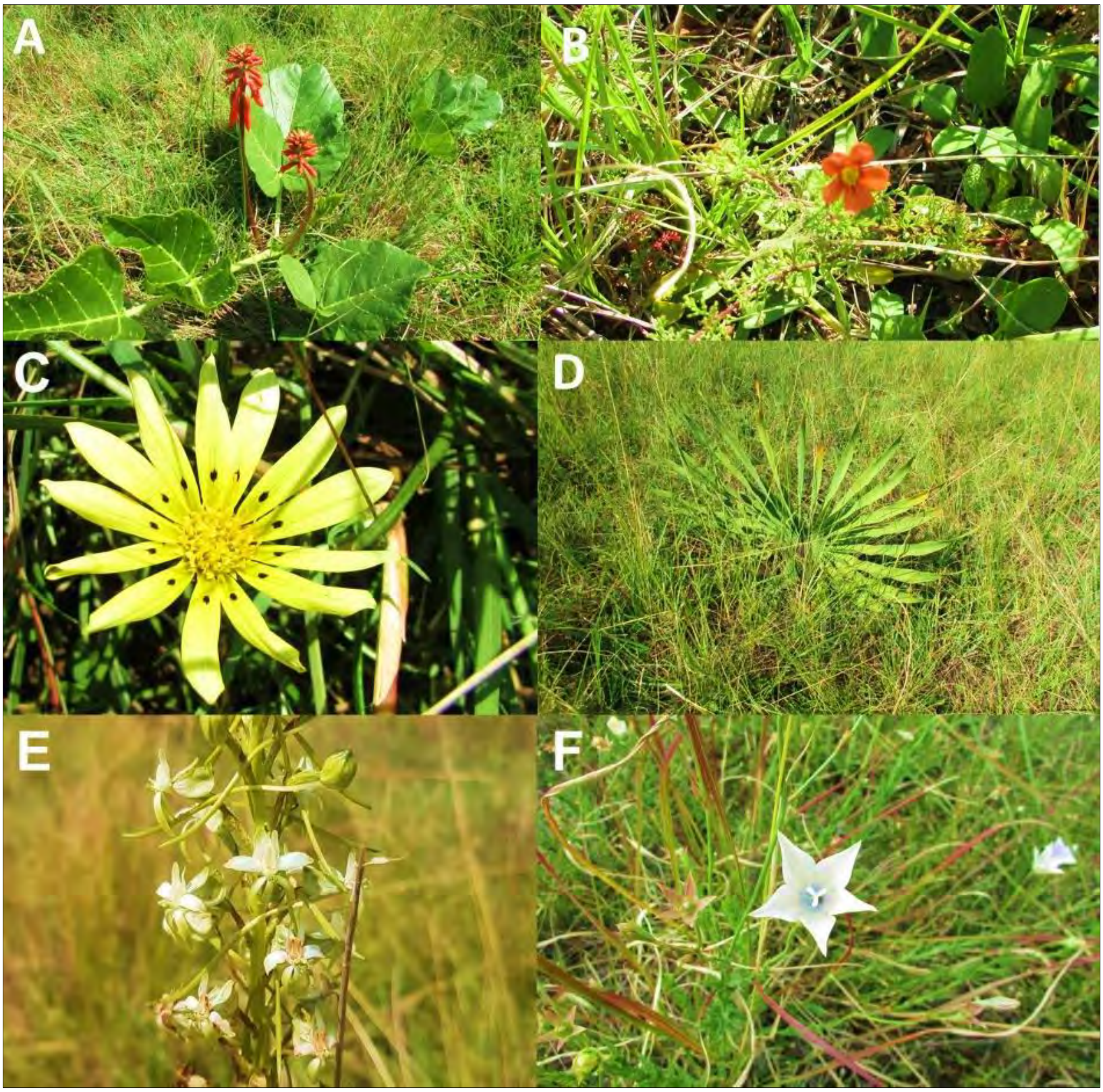


Figure 9-49: Photographic evidence of a selection of plant species recorded within the Mesic grassland habitat: A) *Erythrina zeyheri*; B) *Jamesbrittenia aurantiaca*; C) *Gazania krebsiana*; D) *Boophone disticha*; E) *Habenaria falcicornis subsp. Falcicornis*; and F) *Wahlenbergia grandiflora*

- **Agricultural Lands**

This habitat unit represents the commercial crop fields present across the Project area, consisting mostly of commercially planted maize and soya. Due to the extremely altered nature of this habitat, it is regarded as having a very low sensitivity.

Table 9-39: Plant species recorded within Agricultural lands habitat

Growth form	Species
Suffrutex's	*Erythrina zeyheri*
Graminoids	*Bromus catharticus, Cynodon dactylon, Eragrostis lehmanniana, Melinis repens subsp. repens, Paspalum dilatatum*
Herbs	*Cirsium vulgare, Conyza bonariensis, Cosmos bipinnatus, Datura ferox, Gomphocarpus fruticosus subsp. fruticosus, Gomphrena celosioides, Oenothera rosea, Oenothera stricta subsp. stricta, Oxalis sp, Tagetes minuta, Verbena bonariensis*
Succulents	*Opuntia ficus-indica*

❖ Transformed

This habitat type represents all areas of farms and existing urban infrastructure and includes houses, barns, feedlots, camps, roads etc. Due to the transformed nature of this habitat, it is regarded as having a very low sensitivity.

❖ Alien and Invasive species

Twenty-eight alien and/or invasive plants were recorded during the dual season fieldwork on the Project area. These plants are outlined inTable 9-40.

Table 9-40: Alien and invasive flora species for the Project Area

Family	*Taxon*	NEMBA Category
Rosaceae	*Agrimonia procera Wallr.*	1B
Amaranthaceae	*Amaranthus hybridus L. subsp. hybridus var. hybridus*	
Asteraceae	*Bidens bipinnata L.*	
Asteraceae	*Bidens pilosa L.*	
Poaceae	*Bromus catharticus ahl*	
Asteraceae	*Campuloclinium macrocephalum (Less.) DC.*	1B
Asteraceae	*Cirsium vulgare (Savi) Ten.*	
Asteraceae	*Conyza bonariensis (L.) Cronquist*	
Asteraceae	*Cosmos bipinnatus Cav.*	
Solanaceae	*Datura stramonium L.*	1B
Myrtaceae	*Eucalyptus sp.*	
Amaranthaceae	*Gomphrena celosioides Mart.*	
Malvaceae	*Hibiscus trionum L.*	
Meliaceae	*Melia azedarach L.*	1B
Onagraceae	*Oenothera rosea L'Hér. ex Aiton*	
Onagraceae	*Oenothera stricta Ledeb. ex Link subsp. stricta*	
Cactaceae	*Opuntia imbricata (Haw.) DC.*	1B
Poaceae	*Paspalum dilatatum Poir.*	
Poaceae	*Pennisetum clandestinum Hochst. ex Chiov.*	1B-Wetlands

Family	*Taxon*	NEMBA Category
Polygonaceae	*Persicaria lapathifolia (L.) Gray*	
Solanaceae	*Physalis viscosa L.*	
Salicaceae	*Populus alba L. var. alba*	2
Rosaceae	*Prunus persica (L.) Batsch var. persica*	
Rosaceae	*Pyracantha angustifolia (Franch.) C.K. Schneid.*	1B
Asteraceae	*Schkuhria pinnata (Lam.) Kuntze ex Thell.*	
Solanaceae	*Solanum pseudocapsicum L.*	
Asteraceae	*Tagetes minuta L.*	
Verbenaceae	*Verbena bonariensis L.*	1B

9.7.3.2 Terrestrial Fauna

Avifauna

One hundred and one (101) bird species were recorded in the Project area during the March and April 2018 surveys. Two bird SCC were recorded during the survey, namely Blue Korhaan (*Eupodotis caerulescens*) and Southern Bald Ibis (*Geronticus calvus*). The Blue Korhaans were recorded within the proposed infrastructure development area in Leslie 1A.

Based on the various wetland habitats encountered in the Project area, the likelihood that other bird SCC occur there is rated as very high. Many important roosting and nesting sites were noted during the survey around wetland and marsh areas.

Incidental records of other bird SCC were noted from two landowners in the area. Both landowners mentioned that they have seen Flamingoes and Cranes on their properties and based on the extensive suitable habitat for both these species and previous records (EWT, 2018) of them occurring there, it is taken as evident that these species occur within the Project area.

9.7.3.3 Aquatic Fauna

Intermediate Habitat Integrity Assessment (IHAS)

The results of the habitat assessment in the Blesbokspruit indicates that both riparian and instream habitats are largely modified (class D). The large modification in the instream and riparian habitat can be largely attributed to the modification to the overall river system as a result of the Matla Coal Mine river diversion located approximately 1 km downstream of the site R1.

The results of the instream and riparian integrity assessment in the Kromdraaispruit derived a class D (largely modified) status for the considered river reach in this assessment. The predominant factor influencing the quality of the habitats was largely attributed to instream habitat modification relating to the direct impacts from numerous agricultural impoundments, low water crossings and erosion.

The results of the IHIA for the Wilge River catchment considered in this assessment derived class C or moderately modified instream and riparian habitat. Limited habitat level perturbations are present within the considered reach of this assessment with impacts largely attributed to cumulative low rated impacts.

The results of the instream and riparian integrity assessment in the Waterval River system derived a class D (largely modified) status for the Waterval River reach in this assessment. The predominant factor influencing the quality of the habitats are largely attributed to instream habitat modification through severe water quality deterioration.

Macroinvertebrate Habitat

Habitat availability within the assessed Olifants WMA watercourses was rated as poor. The low biotope score can be attributed to low diversity/abundance of both the stones in current and vegetation biotopes. This is an anticipated result for the considered river reaches due to the zonation of the respective river systems. Typical aquatic habitat largely consisted of marginal and aquatic vegetation with mud substrates.

Habitat availability within the Waterval River system was rated as poor. Similarly, to the rivers within the Olifants WMA, the low biotope score can be attributed to low diversity/abundance of both the stones in current and vegetation biotopes.

Macroinvertebrate Community Assessment

The results of the SASS5 assessment for the Olifants WMA derived SASS5 scores that ranged from 37 at K1 to 101 at K2. The number of taxa identified ranged from 10 at K1 to 21 at K3. The Average Score Per Taxon (ASPT) was found to range from 3.7 to 5.1 at K2. Ecological classes based on the interpretation guidelines were derived to range from class E/F at K1 to class B at K2, K3 and S1.

Table 9-41: Macroinvertebrate Assessment Results Recorded in the Olifants Water Management Area

Site	SASS5	Taxa	ASPT	*Class (Dallas, 2007)
K1	37	10	3.7	E/F
K2	101	20	5.1	B
K3	94	21	4.4	B
K4	69	17	4.1	C
K5	77	19	4.1	C
K6	68	17	4.0	C
K7	74	18	4.1	C
R1	58	15	3.8	D
S1	86	20	4.3	B
*Highveld Lower Ecoregion **SASS5 Interpretation Not Applicable due to Impoundment Conditions				

The SASS5 scores found in the Waterval River system varied from 36 at W4 to 86 at T3. The diversity of taxa was found to range from 10 at W4 to 18 at T3. The ASPT found at the sites ranged from 3.6 at W4 to 4.7 T3. The derived ecological classes were found to range from E/F at W3 and W4 to class B at T3.

Table 9-42: Macroinvertebrate Assessment Results Recorded in the Vaal Water Management Area

Site	SASS5	Taxa	ASPT	*Class (Dallas, 2007)
W1	SEWAGE			
W2	SEWAGE			
W3	41	11	3.7	E/F
W4	36	10	3.6	E/F
T1	82	17	4.8	C**
T2	51	12	4.2	D**
T3	86	18	4.7	B**
*Highveld Lower Ecoregion **SASS5 Interpretation Not Applicable due to Impoundment Conditions				

Largely uniform modified macroinvertebrate assemblages make up the sites which were sampled in the Olifants WMA. An overall SEM of a SASS5 score of 6 was observed between the sites with limited variation observed over spatial processes. However, low diversity and highly tolerant species were observed at the site K1 which was found to be impacted by WWTW seepage, runoff and discharge. Similarly, the sites located in the sewage contaminated Waterval River system exhibited seriously modified ecological categories. This can be attributed to severe water quality deterioration in the upper Waterval River system.

Overall, due to the source zone characteristics and impounded nature of the sites the use of SASS5 interpretations cannot be regarded as accurate. The MIRAI, a more robust model of assessment, was conducted using a modified reference list which reflected more wetland conditions as opposed to high gradient cobbled watercourses.

The results of the MIRAI assessment indicate that a moderately modified invertebrate community was present in the considered Blesbokspruit based on the survey results. The modified condition of the macroinvertebrate assemblage was attributed to cumulative factors of flow, habitat and water quality modification resulting in a largely modified (**class D**) ecological category.

The results of the MIRAI for the Kromdraaispruit show that the macroinvertebrate community within the whole reach over the survey period was moderately modified (**class C**). This can be primarily attributed to poor habitat availability compounded by modified water quality in the upper reaches.

The results of the MIRAI show that the macroinvertebrate community within the whole reach of the Wilge River considered over the survey period was largely modified (**class D**). The modified status of the invertebrate community was derived to be attributed to habitat modification. Erosion has resulted in the modification of the expected cobbled substrate in this watercourse based on survey observations.

Severe water quality deterioration in the upper reaches of the Waterval River system has resulted in a largely modified invertebrate community. However, within the sample points T1-T3 in a second order tributary of the Waterval River, the frequency of more sensitive invertebrates resulted in a higher than expected classification.

Fish Community

A total of five native fish species were captured during this study with an additional two alien species. No listed species are expected directly within the river reaches in the study area. However, downstream of the watercourses two listed species are expected. The listed species are *Oreochromis mossambicus* (Near Threatened {NT}) in the Olifants WMA and *Labeobarbus kimberleyensis* (NT) in the Vaal-Orange River system. *O. mossambicus* is threatened by hybridisation and therefore the proposed project does not pose a threat to this species. *L. kimberleyensis* is threatened by water and habitat quality deterioration and therefore the proposed project may potentially have an effect this species.

The fish species *Enteromius cf. brevipinnis* (NE) was derived to be expected in the sites in the Olifants WMA. The species has recently been separated from *E. neefi* and therefore further assessment into the listed species distribution is required. Considering this listing, the species *E. cf. brevipinnis* is regarded as Endangered in this assessment.

The results of the FRAI in the Blesbokspruit derived a seriously modified (**class E**) fish community. The absence of key species from the survey site in this river reach resulted in the modified fish community. Absent key fish species included *Tilapia sparrmanni,* a common hardy species.

The results of the FRAI derived a largely modified (**class D**) in the Kromdraaispruit. The modified status was largely related to the sampling of modified Frequency of Occurrence of the expected species throughout the catchment. Widely distributed species were found be absent from particular sample points which indicated modification of habitat and connectivity in the watercourse.

The results of the FRAI in the Wilge River indicated a moderately/largely modified fish community. Although the site in the Wilge River system held the most diverse fish community, habitat at the site was capable of supporting taxa which were not sampled. Particular habitat for *Labeobarbus polylepis* was available at the site. The absence of this species provides an indication that habitat and water quality was modified in the watercourse.

The results of the FRAI derived a seriously modified (**class E**) fish community structure for the Waterval River system reach considered in this assessment. The seriously modified status of the fish community can be attributed to severe water quality degradation in the watercourse stemming from eutrophication.

Overall Aquatic Ecology Present Ecological Status (PES)

The results of the PES assessment are provided in Table 9-43. The results of the PES assessment derived largely modified (**class D**) conditions in the Blesbokspruit river reach considered in this assessment. Instream habitat modification has resulted in modified biological responses. Instream habitat modification can be attributed to local agricultural activities and the downstream Matla Coal Mine river diversion.

Table 9-43: Present Ecological Status of the Blesbokspruit assessed in the April 2018 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	44
Riparian Ecological Category	58
Aquatic Invertebrate Ecological Category	53
Fish Ecological Category	35
Ecostatus	**class D**

The results of the PES for the Kromdraaispruit assessment are provided in Table 9-44. Similarly, to the results of the Blesbokspruit, the PES assessment derived largely modified (**class D**) conditions in the Kromdraaispruit reach considered in this assessment. Water quality modification in the upper reaches of the watercourses compounded by extensive instream and riparian habitat modification has resulted in modified aquatic ecology. The modification of the watercourse can be attributed to large-scale agricultural activities compounded by seepage, runoff and discharge from the Leandra WWTW.

Table 9-44: Present Ecological Status of the Kromdraaispruit river reach assessed in the April 2018 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	56
Riparian Ecological Category	50
Aquatic Invertebrate Ecological Category	63
Fish Ecological Category	46
Ecostatus	**class D**

The results of the PES assessment for the Wilge River reach are provided in Table 9-45. The results of the PES assessment derived moderately modified (**class C**) conditions in the Wigle river reach considered in this assessment. Modified biological responses in this river reach are indicative of poor physical conditions within the watercourse. Biological responses indicate that instream habitat modification and water quality deterioration has occurred in the river reach. The modification can be attributed to landscape level impacts associated with extensive agricultural activities.

Table 9-45: Present Ecological Status of the Wilge River reach assessed in the April 2018 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	75
Riparian Ecological Category	70
Aquatic Invertebrate Ecological Category	52
Fish Ecological Category	60
Ecostatus	**class C**

The results of the PES assessment in the Waterval River are provided in Table 9-46. The results of the PES assessment derived largely modified (**class D**) conditions in the Waterval River reach considered in this assessment. Modification to water quality was determined to be the most severe impact in this watercourse. The water quality modification could be directly attributed to sewage runoff from the town of Leandra.

Table 9-46: Present Ecological Status of the Waterval River reach assessed in the April 2018 survey

Aspect Assessed	Ecological Category
Instream Ecological Category	51
Riparian Ecological Category	49
Aquatic Invertebrate Ecological Category	48
Fish Ecological Category	35
Ecostatus	**class D**

Aquatic Ecological Importance and Sensitivity (EIS)

The overall Ecological Importance and Sensitivity (EIS) of the river reaches in this study were assessed according to Kleynhans (1999). The results of the EIS assessment are provided in the tables below.

The results of the EIS assessment derived a moderate EIS for the river reaches in the Olifants WMA. The results of the EIS assessment derived a **moderate** EIS for the river reaches in the Olifants WMA.

Table 9-47: Ecological Importance and Sensitivity Ratings for the Watercourses in the Study area located in the Olifants Water Management Area

Determinant	Rating	Comment
Biological Determinants		
Rare and endangered biota	3	More than one taxon rare or endangered at a local scale
Unique biota	2	The aquatic fauna is distributed widely throughout the upper Olifants WMA
Intolerant biota	2	Source zone conditions make the presence of flowing water rare. Therefore, flow intolerant taxa make up only a small portion of the aquatic fauna
Species richness	2	On a local scale the species richness is moderate
Habitat Determinants		
Diversity of aquatic habitat	2	Impacted system, most of which are permanent impacts
Refuge value of habitat types	2	Wetlands in smaller clean tributaries are refuge areas for water quality sensitive taxa
Sensitivity of habitat to flow modification	1	The source zone watercourses typically are not flowing
Sensitivity to flow related water quality changes	2	The impoundments may be sinks for contaminants making them more sensitive to flow related water quality modification
Migration route corridor for instream and riparian biota	1	The watercourses are in the upper reaches of the river systems
National parks and wilderness areas	0	No NFEPA listing and no nature reserves associated with the watercourses.
Mean	**1.7**	
EIS class	**Moderate**	

The results of the EIS for the watercourses in the study area located in the Vaal WMA are presented in Table 9-48. The results of the EIS assessment derived a **moderate** EIS for the Waterval River reach assessed.

Table 9-48: Ecological Importance and Sensitivity Ratings for the Watercourses in the Study area located in the Vaal Water Management Area

Determinant	Rating	Comment
Biological Determinants		
Rare and endangered biota	3	More than one taxon rare or endangered at a local scale
Unique biota	2	The aquatic fauna is distributed widely throughout the Vaal WMA
Intolerant biota	2	Source zone conditions make the presence of flowing water rare. Therefore, flow intolerant taxa make up only a small portion of the aquatic fauna
Species richness	2	On a local scale the species richness is moderate
Habitat Determinants		
Diversity of aquatic habitat	2	Impacted system, most of which are reversible impacts associated with water quality deterioration
Refuge value of habitat types	2	Wetlands and impoundments in smaller clean tributaries are refuge areas for water quality sensitive taxa
Sensitivity of habitat to flow modification	1	The source zone watercourses typically are not flowing
Sensitivity to flow related water quality changes	2	A loss of flow will concentrate the current pollutants making the watercourse sensitive to flow related water quality changes
Migration route corridor for instream and riparian biota	1	The watercourses are in the upper reaches of the river systems
National parks and wilderness areas	1	NFEPA listing with no nature reserves associated with the watercourses.
Mean	**1.8**	
EIS class	**Moderate**	

Spatial Sensitivity Assessment

The layout of sensitive environments in respect to aquatic ecology is presented in Figure 9-50 and Figure 9-51. It is noted that a 100 m buffer has been presented in these figures based on the delineated watercourses in the project area. It is however noted that a 100 m buffer should be provided for all watercourses assuming that some may have been missed in this delineation. In addition, it was noted that infrastructure within the layout of the Leslie 1A project area is in direct proximity to the Kromdraaispruit. The particular infrastructure that is in proximity to the watercourse is the proposed mine shafts and various topsoil and waste dumps. This proposed infrastructure is within the proposed 100 m buffer zone for surface infrastructure. Furthermore, underground mining activities are proposed to undermine numerous watercourses and wetland systems at an unknown depth. These activities therefore pose a direct threat to sensitive aquatic ecological habitats. Sensitive habitats depicted in should be avoided with a 500 m buffer zone.

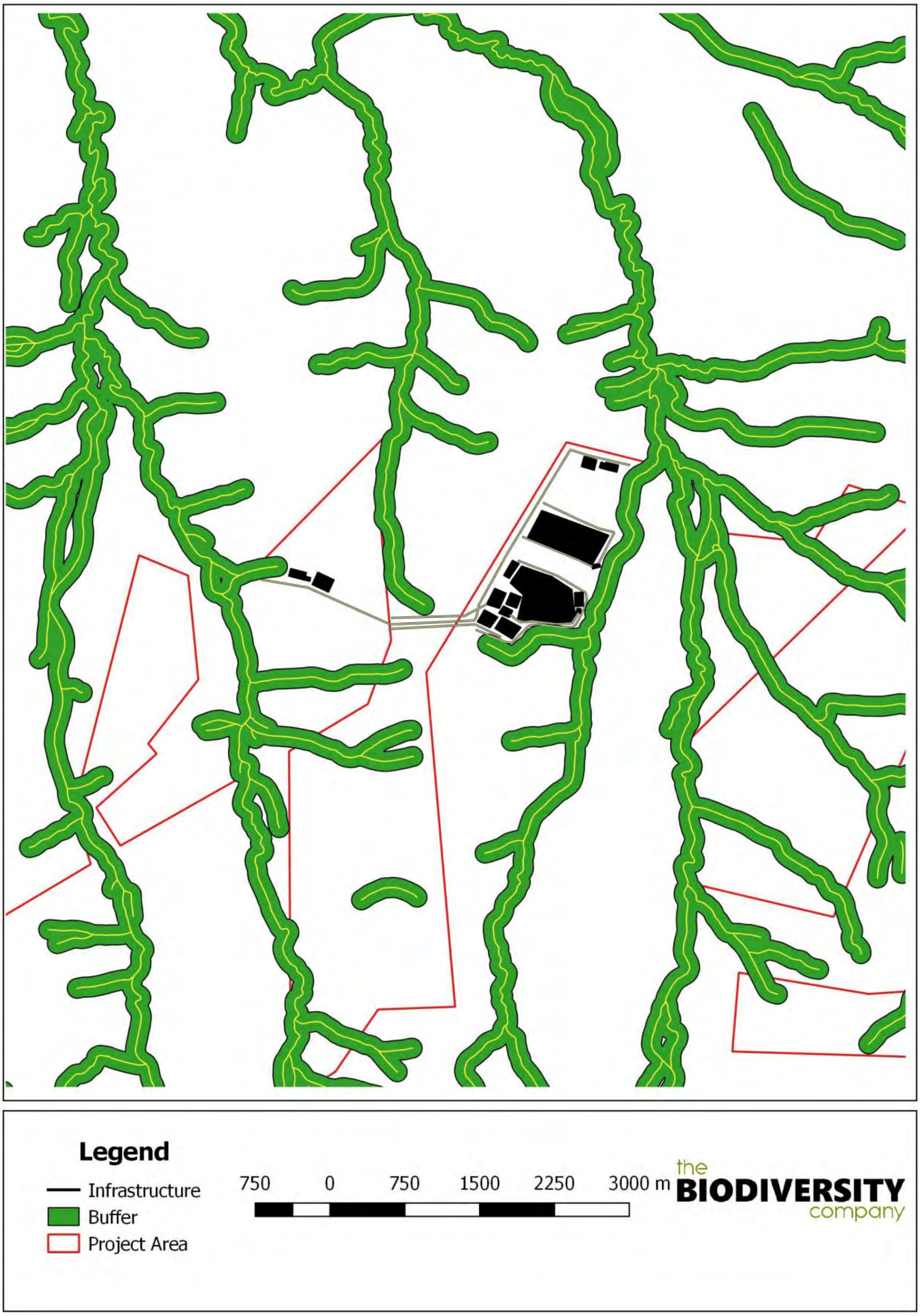


Figure 9-50: Sensitive Aquatic Habitats (Olifants Water Management Area; 61m buffer)

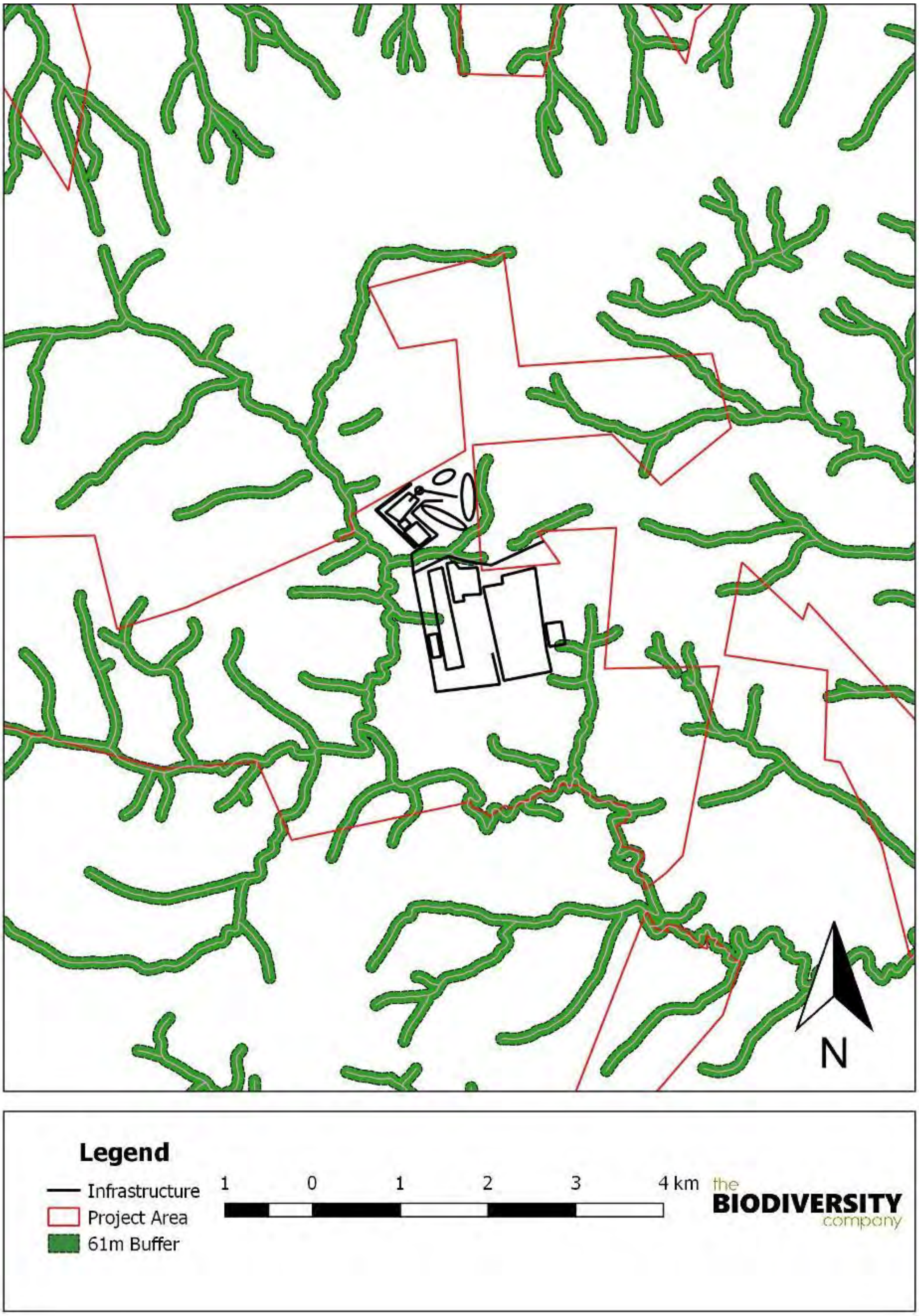


Figure 9-51: Sensitive Aquatic Habitats (Vaal Water Management Area; 61m buffer)

9.7.3.4 Wetlands

Ecological Functionality

The Ecosystem services provided by the hydrogeomorphic (HGM types) identified on site were assessed and rated using the WET-EcoServices method (Kotze et al. 2009). The summarised results are shown in Table 9-49.

HGM 1, HGM 3 and HGM 4 have been scored an "Intermediate" average EcoService score with erosion control as well as the assimilation of phosphates, nitrates and toxicants being the EcoServices scored "High". The reason for the assimilation ability of the wetlands is mainly described to the diffusivity of the flows within the wetland. The erosion control has been scored high due to the current lack of erosional features as well as the dense vegetation cover within the wetland. HGM 4 has the addition of streamflow regulation being scored "High" since the wetland is directly connected with other watercourses.

HGM 2 and HGM 5 have been scored an "Intermediate" average EcoService score with the following EcoServices being scored "High": flood attenuation, streamflow regulation, sediment trapping, phosphate, toxicant and nitrate assimilation, erosion control and provisioning of cultivated foods. Flood attenuation for this system is due to the representation of different hydrological regimes and the frequency with which stormflows are spread across the wetland. The streamflow regulation can be described to the importance of other watercourses down-stream as well as continues sub-surface flows from the adjacent slopes. Sediment trapping is evident in the extent of which sediment sources deliver sediment to the HGM unit. Provisioning of cultivated foods have been scored high due to the locality of the wetland in a rural area as well as the use of water from dams within the wetland to partially irrigate crops.

Table 9-49: The EcoServices being provided by the HGM types

Wetland Unit					HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.4	2.3	1.6	1.3	2.3
			Streamflow regulation		1.7	2.2	1.7	2.7	2.2
			Water Quality enhancement benefits	Sediment trapping	1.5	2.3	1.5	1.4	2.3
				Phosphate assimilation	2.5	2.4	2.8	2.5	2.4
				Nitrate assimilation	2.9	2.4	3.3	3.1	2.4
				Toxicant assimilation	2.0	2.2	2.2	2.2	2.2
				Erosion control	2.8	2.4	2.7	2.8	2.4
			Carbon storage		1.0	1.3	1.0	1.7	1.3
	Direct Benefits	**Biodiversity maintenance**			1.5	1.3	1.3	1.4	1.3
		Provisioning benefits	Provisioning of water for human use		0.3	1.7	0.3	0.8	1.7
			Provisioning of harvestable resources		1.4	1.8	1.4	1.4	1.8
			Provisioning of cultivated foods		1.4	2.4	1.4	1.4	2.4

Wetland Unit				HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
		Cultural benefits	Cultural heritage	1.0	1.0	1.0	1.0	1.0
			Tourism and recreation	1.0	1.4	0.7	0.7	1.4
			Education and research	1.3	1.3	0.8	1.3	1.3
Overall				23.6	28.2	23.5	25.5	28.2
Average Eco Services Score Before the Proposed Impacts				1.6	1.9	1.6	1.7	1.9
Threats				3.0	3.0	3.0	3.0	2.0
Opportunities				3.0	3.0	3.0	3.0	3.0

Table 9-50 indicates that a “High” rating has been scored for all the HGM types in regard to the indirect benefits obtained from the wetlands delineated. This indicates the importance of these systems to attenuate floods, regulate streamflow and enhance water quality. “Moderately Low” scores have been given to HGM 1 and HGM 3 for the direct benefits with “Intermediate” scores for HGM 2, HGM 4 and HGM 5. All of the wetlands delineated have been given “Intermediate” scores for the biodiversity component.

Table 9-50: Direct- and indirect benefits obtained from Eco Services

	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
Indirect Benefits (including water quality enhancement)	2.3	2.3	2.3	2.3	2.3
Direct Benefits (social/cultural benefits)	1.1	1.6	1.1	1.4	1.6
Biodiversity Maintenance (direct benefits)	1.5	1.3	1.3	1.4	1.3

Ecological Health Assessment

The Present Ecological Status (PES) for the assessed HGM units are presented in Table 9-51. The following aspects are noteworthy:

The **Hydrology** of HGM 1 has been impacted upon very little with regard to the hydrology component with an impact score of “Largely Natural (Class B)”. HGM 3 and HGM 4 has been impacted on “Moderately (Class C)” whereas HGM 2 and HGM 5 have been scored “Seriously Modified (Class E)”. Some of the impacts associated with the modification scores include: dam walls and other impeding structures impact significantly onto wetlands with litter, refuse and contaminated water adding to these impacts. Stream modification also plays a significant role in these high impact scores.

The **Geomorphology** component for HGM 1, HGM 3 and HGM 5 has been afforded an “Unmodified (Class A)” score due to the lack of geomorphological impacts relevant to these HGM units. HGM 2 has been rated a “Moderately Modified (Class C)” score whereas HGM 4 has been scored a “Largely Natural (Class B)”. Impacts associated with these scores include excavation and deposition in wetland catchments, especially excavations focussed in capturing sub-surface flows. Impeding structures and erosional features are other factors adding to the list of geomorphological impacts.

The **Vegetation** aspect for HGM 1 and HGM 2 has been rated "Largely Modified (Class D)". A "Critically Modified (Class F)" rating has been scored for HGM 3 whereas only "Moderately Modified (Class C)" scores has been rated for HGM 4 and HGM 5. Impacts associated with these scores include the presence of invading alien species like *Populus alba*, grazing within wetland catchments and a large presence of extensive agricultural activities of which the latter contributes the most to these scores, especially in the case of HGM 3.

The **overall** wetland health for HGM 1 is "Largely Natural (Class B)", which indicates very little disturbances within the delineated wetland's catchment. HGM 2 and HGM 3 are "Largely Modified (Class D)" with HGM 4 and HGM 5 classified as "Moderately Modified (Class C)". These scores are reflective of the degree of disturbances currently occurring within the wetland's catchments.

Table 9-51: Summary of the scores for the wetland PES

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 1	80,00	B: Largely Natural	1,0	A: Unmodified Natural	0,9	D: Largely Modified	4,0
Overall PES Score		1,8		Overall PES Class		B: Largely Natural	
HGM 2	165,00	E: Seriously Modified	7,5	C: Moderately Modified	3,6	D: Largely Modified	5,6
Overall PES Score		5,8		Overall PES Class		D: Largely Modified	
HGM 3	13,00	C: Moderately Modified	3,0	A: Unmodified Natural	0,9	F: Critically Modified	9,4
Overall PES Score		4,2		Overall PES Class		D: Largely Modified	
HGM 4	7,50	C: Moderately Modified	3,0	B: Largely Natural	1,1	C: Moderately Modified	3,0
Overall PES Score		2,7		Overall PES Class		C: Moderately Modified	

Wetland	Area (ha)	Hydrology		Geomorphology		Vegetation	
		Rating	Score	Rating	Score	Rating	Score
HGM 5	95,00	E: Seriously Modified	6,5	A: Unmodified Natural	0,7	C: Moderately Modified	2,1
Overall PES Score		3,6		Overall PES Class		C: Moderately Modified	

Environmental Importance and Sensitivity (EIS)

The wetland EIS assessment was applied to the HGM unit described above to assess the levels of sensitivity and ecological importance of the wetland. The results of the assessment are shown in Table 9-52.

All of the HGM type's **EIS** scores are "High (B)" except for HGM 3 which is characterised by a "Low (D)" score. EIS specifically refers to the presence of unique species, the suitability of habitat for unique species, the protection status, sensitivity and importance of wetlands for their surrounding environment. High scores have been given to the abovementioned HGM systems due to the presence of unique species in the form of otters and Grass Owls. Ideal habitats for unique species within these HGM types include water courses, thick vegetation cover, various tree species as well as a considerably large sized cave carved out by seeping water. The EIS for HGM 3 has been scored as low due to the location of the wetland directly within crop fields, which subsequently is an unsuitable habitat for any unique species.

The **Hydrological/Functional Importance** for all of the HGM units except for HGM 1 has been scored "High (B)" in regard to the hydrological/functional importance of the systems. HGM 1 has been scored a slightly lower "Moderate (C)" score. These scores are reflective of the assimilation ability, the streamflow regulation, flood attenuation and erosional control of the wetlands.

The **Direct Human Benefits** have been scored" Moderate (C)" for all the systems except for HGM 3 which has been scored a "Low (D)" score. These scores are reflective of the current use of the wetland regarding sustaining crops, adding to possible research and education purposes and the direct use thereof in regard to consumption and everyday basic needs. Those wetlands with a "Moderate (C)" score is the highest rated due to the use thereof to partially irrigate crops from dams dug out within the wetlands.

Table 9-52: The EIS results for the delineated HGM types

	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5
	Importance				
Ecological importance and sensitivity	2.7	2.7	0.6	2.7	2.7
Hydrological/functional importance	2.0	2.2	2.1	2.2	2.2
Direct human benefits	1.1	1.6	0.9	1.1	1.6

Risk Assessment

Considerable risks indicated by means of the impact assessment include the construction of associated infrastructure regarding direct loss of wetland systems and loss of sub-surface flows. The latter mentioned impact is the only impact associated with the construction phase that is not expected to be minimized by means of mitigation measures. The loss of sub-surface flows is imminent seeing that these flows are so close to the surface. All excavations and construction will completely drain these flows and compact these areas to such an extent that sub-surface flows are altered.

During the operational phase, the following activities are expected to pose threats which are not expected to be minimised to a “Low” risk score by means of mitigation measures; The operation of the supporting infrastructure regarding reduced catchment water yield and the loss of sub-surface flows. These impacts are expected to have “Medium” and “High” risk scores after the application of recommended mitigation measures. The operation of ROM and overburden stockpiles regarding impacts associated with salinization and AMD have also been rated “High” before mitigation with the possibility to decrease this risk to “Medium” after the application of relevant mitigation measures.

9.7.4 Specialist Conclusions

9.7.4.1 Biodiversity Assessment

Considering the above-mentioned conclusions, it is the opinion of the specialist that the Leslie 1A Project area, with the current proposed infrastructures layout areas, may be favourably considered. The Leslie 1C Project area, although predominantly classed as an HMA, is surrounded by CBAs and is considered to be a more sensitive ecological area. Also, according to the Mining and Biodiversity Guidelines (2013) Leslie 1C is classed as an area which is considered the highest risk for mining and of high biodiversity importance.

Both Leslie 1A and Leslie 1C infrastructure areas are situated close to sensitive critical biodiversity areas as well as close to wetland areas and ridges where species of conservation of concern occur. The presence of some of these species was confirmed during field surveys. Due to the sensitivities of the project environment, and should authorisation be approved for this project, all mitigation measures and recommendations must be strictly adhered to.

9.7.4.2 Aquatic Assessment

The proposed project activities were determined to have two primary impacts to the associated aquatic ecology. The first was determined to be related to the conditions within the physical make-up of the considered river reaches. This includes the riverine substrates, banks, riparian vegetation and water column. These physical components of a water course determine the quality of the aquatic habitats. Therefore, modification of these physical components would result in a habitat quality impact and deterioration. The second impact was determined to be related to negative effects on the chemical properties of water. Considering aquatic biota have requirements for habitat, as well as sensitivity to changes in water chemistry.

It is recommended that an Erosion Risk Assessment and Management Plan is completed and implemented to derive the areas at highest risk for erosion. These high risk areas should then be key points for erosion management.

It is recommended that a Rock Engineering Subsidence Risk Assessment is completed to define areas of high subsidence risk. Areas where high risk has been determined should be completely avoided to reduce the risk for surface hydrology alterations. Should unavoidable subsidence occur, rehabilitation actions must be implemented to avoid further effects to downstream river reaches. This may include the implementation of a river diversion around impacted areas. This would require additional environmental approvals and additional specialist studies should this be required.

The establishment and implementation of a clearly marked buffer zone from all surface project infrastructures. The Wetland Ecology Study for this project defined the proposed buffer zones from delineated wetland areas (TBC, 2018). The designated buffer zones should then be demarcated using signage or fences. The specific area should have a 500 m buffer zone to underground mining activities due the diverse and sensitive nature of the ox-bow lakes systems.

Discard dumps and PCD’s are recommended to be lined with a suitable liner to reduce seepage of contaminated runoff. Furthermore, there is potential for Acid Mine Drainage to develop as a result of underground mining activities. The only mitigation possible for potential mine water decant is the use of passive or active water treatment. This is therefore recommended.

9.7.4.3 Wetlands Assessment

Considering the status and functioning of the wetland ecosystems, and furthermore the nature and requirements of the project, the proposed project infrastructure within Leslie project area 1A might result in the loss (and degradation) of wetland areas, with wetlands in project area 1C being exposed to indirect risks, also possibly resulting in the degradation of these systems.

Due to the amendments to the infrastructure layout and reduced overall project footprint, all high risks posed without mitigation have been reduced to a medium risk with mitigation. Additionally, all medium risks posed without mitigation have been reduced to a low risk with mitigation.

Based on the findings of this assessment, no fatal flaws have been identified for the study. It is required that all the recommendations and mitigation measures prescribed in this report be implemented for this project. The loss (and degradation) of wetlands expected for this project must be compensated for by means of a wetland offset programme.

The following list provides a framework for the anticipated major impacts associated with the project.

- Loss / degradation of ecosystems
    - Project activities that can cause loss of habitat (especially in regard to the two proposed infrastructure areas):
        - Physical removal of vegetation
        - Access roads and servitudes
        - Construction camps & laydown areas
        - Infrastructure development (buildings)
        - Linear trench excavation and berm creation

      - Soil dust precipitation
      - Coal dust precipitation
      - Stochastic events such as fire (cooking fires or cigarettes from staff)
  - Secondary impacts anticipated
      - Loss of shallow recharge zones
      - Displacement/loss of flora & fauna (including SCC)
      - Increased potential for soil erosion (in conjunction with alterations in hydrological regimes)
      - Habitat fragmentation & loss of habitat corridors
      - Increased potential for establishment of alien & invasive vegetation
      - Loss of stored carbon & carbon sequestration potential
      - Loss of ecosystem services
- Spread and/or establishment of alien and/or invasive species
  - Project activities that can cause the spread and/or establishment of alien and/or invasive species
      - Vegetation removal
      - Soil excavations and soil transportation
      - Transportation vehicles potentially spreading seed while moving on, to and from mining areas
      - Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents
      - Creation of infrastructure suitable for breeding activities of alien and/or invasive birds
  - Secondary impacts anticipated
      - Habitat loss for native flora & fauna (including SCC)
      - Reduced forage quality of grazing habitat
      - Spreading of potentially dangerous diseases
      - Alteration of fauna assemblages due to habitat modification
- Direct mortality of fauna
  - Project activities that can cause direct mortality of fauna
      - Clearing of vegetation
      - Roadkill due to vehicle collision
      - Earth moving (removal and storage of topsoil and overburden)
      - Blasting and excavation
      - Pollution of water resources due to dust effects, chemical spills, acid mine drainage etc.
      - Intentional killing of fauna for food (hunting) or otherwise (killing of snakes)
      - Bird collisions with electrical lines and infrastructure guide wires
  - Secondary impacts anticipated
      - Loss of ecosystem services
      - Explosion of rodent populations and associated disease risk
- Reduced dispersal/migration of fauna
  - Project activities that can cause reduced dispersal/migration of fauna

    - Linear trenches and berms
    - Compacted roads
    - Removal of vegetation
  - Secondary impacts associated with reduced dispersal/migration of fauna
    - Loss of ecosystem services
    - Reduced plant seed dispersal
- Environmental pollution due to increased sedimentation and chemical runoff in watercourses
  - Project activities that can cause pollution in water courses
    - Chemical (organic/inorganic) spills
    - Erosion
    - Acid mine drainage (decanting)
    - Untreated runoff or effluent
  - Secondary impacts associated with pollution in water courses
    - Faunal mortality (direct and indirectly e.g. algal blooms)
    - Groundwater pollution
    - Loss of ecosystem services
- Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise
  - Project activities that can cause disruption/alteration of ecological life cycles due to noise
    - Blasting
    - Operation of machinery (generators, crushers, vehicles)
  - Secondary impacts associated with disruption/alteration of ecological life cycles due to noise
    - Loss of ecosystem services
- Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to dust
  - Project activities that can cause disruption/alteration of ecological life cycles due to dust
    - Blasting
    - Operation of vehicles (generators, crushers, vehicles)
    - Coal crushing and transportation
    - Uncovered soil and coal stockpiles
  - Secondary impacts associated with disruption/alteration of ecological life cycles due to dust
    - Loss of ecosystem services
- Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to light
  - Project activities that can cause disruption/alteration of ecological life cycles due to light
    - External lighting to enable project activities at night
    - Vehicles operating at night
  - Secondary impacts associated with disruption/alteration of ecological life cycles due to light
    - Loss of ecosystem services
- Staff interacting directly with potentially dangerous fauna
  - Project activities that can cause staff to interact directly with potentially dangerous fauna
    - All activities outdoors

9.8 Air Quality

An Air Quality Impact Assessment was undertaken by Gondwana Environmental for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D7.

9.8.1 Environmental Status Quo

The proposed Leslie 1 Project falls within the declared Highveld Priority Area (HPA) for air quality. The Minister declared the HPA on 23 November 2007 as the second National Priority Area (Government Notice No. 1123, 2007). The Highveld area in South Africa is associated with poor air quality. Elevated concentrations of criteria pollutants occur due to the concentration of industrial and non-industrial sources (Held, 1996; DEAT, 2006). The draft midterm review of the 2011 HPA air quality management plan (AQMP) (DEA, 2015) showed that ambient concentrations of PM10 in Leandra were increasing, and that the annual average concentration of PM_{10} in Leandra was above the NAAQS of 40µg/m^3 for the year 2014 (air quality monitoring data is only available from the SAAQIS website for the Leandra monitoring station up to the end of 2014). This may be a significant risk to human health.

The HPA Air Quality Management Plan (AQMP) found that the total annual emission of fine particulate matter (PM_{10}) in the HPA is estimated at 280 000 tons, of which approximately half is attributed to particulate entrainment on mine haul roads. Primary metallurgical industries followed with 17% and power generation with 12% of annual PM_{10} emissions (Government Notice No. 144, 2012). The main economic sectors in the Govan Mbeki Local Municipality are commercial agriculture, the petrochemical sector with SASOL as its key industry, and the mining sector with coal and gold mining (Government Notice No. 144, 2012).

Although ambient air quality monitoring is relatively limited in the HPA, there are a few ambient air quality monitoring stations in the region of the proposed Leslie 1 Project. The closest are located in Leandra, Secunda, Embalenhle and Kriel Village. The Leandra and Kriel Village monitoring stations are run by Eskom, with data for Leandra only available until December 2014 and data for Kriel Village only available from January 2017. The Secunda monitoring station is run by the DEA, and the Embalenhle monitoring station is run by Sasol. Graphs of the PM_{10} data, compiled on the South African Air Quality Information System (SAAQIS) website, are shown in Figure 9-52 and Figure 9-53.

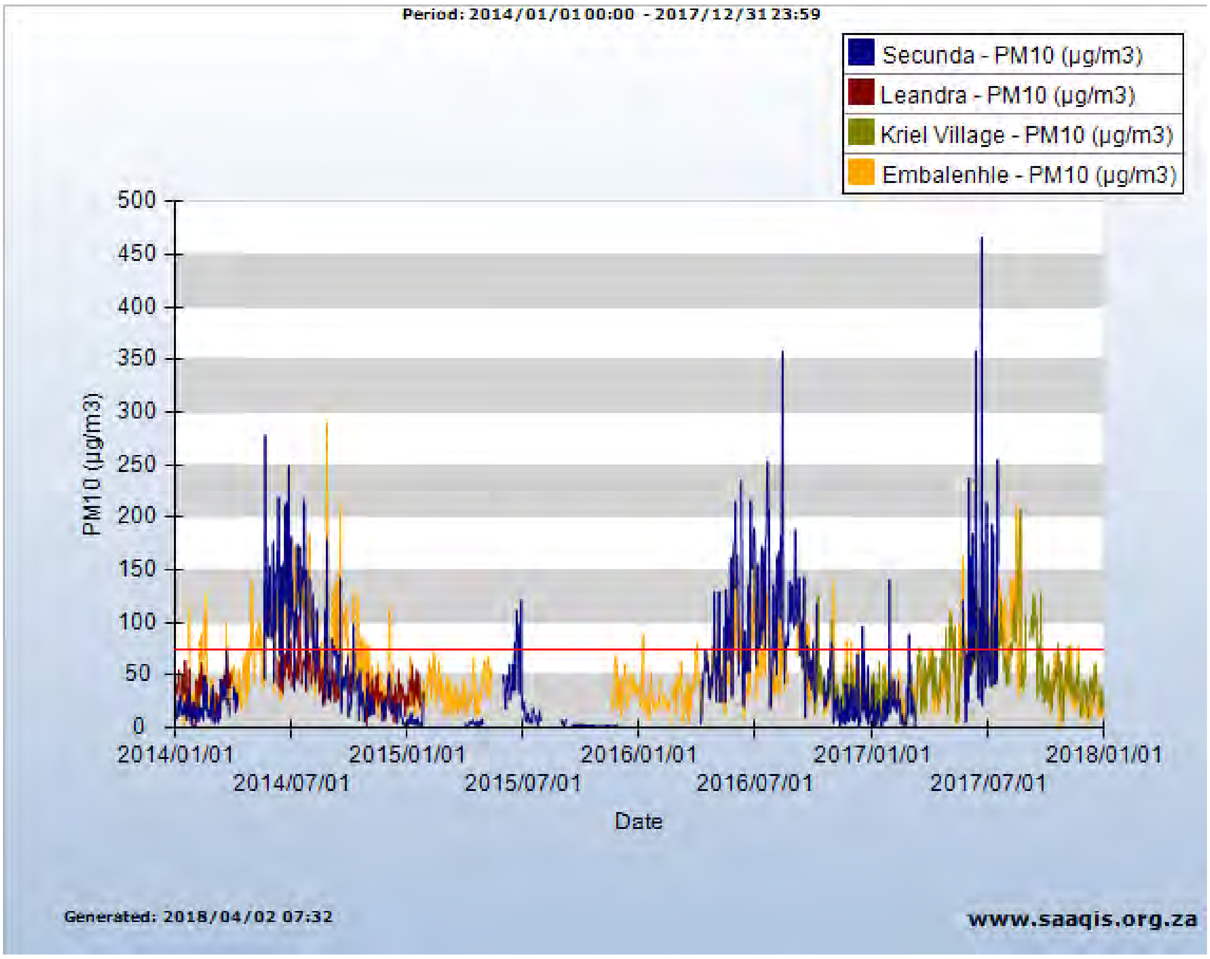


Figure 9-52: Daily average PM_{10} concentrations for Secunda, Leandra, Kriel Village and Embalenhle (SAAQIS, 2018).

The graphs in Figure 9-52 show regular exceedances of the 24-hour NAAQS, particularly during the winter months. This could be attributed both to an increase in the incidences of inversions and an increase in household fuel burning during winter. The diurnal variations seen in Figure 9-53, with peaks in the morning and evening are an indication of the influence of domestic fuel burning.

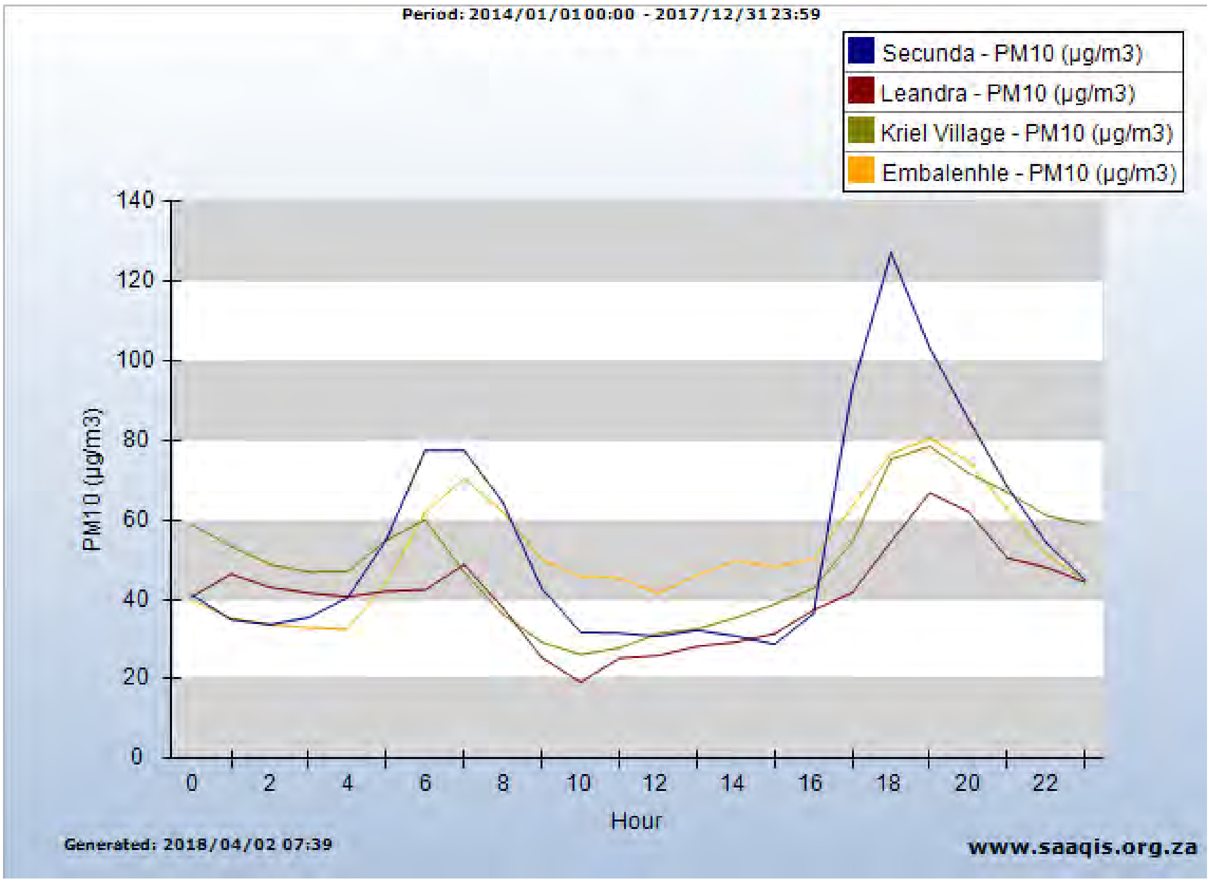


Figure 9-53: Diurnal PM_{10} concentrations for Secunda, Leandra, Kriel Village and Embalenhle (SAAQIS, 2018).

Data of $PM_{2.5}$ concentrations are only available for Secunda and Embalenhle (Figure 9-54). The data indicates a trend of increasing concentrations over the four-year period from 2014 to 2017. Caution should however be taken when extrapolating this information for the area around the proposed Leslie 1 Project, as the ambient air quality is mostly influenced by sources in the close vicinity. It does however show that ambient concentrations can be expected to be elevated as in the rest of the Highveld Priority Area. Sources that may contribute to the PM_{10} levels in the area include industrial and mining activities, domestic fuel burning, vehicle entrainment on road surfaces, biomass burning and wind-blown dust from open areas and stockpiles. The proximity of the proposed Leslie 1 Project to several other mining sites and power stations is therefore a concern for ambient air quality.

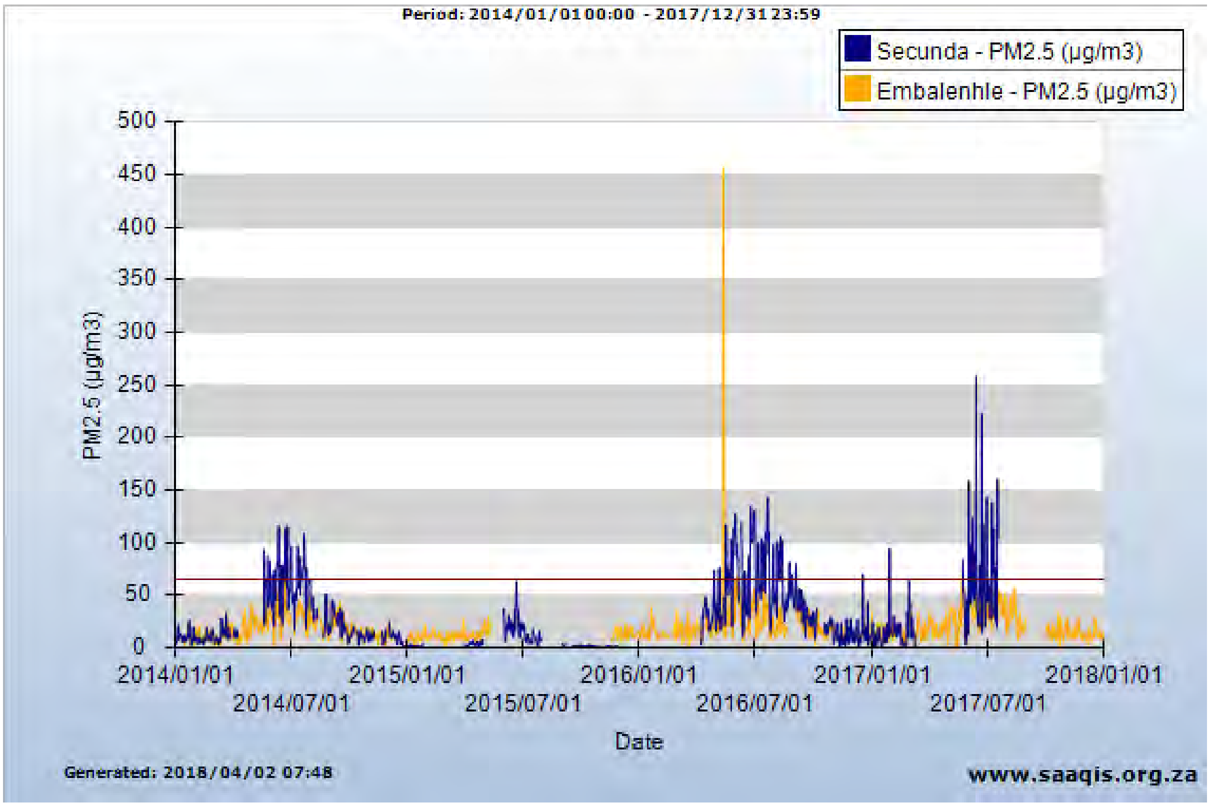


Figure 9-54: Daily average $PM_{2.5}$ concentrations for Secunda and Embalenhle (SAAQIS, 2018).

9.8.2 Specialist Assessment Methods

Dispersion models were designed to predict the ambient concentration in the air of pollutants emitted to the atmosphere from a variety of processes. The modelling system consists of one main program (AERMOD) and two pre-processors (AERMET and AERMAP). AERMOD is a steady-state plume dispersion model that incorporates air dispersion based on planetary boundary layer (PBL) turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. The basic purpose of AERMET is to use meteorological measurements, representative of the modelling domain, to compute certain boundary layer parameters used to estimate profiles of wind, turbulence and temperature.

To determine the maximum amounts of PM_{10} and $PM_{2.5}$, originating from the Leslie 1 Project, the following steps were undertaken by Gondwana Environmental:

1. Compile and emissions inventory
2. Establish a set of predictive emission factors which will include:
    a. Prediction of Fugitive Dust emissions from vehicle activity on unpaved roads;
    b. Prediction of Fugitive Dust emissions from materials handling;
    c. Prediction of Dust emissions as a result of wind erosion from exposed areas;
    d. Prediction of Particulate matter emissions resulting from crushing and screening activities; and
    e. Prediction of Fugitive Dust emissions from drilling and blasting

3. Calculate the emissions rate based on the general equation for emissions estimation; and
4. Modelling of surface meteorological data, upper air data and the predicted site-specific emission rates.

The mandate for regulatory modelling of air pollution is not to simulate reality, but to estimate worst-case scenarios. Five scenarios were chosen for the modelling:

- **Year 4 at Leslie 1A** was chosen because there will be full production of coal and therefore the highest expected emissions from off-site hauling and the CHPP.
- **Year 6 at Leslie 1A** was chosen because there will be full production of coal and therefore the highest expected emissions from off-site hauling and the CHPP. Added to this is the simultaneous preparation of the west mine access portal.

Three production scenarios were chosen for modelling potential emissions from Leslie 1C because of its proximity to the N17 highway and its proximity to the residential areas of Leandra.

- **The first year of production at Leslie 1C** was chosen because of the open pit mining in the preparation of the underground mine access portal, and it was assumed that the waste dump sites, co-disposal discard dump and all of the soil stockpiles will be prepared at the same time.
- **A year of full underground mining production at Leslie 1C** (with production quantities equivalent to those given for Leslie 1A in the Draft Mining Work Programme (Leslie Coal Mine (Pty) Ltd, 2018)) was chosen to estimate the worst-case ambient concentrations resulting from the mining activities and the CHPP.
- **The year of full underground production at Leslie 1C was also modelled without a CHPP**. For this scenario it was assumed that all ROM coal will be removed from the site by haul trucks.

The predicted air pollutant concentrations were then evaluated against National Ambient Air Quality Standards, and the predicted deposition rates were evaluated against acceptable dustfall rates as set out for both residential and non-residential areas in the National Dust Control Regulations (Government Notice No. R827, 2013).

9.8.3 Specialist Findings

An emissions inventory provides a list of all sources that would generate pollutants of concern. $PM_{2.5}$ and PM_{10} are the criteria pollutants of concern expected from the proposed Leslie 1 Project. The activities and the associated emissions are outlined in Table 9-53.

Table 9-53: Activities and related atmospheric emissions identified for the operational phase of the Leslie 1 Project

Emission	Source	Activity
Generation of TSP, PM_{10}	Materials handling operations	Soil removal by shovel and truck.
		Overburden removal by shovel and truck.

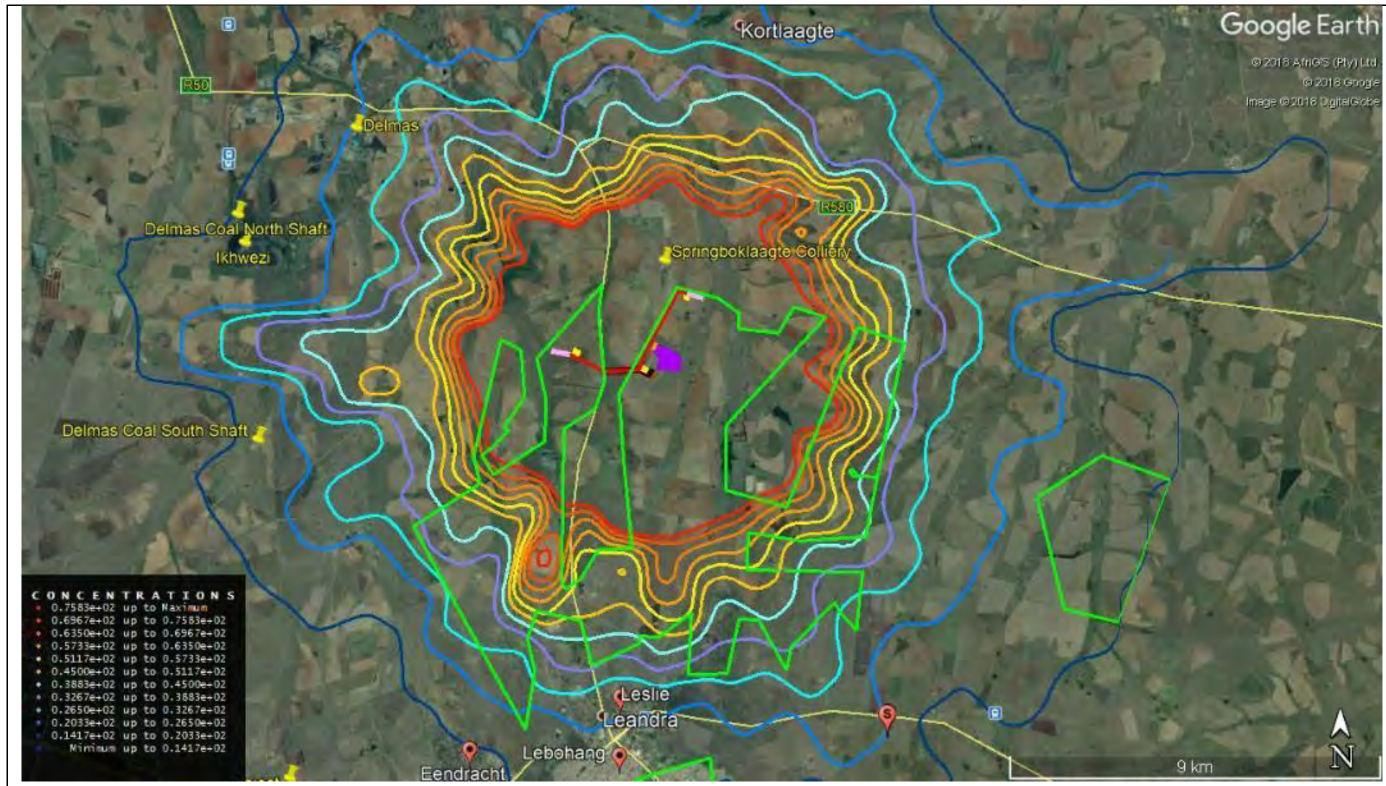
Emission	Source	Activity
		Offloading of topsoil and overburden.
		Conveyor transfer points.
		Tipping onto waste rock stockpile.
		Loading of coal into crushers.
		Tipping of ore from crushers onto storage piles.
		Stockpiling of product.
	Vehicle activity on unpaved roads	Haul trucks transporting topsoil to stockpiles.
		Haul trucks transporting overburden/waste from the mine to waste rock dumps or stockpiles.
		Haul trucks transporting coal from the CHPP off site.
	Wind erosion	Soil storage piles.
		Waste/overburden rock dumps.
		Conveyors.
		Coal storage piles.
	Crushing and screening	Crushing and screening activities.
NO_2	Vehicle activity	Tailpipe emissions from haul vehicles, and vehicles for mine personnel movement.
SO_2	Vehicle activity	Tailpipe emissions from haul vehicles, and vehicles for mine personnel movement.
SO_2, NO_X, H_2S, CO	Spontaneous combustion	Stockpiles, underground workings and waste dumps.

9.8.3.1 Leslie 1A

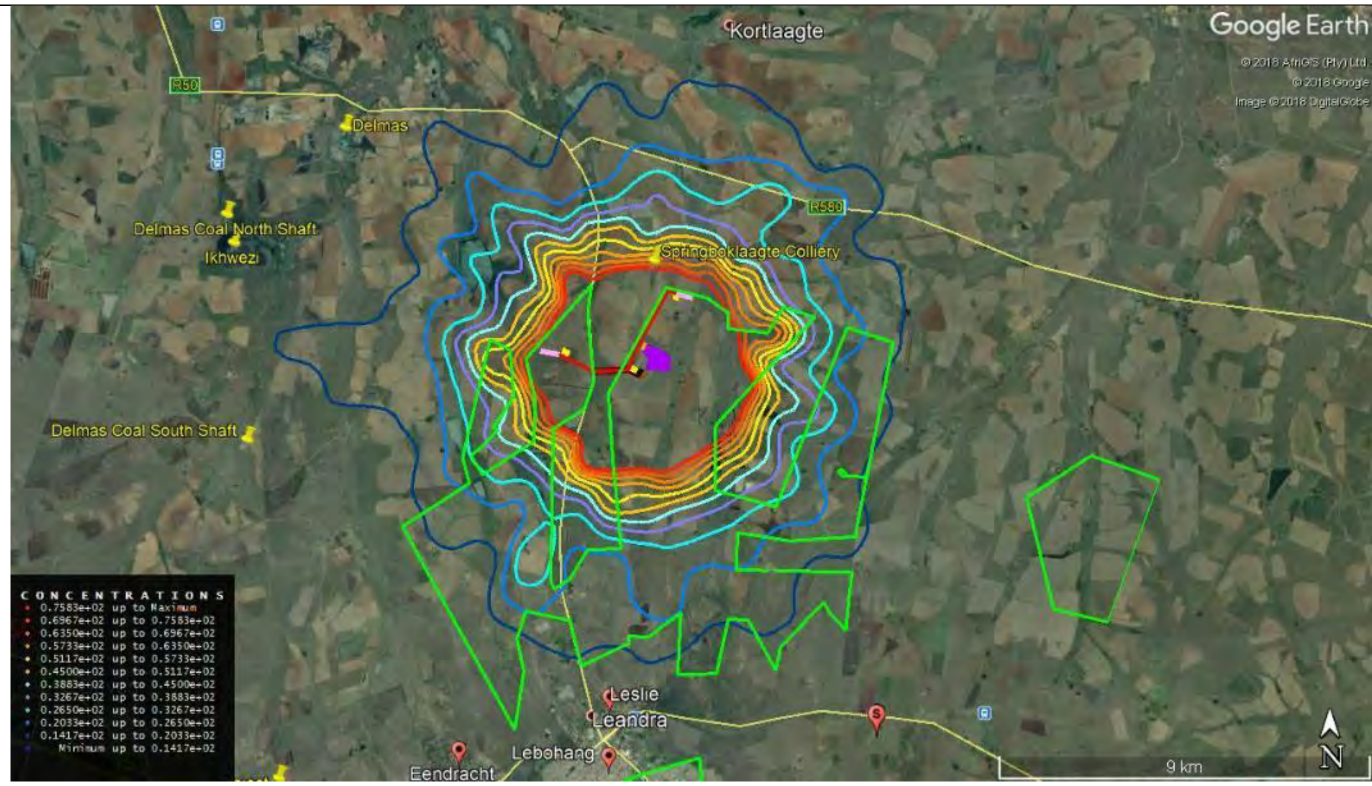
Table 9-54: Leslie 1A year 6 (Full Production East and Initial Production West)

Particle	No Mitigation Measures	With Mitigation Measures
PM_{10}	❖ PM_{10} (24-hour Average Concentrations) – Without any mitigation measures, the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m³ up to approximately 3.8 km from the mine footprint, including exceedances over the Springboklaagte Colliery mining area. This is a concern for cumulative PM_{10} concentrations in the area. ❖ PM_{10} (Annual Average Concentrations) – Without any mitigation measures, the predicted maximum annual average concentrations exceed the national	❖ PM_{10} (24-hour Average Concentrations) – With mitigation measures, the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m³ up to approximately 2.2 km from the mine footprint, including exceedances over the middle southward protrusion of the Springboklaagte Colliery mining area. This is a concern for cumulative PM_{10} concentrations in the area. ❖ PM_{10} (Annual Average Concentrations) – With mitigation measures, the predicted maximum annual average concentrations exceed the national annual average

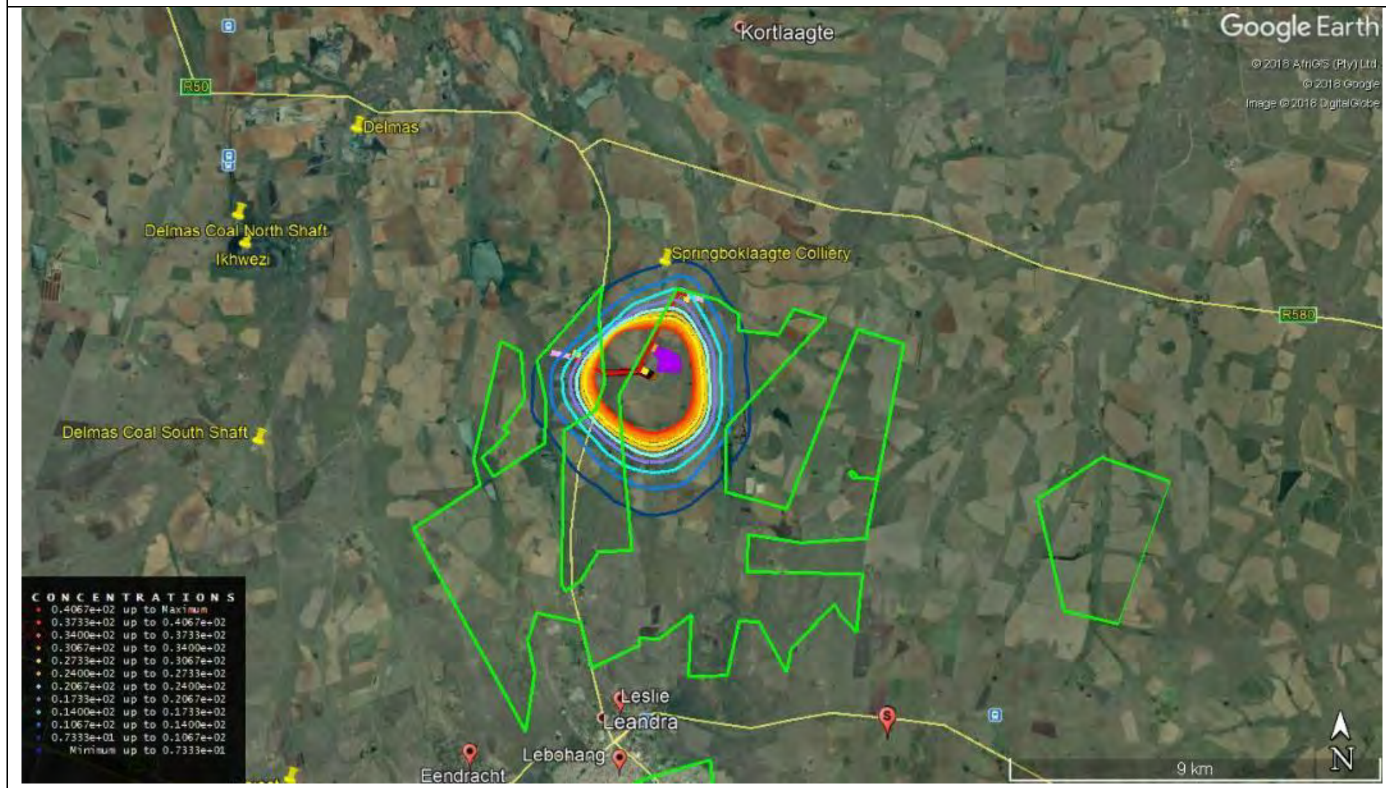
Particle	No Mitigation Measures	With Mitigation Measures
	annual average standard of 40µg/m³ up to approximately 1.2 km from the mine surface footprint. The proximity of the Springboklaagte Colliery is a concern for cumulative PM_{10} concentrations in the area.	standard of 40µg/m³, extending up to approximately 750 m from the mine footprint including the southernmost part of the middle southward protrusion of the Springboklaagte Colliery. This is a concern for cumulative PM_{10} concentrations in the area.
$PM_{2.5}$	❖ $PM_{2.5}$ (24-hour Average Concentrations) – Without any mitigation measures, the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m³ up to approximately 2.6 km from the mine footprint, including exceedances over the Springboklaagte Colliery mining area. This is a concern for cumulative $PM_{2.5}$ concentrations in the area. ❖ $PM_{2.5}$ (Annual Average Concentrations) – Without any mitigation measures, the predicted maximum annual average concentrations exceed the current national annual average standard of 20µg/m³ extending up to approximately 700 m from the mine footprint. The proximity of the Springboklaagte Colliery is a concern for cumulative $PM_{2.5}$ concentrations in the area.	❖ $PM_{2.5}$ (24-hour Average Concentrations) – With mitigation measures, the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m³ up to approximately 1.5 km from the mine footprint, including exceedances over the middle southward protrusion of the Springboklaagte Colliery mining area. This is a concern for cumulative $PM_{2.5}$ concentrations in the area. ❖ $PM_{2.5}$ (Annual Average Concentrations) – With mitigation measures, the predicted maximum annual average concentrations are only expected to exceed the national annual average standard of 20µg/m³ within the mining right area, extending up to approximately 300 m south of the mine footprint.



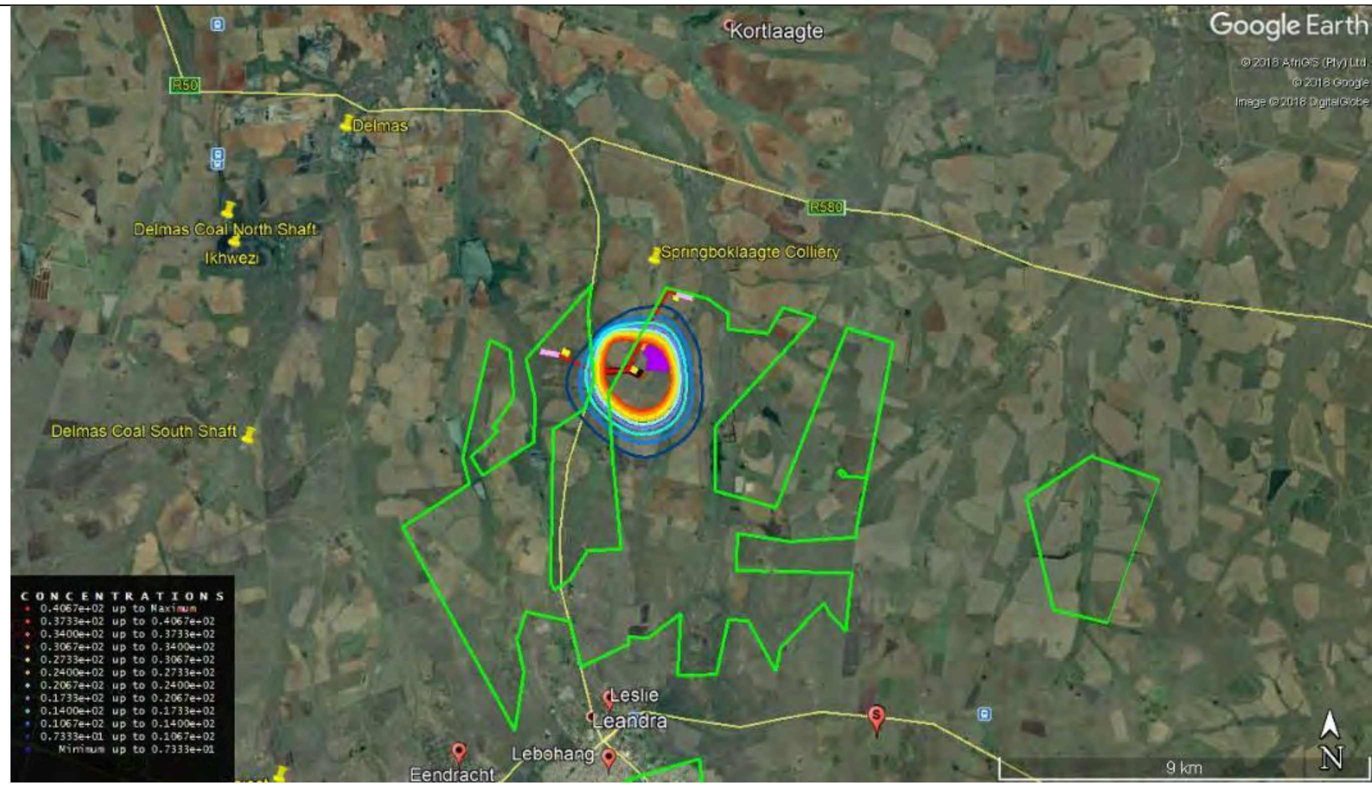
Maximum 24-hour average PM_{10} concentrations, without mitigation measures



Maximum 24-hour average PM_{10} concentrations, with mitigation measures

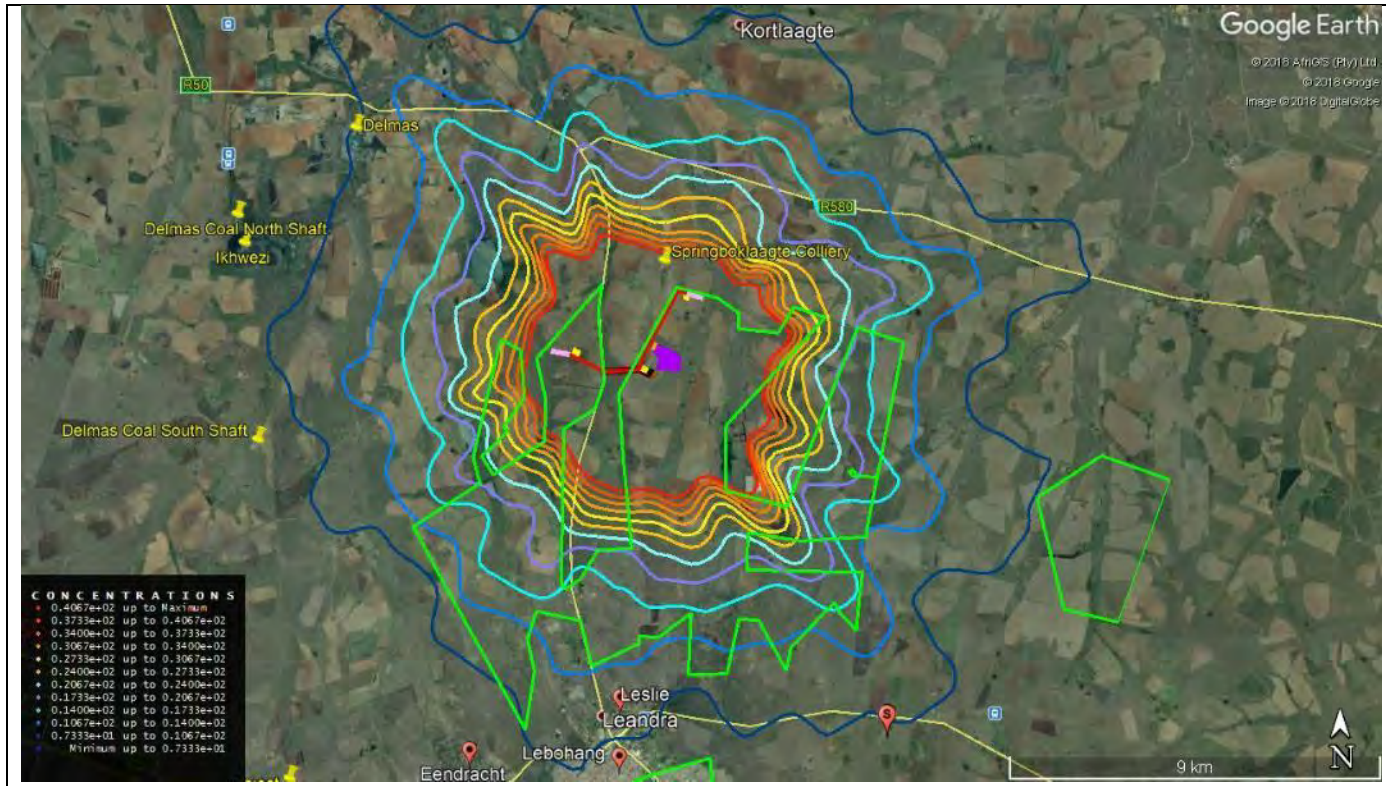


Annual average PM_{10} concentrations, without mitigation measures

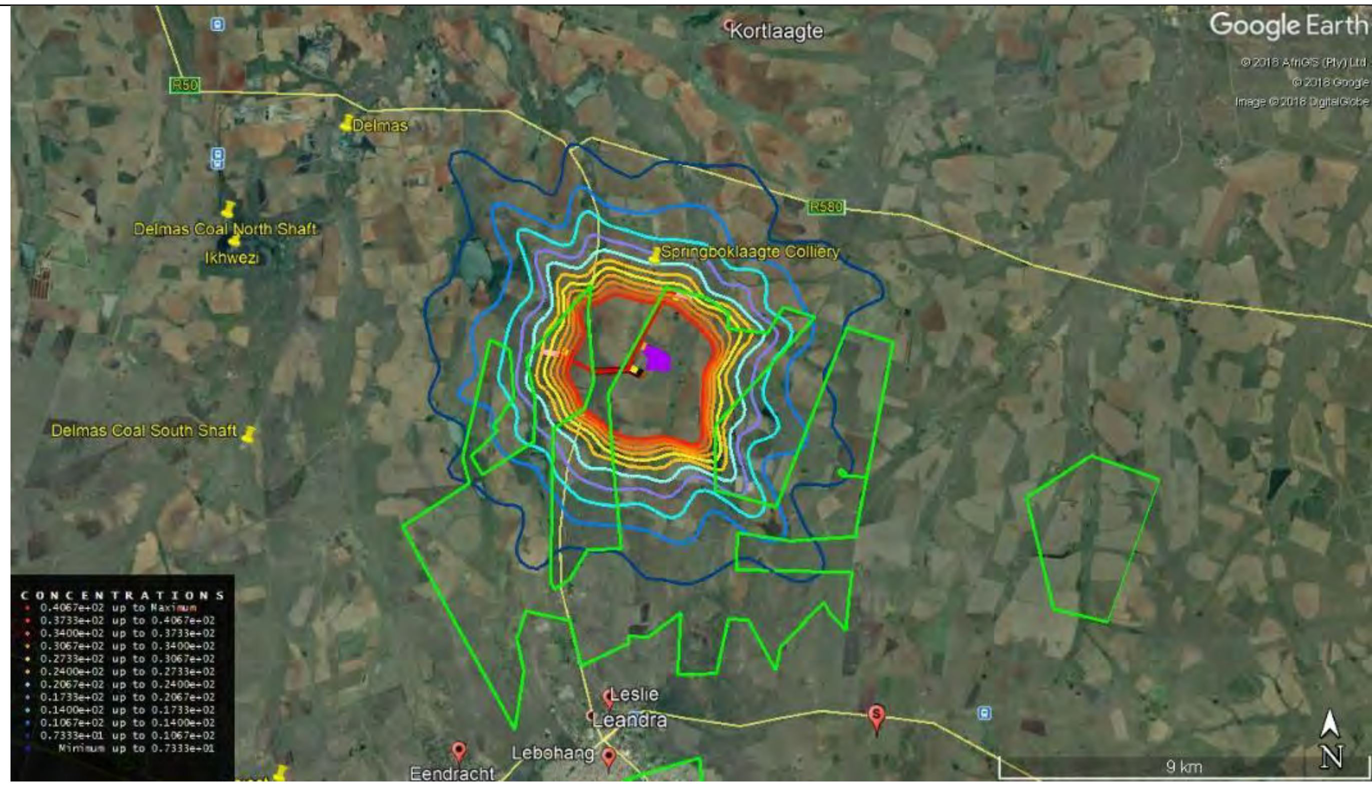


Annual average PM_{10} concentrations, with mitigation measures

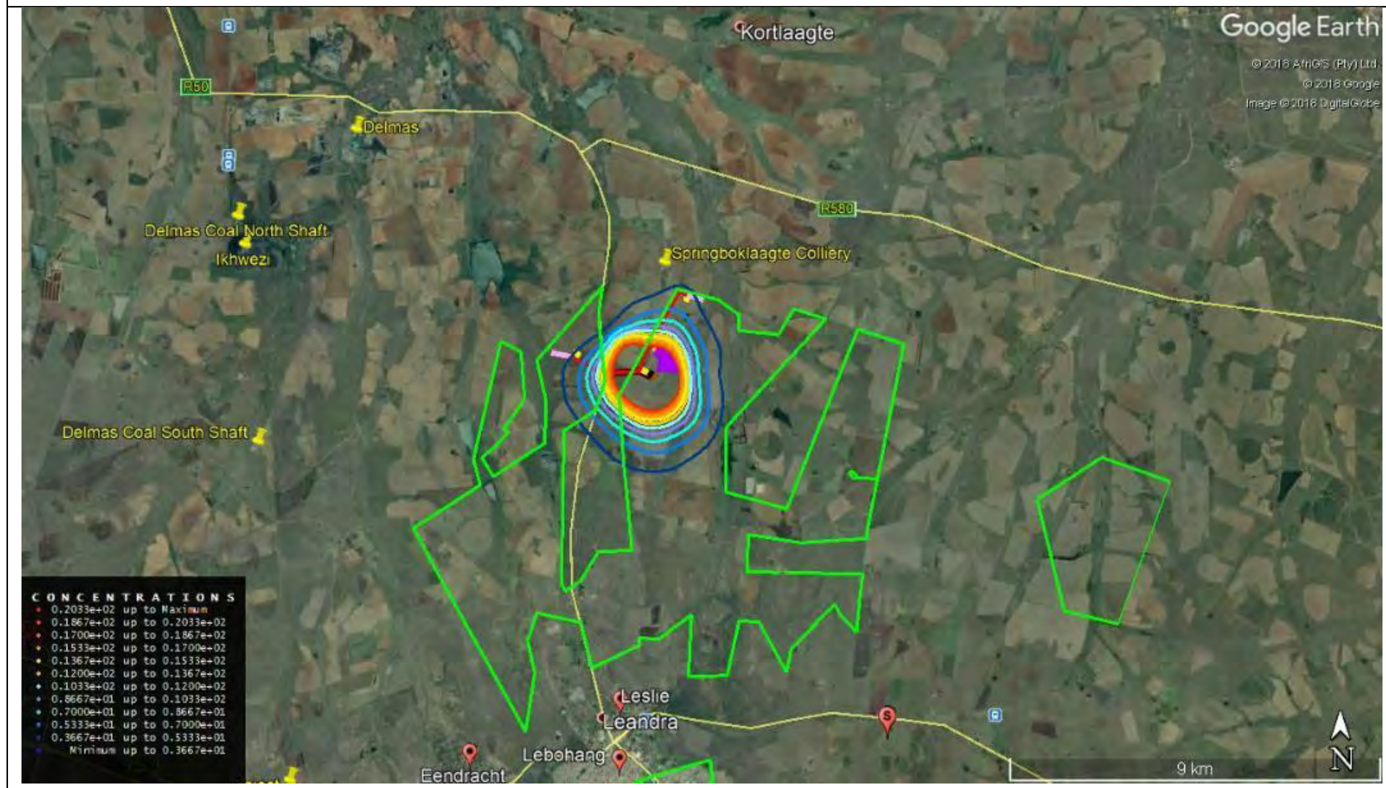
Figure 9-55: Modelling results for PM_{10} for Leslie 1A year 6 (Full Production East and Initial Production West).



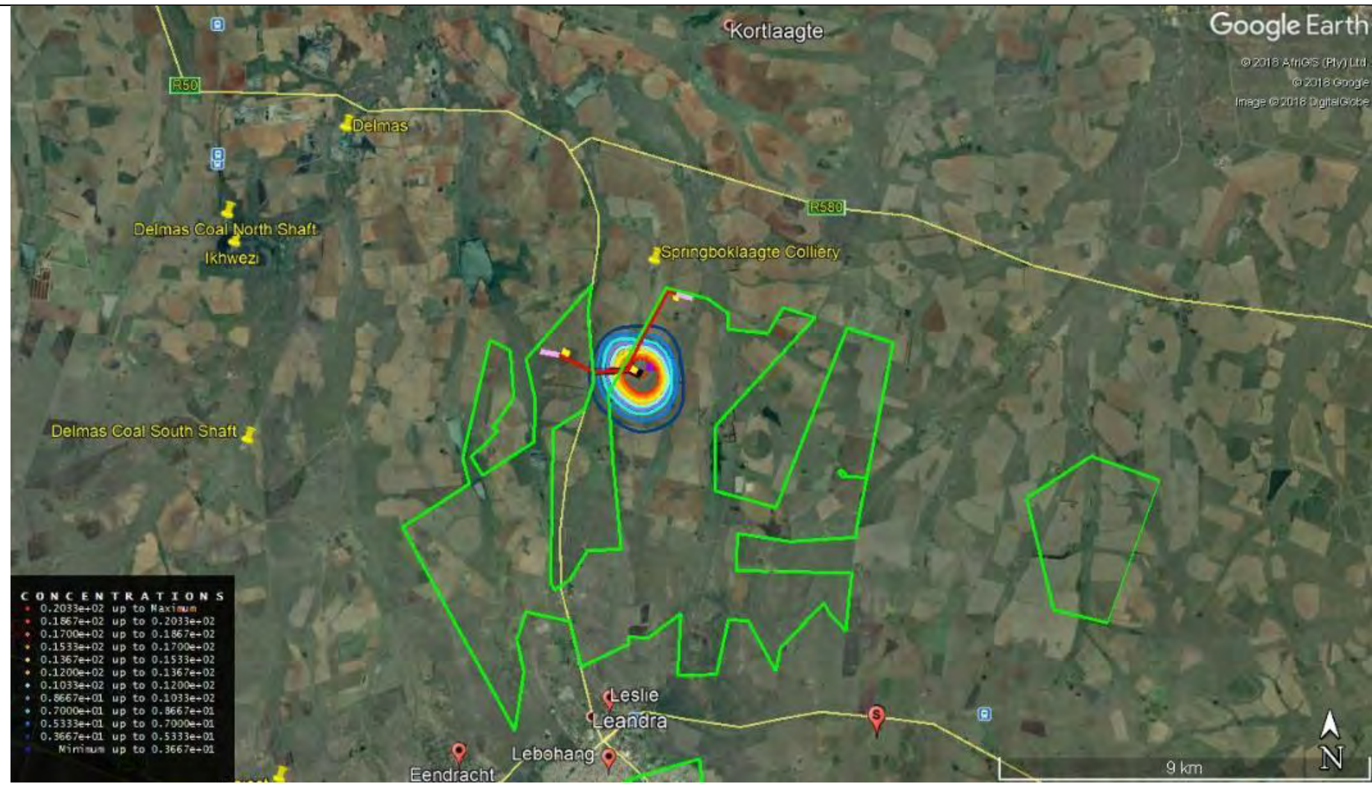
Maximum 24-hour average $PM_{2.5}$ concentrations, without mitigation measures



Maximum 24-hour average $PM_{2.5}$ concentrations, with mitigation measures



Annual average $PM_{2.5}$ concentrations, without mitigation measures



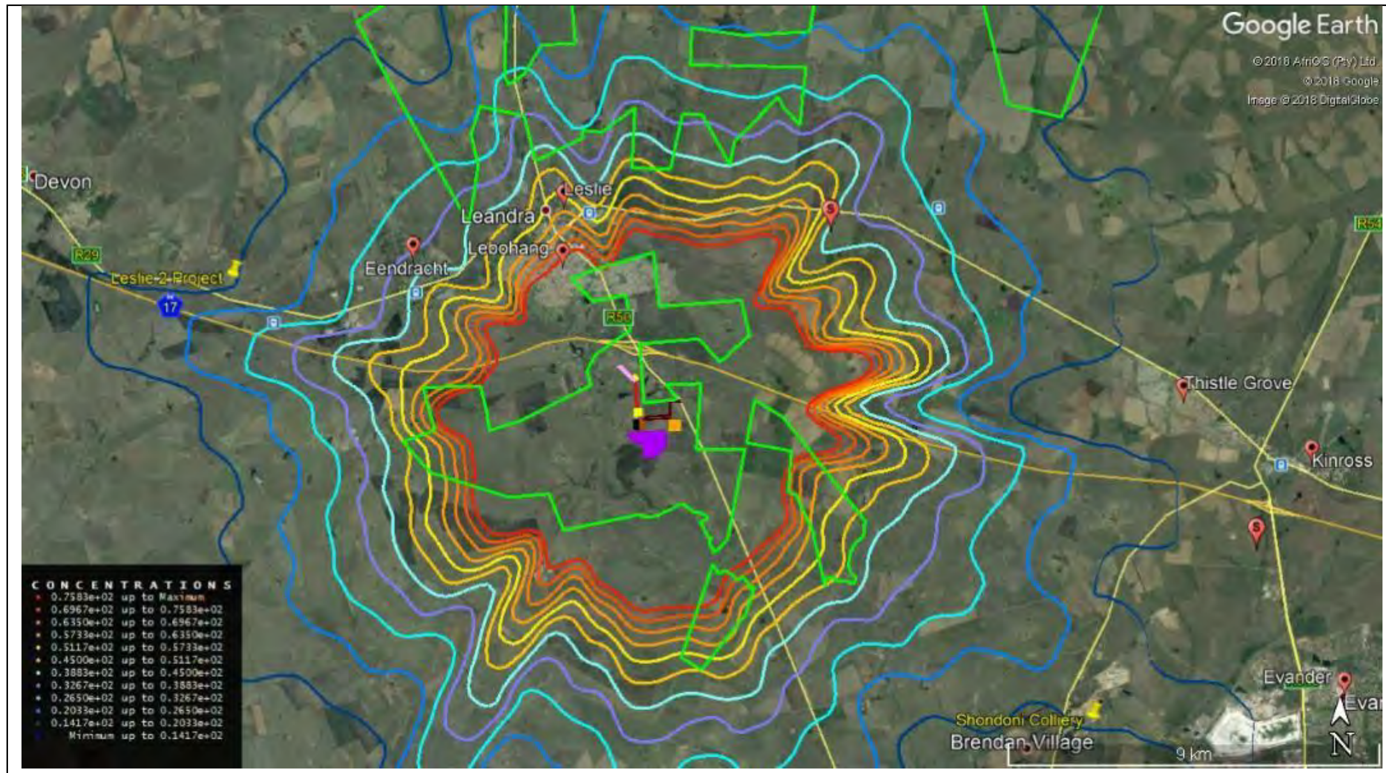
Annual average $PM_{2.5}$ concentrations, with mitigation measures

Figure 9-56: Modelling results for $PM_{2.5}$ for Leslie 1A year 6 (Full Production East and Initial Production West).

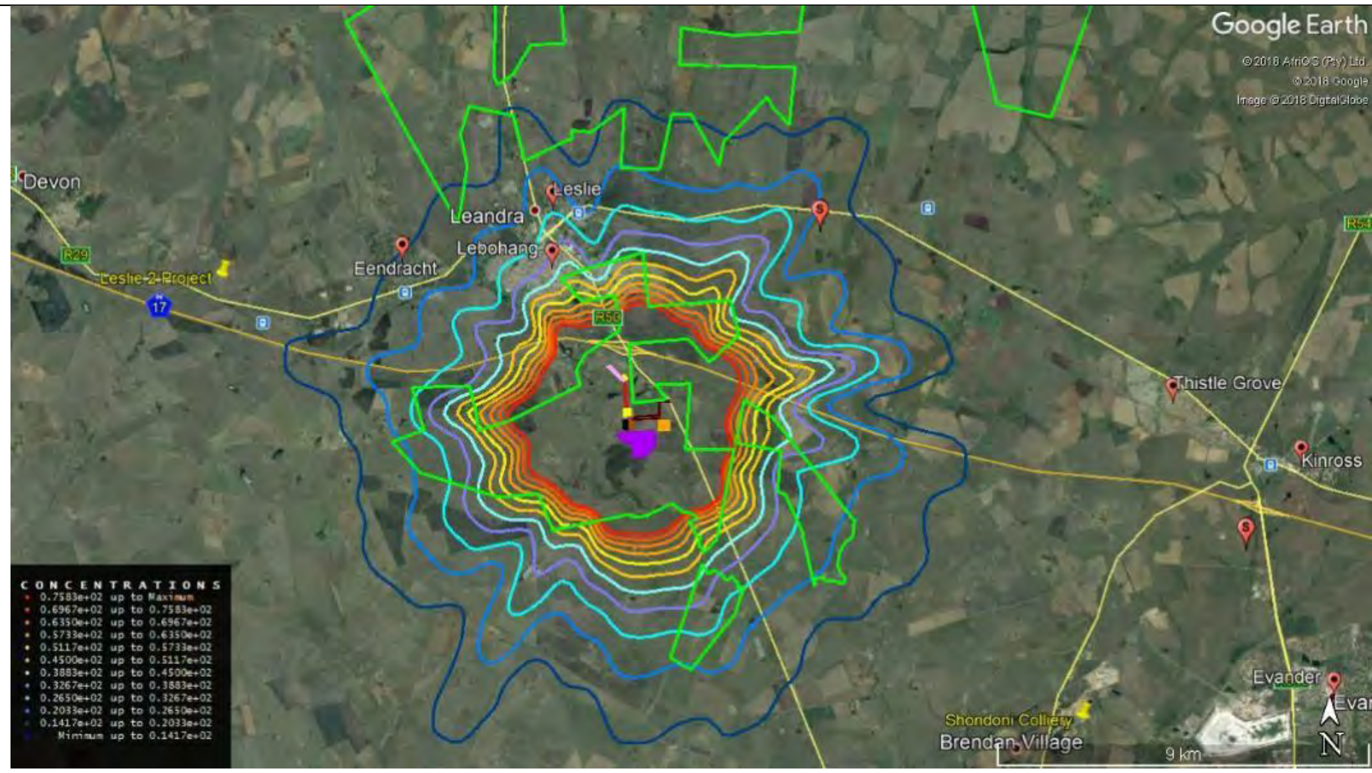
9.8.3.2 Leslie 1C

Table 9-55: Leslie 1C (full production)

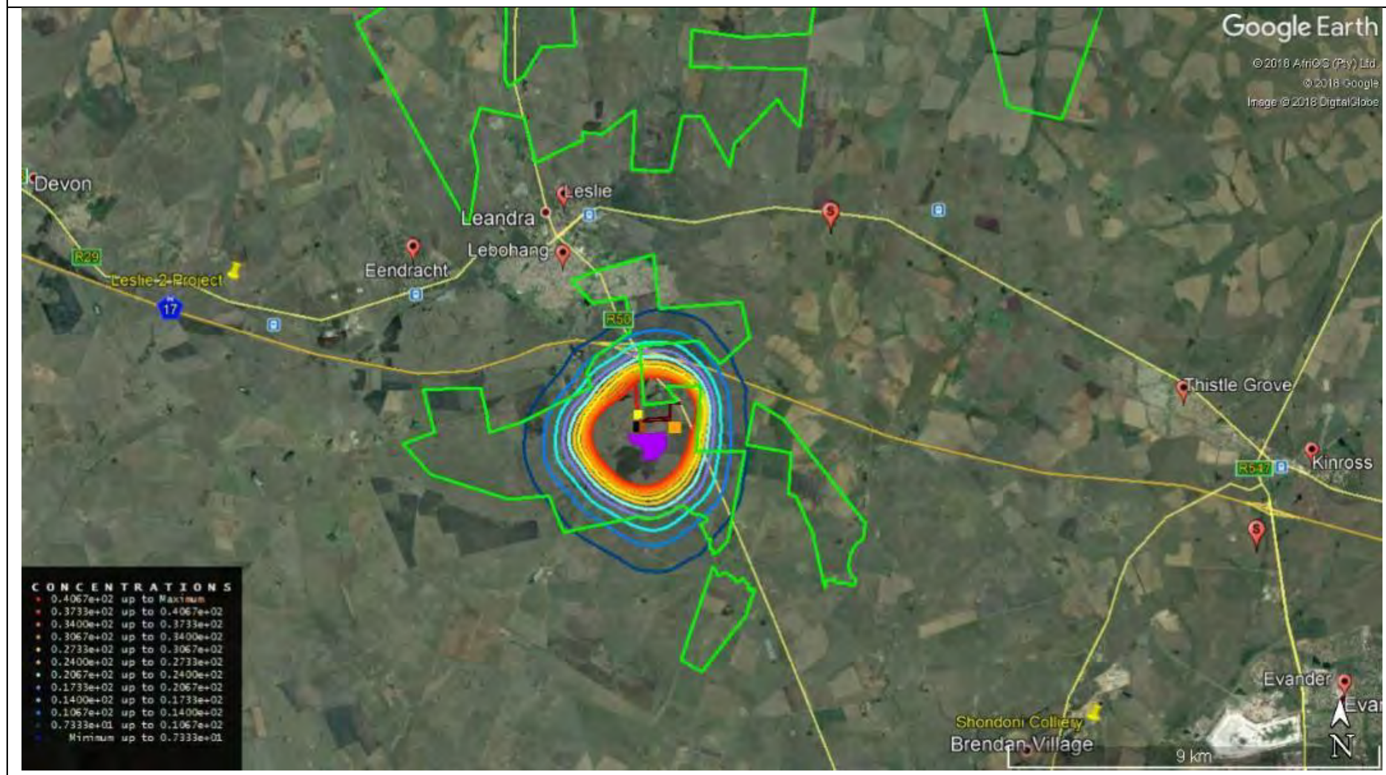
Particle	No Mitigation Measures	With Mitigation Measures
PM_{10}	❖ PM_{10} (24-hour Average Concentrations) – Without any mitigation measures, the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m^3 up to approximately 4 km from the surface mining activities, including exceedances over the residential areas of Lebohang. This is a health risk for the residents of these areas. ❖ PM_{10} (Annual Average Concentrations) – Without any mitigation measures, the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m^3 up to approximately 1.3 km from the surface mining activities.	❖ PM_{10} (24-hour Average Concentrations) – With mitigation measures, the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m^3 up to approximately 2.5 km from the surface mining activities. ❖ PM_{10} (Annual Average Concentrations) – With mitigation measures, the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m^3, extending up to approximately 350 m from the surface mining activities.
$PM_{2.5}$	❖ $PM_{2.5}$ (24-hour Average Concentrations) – Without any mitigation measures, the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m^3 up to approximately 2.8 km from the surface mining activities, including exceedances over the southern parts of the residential areas of Lebohang. This is a health risk for the residents of these areas. ❖ $PM_{2.5}$ (Annual Average Concentrations) – Without any mitigation measures, the predicted maximum annual average concentrations only exceed the national annual average standard of 20µg/m^3 up to approximately 300 m from the surface mining activities.	❖ $PM_{2.5}$ (24-hour Average Concentrations) – With mitigation measures, the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m^3 up to approximately 1.8 km from the surface mining activities. ❖ $PM_{2.5}$ (Annual Average Concentrations) – With mitigation measures, the predicted maximum annual average concentrations are not expected to exceed the national annual average standard of 20µg/m^3 beyond the surface mining activities.



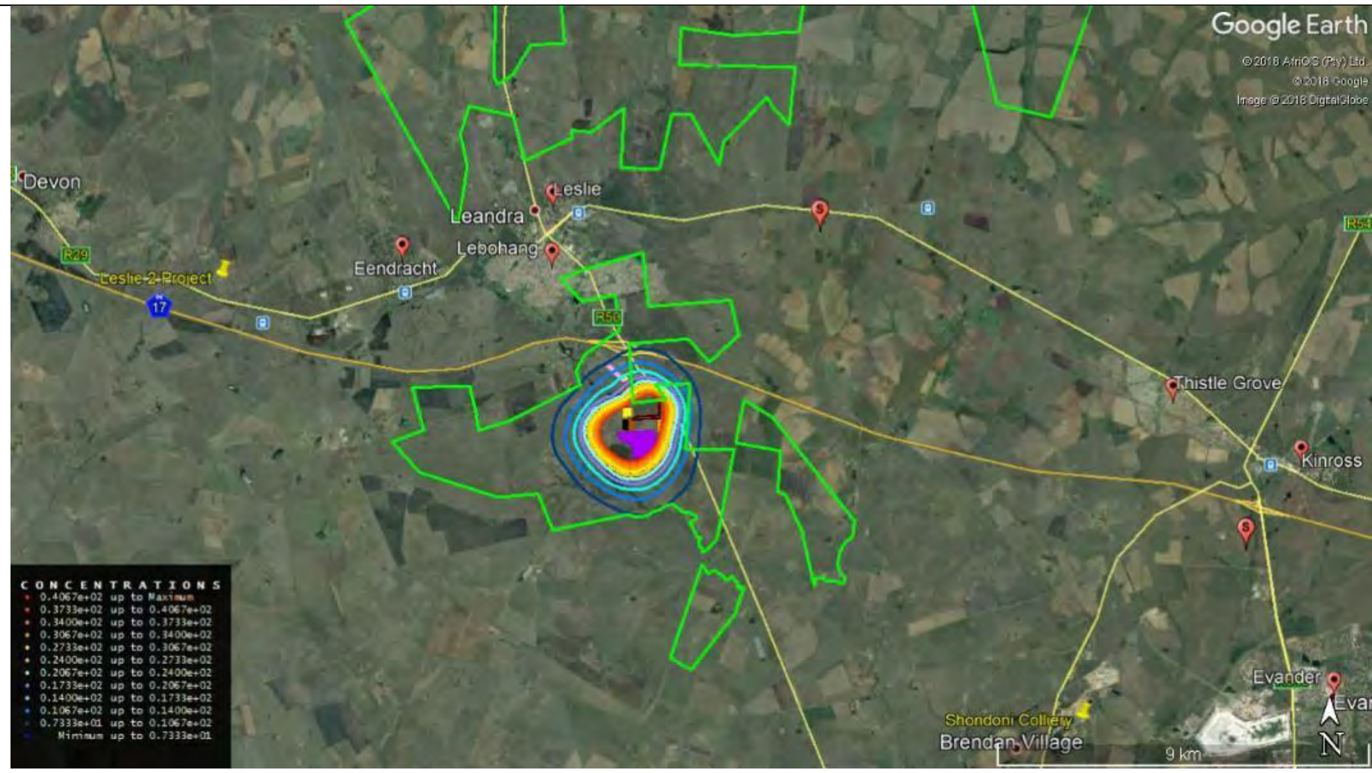
Maximum 24-hour average PM_{10} concentrations, without mitigation measures



Maximum 24-hour average PM_{10} concentrations, with mitigation measures

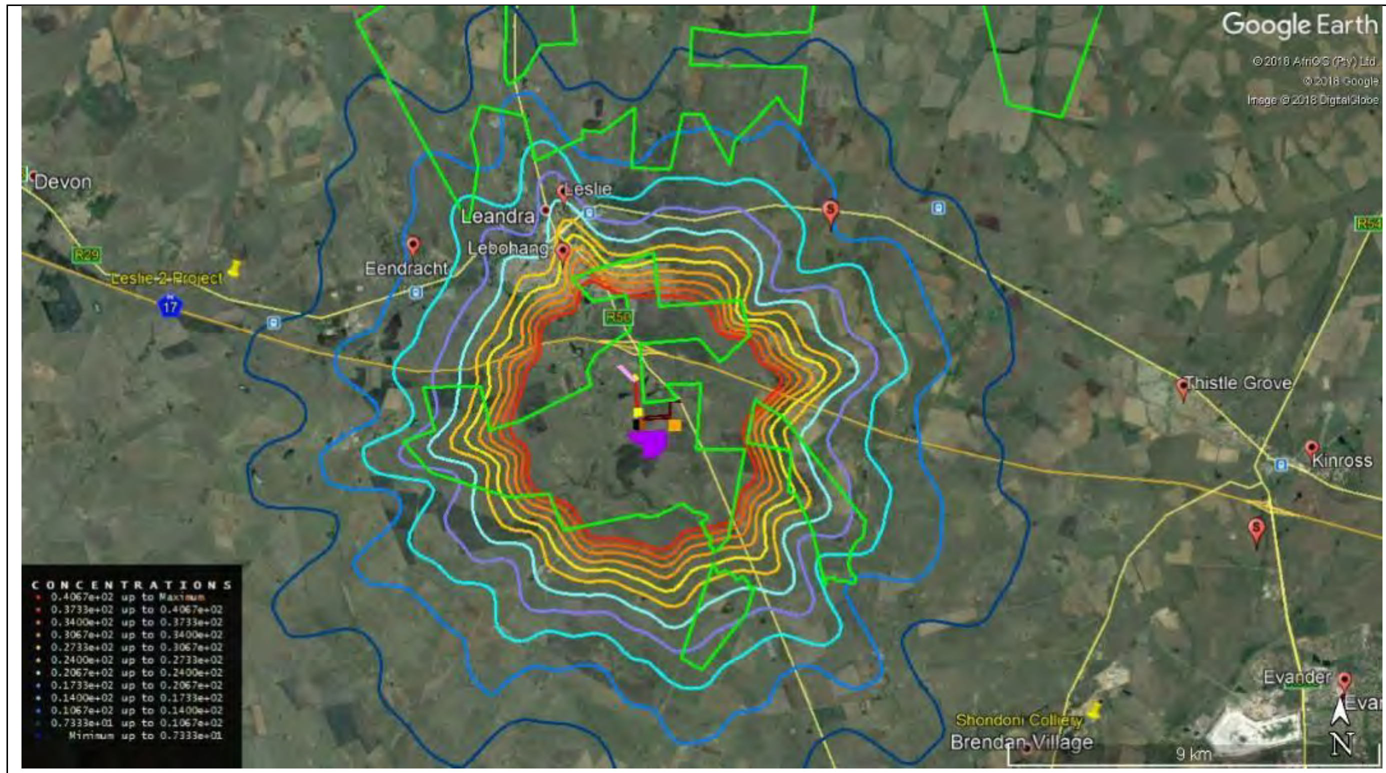


Annual average PM_{10} concentrations, without mitigation measures

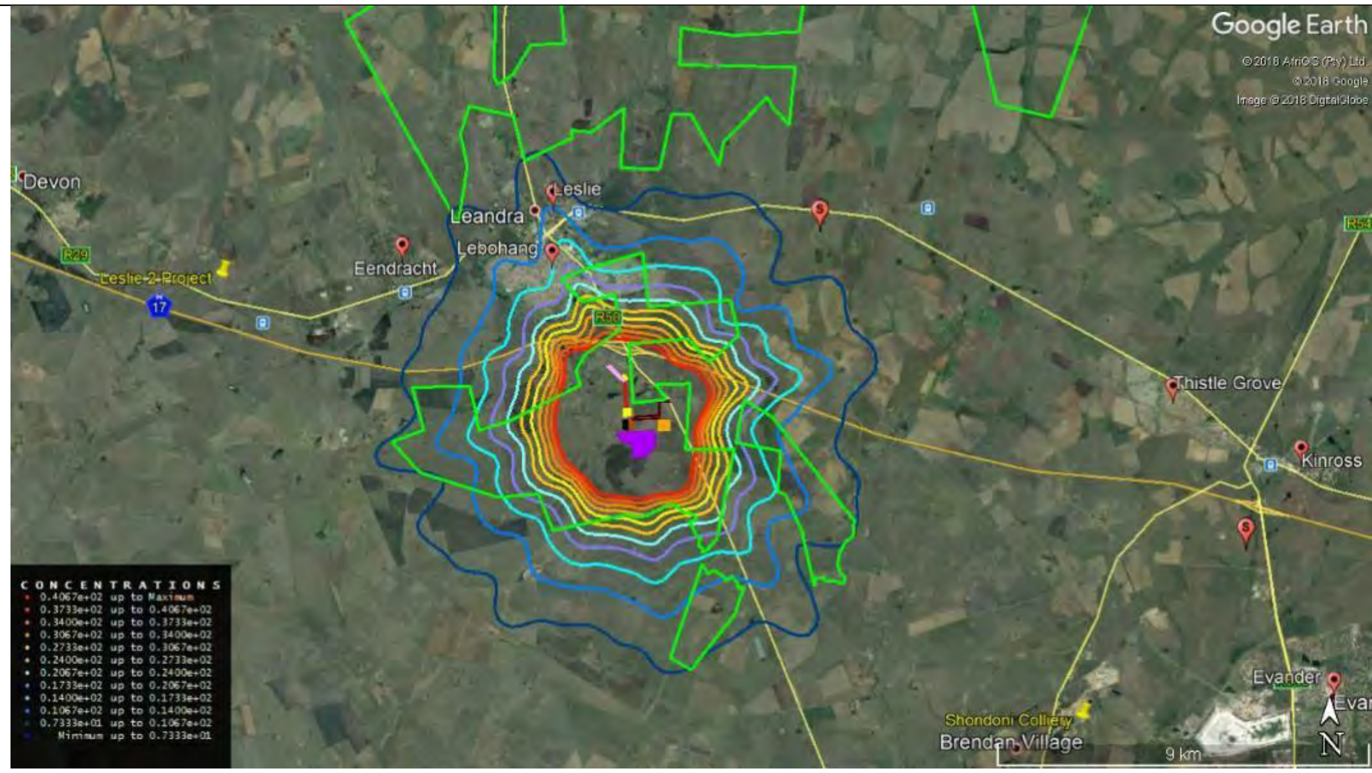


Annual average PM_{10} concentrations, with mitigation measures

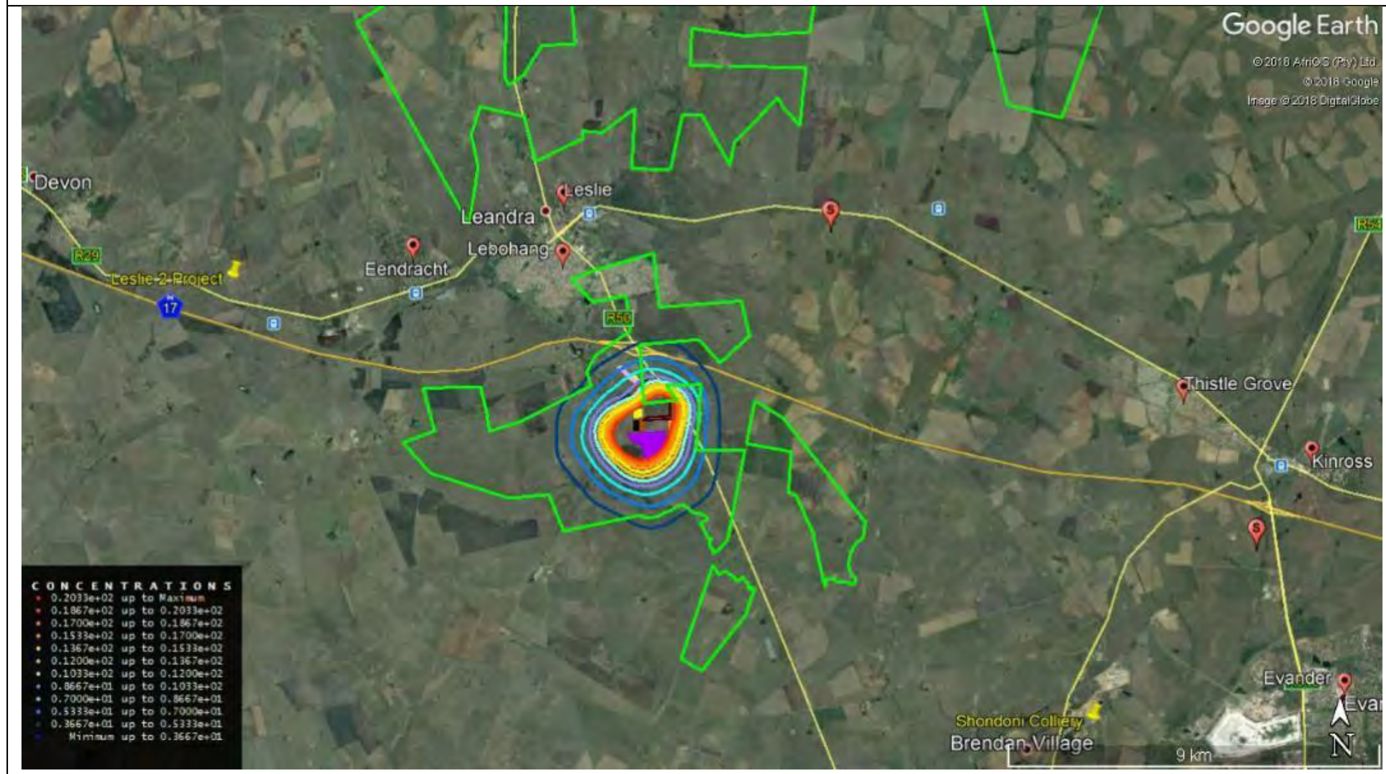
Figure 9-57: Modelled prediction of PM_{10} concentrations for Leslie 1C full production including a CHPP



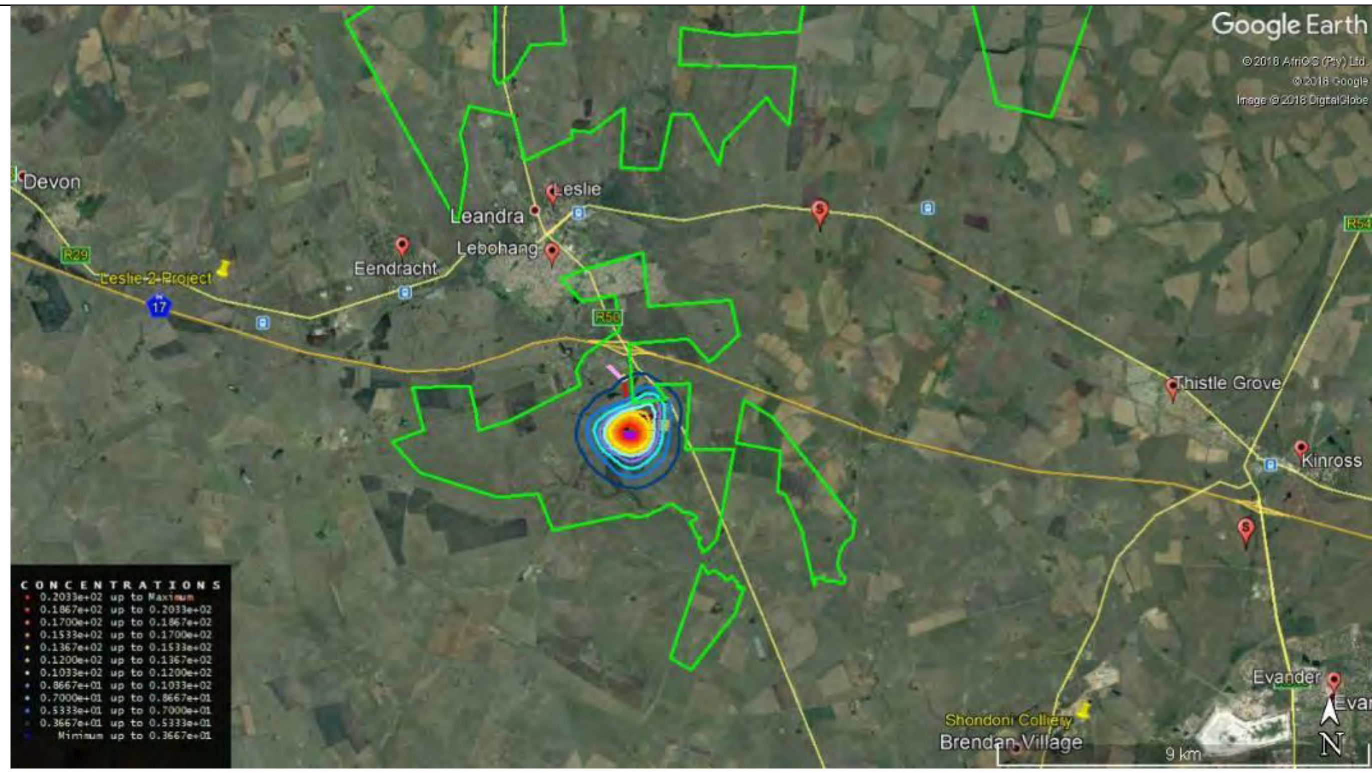
Maximum 24-hour average $PM_{2.5}$ concentrations, without mitigation measures



Maximum 24-hour average $PM_{2.5}$ concentrations, with mitigation measures



Annual average $PM_{2.5}$ concentrations, without mitigation measures



Annual average $PM_{2.5}$ concentrations, with mitigation measures

Figure 9-58: Modelled prediction of $PM_{2.5}$ concentrations for Leslie 1C full production including a CHPP

9.8.3.3 Impacts on Vegetation

The impact of dust on vegetation and grazing quality was raised as a concern during the public meetings.

In 2012, a desktop study was undertaken to assess the potential impact of coal dust on agriculture from a proposed mine in Mpumalanga, South Africa (Stevens, 2012). It was found that coal dust is composed predominantly of carbon and is not toxic to vegetation. Similarly, road dust is 'inert' and not toxic to vegetation. Effects of dust deposition on plants, other than toxicity, were also considered in the study. Direct effects at the leaf and plant level include the blockage of stomata; alteration of energy exchange and light absorption which leads to reduced photosynthesis; changes in transpiration; and reduced growth and production. Indirect effects include deposition to the soil which may ultimately influence growth; reduced effectiveness of sprays (e.g. herbicides, insecticides) therefore an increase in incidence of pests; hindrance to pollination which results in yield loss; and exacerbation of secondary stresses (e.g. drought, insects and pathogens) (Doley, 2006; Farmer, 1993; Grantz, Garner, & Johnson, 2003; Prajapati, Ecological effect of airborne particulate matter on plants, 2012; Seyyednejad, Niknejad, & Koochak, 2011).

Unlike in the health sector, it is the coarser particles that have an effect on vegetation. The greatest impacts will, therefore, be seen in the areas close to surface coal mining activities and within a 300m wide corridor from the centre of unpaved roads (Greening, 2011; McCrea, 1984) where most of the total suspended particles (TSP) will be deposited.

It is, however, not only the rate of dust deposition that will determine whether plants are affected by dust. Leaf orientation, leaf morphology, leaf age, leaf wettability (Beckett, Freer-Smith, & Taylor, 2000; Prajapati & Tripathi, 2008) and environmental conditions such as wind and rain (Raupach, Woods, Dorr, Leys, & Cleugh, 2001) affect the dust loading of the leaves and therefore also influence whether vegetation will be affected by dust deposition. Xiong-Wen (2001) found that the low dust carrying-capacity of maize makes it a suitable crop to grow in frequent dust storm areas. According to Stevens (2012), there was no specific information on the dust loading capacity of soybean or apple leaves, therefore, these plants may be more at risk because of their leaf structures.

According to Stevens (2012), there is very little experimental evidence for the impacts of dust on pastures and livestock, and it is difficult to link possible impacts directly to road or mine dust. Dust can cause respiratory and other health problems in animals as in humans for example, bovine pneumonia and pinkeye. However, it is difficult to link this directly to road or mine dust as there are other sources of dust (livestock themselves) on these farms. McCrea (1984) concludes that it is most unlikely that road dust (ingested with normal pasture feed) has any physiological effect on animal growth and development. It is suggested that game animals avoid grazing on dusty grass alongside a road and prefer grass some distance away (Greening, 2011). The reduced pasture yields and reluctance of livestock to eat contaminated grass could contribute to a 1% decrease in lambing rate and a reduced milk fat yield (McCrea, 1984).

In conclusion, data suggests that there may be some limited impacts on the vegetation and livestock in the areas surrounding the surface activities and the roads of the proposed Leslie 1 Mining project, but quantification of the impacts would require further research.

9.8.3.4 Spontaneous Combustion

The spontaneous combustion of coal results in many of the same types of emissions that arise from coal combustion in power plants but, since there are no control technologies in place, the emission factors are generally higher for spontaneous combustion (Sloss, 2013). Should spontaneous combustion occur, it would therefore, be a significant source of air pollution. The ROM stockpiles are at risk of spontaneous combustion, and the overburden stockpiles may also contain materials that have the propensity to combust spontaneously. Any coal left *in situ* in the underground mining areas is also at risk of spontaneous combustion. Nevertheless, because coal fires are very dynamic and irregular by nature, and because of variations in the chemical composition of different coal seams and variability in the composition of discard dumps, it is virtually impossible to quantify emissions from spontaneous combustion. If the composition of a discard dump were known, unrealistic assumptions such as complete and uniform combustion over a set period of time would have to be made to predict emissions. Furthermore, there are no known national or international methods prescribed for quantifying emissions from spontaneous combustion. In general, therefore, the mine should be designed to preclude spontaneous combustion by such measures as cladding and compression.

9.8.4 Specialist Conclusions

The proximity of the proposed 1A mining areas to the Springboklaagte Colliery, is of concern because of cumulative ambient concentrations of particulate matter in this area. Furthermore, although the modelling does not predict exceedances of the NAAQS over the residential areas of Leandra it must be remembered that the modelling only reflects emissions caused by the proposed Leslie 1 Project. Exceedances of the PM_{10} 24-hour NAAQS were already measured at the Eskom monitoring station in Leandra in 2014. There are other coal mines in the area, such as the Leslie 2 project, Delmas Coal and Springboklaagte, which will also add to the cumulative concentrations of PM and impact on the air quality of Leandra. The modelling predicts a worst-case ambient concentration over Leandra, caused solely by the proposed Leslie 1A mine of 10.67µg/m^3 and 20.33µg/m^3 for $PM_{2.5}$ and PM_{10} respectively. This is approximately 25% of the allowed maximum ambient air concentrations in air that is already polluted.

The modelling results of the alternative mine layout for Leslie 1C with maximum efficiency mitigation measures in place, do not predict exceedances over the residential areas of Leandra resulting from the mine. However the location of the mine in a priority area for air quality, poses a concern for cumulative ambient concentrations. Therefore, everything possible must be done to keep the impact of the mine to a minimum. This must include:

- Using the best possible mitigation methods on the crushing and screening activities at the CHPP.
- If at all possible, reducing the number of crushing cycles at the CHPP to one.
- Wet suppression on the ROM and product stockpiles.
- Either tarring and sweeping/vacuuming of the haul road or efficient, regular wet suppression or chemical suppression of the unpaved haul road.
- Wet suppression or other mitigation of all conveyor transfer points.
- Covering of all conveyors.

- Reducing the number of transfer points through careful planning and design, because each time the coal is dropped onto a stockpile, emissions are generated (for example, when the crushing and screening plant is in operation, the coal from the mine conveyor should bypass the ROM plant feed stockpile into the plant for screening and crushing, thus reducing handling of coal).

Furthermore, a comprehensive, continuous air quality monitoring programme must be implemented in order to ensure that the above mitigation measures are applied at all times to keep emissions within the NAAQS in residential areas.

It is also essential that measures must be put in place to prevent spontaneous combustion from occurring at all of the proposed mining areas.

9.9 Noise

A Noise Impact Assessment was undertaken by EAR for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D8.

9.9.1 Environmental Status Quo

Ambient (background) noise levels were measured over a five night-time period from 11 - 16 April 2018 at four locations (Figure 9-59) in accordance with the South African National Standard SANS 10103:2008.

Additional traffic information was calculated from the Mpumalanga Provincial Road Asset Management System (RAMS). Though traffic volumes (and speeds) would be different at different times of the day, varying significantly between the different days and months, constant traffic volumes were assumed to illustrate potential noise contours due to traffic as highlighted below:

- N17: Average daytime traffic with 790 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h);
- N17: Average night-time traffic, with 250 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h);
- R50 south of the N17: Average daytime traffic with 40 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h);
- R50 south of the N17: Average night-time traffic, with 15 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h);
- R50 north of the N17: Average daytime traffic with 154 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h);
- R50 north of the N17: Average night-time traffic, with 54 vehicles per hour travelling at 120km/h (10% trucks travelling at 100km/h).

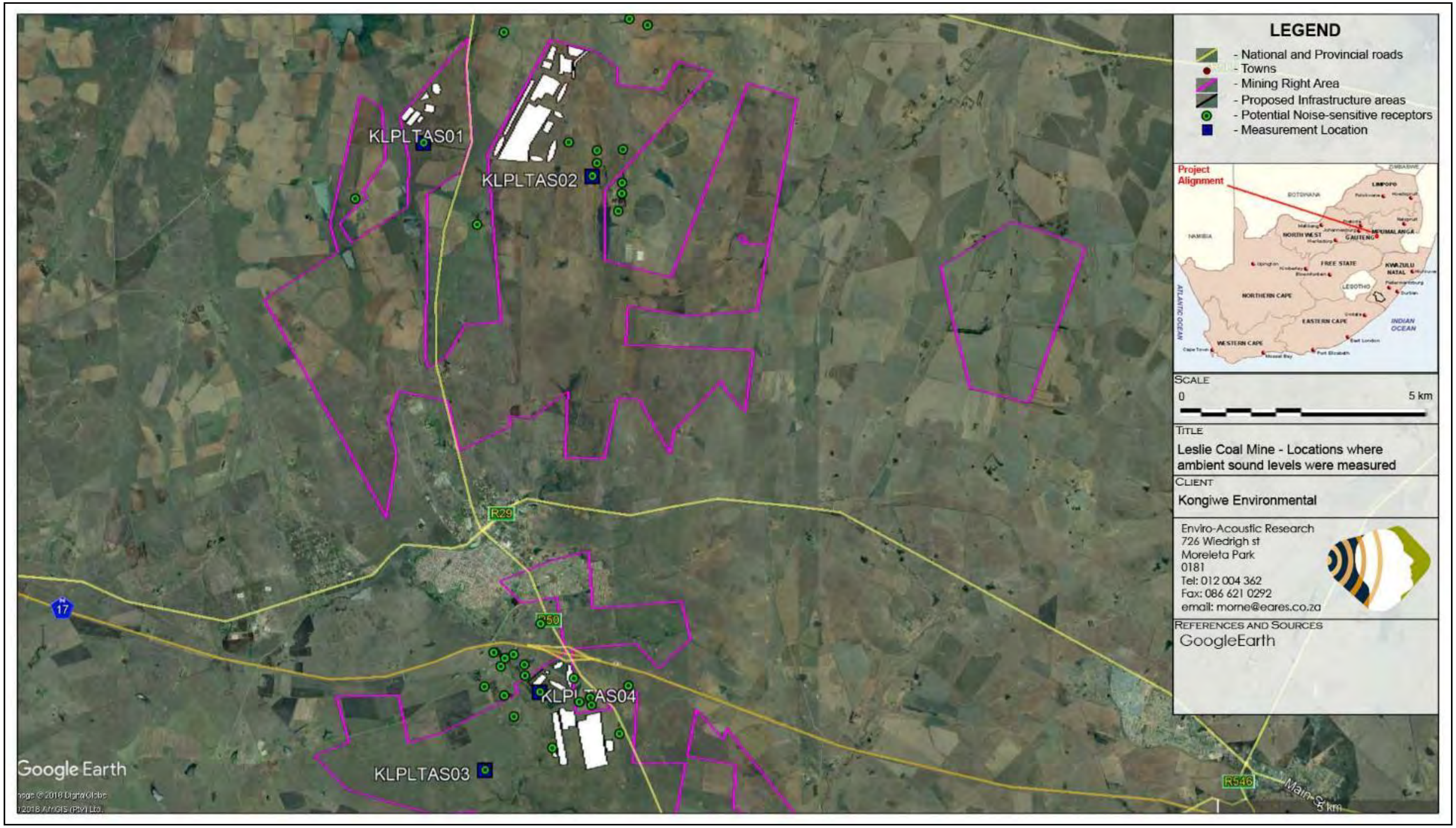


Figure 9-59: Localities where ambient sound levels were measured

- **KLPLTAS01**: While measured ambient sound levels were higher, considering the developmental character of the area, the acceptable zone rating level would be typical of a **sub-urban area** (40 dBA at night and 50 dBA during the day) as defined in SANS 10103:2008.
- **KLPLTAS02**: As a result of equipment failure no data was recorded at this location.
- **KLPLTAS03**: While measured ambient sound levels were slightly higher, considering the developmental character of the area, the acceptable zone rating level would be typical of a **rural noise district** (35 dBA at night and 45 dBA during the day) as defined in SANS 10103:2008.
- **KLPLTAS04**: While measured ambient sound levels were higher, considering the developmental character of the area, the acceptable zone rating level would be typical of a **sub-urban area** (40 dBA at night and 50 dBA during the day) as defined in SANS 10103:2008.

9.9.2 Specialist Assessment Methods

A noise impact assessment must be completed for the following reasons:

- If there are potential noise-sensitive receptors staying within 2,000m from any wind turbine (SANS 10328:2008)
- It is a controlled activity in terms of the NEMA regulations and an ENIA is required, because:
- It may cause a disturbing noise that is prohibited in terms of section 18(1) of the Government Notice 579 of 2010; and
- It is generally required by the local or district authority as part of the environmental authorization or planning approval in terms of Regulation 2(d) of GN R154 of 1992.

The document that addresses the issues concerning environmental noise in South Africa is SANS 10103:2008, which was revised and brought in line with the guidelines of the World Health Organisation (WHO) during 2006 - 2008. It provides the maximum average ambient noise levels during the day and night to which different types of developments indoors may be exposed.

In addition, the South African National Standard (SANS) 10328:2008 (Edition 2) specifies the methodology to assess the potential noise impacts on the environment due to a proposed activity that might impact on the environment. This standard also stipulates the minimum requirements to be investigated. These minimum requirements are:

- The purpose of the investigation;
- A brief description of the planned development or the changes that are being considered;
- A brief description of the existing environment;
- The identification of the noise sources that may affect the particular development, together with their respective estimated sound pressure levels or sound power levels (or both);
- The identified noise sources that were not taken into account and the reasons why they were not investigated;
- The identified noise-sensitive developments and the estimated impact on them;
- Any assumptions made with regard to the estimated values used;

- An explanation, either by a brief description or by reference, of the methods that were used to estimate the existing and predicted rating levels;
- The location of the measurement or calculation points, i.e. a description, sketch or map;
- Estimation of the environmental noise impact;
- Alternatives that were considered and the results of those that were investigated;
- A list of all the interested or affected parties that offered any comments with respect to the environmental noise impact investigation;
- A detailed summary of all the comments received from interested or affected parties as well as the procedures and discussions followed to deal with them;
- Conclusions that were reached;
- Recommendations, i.e. if there could be a significant impact, or if more information is needed, a recommendation that an environmental noise impact assessment be conducted; and

If remedial measures will provide an acceptable solution, which would prevent a significant impact, these remedial measures should be outlined in detail and included in the final record of decision if the approval is obtained from the relevant authority. If the remedial measures deteriorate after a certain time and a follow-up auditing or maintenance programme (or both) is instituted, this programme should be included in the final recommendations and accepted in the record of decision if the approval is obtained from the relevant authority.

9.9.3 Specialist Findings

9.9.3.1 Sensitive receptors

Potential receptors, within approximately 1 000 m in and around the proposed project were identified.

Figure 9-60: Aerial image indicating potentially noise-sensitive receptors and closest mining infrastructure for Leslie 1A

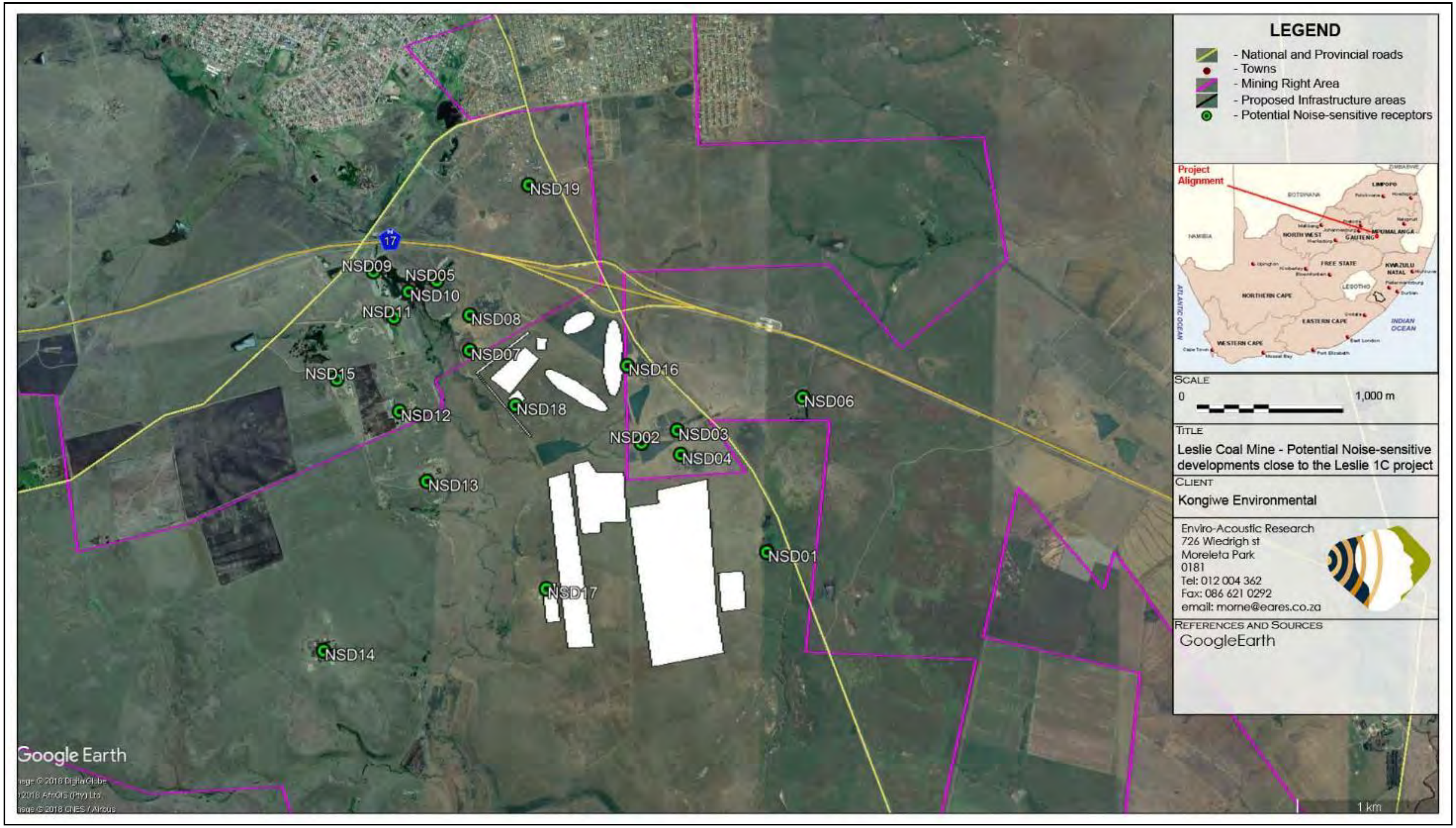


Figure 9-61: Aerial image indicating potentially noise-sensitive receptors and closest mining infrastructure for Leslie 1C

9.9.3.2 Sources of Noise

The following are likely the main construction related sources:

- Site survey and development of a contractor's camp and storage;
- Transport of components & equipment to site – brought to site by means of flatbed trucks;
- Development of the internal and access roads – bulldozers, graders;
- Vegetation removal and the stripping of topsoil at shaft areas, open cast pits, dump and stockpile areas as well as certain infrastructure by means of bulldozers, excavators, front end loaders (FEL), articulated dump trucks (ADT), water dozers, etc. Typical practice is to stockpile stripped topsoil close to the mining or project areas as a berm, to be used for backfilling or to be hauled to specific stockpiles/dumps;
- Development of the topsoil, hards, softs and overburden dumps/stockpiles (around mining pits) - bulldozers, articulated dump trucks (ADT), etc.;
- Development of the initial incline portal(s) - excavators, articulated dump trucks (ADT), drill rigs, etc. This exclude potential blasting activities (separate specialist study) done to break hard rock for excavation;
- Digging of foundations for certain structures; and
- Civil construction activities.

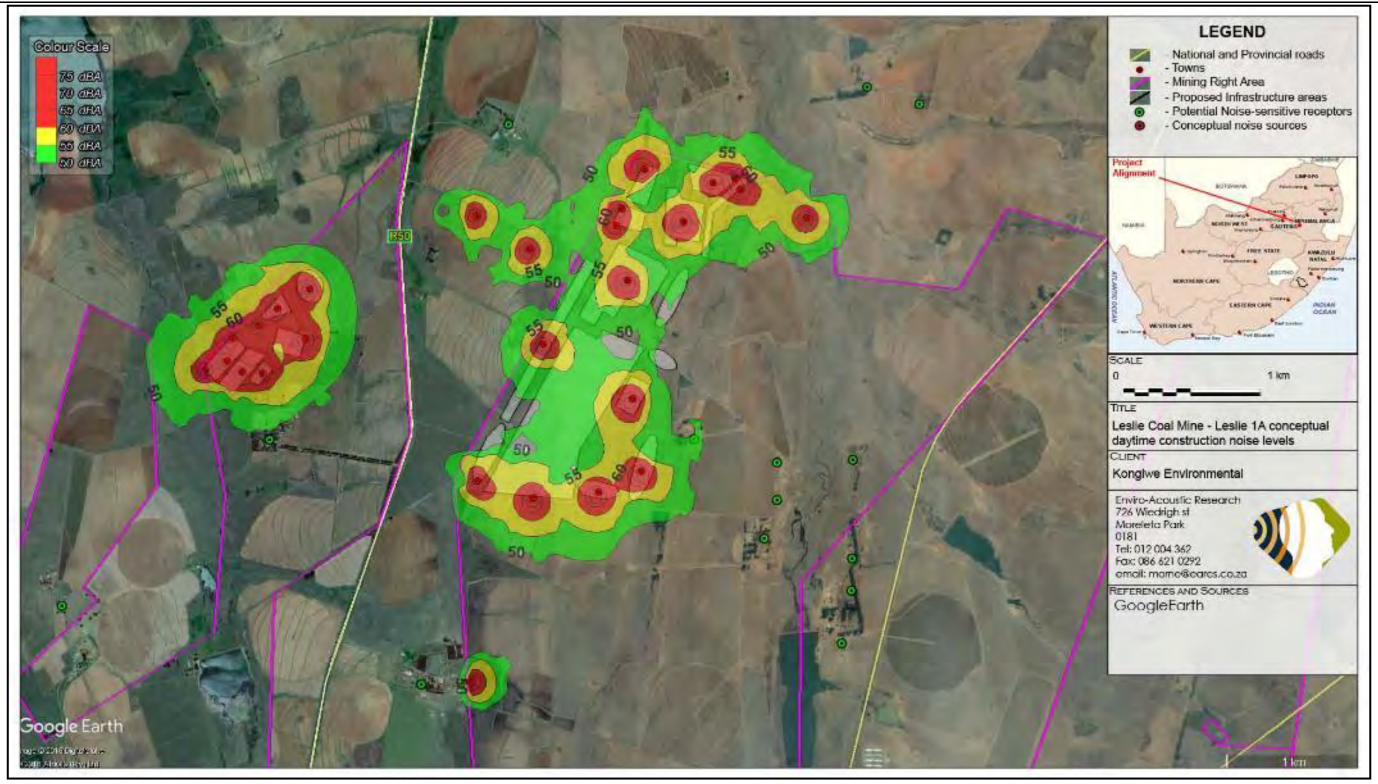
The following mining and related activities (actions and processes) are expected to occur during the remainder of the Operational Phase:

- *Mining activities:* Mining will take place underground. Noise generated underground is seldom audible above the ground;
- *Underground activities:* Certain infrastructure is located above-ground to support or provide necessary ancillary services to the underground section which may include: ventilation fans, compressors, vehicular movement on the ramps, etc.;
- *Material movement:* ROM will be conveyed from underground to the ROM stockpile, material handling and loading, conveying to plant as required, conveying to product stockpiles, loading product onto trucks using a FEL;
- *Plant activities:* Crushing and screening, material movement, etc.;
- *Rehabilitation activities:* Material loading, material transport and management, sloping of areas, re-vegetation and maintenance – note this is generally activities that are mostly limited to the daylight hours;
- *Related activities*: Utilisation and management of surface infrastructure, does not generate significant noises.

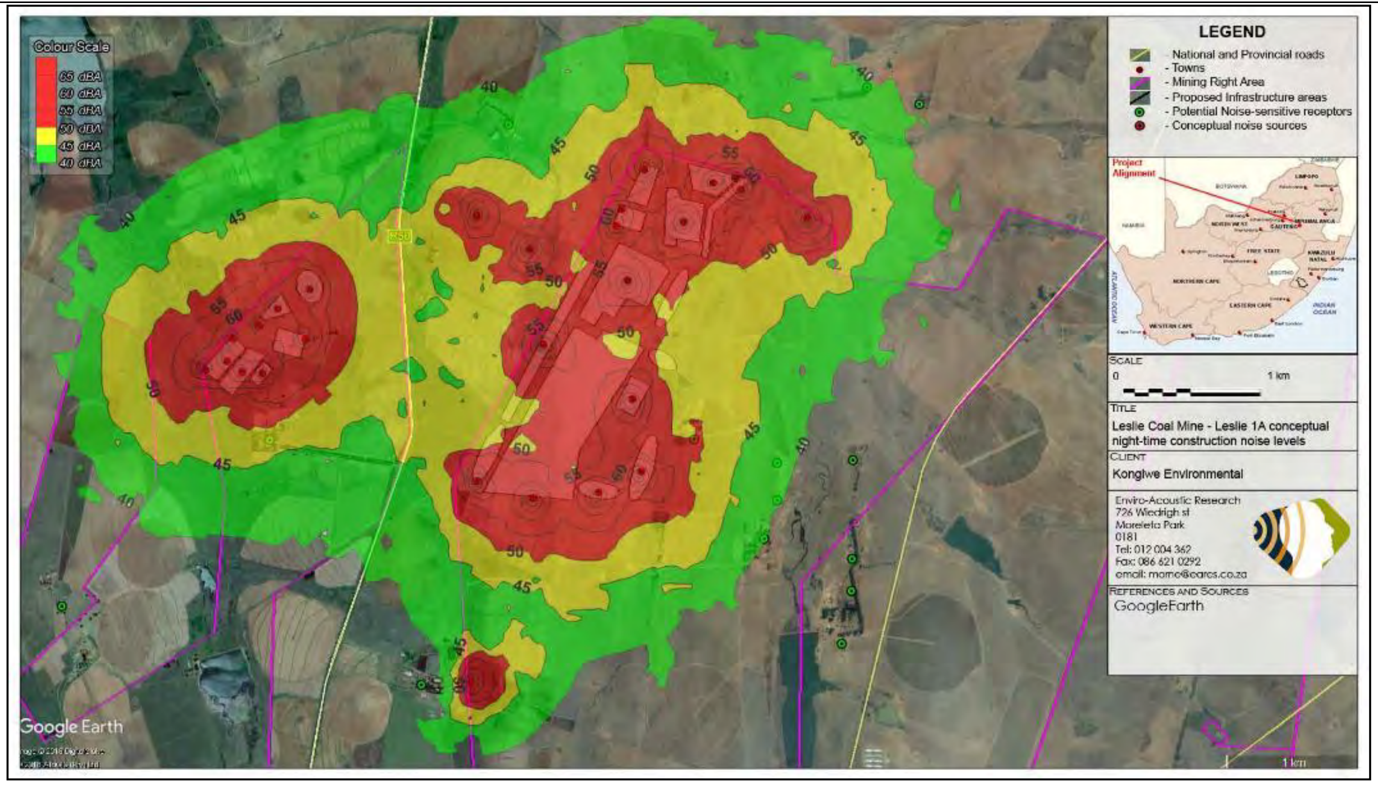
9.9.3.3 Noise Modelling

The conceptual scenario envisioned is illustrated in Figure 9-62 for the construction phase and Figure 9-63 for the operational phase. These conceptual scenarios were modelled to estimate a potential worse-case noise rating levels around the two mining sections during the construction phase, assuming multiple activities taking place simultaneously (all equipment under full load).

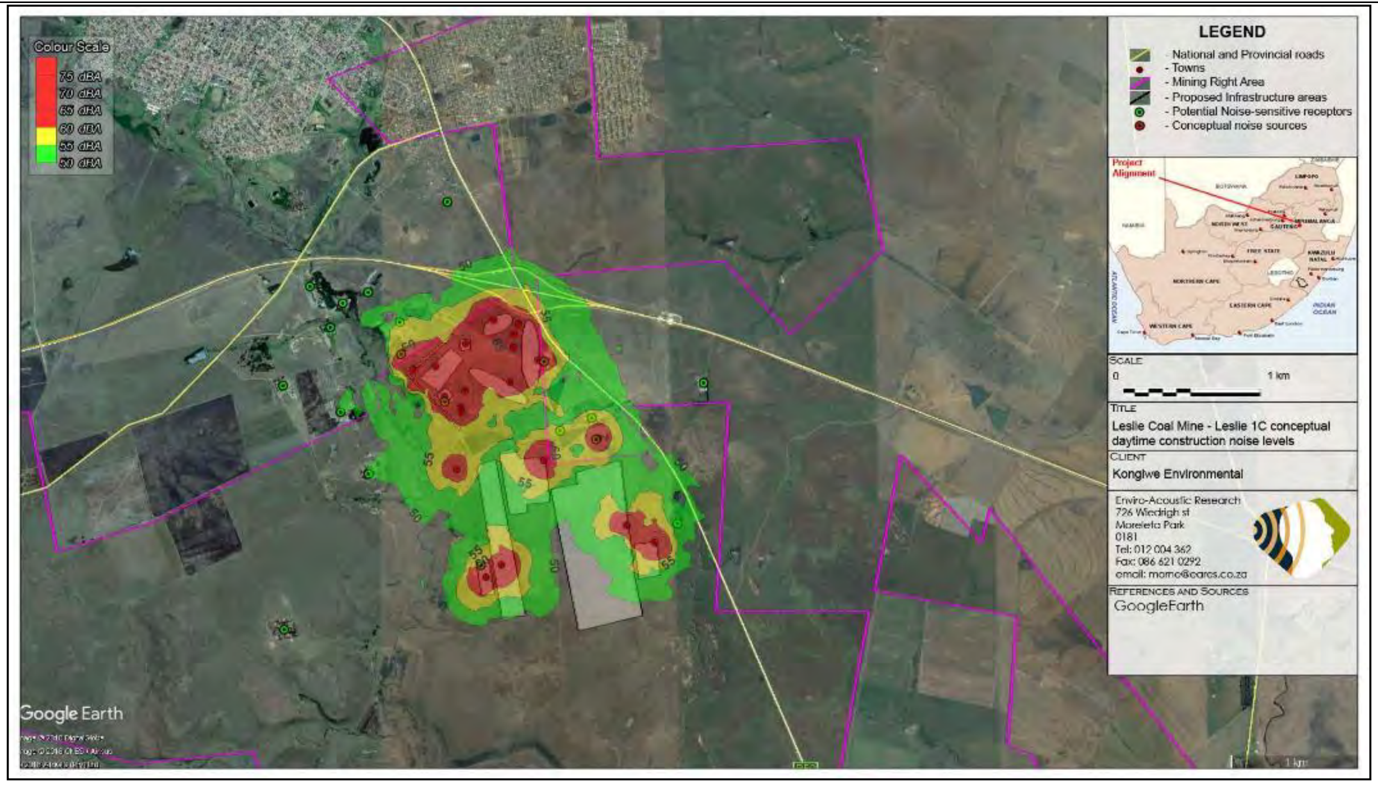
Decommissioning, closure and post closure activities generally generate far less noise than the other phases due to the low urgency as well as the fact that these activities are generally limited to daytime hours. Post closure activities are limited to care and maintenance that have a very low noise impact.



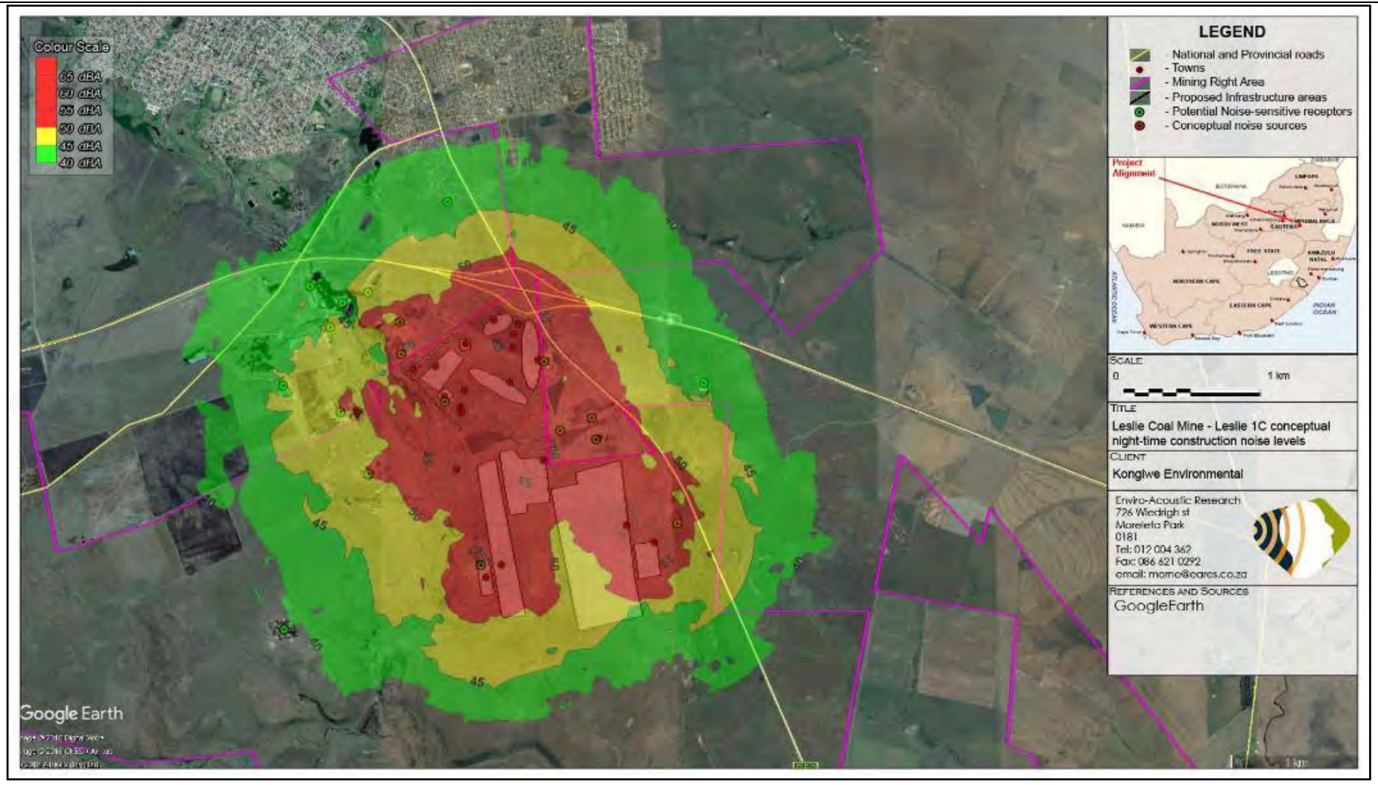
Leslie 1A - Daytime



Leslie 1A – Night-time

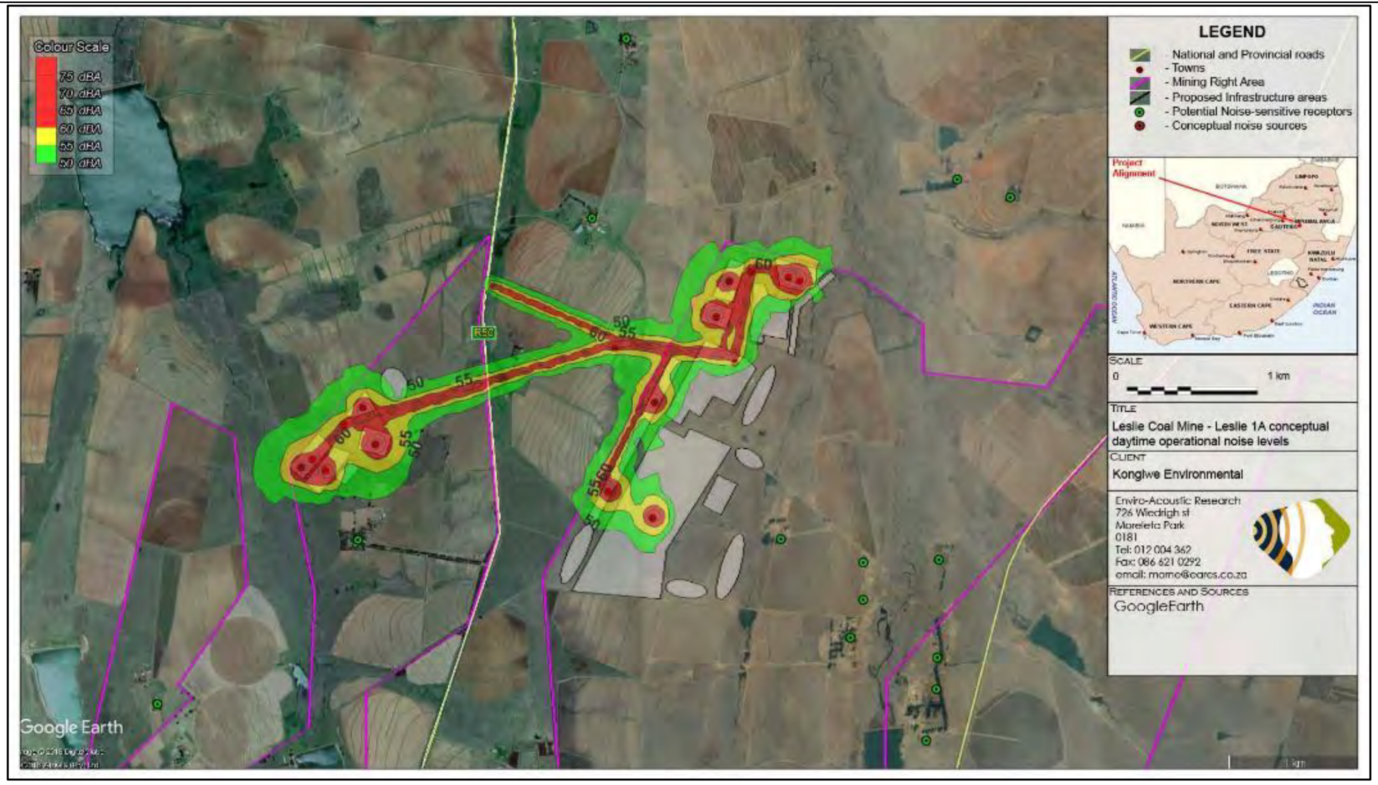


Leslie 1C - Daytime

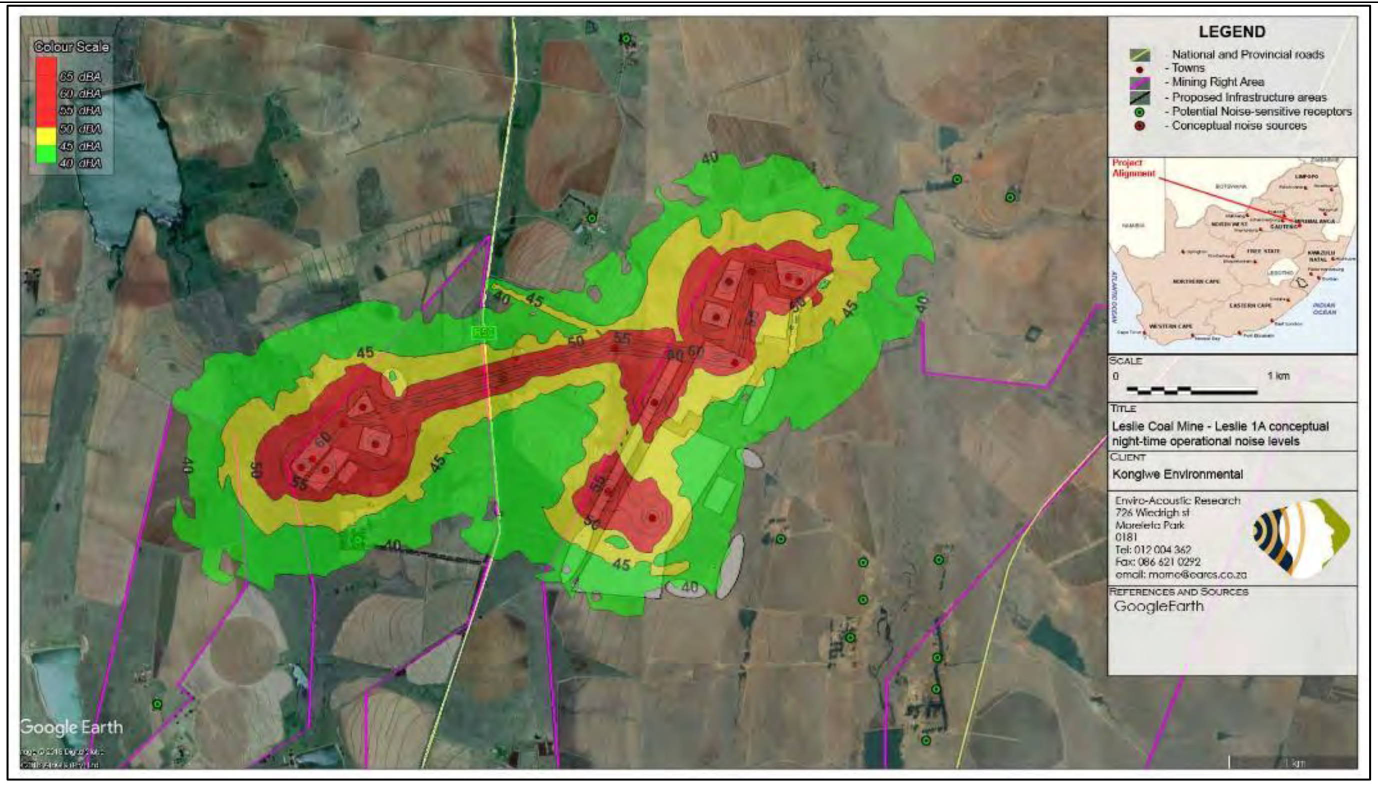


Leslie 1C – Night-time

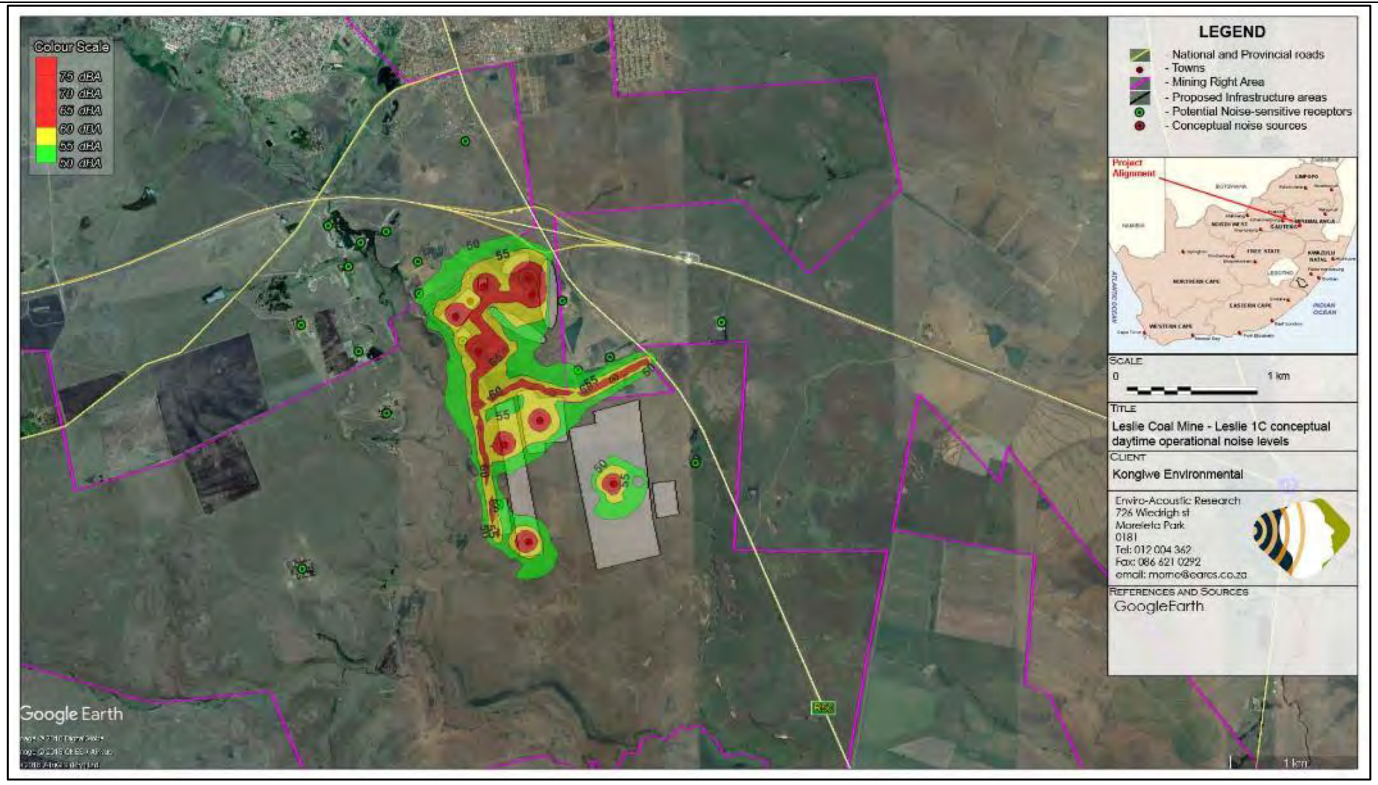
Figure 9-62: Projected conceptual construction noise rating levels



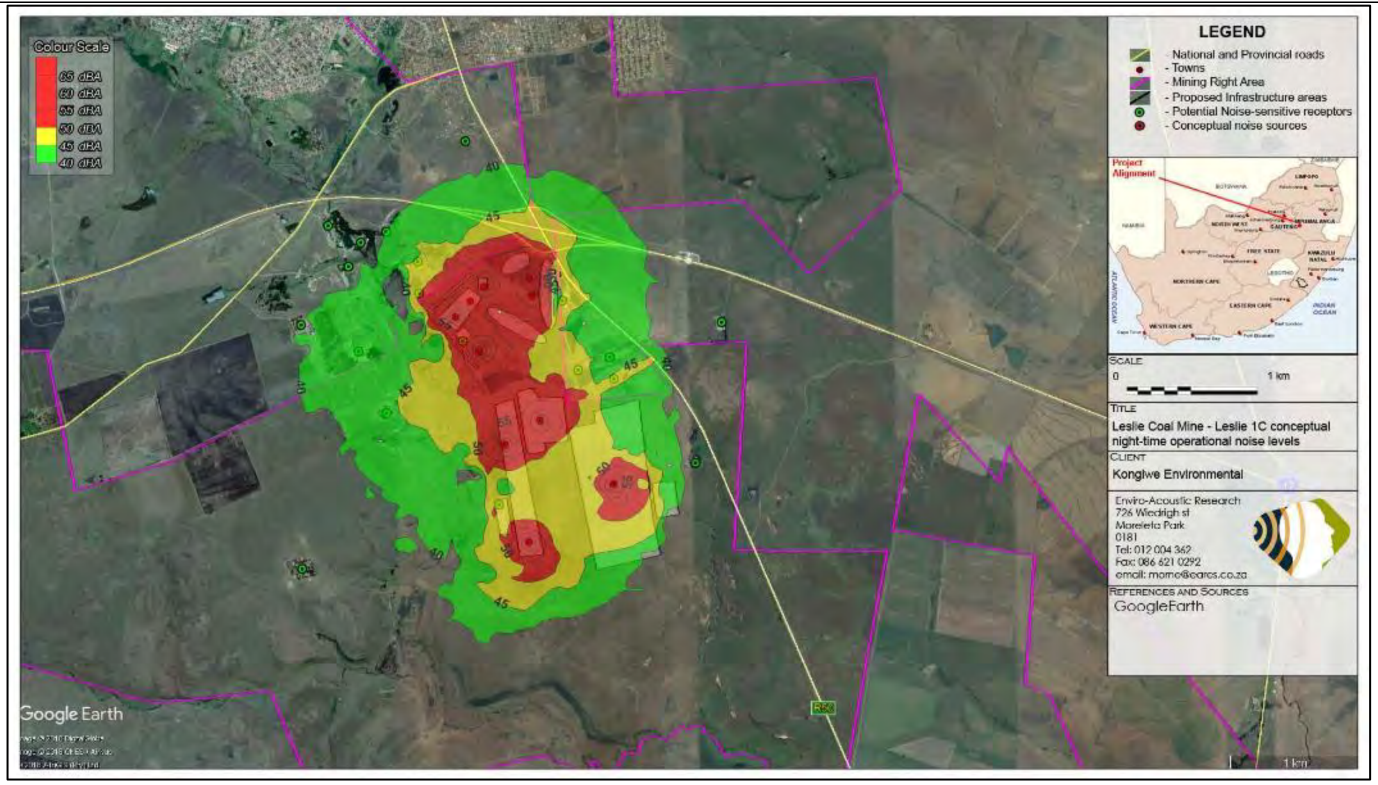
Leslie 1A - Daytime



Leslie 1A – Night-time



Leslie 1C - Daytime



Leslie 1C – Night-time

Figure 9-63: Projected conceptual operational noise rating levels

9.9.4 Specialist Conclusions

Conceptual noise propagation models were developed for various scenarios as described in this report. There are a number of receptors staying on, or very close to the proposed mining infrastructure. This will result in a noise impact of high significance. The output of the modelling highlighted a potential for a noise impact of medium significance due to day and night-time construction activities, especially at the Leslie 1C section. This is due to the number of occupied dwellings located within 1 000 m from the proposed mining activity. Mitigation is available, and measures proposed that may assist in reducing the potential magnitude of noise levels or lower the probability of a receptors being annoyed by noises from the mining activity.

The additional activities will raise the noise levels from the project during all phases of the project. The changes in ambient sound levels could be significant at night and the closest receptors may find the noises disturbing and unacceptable, especially at the Leslie 1C section. Management and mitigation are available to reduce the significance of the noise impact, but the mining activity will be audible and the closest receptors may still find it disturbing.

In terms of acoustics, the proposed project will not introduce potential fatal flaws. With the selection of the required mitigation options, projected noise levels can be managed, and this project can be authorized.

9.10 Blasting and Vibration

A Blasting and Vibration Impact Assessment was undertaken by Blast Management & Consulting for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D9.

9.10.1 Environmental Status Quo

The Leslie 1 Project is a Greenfields project with no existing blasting operations. The evaluation of effects yielded by blasting operations was evaluated over an area as wide as 1 500 m from the Mine Areas considered. The range of structures observed is typical roads (tar and gravel), low cost houses, corrugated iron structures, powerlines, brick and mortar houses, boreholes and heritage sites.

9.10.1.1 Points of Interest

A review of each box cut and the surrounding areas was done before any specific analysis is undertaken and sensitivity mapping was done, based on typical areas and distance from the proposed mining area (Figure 9-64 to Figure 9-69). This sensitivity map used distances normally associated where possible influences may occur and where influence is expected to be very low or none. Three different areas were identified in this regard:

- A highly sensitive area of 500 m around the mining area. Normally, this 500 m area is considered an area that should be cleared of all people and animals prior to blasting. Levels of ground vibration and air blast are also expected to be higher closer to the box-cut area.
- An area 500 m to 1 500 m around the box-cut area can be considered as being a medium sensitive area. In this 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.
- An area greater than 1 500 m is considered low sensitivity area. In this area, it is relatively certain that influences will be low with low possibility of damages and limited possibility to upset people.

A list of structure locations was required to determine the allowable ground vibration limits and air blast limits. The type of POIs identified is grouped into different classes. Table 9-56 shows the descriptions for the classifications used. The identified POIs are listed in Table 9-57. The structures within the different sensitivity areas have been highlighted (high: red, medium: orange).

Table 9-56: POI Classification used

Class	Description
1	Rural Building and structures of poor construction
2	Private Houses and people sensitive areas
3	Office and High-rise buildings
4	Animal related installations and animal sensitive areas
5	Industrial buildings and installations
6	Earth like structures – no surface structure
7	Graves & Heritage
8	Water Borehole

Table 9-57: List of points of interest identified (WGS – LO 29°)

Tag	Description	Classification	Y	X
	Leslie 1A West			
1	Hydrocensus Borehole (Spr01)	8	9753.06	2908968.64
2	Pan	6	9902.27	2908784.99
3	Heritage Site (LES004 - Old structure. bricks and concrete foundation)	7	9411.57	2908988.33
4	Cement Dam	5	9264.64	2909067.32
5	Informal Housing	1	9344.25	2909162.41
6	Cement Dam	5	10361.09	2909047.07
7	Farm Buildings/Structures	2	9357.76	2909446.56
8	Farm Buildings/Structures	2	9145.50	2909262.35
9	Informal Housing	1	8650.86	2908670.53
10	Cement Dam	5	8670.63	2908777.48
11	Pan	6	10159.29	2908268.64
12	Cultivated Fields	6	9348.27	2909952.32
13	Dam	5	9523.33	2909840.91
14	Cultivated Fields	6	9054.53	2909349.34
15	R50 Road	5	8305.12	2908766.05

Tag	Description	Classification	Y	X
16	R50 Road	5	8256.97	2909385.58
17	Cultivated Fields	6	9450.12	2908592.95
18	Cultivated Fields	6	8973.67	2908314.33
19	Dam	5	11020.72	2909511.25
20	Cement Dam	5	10938.95	2909617.15
21	Cultivated Fields	6	10263.01	2909512.53
22	Cultivated Fields	6	10556.09	2908964.92
23	Pivot Irrigation	5	10221.62	2910295.59
24	Dam	5	9809.99	2910399.10
25	Dam	5	9377.03	2909782.59
26	Dam	5	8258.72	2908301.64
27	Cultivated Fields	6	9577.95	2908192.16
28	Cultivated Fields	6	9840.03	2908471.15
29	Cultivated Fields	6	9586.18	2907567.76
30	Heritage Site (LES002)	7	9666.09	2908936.77
31	Heritage Site (LES001)	7	9299.74	2909529.46
32	Heritage Site (LES003)	7	8933.44	2907782.12
33	Heritage Site (LES011)	7	8029.61	2907968.76
Leslie 1A East				
1	Heritage Site (LES012)	7	6041.63	2907891.04
2	Cultivated Fields	6	6414.76	2907706.15
3	Cultivated Fields	6	6068.68	2907110.00
4	Ruins	1	5734.82	2906735.89
5	Power Lines/Pylons	5	5598.84	2906217.98
6	Power Lines/Pylons	5	5511.66	2906726.41
7	Power Lines/Pylons	5	5437.79	2907116.71
8	Power Lines/Pylons	5	5435.78	2907321.45
9	Power Lines/Pylons	5	5436.25	2907767.92
10	Power Lines/Pylons	5	5432.14	2908239.27
11	Power Lines/Pylons	5	5432.11	2908692.18
12	Cultivated Fields	6	6293.51	2906683.05
13	Cement Dam	5	6938.51	2906915.67
14	Cultivated Fields	6	7157.97	2907575.47
15	Farm Buildings/Structures	2	4370.32	2906839.51
16	Informal Housing	1	4753.33	2906695.93
17	Ruins	1	4960.83	2906682.49
18	Informal Housing	1	4882.70	2906657.61
19	Dam	5	4885.65	2906459.22
20	Structure	2	5167.95	2906761.45
21	Farm Buildings/Structures	2	7490.98	2907064.28
22	Cultivated Fields	6	6708.33	2908187.91
23	Pan	6	6391.67	2908676.13
24	Dam	5	6180.78	2908959.26
25	Hydrocensus s Borehole (Wel04)	8	6185.88	2908742.75
26	Cultivated Fields	6	4724.50	2907569.53

Tag	Description	Classification	Y	X
27	Hydrocensus Borehole (Wel22)	8	4290.79	2908189.12
28	Hydrocensus Borehole (Wel03)	8	6183.97	2909195.89
29	Heritage Site (LES006)	7	5863.38	2908566.22
30	Heritage Site (LES007)	7	6264.12	2908663.01
31	Heritage Site (LES008)	7	6009.39	2908986.63
32	Heritage Site (LES009)	7	5990.53	2908966.79
33	Heritage Site (LES005 -single grave. granite headstone)	7	5775.58	2909257.52
Leslie 1B				
1	Hydrocensus Borehole (Fris01)	8	-3249.72	2912414.34
2	Hydrocensus Borehole (Fris02)	8	-3328.53	2912277.20
3	Heritage Site (LES015 -burial ground)	7	-5069.39	2912642.94
4	Heritage Site (1BGraves -burial ground)	7	-2889.23	2911783.95
5	Dam	5	-4568.64	2911540.88
6	Cultivated Fields	6	-4242.81	2911323.36
7	Cement Dam	5	-4973.26	2911268.00
8	Pan	6	-3849.12	2911959.55
9	Pan	6	-3751.86	2912344.21
10	Cultivated Fields	6	-4522.15	2912620.38
11	Pan	6	-3690.89	2912870.20
12	Farm Buildings/Structures	2	-3333.38	2912379.31
13	Cultivated Fields	6	-4873.30	2912872.23
14	Road	5	-4833.81	2913522.11
15	Dam	5	-4774.89	2913697.18
16	Pan	6	-4352.19	2913551.57
17	Cultivated Fields	6	-4260.45	2913720.24
18	Farm Buildings/Structures	2	-5398.40	2913715.53
19	Farm Buildings/Structures	2	-5537.87	2913721.20
20	Ruins	5	-5443.83	2913791.70
21	Pan	6	-5439.23	2913564.31
22	Informal Housing	1	-5388.43	2913222.32
23	Informal Housing	1	-5401.52	2913301.93
24	Informal Housing	1	-5426.98	2913388.35
25	Road	5	-6297.83	2912801.70
26	Cultivated Fields	6	-5465.40	2912668.74
27	Dam	5	-5352.07	2912490.63
28	Cultivated Fields	6	-5217.83	2912137.47
29	Cultivated Fields	6	-5521.48	2911696.19
Leslie 1C				
1	Cultivated Fields	6	6270.98	2921063.03
2	R50 Road	5	5987.03	2921053.93
3	R50 Road	5	5874.06	2921214.69
4	Farm Buildings/Structures	2	5983.52	2921296.43
5	Dam	5	5892.77	2921321.38
6	Dam	5	5965.69	2921527.52
7	Informal Housing	1	5785.78	2921722.98

Tag	Description	Classification	Y	X
8	Farm Buildings/Structures	2	5644.01	2921699.87
9	Farm Buildings/Structures	2	5857.41	2921824.10
10	Dam	5	5882.94	2921876.04
11	Farm Buildings/Structures	2	5589.23	2921865.43
12	Dam	5	6591.05	2921889.82
13	Farm Buildings/Structures	2	6702.47	2921596.70
14	Pan	6	6679.66	2921005.88
15	N17 Road	5	6185.69	2920927.16
16	N17 Road Bridge	5	6153.24	2920766.56
17	N17 Road	5	6432.11	2920766.39
18	N17 Road Toll Booth	5	6267.72	2920857.17
19	N17 Road Bridge	5	5901.35	2920904.85
20	N17 Road Bridge	5	5861.72	2920827.02
21	N17 Road Toll Booth	5	5061.58	2920993.71
22	N17 Road Toll Buildings	5	5056.89	2920952.77
23	R50 Road	5	5642.83	2921433.22
24	Informal Housing	1	5586.77	2922283.77
25	Building/Structure	2	6194.64	2922396.34
26	Pan	6	6222.04	2922258.24
27	Buildings/Structures	2	6256.79	2922366.02
28	Dam	5	6947.45	2921356.60
29	Farm Buildings/Structures	2	7051.88	2921245.60
30	Dam	5	7186.31	2921142.88
31	Ruins	1	7197.52	2921087.23
32	Farm Buildings/Structures	2	7053.55	2921009.31
33	Buildings/Structures	2	7200.06	2920723.90
34	Farm Buildings/Structures	2	7323.85	2920776.40
35	N17 Road Bridge	5	7078.03	2920578.99
36	Ruins	1	6958.98	2920368.99
37	N17 Road Toll Booth	5	6340.85	2920628.44
38	Informal Housing	1	5389.19	2922170.22
39	Informal Housing	1	5383.43	2922254.19
40	Dam	5	4971.49	2922363.57
41	Farm Buildings/Structures	2	5052.13	2922525.03
42	Cement Dam	5	5329.14	2922662.72
43	Cultivated Fields	6	5683.45	2922521.17
44	Farm Buildings/Structures	2	6459.72	2922840.37
45	Informal Housing	1	6989.12	2922306.95
46	Farm Buildings/Structures	2	7314.43	2922154.03
47	Farm Buildings/Structures	2	7507.85	2921681.60
48	Dam	5	7425.38	2921716.72
49	Farm Buildings/Structures	2	7570.11	2921295.26
50	Farm Buildings/Structures	2	7613.09	2921056.03
51	Farm Buildings/Structures	2	7509.16	2920876.78
52	Dam	5	7587.73	2920897.49

Tag	Description	Classification	Y	X
53	Farm Buildings/Structures	2	7766.36	2920731.62
54	Farm Buildings/Structures	2	7966.21	2921475.94
55	Dams	5	6996.19	2920302.85
56	Lebohang Community Houses	2	6898.61	2920135.65
57	Lebohang Community Houses	2	6718.71	2920091.14
58	Lebohang Community Houses	2	6590.22	2920041.91
59	Lebohang Community Houses	2	6825.10	2919962.78
60	Lebohang Community Houses	2	6785.33	2919782.20
61	Reservoir	5	5553.53	2919746.89
62	Farm Buildings/Structures	2	4759.11	2921477.82
63	Structure	2	6245.24	2919684.23
64	Hydrocensus Borehole (Wat07)	8	6719.16	2921627.95
65	Hydrocensus Borehole (Land01)	8	5569.92	2922220.15
66	Hydrocensus Borehole (Wat14)	8	5485.61	2921769.07
67	Hydrocensus Borehole (Wat15)	8	5591.78	2921750.28
68	Hydrocensus Borehole (Wat13)	8	5518.06	2921731.86
69	Hydrocensus Borehole (Wat12)	8	5477.17	2921682.21
70	Hydrocensus Borehole (Wat11)	8	5279.78	2921541.75
71	Hydrocensus Borehole (Wat16)	8	5831.77	2921651.45
72	Hydrocensus Borehole (Wat08)	8	7243.53	2922224.31
73	Hydrocensus Borehole (Wat Spring2)	8	6620.18	2922607.54
74	Hydrocensus Borehole (Wat09)	8	6445.53	2922929.53
75	Heritage Site (LES019)	7	6068.23	2921674.72
76	Heritage Site (LES021 - single grave)	7	5499.87	2921586.83
77	Heritage Site (LES022 - 8 graves)	7	5905.42	2921874.07
78	Heritage Site (LES013)	7	5061.90	2922505.35
79	Heritage Site (LES016)	7	6755.02	2923086.25
80	Heritage Site (LES017)	7	6732.77	2923098.20
81	Heritage Site (LES024 - burial ground. 15-20 graves)	7	7270.61	2922347.09
82	Heritage Site (LES025 - 4 possible stone packed graves/ remains old stone wall)	7	6892.01	2921758.89
83	Heritage Site (LES020 -stone wall in front of rock shelter)	7	7058.20	2921433.14
84	Heritage Site (Graves)	7	7115.57	2920920.08
Leslie 1D				
1	N17 Road/Road Bridge	5	3293.00	2921627.49
2	N17 Road	5	2642.14	2921881.81
3	N17 Road	5	1990.14	2922137.74
4	Farm Buildings/Structures	2	3198.86	2921573.36
5	Power Lines/Pylons	5	3266.06	2921034.19
6	Power Lines/Pylons	5	3087.01	2921495.68
7	Power Lines/Pylons	5	2928.92	2921914.09
8	Power Lines/Pylons	5	2745.57	2922399.21
9	Power Lines/Pylons	5	2572.89	2922844.65
10	Power Lines/Pylons	5	2428.62	2923227.18
11	Power Lines/Pylons	5	2241.56	2923717.79

Tag	Description	Classification	Y	X
12	Power Lines/Pylons	5	2109.55	2924033.51
13	Power Lines/Pylons	5	2019.99	2924314.68
14	Power Lines/Pylons	5	1842.91	2924439.57
15	Power Lines/Pylons	5	2135.33	2924446.23
16	Power Lines/Pylons	5	1849.80	2924139.45
17	Power Lines/Pylons	5	1661.41	2923915.74
18	Power Lines/Pylons	5	1407.77	2923631.02
19	Power Lines/Pylons	5	1228.73	2923504.52
20	Power Lines/Pylons	5	1159.86	2923319.96
21	Dam	5	2690.89	2921663.13
22	Dam	5	2465.51	2921775.53
23	Cultivated Fields	6	2941.79	2922481.84
24	Cultivated Fields	6	2373.37	2922691.00
25	Dam	5	4544.39	2922794.81
26	Dam	5	1830.42	2923455.62
27	Dam	5	1395.41	2923504.81
28	Pivot Irrigation	5	1484.84	2924275.17
29	Dam	5	2216.98	2924378.91
30	Dam	5	3229.45	2924089.26
31	Hydrocensus Borehole (Sal05)	8	3363.07	2924058.79
32	Hydrocensus Borehole (Sal04)	8	3495.97	2923965.21
33	Cement Dam	5	3057.61	2922917.44
34	Cement Dam	5	3276.22	2922163.86
35	Cultivated Fields	6	3235.55	2923352.12
36	Cultivated Fields	6	2209.26	2923079.11
37	Heritage Site (LES014)	7	4976.35	2923171.52
38	Heritage Site (LES018 -remains of stone structure)	7	5096.66	2923428.28
39	Heritage Site (LES013)	7	5061.90	2922505.35
40	R50 Road	5	4703.26	2922759.84
41	R50 Road	5	4552.40	2923113.21
42	Road	5	4182.79	2922255.48
Leslie 1E				
1	Hydrocensus Borehole (Sal02)	8	3675.63	2924997.98
2	Hydrocensus Borehole (Sal03)	8	3671.04	2925011.82
3	R50 Road	5	3213.88	2926216.03
4	River	6	4152.97	2926167.04
5	Road	5	4311.59	2926191.81
6	Farm Buildings/Structures	2	3620.76	2925017.06
7	R50 Road	5	3417.46	2925693.32
8	River	6	3114.91	2926371.59
9	Farm Buildings/Structures	2	3246.39	2927141.21
10	Farm Buildings/Structures	2	3569.35	2927108.64
11	Cultivated Fields	6	4380.66	2927042.64
12	Dam	5	5370.01	2926093.05
13	River	6	4207.58	2925711.16

Tag	Description	Classification	Y	X
14	River	6	4455.64	2925292.67
15	River	6	3633.52	2926206.26
16	River	6	3434.44	2926490.42
17	Power Lines/Pylons	5	3051.91	2925470.95
18	Power Lines/Pylons	5	3270.31	2925726.29
19	Power Lines/Pylons	5	3568.40	2925859.19
20	Power Lines/Pylons	5	4162.98	2926104.77
21	Power Lines/Pylons	5	4463.98	2926264.24
22	Power Lines/Pylons	5	4770.42	2926435.76
23	Power Lines/Pylons	5	5044.75	2926633.46
24	Power Lines/Pylons	5	5366.57	2926854.24
25	Power Lines/Pylons	5	5640.93	2927041.29
26	Building/Structure	2	3771.72	2926960.27
27	Dam	5	4755.80	2926719.59
28	Road	5	4370.53	2926271.71
29	River	6	4265.80	2925967.40
30	Dam	5	3084.54	2927233.45
31	Chicken Farm	4	2965.81	2927735.64

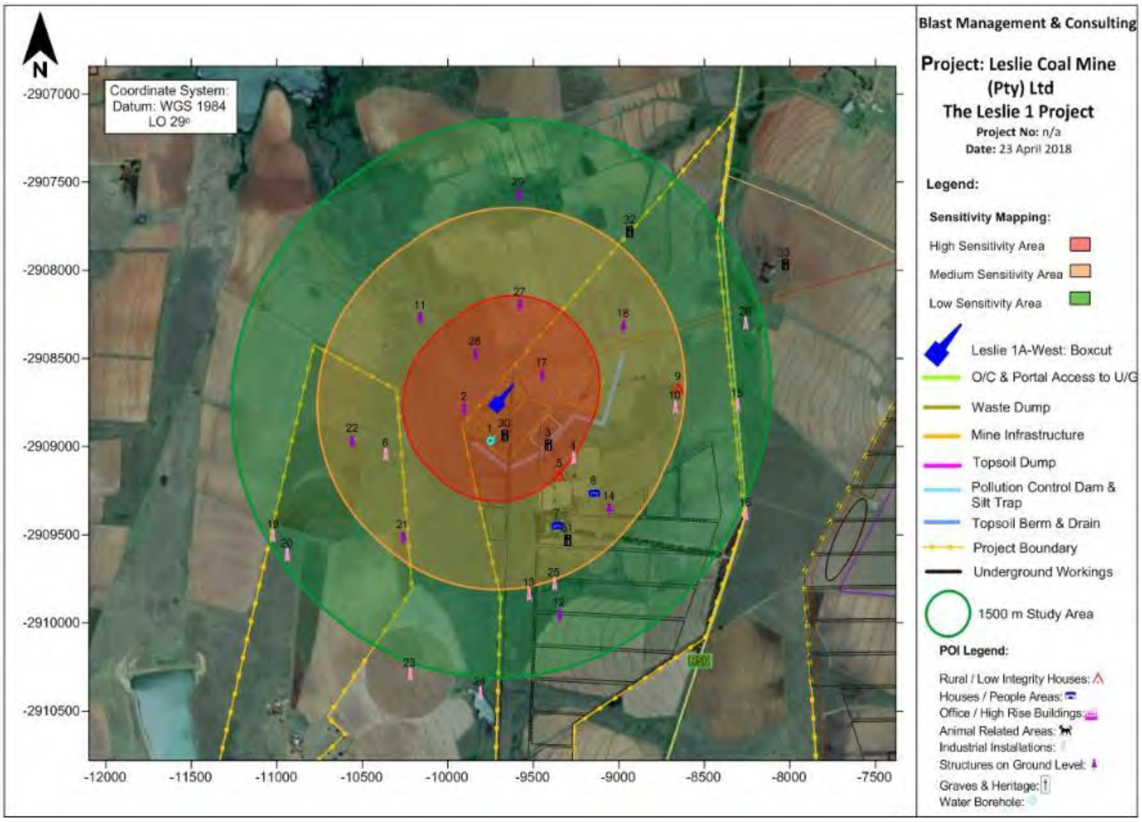


Figure 9-64: Identified sensitive areas for Leslie 1A West Underground Mining Area.

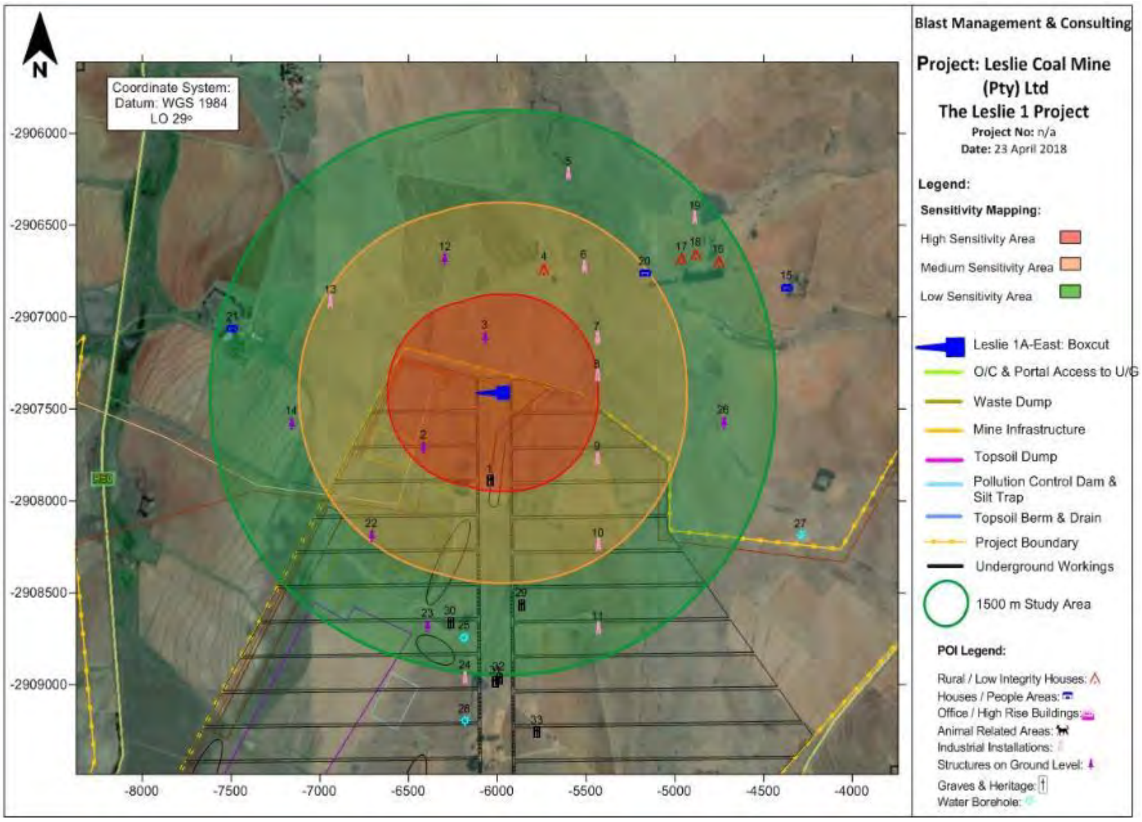


Figure 9-65: Identified sensitive areas for Leslie 1A East Underground Mining Area

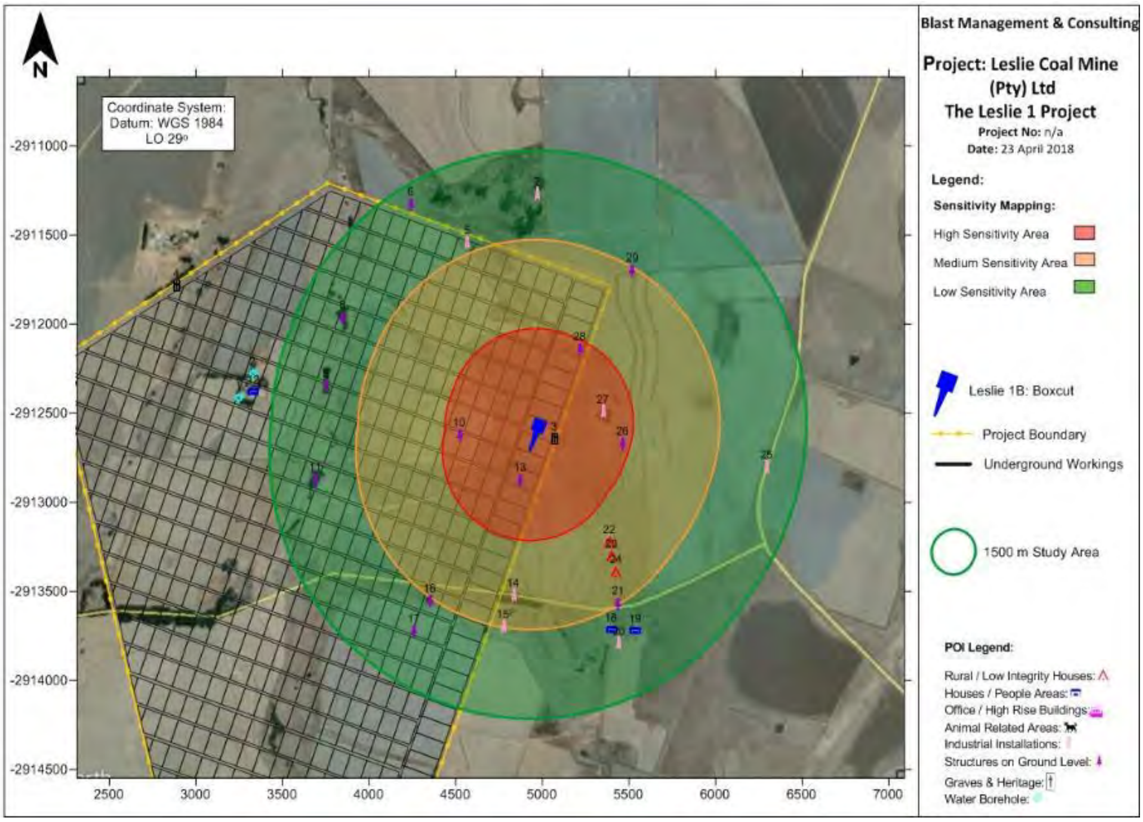


Figure 9-66: Identified sensitive areas for Leslie 1B Underground Mining Area

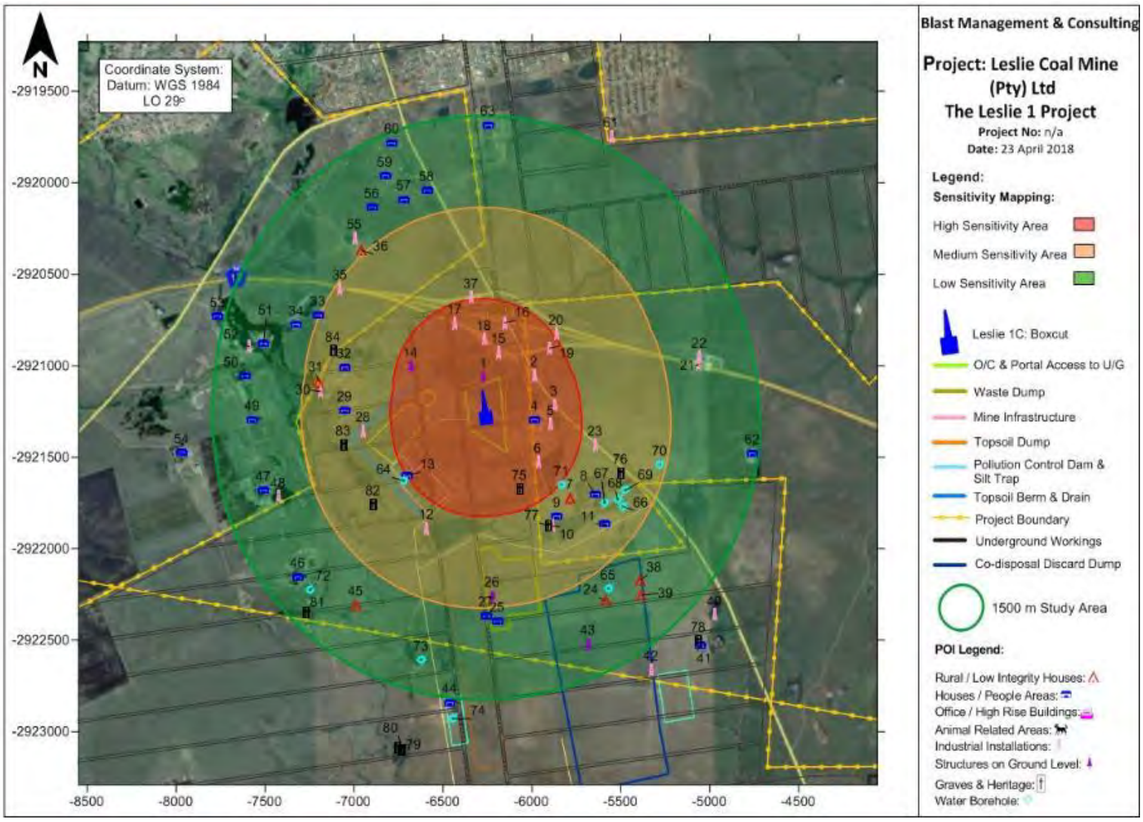


Figure 9-67: Identified sensitive areas for Leslie 1C Underground Mining Area

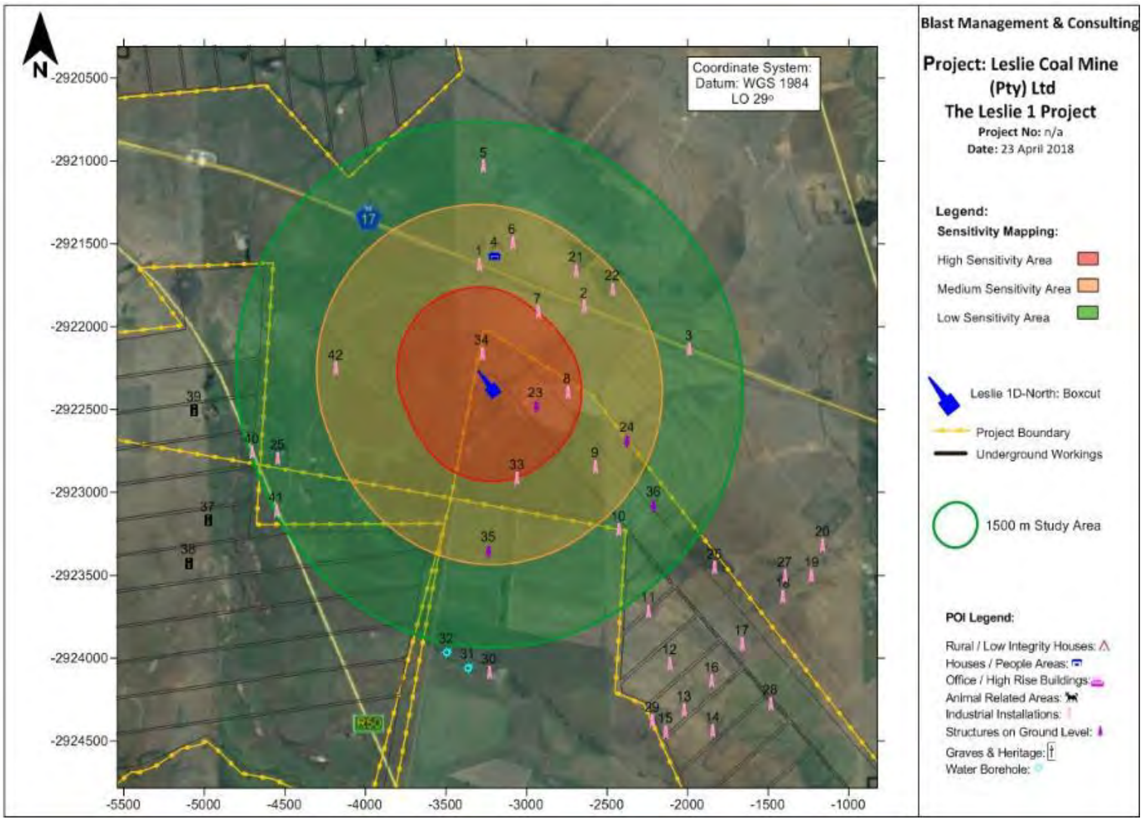


Figure 9-68: Identified sensitive areas for Leslie 1D Underground Mining Area

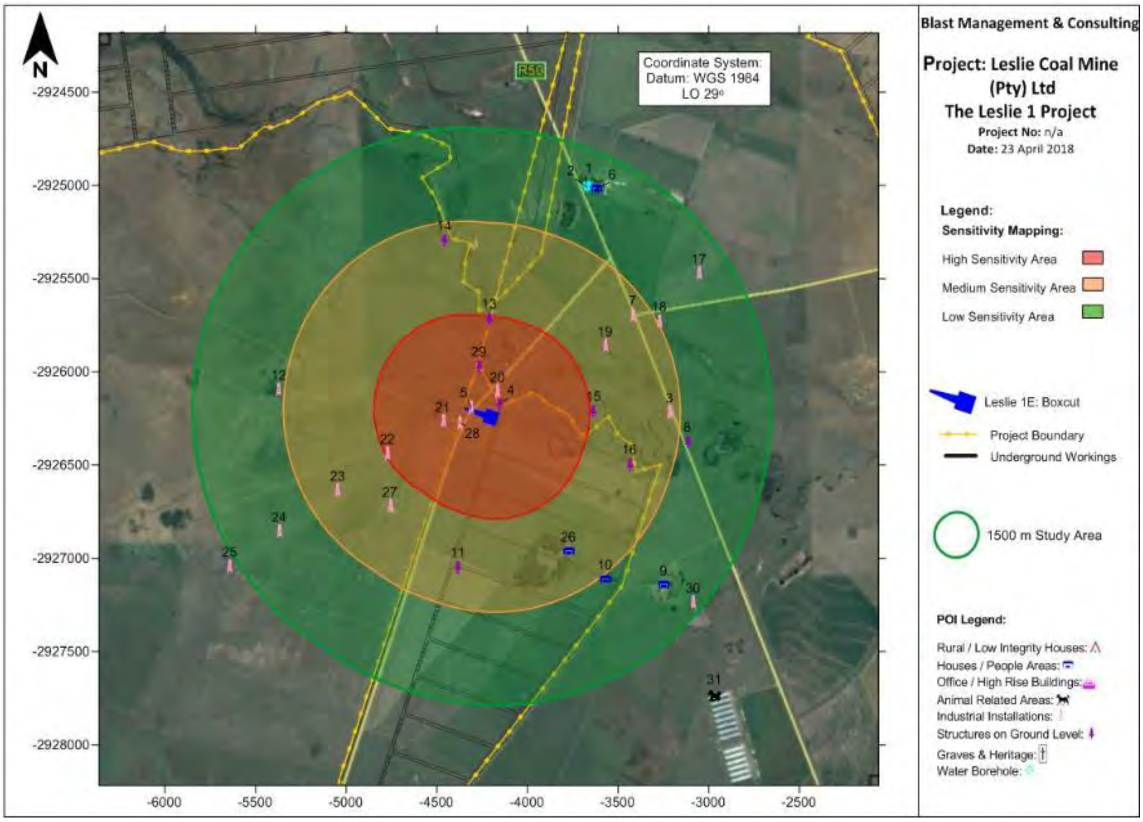


Figure 9-69: Identified sensitive areas for Leslie 1E Underground Mining Area

9.10.2 Specialist Assessment Methods

The detailed plan of study consisted of the following sections:

- Site visit: Intention to understand location of the site and its surroundings;
- Identifying surface structures / installations that are found within reason from project site. A list of Point of Interests (POI's) was created that will be used for evaluation;
- Baseline influence or Blast Monitoring: The project evaluated is a new operation with no blasting activities currently being done. No monitoring is thus specifically required as baseline is considered zero with no influence;
- Site evaluation: This consisted of evaluation of the mining operations and the possible influences from blasting operations. The methodology is modelling the expected impact based on the expected drilling and blasting information provided for the project. Various accepted mathematical equations are applied to determine the attenuation of ground vibration, air blast and fly rock. These values are then calculated over the distance investigated from site and shown as amplitude level contours. Overlaying these contours on the location of the various receptors then gives an indication of the possible impacts and the expected results of potential impacts. Evaluation of each receptor according to the predicted levels then gives an indication of the possible mitigation measures to be applied. The possible environmental or social impacts are then addressed in the detailed EIA phase investigation;
- Reporting: All data is prepared in a single report and provided for review.

There are specific requirements and regulations with regards to blasting operations and the effect of ground vibration and air blast and some of the aspects addressed in the report. The acts consulted are: NEMA; the Mine Health and Safety Act, Act No. 29 of 1996 (MHSA); the MPRDA; and the Explosives Act, Act No. 15 of 2003 (EA).

The guidelines and safe blasting criteria applied in the study are as per internationally accepted standards, and specifically the United States Bureau of Mines (USBM) criteria for safe blasting for ground vibration and the recommendations on air blast. There are no specific South African standards and the USBM is well accepted as standard for South Africa. Additional criteria required by various institutions in South Africa was also taken into consideration, i.e. Eskom, Telkom, Transnet, Rand Water, etc.

The current box cut layout indicates a prospect that planned box cut areas may be close private installations. The MHSA has specific requirements regarding blasting within 500 m from private installations.

9.10.3 Specialist Findings

9.10.3.1 Ground Vibration

The portals were evaluated for expected levels of ground vibration from future blasting operations. Review of the sites and the surrounding installations / houses / buildings showed that structures vary in distances from the box-cut areas. The influences will also vary with distance from the specific areas. The evaluation considered a distance up to 1 500 m from the mining areas. The calculated data is generally within acceptable margins except where structures are closer to the operations. It will be imperative to ensure that a monitoring program is done to confirm levels of ground vibration to ensure that ground vibration levels are not exceeded.

The distance between structures and the portal areas is a contributing factor to the levels of ground vibration expected and the subsequent possible influences. It is observed that for the different charge masses evaluated that levels of ground vibration will change as well. In view of the maximum charge specific attention will need to be given to specific areas. The minimum charge used indicated two POI's (POI 30 at Leslie 1A West and POI 5 at Leslie 1E) of concern and the maximum charge indicated four POI's (POI 30 at Leslie 1A West; POI 3 at Leslie 1B; POI 10 at Leslie 1D South and POI 5 at Leslie 1E) of concern in relation to possible structural damage. On a human perception scale one POI was identified where vibration levels may be perceptible and higher for the minimum charge and twenty POI's for the maximum charge. Perceptible levels of vibration may be experienced up to 1008 m and unpleasant up to 236 m.

The evaluation mainly considered a distance up to 1 500 m from the box-cut areas. The closest structures observed are the Heritage Site (LES002), Heritage Site (LES015 – burial ground), Power Lines/Pylons and Road at Leslie1E that runs through the box-cut area. 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 0.2 mm/s and 1 792.5 mm/s for structures surrounding the box-cut areas.

Structure conditions ranged from industrial construction to poor condition structures. The nearest public houses are located 236 m from the Leslie 1 C box-cut boundary. Ground vibration level predicted at this building where people may be present is 8.1 mm/s. In view of this specific mitigations will be required.

Various Heritage Sites which include Old structures, graves and stone walls were identified by the Heritage Specialist. Two of these sites fall at closest distance of 133 m - (LES002) and 74 m - (LES015 -burial ground) to the box-cut areas. Both sites could be problematic in terms of potential structural damage.

Water boreholes identified are at close proximity for the box-cut areas. A mitigation plan will be required to determine if these boreholes will be retained or replaced.

- **Human Perception**

Based on the maximum charge and ground vibration predicted over distance it can be seen that up to a distance of 1 008 m people may experience levels of ground vibration as perceptible. At 236 m and closer the perception of ground vibration could be unpleasant. The importance of good public relations cannot be over-stressed. People tend to react negatively on experiencing effects from blasting such as ground vibration and air blast. Even at low levels when damage to structures is out of the question it may upset people. Proper and appropriate communication with neighbours about blasting, monitoring and actions done for proper control will be required.

- **Roads**

There are National and provincial roads in the vicinity of the project areas to be considered. The N17 road closest to the Leslie 1C area is located at 227 m and the N17 Road Toll Booth at 278 m. The R50 road is closest to the Leslie 1C area and is located at 299 m. Ground vibration levels calculated is expected to yield levels within acceptable limits for these roads. There is a gravel road that runs through the Leslie 1E area. Expected ground vibration levels at this road are higher than the recommended limits and changed blasting parameters will have to be applied to ensure levels are within accepted norms. This route is specifically of concern when blasting is done. There may be people and animals on these routes and will require careful planning to main safe blasting radius.

- **Adjacent Communities**

Ground vibration and air blast generally upset people living in the vicinity of mining operations. The nearest settlement of people is a farmstead approximately 236 m from the planned Leslie 1C portal operation. This settlement is located such that levels of ground vibration predicted may be perceptible and unpleasant but not damaging.

- **Cracking of houses and consequent devaluation**

The structures found in the areas of concern ranges from informal building style to brick and mortar structures. There are various buildings found within the 1 500 m range from the mining area. The proposed limits as applied in this document i.e. 6 mm/s, 12.5 mm/s and 25 mm/s are considered sufficient to ensure that additional damage is not introduced to the different categories of structures. It is expected that, should levels of ground vibration be maintained within these limits, the possibility of inducing damage is limited.

9.10.3.2 Air Blast

Review of the air blast levels indicates the same concerns as with ground vibrations. Air blast predicted for the maximum charge ranges between 113.3 and 133.2 dB for all the POI's considered. This includes the nearest points such as the Farm Buildings/Structures and Informal Housing. 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.

Table 9-58 shows the minimum and maximum air blast influence on identified POI. The closest structures at 236 m (POI 4 – Leslie 1 C) showed concerns of possible damage at maximum charge. Minimum charge predictions identified that nine POI's at all box-cut areas could experience levels of air blast that could lead to complaints. Maximum charge predictions indicate that eighteen POI's at all box-cut areas could experience air blast that could lead to complaints and one POI is identified where damage may be induced.

The current accepted limit on air blast is 134 dBL. 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 215 m and closer to box-cut boundaries. The Farm Buildings/Structures (POI 4 – Leslie 1 C) are a concern. Infrastructure at all pit areas such as roads, heritage sites, power lines/pylons and Hydrocensus 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.

Table 9-58: Air blast evaluation for Leslie 1

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
	Leslie 1A West Portal				
1	Hydrocensus Borehole (Spr01)	163	132.4	N/A	N/A
2	Pan	140	133.6	N/A	N/A
3	Heritage Site (LES004 - Old structure. bricks and concrete foundation)	342	126.1	N/A	N/A
4	Cement Dam	506	122.8	N/A	N/A
5	Informal Housing	507	122.8	Complaint	Complaint
6	Cement Dam	660	120.6	N/A	N/A
7	Farm Buildings/Structures	726	119.8	Acceptable	Complaint
8	Farm Buildings/Structures	722	119.8	Acceptable	Complaint

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
9	Informal Housing	965	117.4	Acceptable	Complaint
10	Cement Dam	954	117.5	N/A	N/A
11	Pan	626	121.0	N/A	N/A
12	Cultivated Fields	1197	115.6	N/A	N/A
13	Dam	1046	116.7	N/A	N/A
14	Cultivated Fields	848	118.5	N/A	N/A
15	R50 Road	1316	114.8	N/A	N/A
16	R50 Road	1542	113.4	N/A	N/A
17	Cultivated Fields	174	131.8	N/A	N/A
18	Cultivated Fields	723	119.8	N/A	N/A
19	Dam	1461	113.9	N/A	N/A
20	Cement Dam	1451	114.0	N/A	N/A
21	Cultivated Fields	893	118.1	N/A	N/A
22	Cultivated Fields	817	118.8	N/A	N/A
23	Pivot Irrigation	1570	113.3	N/A	N/A
24	Dam	1591	113.2	N/A	N/A
25	Dam	1027	116.9	N/A	N/A
26	Dam	1400	114.2	N/A	N/A
27	Cultivated Fields	456	123.7	N/A	N/A
28	Cultivated Fields	271	128.1	N/A	N/A
29	Cultivated Fields	1079	116.5	N/A	N/A
30	Heritage Site (LES002)	133	134.1	N/A	N/A
31	Heritage Site (LES001)	827	118.7	N/A	N/A
32	Heritage Site (LES003)	1101	116.3	N/A	N/A
33	Heritage Site (LES011)	1725	112.6	N/A	N/A
	Leslie 1A East Portal				
1	Heritage Site (LES012)	446	123.9	N/A	N/A
2	Cultivated Fields	416	124.5	N/A	N/A
3	Cultivated Fields	276	127.9	N/A	N/A
4	Ruins	671	120.5	Complaint	Complaint
5	Power Lines/Pylons	1206	115.6	N/A	N/A
6	Power Lines/Pylons	775	119.2	N/A	N/A
7	Power Lines/Pylons	560	122.0	N/A	N/A
8	Power Lines/Pylons	501	122.9	N/A	N/A
9	Power Lines/Pylons	591	121.5	N/A	N/A
10	Power Lines/Pylons	938	117.6	N/A	N/A
11	Power Lines/Pylons	1343	114.6	N/A	N/A
12	Cultivated Fields	748	119.6	N/A	N/A
13	Cement Dam	958	117.4	N/A	N/A
14	Cultivated Fields	1051	116.7	N/A	N/A

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
15	Farm Buildings/Structures	1653	112.9	Acceptable	Acceptable
16	Informal Housing	1362	114.5	Acceptable	Acceptable
17	Ruins	1195	115.6	Acceptable	Acceptable
18	Informal Housing	1273	115.0	Acceptable	Acceptable
19	Dam	1393	114.3	N/A	N/A
20	Structure	982	117.3	Acceptable	Complaint
21	Farm Buildings/Structures	1415	114.2	Acceptable	Acceptable
22	Cultivated Fields	973	117.3	N/A	N/A
23	Pan	1289	115.0	N/A	N/A
24	Dam	1523	113.5	N/A	N/A
25	Hydrocensus Borehole (Wel04)	1309	114.8	N/A	N/A
26	Cultivated Fields	1214	115.5	N/A	N/A
27	Hydrocensus Borehole (Wel22)	1802	112.1	N/A	N/A
28	Hydrocensus Borehole (Wel03)	1758	112.4	N/A	N/A
29	Heritage Site (LES006)	1122	116.1	N/A	N/A
30	Heritage Site (LES007)	1244	115.3	N/A	N/A
31	Heritage Site (LES008)	1539	113.4	N/A	N/A
32	Heritage Site (LES009)	1520	113.6	N/A	N/A
33	Heritage Site (LES005 -single grave. granite headstone)	1818	112.0	N/A	N/A
	Leslie 1B				
1	Hydrocensus Borehole (Fris01)	1695	112.7	N/A	N/A
2	Hydrocensus Borehole (Fris02)	1637	113.0	N/A	N/A
3	Heritage Site (LES015 -burial ground)	74	139.0	N/A	N/A
4	Heritage Site (1BGraves -burial ground)	2199	110.5	N/A	N/A
5	Dam	1060	116.6	N/A	N/A
6	Cultivated Fields	1400	114.2	N/A	N/A
7	Cement Dam	1258	115.2	N/A	N/A
8	Pan	1246	115.3	N/A	N/A
9	Pan	1209	115.5	N/A	N/A
10	Cultivated Fields	412	124.6	N/A	N/A
11	Pan	1245	115.3	N/A	N/A
12	Farm Buildings/Structures	1616	113.1	Acceptable	Acceptable
13	Cultivated Fields	168	132.1	N/A	N/A
14	Road	814	118.8	N/A	N/A
15	Dam	996	117.1	N/A	N/A
16	Pan	1016	117.0	N/A	N/A
17	Cultivated Fields	1207	115.5	N/A	N/A
18	Farm Buildings/Structures	1108	116.3	Acceptable	Complaint
19	Farm Buildings/Structures	1179	115.7	Acceptable	Acceptable

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
20	Ruins	1196	115.6	N/A	N/A
21	Pan	994	117.1	N/A	N/A
22	Informal Housing	686	120.3	Complaint	Complaint
23	Informal Housing	756	119.5	Acceptable	Complaint
24	Informal Housing	840	118.6	Acceptable	Complaint
25	Road	1298	114.9	N/A	N/A
26	Cultivated Fields	456	123.7	N/A	N/A
27	Dam	333	126.3	N/A	N/A
28	Cultivated Fields	456	123.7	N/A	N/A
29	Cultivated Fields	988	117.2	N/A	N/A
	Leslie 1C				
1	Cultivated Fields	252	128.7	N/A	N/A
2	R50 Road	500	122.9	N/A	N/A
3	R50 Road	555	122.0	N/A	N/A
4	Farm Buildings/Structures	438	124.1	Complaint	Complaint
5	Dam	528	122.5	N/A	N/A
6	Dam	505	122.8	N/A	N/A
7	Informal Housing	759	119.4	Acceptable	Complaint
8	Farm Buildings/Structures	870	118.3	Acceptable	Complaint
9	Farm Buildings/Structures	764	119.4	Acceptable	Complaint
10	Dam	783	119.2	N/A	N/A
11	Farm Buildings/Structures	1001	117.1	Acceptable	Complaint
12	Dam	606	121.3	N/A	N/A
13	Farm Buildings/Structures	386	125.1	Complaint	Complaint
14	Pan	209	130.3	N/A	N/A
15	N17 Road	404	124.7	N/A	N/A
16	N17 Road Bridge	542	122.2	N/A	N/A
17	N17 Road	400	124.8	N/A	N/A
18	N17 Road Toll Booth	398	124.9	N/A	N/A
19	N17 Road Bridge	652	120.7	N/A	N/A
20	N17 Road Bridge	724	119.8	N/A	N/A
21	N17 Road Toll Booth	1395	114.3	N/A	N/A
22	N17 Road Toll Buildings	1409	114.2	N/A	N/A
23	R50 Road	788	119.1	N/A	N/A
24	Informal Housing	1284	115.0	Acceptable	Acceptable
25	Building/Structure	1112	116.2	Acceptable	Complaint
26	Pan	971	117.3	N/A	N/A
27	Buildings/Structures	1071	116.5	Acceptable	Complaint
28	Dam	397	124.9	N/A	N/A
29	Farm Buildings/Structures	473	123.4	Complaint	Complaint

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
30	Dam	609	121.3	N/A	N/A
31	Ruins	628	121.0	Complaint	Complaint
32	Farm Buildings/Structures	512	122.7	Complaint	Complaint
33	Buildings/Structures	784	119.1	Acceptable	Complaint
34	Farm Buildings/Structures	858	118.4	Acceptable	Complaint
35	N17 Road Bridge	792	119.0	N/A	N/A
36	Ruins	893	118.1	Acceptable	Complaint
37	N17 Road Toll Booth	559	122.0	N/A	N/A
38	Informal Housing	1345	114.6	Acceptable	Acceptable
39	Informal Housing	1404	114.2	Acceptable	Acceptable
40	Dam	1793	112.3	N/A	N/A
41	Farm Buildings/Structures	1832	112.0	Acceptable	Acceptable
42	Cement Dam	1740	112.5	N/A	N/A
43	Cultivated Fields	1420	114.2	N/A	N/A
44	Farm Buildings/Structures	1533	113.5	Acceptable	Acceptable
45	Informal Housing	1147	115.9	Acceptable	Acceptable
46	Farm Buildings/Structures	1196	115.6	Acceptable	Acceptable
47	Farm Buildings/Structures	1043	116.8	Acceptable	Complaint
48	Dam	988	117.2	N/A	N/A
49	Farm Buildings/Structures	994	117.1	Acceptable	Complaint
50	Farm Buildings/Structures	1043	116.7	Acceptable	Complaint
51	Farm Buildings/Structures	985	117.2	Acceptable	Complaint
52	Dam	1053	116.7	N/A	N/A
53	Farm Buildings/Structures	1277	115.0	Acceptable	Acceptable
54	Farm Buildings/Structures	1412	114.2	Acceptable	Acceptable
55	Dams	969	117.4	N/A	N/A
56	Lebohang Community Houses	1082	116.5	Acceptable	Complaint
57	Lebohang Community Houses	1079	116.5	Acceptable	Complaint
58	Lebohang Community Houses	1113	116.2	Acceptable	Complaint
59	Lebohang Community Houses	1226	115.4	Acceptable	Acceptable
60	Lebohang Community Houses	1395	114.3	Acceptable	Acceptable
61	Reservoir	1714	112.6	N/A	N/A
62	Farm Buildings/Structures	1670	112.8	Acceptable	Acceptable
63	Structure	1497	113.7	Acceptable	Acceptable
64	Hydrocensus Borehole (Wat07)	421	124.4	N/A	N/A
65	Hydrocensus Borehole (Land01)	1248	115.3	N/A	N/A
66	Hydrocensus Borehole (Wat14)	1043	116.8	N/A	N/A
67	Hydrocensus Borehole (Wat15)	940	117.6	N/A	N/A
68	Hydrocensus Borehole (Wat13)	997	117.1	N/A	N/A
69	Hydrocensus Borehole (Wat12)	1015	117.0	N/A	N/A

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
70	Hydrocensus Borehole (Wat11)	1165	115.8	N/A	N/A
71	Hydrocensus Borehole (Wat16)	682	120.3	N/A	N/A
72	Hydrocensus Borehole (Wat08)	1206	115.6	N/A	N/A
73	Hydrocensus Borehole (Wat Spring2)	1315	114.8	N/A	N/A
74	Hydrocensus Borehole (Wat09)	1622	113.1	N/A	N/A
75	Heritage Site (LES019)	509	122.8	N/A	N/A
76	Heritage Site (LES021 - single grave)	962	117.4	N/A	N/A
77	Heritage Site (LES022 - 8 graves)	766	119.3	N/A	N/A
78	Heritage Site (LES013)	1811	112.1	N/A	N/A
79	Heritage Site (LES016)	1810	112.1	N/A	N/A
80	Heritage Site (LES017)	1817	112.0	N/A	N/A
81	Heritage Site (LES024 - burial ground. 15-20 graves)	1322	114.7	N/A	N/A
82	Heritage Site (LES025 - 4 possible stone packed graves/ remains old stone wall)	623	121.1	N/A	N/A
83	Heritage Site (LES020 -stone wall in front of rock shelter)	530	122.4	N/A	N/A
84	Heritage Site (Graves)	606	121.3	N/A	N/A
	Leslie 1D				
1	N17 Road/Road Bridge	1578	113.3	N/A	N/A
2	N17 Road	1152	115.9	N/A	N/A
3	N17 Road	1067	116.6	N/A	N/A
4	Farm Buildings/Structures	1587	113.3	Acceptable	Acceptable
5	Power Lines/Pylons	2114	110.9	N/A	N/A
6	Power Lines/Pylons	1620	113.1	N/A	N/A
7	Power Lines/Pylons	1173	115.8	N/A	N/A
8	Power Lines/Pylons	656	120.6	N/A	N/A
9	Power Lines/Pylons	187	131.2	N/A	N/A
10	Power Lines/Pylons	58	141.1	N/A	N/A
11	Power Lines/Pylons	572	121.8	N/A	N/A
12	Power Lines/Pylons	915	117.8	N/A	N/A
13	Power Lines/Pylons	1208	115.5	N/A	N/A
14	Power Lines/Pylons	1396	114.3	N/A	N/A
15	Power Lines/Pylons	1296	115.0	N/A	N/A
16	Power Lines/Pylons	1133	116.1	N/A	N/A
17	Power Lines/Pylons	1088	116.4	N/A	N/A
18	Power Lines/Pylons	1155	115.9	N/A	N/A
19	Power Lines/Pylons	1287	115.0	N/A	N/A
20	Power Lines/Pylons	1324	114.7	N/A	N/A
21	Dam	1374	114.4	N/A	N/A

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
22	Dam	1261	115.2	N/A	N/A
23	Cultivated Fields	662	120.5	N/A	N/A
24	Cultivated Fields	395	124.9	N/A	N/A
25	Dam	1940	111.6	N/A	N/A
26	Dam	697	120.1	N/A	N/A
27	Dam	1126	116.1	N/A	N/A
28	Pivot Irrigation	1466	113.9	N/A	N/A
29	Dam	1211	115.5	N/A	N/A
30	Dam	1159	115.8	N/A	N/A
31	Hydrocensus Borehole (Sal05)	1215	115.5	N/A	N/A
32	Hydrocensus Borehole (Sal04)	1240	115.3	N/A	N/A
33	Cement Dam	461	123.6	N/A	N/A
34	Cement Dam	1117	116.2	N/A	N/A
35	Cultivated Fields	669	120.5	N/A	N/A
36	Cultivated Fields	291	127.5	N/A	N/A
37	Heritage Site (LES014)	2353	110.0	N/A	N/A
38	Heritage Site (LES018 -remains of stone structure)	2496	109.4	N/A	N/A
39	Heritage Site (LES013)	2503	109.4	N/A	N/A
40	R50 Road	2102	110.9	N/A	N/A
41	R50 Road	1927	111.6	N/A	N/A
42	Road	1761	112.4	N/A	N/A
	Leslie 1E				
1	Hydrocensus Borehole (Sal02)	1315	114.8	N/A	N/A
2	Hydrocensus Borehole (Sal03)	1304	114.9	N/A	N/A
3	R50 Road	944	117.6	N/A	N/A
4	River	53	141.8	N/A	N/A
5	Road	9	156.8	N/A	N/A
6	Farm Buildings/Structures	1319	114.8	Acceptable	Acceptable
7	R50 Road	909	117.9	N/A	N/A
8	River	1053	116.7	N/A	N/A
9	Farm Buildings/Structures	1264	115.1	Acceptable	Acceptable
10	Farm Buildings/Structures	1023	116.9	Acceptable	Complaint
11	Cultivated Fields	782	119.2	N/A	N/A
12	Dam	1030	116.8	N/A	N/A
13	River	489	123.1	N/A	N/A
14	River	909	117.9	N/A	N/A
15	River	524	122.5	N/A	N/A
16	River	771	119.3	N/A	N/A
17	Power Lines/Pylons	1336	114.6	N/A	N/A

Tag	Description	Distance (m)	Air blast (dB)	Possible Concern?	
				Minimum charge 34kg	Maximum Charge 138 kg
18	Power Lines/Pylons	1016	117.0	N/A	N/A
19	Power Lines/Pylons	692	120.2	N/A	N/A
20	Power Lines/Pylons	109	135.8	N/A	N/A
21	Power Lines/Pylons	137	133.8	N/A	N/A
22	Power Lines/Pylons	488	123.1	N/A	N/A
23	Power Lines/Pylons	825	118.7	N/A	N/A
24	Power Lines/Pylons	1215	115.5	N/A	N/A
25	Power Lines/Pylons	1547	113.4	N/A	N/A
26	Building/Structure	787	119.1	Acceptable	Complaint
27	Dam	664	120.5	N/A	N/A
28	Road	76	138.8	N/A	N/A
29	River	236	129.2	N/A	N/A
30	Dam	1447	114.0	N/A	N/A
31	Chicken Battery	1889	111.8	Acceptable	Acceptable

9.10.3.3 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.

Calculations are also used to help and assist determining safe distances. A safe distance from blasting is calculated following rules and guidelines from the International Society of Explosives Engineers (ISEE) Blasters Handbook. Using this calculation, the minimum safe distances can be determined that should be cleared of people, animals and equipment. A possible fly rock range with a safety factor of 2 was calculated to be 273 m. The absolute minimum unsafe zone is then 273 m. This calculation is a guideline and any distance cleared should not be less. The occurrence of fly rock can however never be 100% excluded. Best practices should be implemented at all times. The occurrence of fly rock can be mitigated but the possibility of the occurrence thereof can never be eliminated.

Review of the calculated unsafe zone showed twenty POI's for all the Leslie 1 portal areas are within the unsafe zone (Table 9-59).

Table 9-59: Fly rock concern POI's

Tag	Description	Y	X
Leslie 1A West			
1	Hydrocensus Borehole (Spr01)	9753.06	2908968.64
2	Pan	9902.27	2908784.99
17	Cultivated Fields	9450.12	2908592.95

Tag	Description	Y	X
28	Cultivated Fields	9840.03	2908471.15
30	Heritage Site (LES002)	9666.09	2908936.77
Leslie 1A West			
None			
Leslie 1B			
3	Heritage Site (LES015 -burial ground)	-5069.39	2912642.94
13	Cultivated Fields	-4873.30	2912872.23
Leslie 1C – Option 1			
1	Cultivated Fields	6270.98	2921063.03
14	Pan	6679.66	2921005.88
Leslie 1C – Option 2			
20	R50 Road	4231.70	2923840.94
Leslie 1D North			
23	Cultivated Fields	2941.79	2922481.84
34	Cement Dam	3276.22	2922163.86
Leslie 1D South			
9	Power Lines/Pylons	2572.89	2922844.65
10	Power Lines/Pylons	2428.62	2923227.18
Leslie 1E			
4	River	4152.97	2926167.04
5	Road	4311.59	2926191.81
20	Power Lines/Pylons	4162.98	2926104.77
21	Power Lines/Pylons	4463.98	2926264.24
28	Road	4370.53	2926271.71
29	River	4265.80	2925967.40

9.10.3.4 Water borehole influence

Location of boreholes for water was evaluated for possible influence from blasting. Twenty-three Hydrocensus boreholes (Table 9-60) were identified within the influence area at the portal areas. There are boreholes that are in close proximity of the blasting areas but are found to be within acceptable limits.

Table 9-60: Identified water boreholes

Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m) to nearest Pit	Predicted PPV (mm/s)
	Leslie 1A West					
1	Hydrocensus Borehole (Spr01)	9753.06	2908968.64	50	163	14.9
	Leslie 1A East					
25	Hydrocensus Borehole (Wel04)	6185.88	2908742.75	50	1309	0.5
27	Hydrocensus Borehole (Wel22)	4290.79	2908189.12	50	1802	0.3
28	Hydrocensus Borehole (Wel03)	6183.97	2909195.89	50	1758	0.3
	Leslie 1B			50		
1	Hydrocensus Borehole (Fris01)	-3249.72	2912414.34	50	1695	0.3
2	Hydrocensus Borehole (Fris02)	-3328.53	2912277.20	50	1637	0.3

Tag	Description	Y	X	Specific Limit (mm/s)	Distance (m) to nearest Pit	Predicted PPV (mm/s)
	Leslie 1C – Option 1			50		
64	Hydrocensus Borehole (Wat07)	6719.16	2921627.95	50	421	3.1
65	Hydrocensus Borehole (Land01)	5569.92	2922220.15	50	1248	0.5
66	Hydrocensus Borehole (Wat14)	5485.61	2921769.07	50	1043	0.7
67	Hydrocensus Borehole (Wat15)	5591.78	2921750.28	50	940	0.8
68	Hydrocensus Borehole (Wat13)	5518.06	2921731.86	50	997	0.8
69	Hydrocensus Borehole (Wat12)	5477.17	2921682.21	50	1015	0.7
70	Hydrocensus Borehole (Wat11)	5279.78	2921541.75	50	1165	0.6
71	Hydrocensus Borehole (Wat16)	5831.77	2921651.45	50	682	1.4
72	Hydrocensus Borehole (Wat08)	7243.53	2922224.31	50	1206	0.5
73	Hydrocensus Borehole (Wat Spring2)	6620.18	2922607.54	50	1315	0.5
74	Hydrocensus Borehole (Wat09)	6445.53	2922929.53	50	1622	0.3
	Leslie 1 D South			50		
31	Hydrocensus Borehole (Sal05)	3363.07	2924058.79	50	1215	0.5
32	Hydrocensus Borehole (Sal04)	3495.97	2923965.21	50	1240	0.5
	Leslie 1 E			50		
1	Hydrocensus Borehole (Sal02)	3675.63	2924997.98	50	1315	0.5
2	Hydrocensus Borehole (Sal03)	3671.04	2925011.82	50	1304	0.5

9.10.4 Specialist Conclusions

The location of structures around the Leslie 1 Box-cut areas is such that the charge evaluated showed possible influences due to ground vibration. Ground vibration mitigation will be required for these structures. Ground vibrations predicted for all box-cut areas ranged between low and very high. There are four POI's identified for all box-cut areas considered, Leslie 1A West; Leslie 1B; Leslie 1D South and Leslie 1E that is the main concern with regards to ground vibration. There are POI's as close as 9 m from the box-cut boundary. The expected levels of ground vibration for these structures are high and will require specific mitigations in the way of adjusting charge mass per delay to reduce the levels of ground vibration. Ground vibration at structures and installations other than the identified problematic structures is well below any specific concern for inducing damage.

Review of the air blast levels indicates the same concerns. Air blast predicted for the maximum charge ranges between 113.3 and 133.2 dB for all the POI's considered. This includes the nearest points such as the Farm Buildings/Structures and Informal Housing. 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 236 m (POI 4 – Leslie 1 C) showed concerns of possible damage at maximum charge. Minimum charge predictions identified that nine POI's at all box-cut areas could experience levels of air blast that could lead to complaints. Maximum charge predictions indicate that eighteen POI's at all box-cut areas could experience air blast that could lead to complaints and one POI is identified where damage may be induced.

The current accepted limit on air blast is 134 dBL. 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 215 m and closer to box-cut boundaries. The Farm Buildings/Structures (POI 4 – Leslie 1 C) are a concern. Infrastructure at all pit areas such as roads, heritage sites, power lines/pylons and Hydrocensus boreholes are present but air blast does not have any influence on these installations.

An exclusion zone for safe blasting was also calculated. The exclusion zone was established to be at least 273 m. The use of the normal practice observed in mines of 500 m exclusion zone will include the Farm Buildings/Structures, Hydrocensus Boreholes and Heritage Sites. The use of minimum 500 m exclusion zone is rather recommended and it will be required that evacuation be negotiated when blasting.

Twenty-three Hydrocensus boreholes were identified within the influence area at the Box-cut areas. There are boreholes that are in close proximity of the blasting areas but are found to be within acceptable limits.

Recommendations were made and should be considered. Specific actions will be required for all box-cut areas such as Mine Health and Safety Act requirements when blasting is done within 500 m from private structures. Specific blast design that will consider the installations around the box-cut areas will be needed. Closure of roads and considering the farming community around the pit areas must also be considered.

The portal areas are located such that specific concerns were identified and addressed in the report. The author is of the opinion that with careful planning of blasting operations and necessary permissions blasting operations will be possible. A changed consideration of blast designs may be required.

9.11 Visual

A Visual Impact Assessment was undertaken by Kongiwe Environmental (Pty) Ltd for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D10.

9.11.1 Environmental Status Quo

9.11.1.1 Leslie 1A

Leslie 1 A is categorised by plain and low gently undulating terrain with topography of the immediate site ranging from 1 545 m to 1 670 m sloping to the west. No prominent mountains or steep hills are evident on site. The site consists mainly of farms and rivers running north and south of the proposed mine and grassland areas with manmade landscape (noticeably the large agricultural area in a form of cultivated maize fields, electricity powerlines, business buildings, scattered farmsteads patterns, animal shelters, dams and gravel access roads,). There are already existing mines within the 15 km radius of the proposed Leslie 1A site. Delmas and iKhwezi collieries are located approximately 7 km northwest of Leslie 1A while

Matla Colliery is directly 15 km northeast of the proposed site. The Eskom Kendal Power station situated approximately 21 km north of the proposed mine area and is visible in the skyline looking to the north.

Farmers house and dam looking NW towards Leslie 1A surface infrastructure. Source Google Earth 2018

Business Buildings southeast of Leslie 1A surface infrastructure. Source Google Earth 2018

Cultivated land looking east towards Leslie 1A surface. source Google Earth 2018Infrastructure

Maize farm looking northwest towards Leslie1A surface Infrastructure. source Google Earth 2018

Figure 9-70: Landscape setting for Leslie 1A

During the stakeholder meetings it was indicated by the Mahlangu Royal family from the amaNdebele ethnic group that they have been holding their initiation school process and ceremony on portion 12 of farm Weltevreden 307 IR since the early 1970's. The family indicated that there are cultural restriction that apply to the site being visible to the public during the ceremonies which are held every four years. Due to the sensitivity of the cultural ceremonies associated with the Ndebele initiation process, the exact location of the ceremony site could not be indicated but only alluded to.

9.11.1.2 Leslie 1C

Leslie 1C is categorised also by plain and low gently undulating terrain with topography of the immediate site ranging from 1600 m to 1665 m sloping to the southeast. No prominent mountains or steep hills are evident on site. The site is traversed by a drainage lines and consist mainly farms and rivers running south of the proposed mine and grassland area with manmade features (noticeably the Lebogang township, and cultivated maize fields, AFRGRI Silos, electricity powerlines, business buildings, scattered farmsteads patterns, animal shelters, dams and gravel access roads,). The mine area traversed by the N17 which is a major road that linked Gauteng ad Swaziland. The closest visible old dumps lie approximately 9 km south east of the Leslie 1C, while towards the west and the immediate site is still Greenfields and consist of mostly cultivated land. North of the N17 is the township Lebogang which is a mixture of formal and informal settlement and borders the town Leandra (Figure 9-71).

Entrance to Lebohang township from the R50 north of the N17.Appoximatly 1.5km from Leslie 1C surface Infrastructure

Entrance to Lebohang township informal settlement west on the R50 North of N17

Dams and J.A Rolf property looking west towards Leslie 1C surface infrastructure from R50 south of N17. Source Google earth

Grass land looking southwest towards the Leslie 1C proposed surface Infrastructure from the R50. Source Google earth

Figure 9-71: Landscape Setting for Leslie 1C

9.11.2 Specialist Assessment Methods

The VIA was undertaken in accordance with the *Guidelines for Involving Visual and Aesthetic Specialists in EIA process,* as issued by the Western Cape Government's Department of Environmental Affairs and Development Planning during 2005[13]. The VIA was undertaken in distinct steps, as set out in Figure 9-72, to evaluate the impacts of the proposed activity. In this process the inherent scenic value of the landscape was first determined. Data collected during a site visit (09 April 2018) allowed for a comprehensive description and evaluation of the receiving environment.

Legislation and guideline

- National legislation, provincial by-laws and guideline use to evaluate the project

Existing proposed site environment

- The existing environmental characterisitics of the project area are described and illustrated

Project Description

- Description & categorisation of the proposed project in terms of set guidelines addressed by this visual assessment

Impact Assessment

- Quantification of the visual extent of the affected visual environmental, the viewing distance and the critical views/visual receptors that may be affected by the proposed project.This also includes the ability of the landscape to accommodate the proposed project from a visual perspective.

Visual Impact mitigations

- The severity of the impact on the visual environment of the proposed development and the measures that could mitigate/offset any negative impacts of the proposed surface infrastructure on the receiving environment

Figure 9-72: Study Methodology used in the VIA

9.11.3 Specialist Findings

9.11.3.1 Leslie 1A

Triggers and Categorisation

The proposed mining activities falls within the **Category 5** development, with a **high** visual impact expected. This translates to the proposed mine area (Leslie 1 A) potentially having significant effect and a noticeable change on the wilderness quality and scenic appearance of the immediate environment.

[13] No similar policy exists for the Mpumalanga Province. However, the Guidelines are based upon universally accepted principles and are therefore applicable to the said project.

Viewshed

Figure 9-73 spatially depicts the viewshed area and the areas which have direct visibility of the proposed surface infrastructure area. A single analysis viewshed of the proposed surface infrastructure was used, meaning that the figure illustrates all areas from which the surface infrastructure will be visible, incorporating vertical offset heights (height above natural terrain level) and an offset height of 2m for observation points. The total area that has a direct visual connection of the footprint areas amounts to 21 034.19 Ha (52.29% of the Zone of Influence (ZOI)).

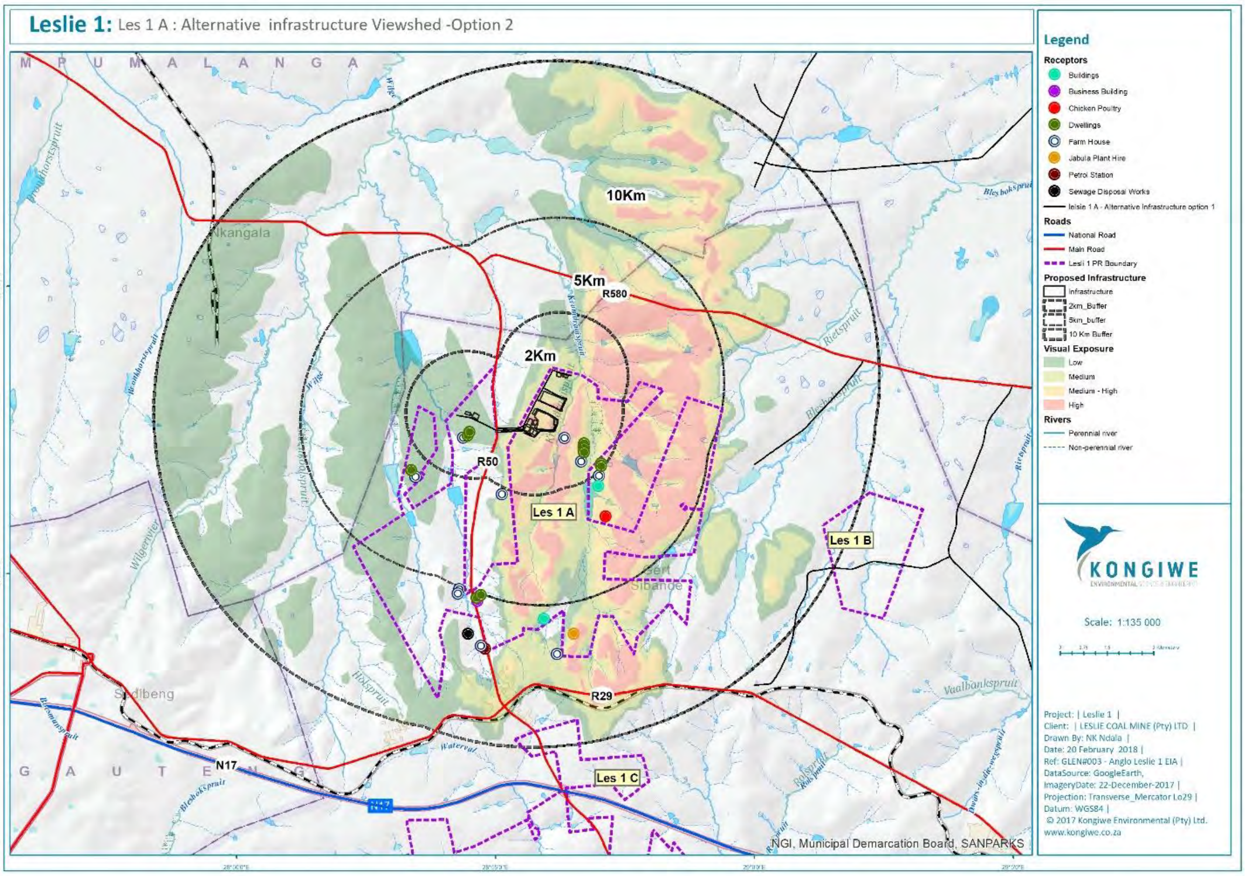


Figure 9-73: Leslie 1A Surface Infrastructure Viewshed

The viewshed indicates that Leslie 1A surface infrastructure will be **highly** visible from the southeast to northeast direction of the development and will be **low** from the southwest to the northwest of the development for 10km.

Viewing Distance

For Leslie 1A, a potential zone of influence (ZOI) (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was determined at 10km. Over 10km the impact of the proposed infrastructure would have diminished considerably due to the diminishing effect of distance and atmospheric conditions (haze) on visibility.

From the receptor visual exposure map below, it is clear that there are sensitive receptors (residents, Amandebele Initiation site and motorists) located within 0 - 2km and the majority reside in the direction of high visibility. Whilst residents and motorists also fall within 2 - 10km distance of the proposed surface infrastructure.

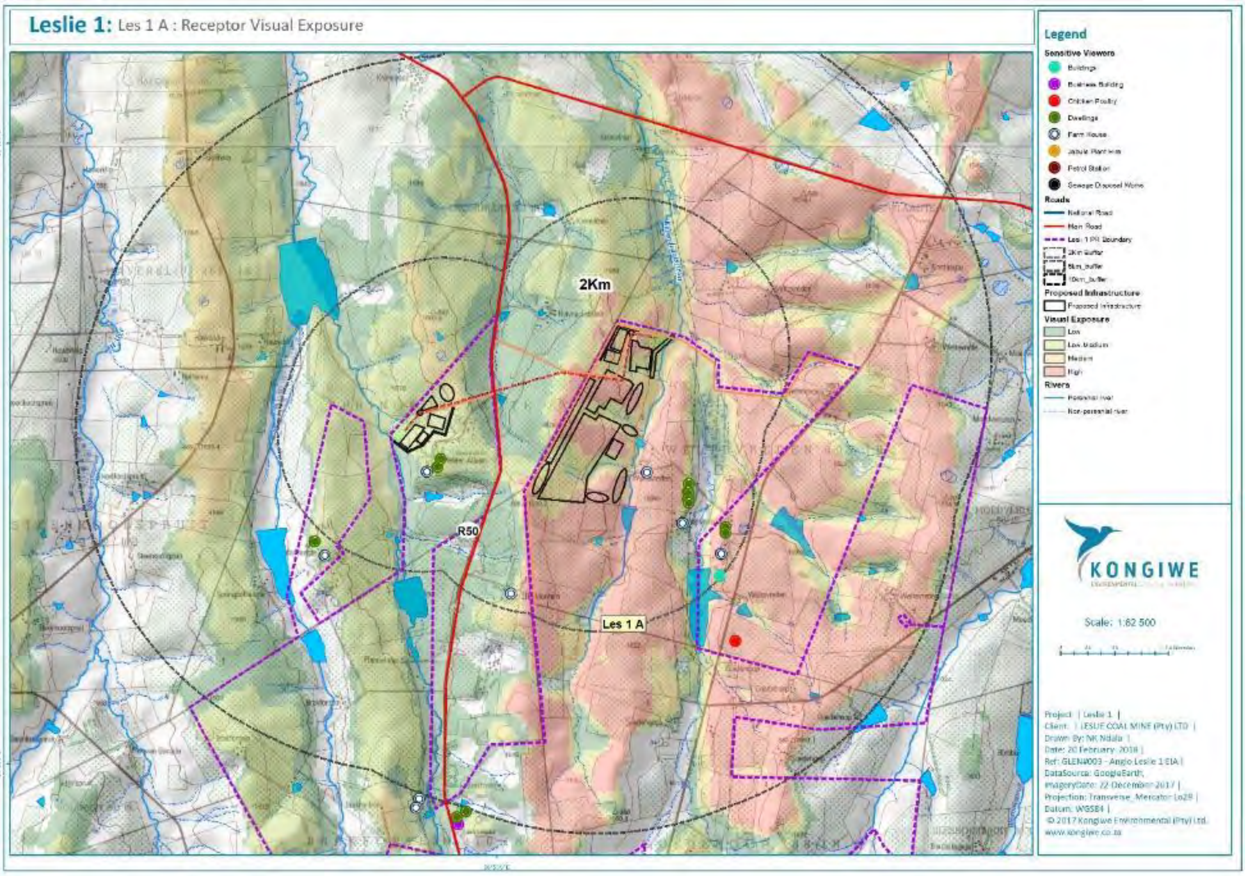


Figure 9-74: Leslie 1 A Receptors Visual Exposure

Sensitive Receptors

On the immediate site itself (where proposed surface infrastructure is to be placed), there is a farmer's house together with farm workers compounds located on the farmstead. Several gravel roads traverse the farm and join the main R50 road on the south east which is mostly used by motorist, tractors and trucks commuting to the local milling and mines in the surrounding area. The area is not a high tourism area, nor are there any tourist attractions in this part of the municipality, therefore there is a low chance of tourist utilising the road. The surrounding area is also occupied by farmers houses and workers compounds for the most part of the 10km ZOI.

Residents, the Ndebele Initiation site, workers on the farms and motorist within 2km of the proposed operation and within areas of high visual exposure were based on the viewshed analysis, regarded as critical viewers against which the visual impact would be evaluated. These are areas where any visual impacts associated with the proposed Leslie 1A would have the greatest impact on receptors due to the proximity and direct line of sight of towards the proposed development area.

Table 9-61: Sensitive Viewers within 0-2km of proposed surface infrastructure

Sensitive Viewers within 2 km of the proposed surface Infrastructure			
Farm	**Sensitive Viewer**	**Distance from Surface Infrastructure**	**Viewing distance sensitivity**
Weltevreden 307 IR portion 13/307	Farm House	0.23 km	High
Weltevreden 307 IR portion 3/307	Dwellings	0.95km	High
Weltevreden 307 IR portion3/307	Farm Houses	0.96 km	High
Weltevreden 307 IR portion 21/307	Farm Houses	1.32 km	High
Weltevreden 307 IR portion 12/307	AmaNdebele Initiation site	1.45 km	High
Goedehoop 308 IR portion 27/308	Farm House	3.58 km	High
Springboklaagte 306 IR portion 8/306	Farm House	0.37 km	High
Springboklaagte 306 IR portion 9/306	Farm House	1.03km	High
Springboklaagte 306 IR portion 8/306	Dwellings	0.41 km	High
Springboklaagte 306 IR portion 11/306	Farm Houses	1.78 km	High
Springboklaagte 306 IR portion 11/306	Farm House	1.9km	High
Springboklaagte 310 IR portion 11/310	Fam House	1.33 km	High
	Motorist on the R50	0.54 km	Medium

Viewpoints

Several critical viewpoints were identified towards the project area (Leslie 1A) to illustrate how the surface infrastructure would have an impact on sensitive viewers. The most critical viewers were identified as residents and the Ndebele initiation site while farm workers and motorist travelling on the R50 where identified as least critical viewers within 2 km of the proposed development area, falling within areas of high visual exposure to the proposed Leslie 1A mine area. These receptors were categorised according to the criteria provided in Table 9-61 and the results are set out in Table-9-62 below.

Table-9-62: Sensitivity of the receptors for the proposed Leslie 1A

Sensitivity of Receptors for the proposed Pit BE			
	High (Residents, Ndebele initiation Site)	Moderate (People engaged in sport or recreation, so views are not focused on landscape)	Low (People at work, motorists travelling on the R50 and people who are focused on other activities)
Proposed Leslie 1A and Surface infrastructure	Farm residents, the Ndebele initiation site		Motorist on R50 and Farm workers

Figure 9-75: Farm House 0.9km looking south east towards the proposed Surface Infrastructure: source Google Earth 2018, Imagery date 18-11-2017

Figure 9-76: Motorist travelling on the R50 approximately 0.56 km SE of proposed surface infrastructure source Google Earth 2018, Imagery date 18-11-2017

Figure 9-77: Boshoff Boerdery approximately 1.4km looking northeast towards the proposed Surface Infrastructure: source Google Earth 2018, Imagery date 18-11-2017

Visual Absorption Capacity

Visual Absorption Capacity (VAC) signifies the ability of the landscape to accept additional human intervention without serious loss of character and visual quality or value. VAC is founded on the characteristics of the physical environment.

As mentioned previously, areas which have a **high** visual absorption capacity are easily able to accept objects so that their visual impact is less noticeable. Conversely areas with **low** visual absorption capacity will suffer a higher visual impact from structures imposed on them.

It is apparent that the landscape surrounding the mining operations ability to 'visually absorb' the proposed surface infrastructure area is **moderate - low** due to the following:

- The proposed Leslie 1A site is situated on a uniform landform type with flat terrain surrounding the immediate side and small hills in some areas;
- The degree of visual screening is low due to the flat surrounding topography, the absence of mountains and lack of visual screening vegetation;
- The colour and contrast of the proposed operations is in contrast with the current natural colours of the area.
- The terrestrial environment is currently disturbed by activities associated with farming, settlements and mining. Mining infrastructure, such as the planned activities within the surface infrastructure area, would not be entirely alien but invasive to the surrounding environments.
- Land use as there are numerous other coal mine within 10km of the proposed development area and the Eskom Power plant infrastructure visible in the skyline.

The landscape therefore has a **moderate to low visual** absorption capacity.

Magnitude

In synthesising the criteria used to establish the magnitude of visual impact, a numerical or weighting system is avoided. This table is arrived at by combining the ratings of each of the sections above (viewshed, viewing distance, visual absorption capacity, and sensitivity receptors). The ratings for each of these criteria are indicated in Table 9-63 and derived from the discussion in the preceding sections. These results are based on worst-case scenarios (i.e., at full size and extent of the proposed mining infrastructure in the operational phase of mining) when the impact of all aspects is taken together. It is evident that the Visual impact expected is **very high**.

Table 9-63 : Magnitude of Visual Impact results

Magnitude of Visual Impact for Leslie 1A					
	Triggers & Category of Environment	**Viewshed Analysis Results**	**Viewing Distance Results**	**Sensitive Receptors**	**Visual Absorption Capacity Results**
Proposed Leslie 1A mine area and associated Infrastructure	**High-** Visual Impact expected	**High** - Visible to >50% of the ZOI	**High** -Sensitive viewers are within <2km of the proposed site	**High** - Includes residents in close proximity to the proposed site	Moderate - Low

9.11.3.2 Leslie 1C

Triggers and Categorisation

The proposed mining activities falls within the **Category 5** development, with a **high** visual impact expected. This translates to the proposed mine area (Leslie 1C) potentially having significant effect and a noticeable change on the wilderness quality and scenic appearance of the immediate environment and this type of project may establish a new precedent for the development area. Which will cumulatively add to the current increase in infrastructure development and the decrease of the natural form of the place.

Viewshed

This viewshed analysis is carried out to define areas, which contain all possible observation sites from which the Leslie 1C and associated Surface infrastructure will be seen. The topography was determined by using a Digital Elevation Model (DEM) from 5m contours of the area. Figure 9-78 spatially depicts the viewshed area and the areas which have direct visibility of the proposed surface infrastructure area. A single analysis viewshed of the proposed surface infrastructure was used, meaning that the figure illustrates all areas from which the surface infrastructure will be visible, incorporating vertical offset heights (height above natural terrain level) and an offset height of 2m for observation points. The total area that has a direct visual connection of the footprint areas amounts to 19 102.8 Ha (48.9% of the Zone of Influence).

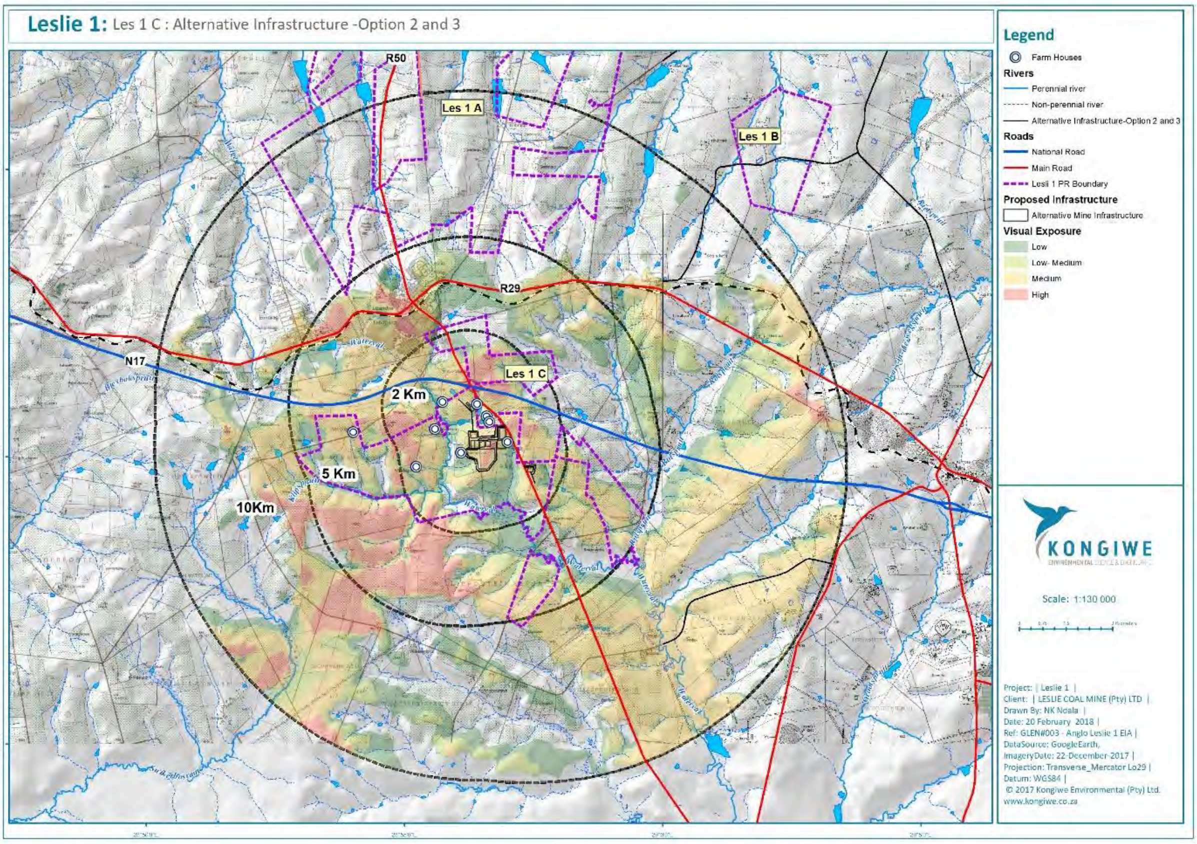


Figure 9-78: Leslie 1C Viewshed Results

The viewshed analysis for Leslie 1 C indicates that the surface infrastructure will be **- moderately visible** to the northwest and southwest of the proposed mine within the 0-5 km radius (ZOI). This is an improvement from the high visibility of the initial mine layout, while it will have **medium -low** visibility to the south and southeast direction for 5-10km radius (ZOI).

Viewing Distance

For this Leslie 1C, a potential zone of influence (the area defined as the radius about the centre point of the project beyond which the visual impact of the most visible features will be insignificant) was determined at 10km. Over 10km the impact of the proposed infrastructure would have diminished considerably due to the diminishing effect of distance and atmospheric conditions (haze) on visibility.

A 10km ZOI was determine for the proposed mine area (Leslie 1C). It is evident from the viewshed maps that the surface infrastructure visibility does not diminish significantly from the southwest and north west direction as the distance from the site increases due to the flat topography of the area. Most of the visibility occurs within 0-2km which results in a **high** visibility impact.

From the receptor visual exposure below, it is clear that there are sensitive receptors i.e. residents located within 0 - 2km, whilst residents, workers and motorists also fall within 2 - 5km, and residents, motorists and tourists within 5 - 10km viewing distance of the proposed surface infrastructure.

Sensitive Receptors

On the immediate site itself north of the N17, there is the Lebohang township extension with a mixture of formal and informal settlement, cow grazing and open fields. While south of the N17 are very distinctive drainage lines, wetlands, dams, farm houses and agricultural and grazing land. Leslie 1C is located directly adjacent the N17 highway which is a travel route that links Gauteng with Swaziland.

Residents directly adjacent to Leslie 1C and high volumes of motorist travelling on the N17 highway within 2km of the proposed operations and within areas of high visual exposure based on the viewshed analysis were regarded as critical view zones against which the visual impact would be evaluated. These are areas where any visual impacts associated with the proposed Leslie 1 C would have the greatest impact on receptors due to the proximity and direct line of sight of towards the proposed development area These receptors were categorised according to the criteria provided in Table 9-64 and the results as below:

Table 9-64: Sensitivity of Receptors Results for Leslie 1C

Sensitivity of Receptors for the proposed Pit BF			
	High (Tourist, Residents)	Moderate (People engaged in sport or recreation, so views are not focused on landscape)	Low (People at work, motorists travelling on the N17 and people who are focused on other activities)
Leslie 1C Surface infrastructure	• Lebohang Residents • Farm residents		• Motorist on N17 and R50 • workers on the farms

The most critical viewpoints were identified as residents of the adjacent farms and the residents from Lebohang within 0-2 km of the proposed development area. These critical viewpoints fall within areas of high visual exposure of the proposed Leslie 1C mine area. The least affected receptors will be motorists travelling on the N17 and the R50 and the workers at chicken farms and cultivated land.

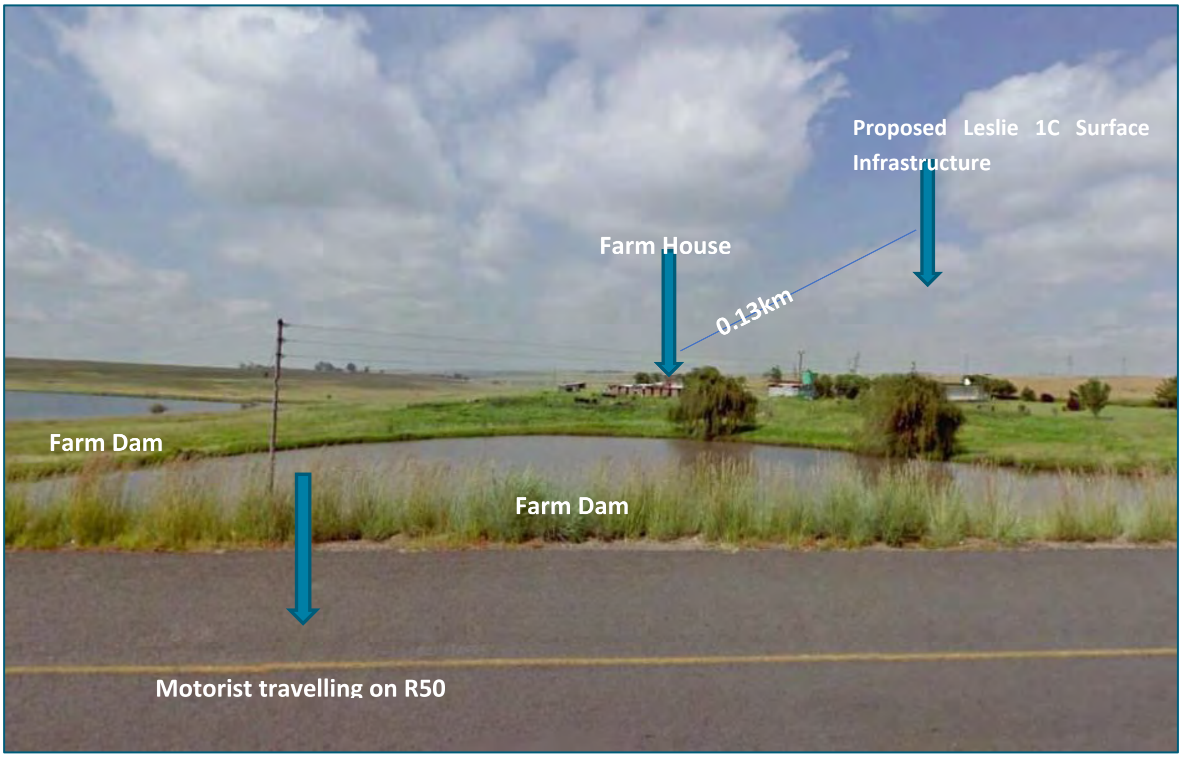


Figure 9-79: View from farm house looking directly northwest approximately 0.13km of the proposed Leslie 1C surface infrastructure (Source *Google earth 2018)*

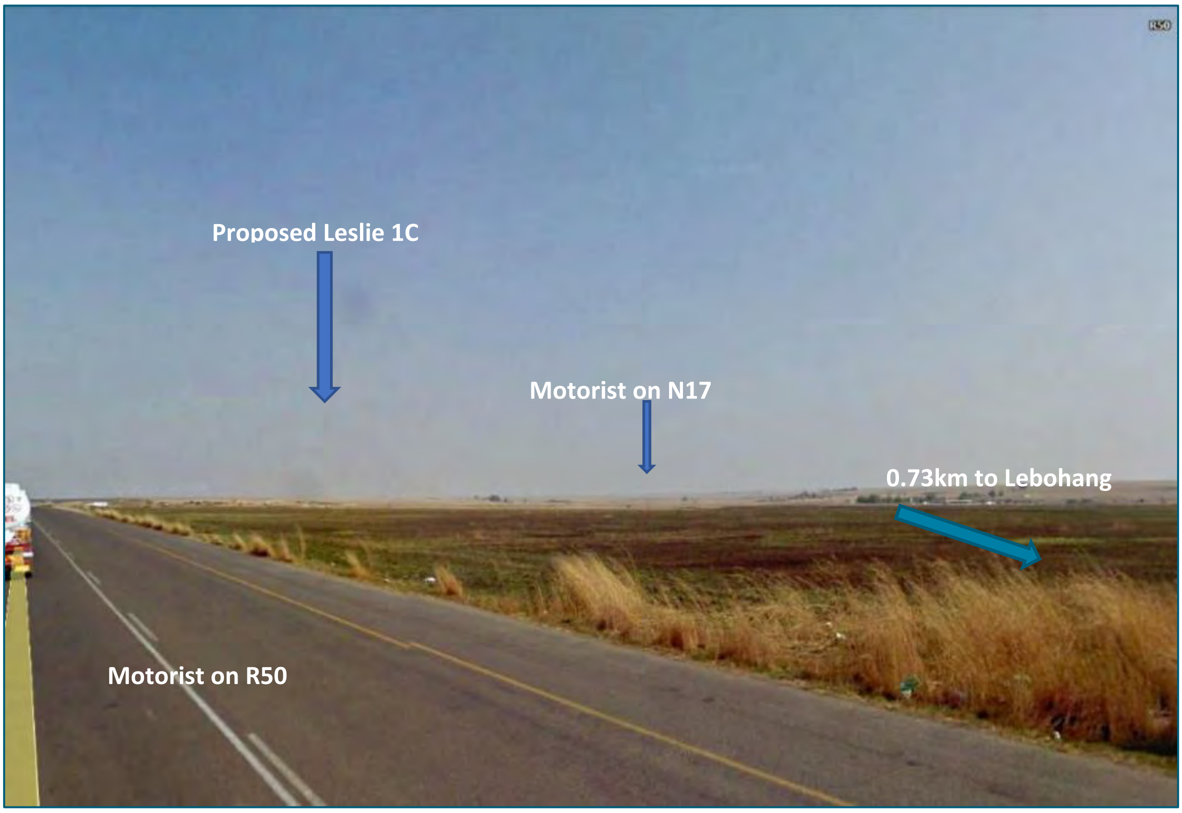


Figure 9-80: View from Lebohang township 0.73km north from the points the picture was taken and motorist driving towards Leslie 1C from Lebohang : Source *Google Earth 2018*

Visual Absorption Capacity

It is apparent that the landscape surrounding the mining operations ability to 'visually absorb' the proposed surface infrastructure area is **moderate - low** due to the following:

- The proposed Leslie 1C site is situated on a uniform landform type with moderate hills surrounding the immediate side;
- The degree of visual screening is low due to the moderate hills and some plain surrounding topography, the absence of mountains and lack of visual screening vegetation with the exception of areas with patches of trees which are likely to be removed in preparation of the development.
- The colour and contrast of the proposed operations is in contrast with the current natural colours of the area.
- The terrestrial environment is already disturbed by activities associated with cultivation and grazing lands, farm houses, and the Lebohang settlement. Most parts of the proposed mine area are still natural grassland with traverses of gravel roads. The surface infrastructure would be entirely alien and invasive from the southwest of the site but would be adding on to existing mines coming from the southeast, such as the Sasol coal mine in Evander situated 10km of the proposed development area.

The landscape therefore has a **moderate to low** visual absorption capacity.

Magnitude

In synthesising the criteria used to establish the magnitude of visual impact, a numerical or weighting system is avoided. This table is arrived at by combining the ratings of each of the sections above (viewshed, viewing distance, visual absorption capacity, and sensitivity receptors). The ratings for each of these criteria are derived from the discussion in the preceding sections. These results are based on worst-case scenarios i.e. (at full size and extent of the proposed mining infrastructure in the operational phase of mining) when the impact of all aspects is taken together. It is evident that the Visual impact expect is **very high**.

Table 9-65: Combination of rating to determine the magnitude of visual impact for Leslie 1C

Magnitude of Visual Impact for Leslie 1C					
	Triggers & Category of Environment	Viewshed Analysis Results	Viewing Distance Results	Sensitive Receptors	Visual Absorption Capacity Results
Proposed Pit BF mine area and associated Infrastructure	**High-** Visual Impact expected	**Moderate-** Visible to <50% of the ZOI	**High** -Sensitive viewers are within <2km of the proposed site	**High** - Includes residents in close proximity to the proposed site	Moderate - Low

9.11.4 Specialist Conclusions

For all the mine areas, visual impacts will result from the construction, operation and closure phase of the proposed mine activities within the proposed development area. Specifically, impacts will result from the excavation and construction of the incline portals, pollution control dams, offices and the proposed mobile plant area (including ancillary activities and surface infrastructure such as ROM stockpiles), in terms of the viewshed, viewing distance and visual absorption capacity on the receiving environment.

The potential visual impact on the residents and motorists will be of moderate significance during the construction phase, moderate - high significance during the operational phase and a moderate - low significance during closure phase. This impact can be reduced to a low significance during the closure phase by adhering to the recommended mitigation measures, a potentially a positive impact post-closure when all surface infrastructure and associated activities have been rehabilitated. Whilst tourism activities exist in the region, no major impacts are expected on the tourism industry as there are no major tourism attractions within 5-10km of the proposed mine areas.

9.12 Traffic

A Traffic Impact Assessment was undertaken by WSP for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D11.

9.12.1 Environmental Status Quo

The functional road hierarchy plan is shown on Figure 9-81. Based on the GSDM Spatial Development Framework, 2014, the surrounding road network is classified as follows:

- **National Roads:** The N17 is classified as a National Road. The N17 falls under the jurisdiction of the South African National Roads Agency (SANRAL). It can be classified as a Class 1 Principal arterial (Freeway). The road borders Leslie 1C to the north. The road exists as a single lane per direction. It forms an interchange with the R50.
- **Main Roads**: The R50, R29 and R580 roads are classified as Main Roads.
  - R50: The R50 falls under the jurisdiction of the Mpumalanga Province Department of Roads and Transport. It can be classified as a Class 2 Major arterial. The road transverse Leslie 1A to the centre and Leslie 1C to the east. The road exists as a single lane per direction. The R50 forms the following intersections in the study area:
    - It forms an interchange with the N17;
    - It forms a 4-legged, 2-way stop controlled (2WSC) intersection with the R29 (Norda Street); and
    - It forms a 3-legged, 2WSC intersection with R580.
  - R29: The R29 falls under the jurisdiction of the Govan Mbeki Local Municipality. It can be classified as a Class 3 Minor arterial. The road exists as a single lane per direction. It forms a 4-legged, 2WSC intersection with the R50.

- R580: The R580 falls under the jurisdiction of the Govan Mbeki Local Municipality. It can be classified as a Class 3 Minor arterial. The road exists as a single lane per direction. The R580 forms the following intersections in the study area:
  - It forms a 3-legged, 2WSC intersection with the R50; and
  - It forms a 4-legged, 2WSC intersection with the Unnamed Road.

❖ **Local Roads**: The Unnamed Road is classified as a Local Road. The Unnamed Road falls under the jurisdiction of the Govan Mbeki Local Municipality. It can be classified as a Class 4 Collector street (commercial). The road borders Leslie 1A to the east. The road exists as a single lane per direction. The Unnamed Road forms the following intersections in the study area:
- It forms a 3-legged, 2WSC intersection with the R29; and
- It forms a 4-legged, 2WSC intersection with the R580.

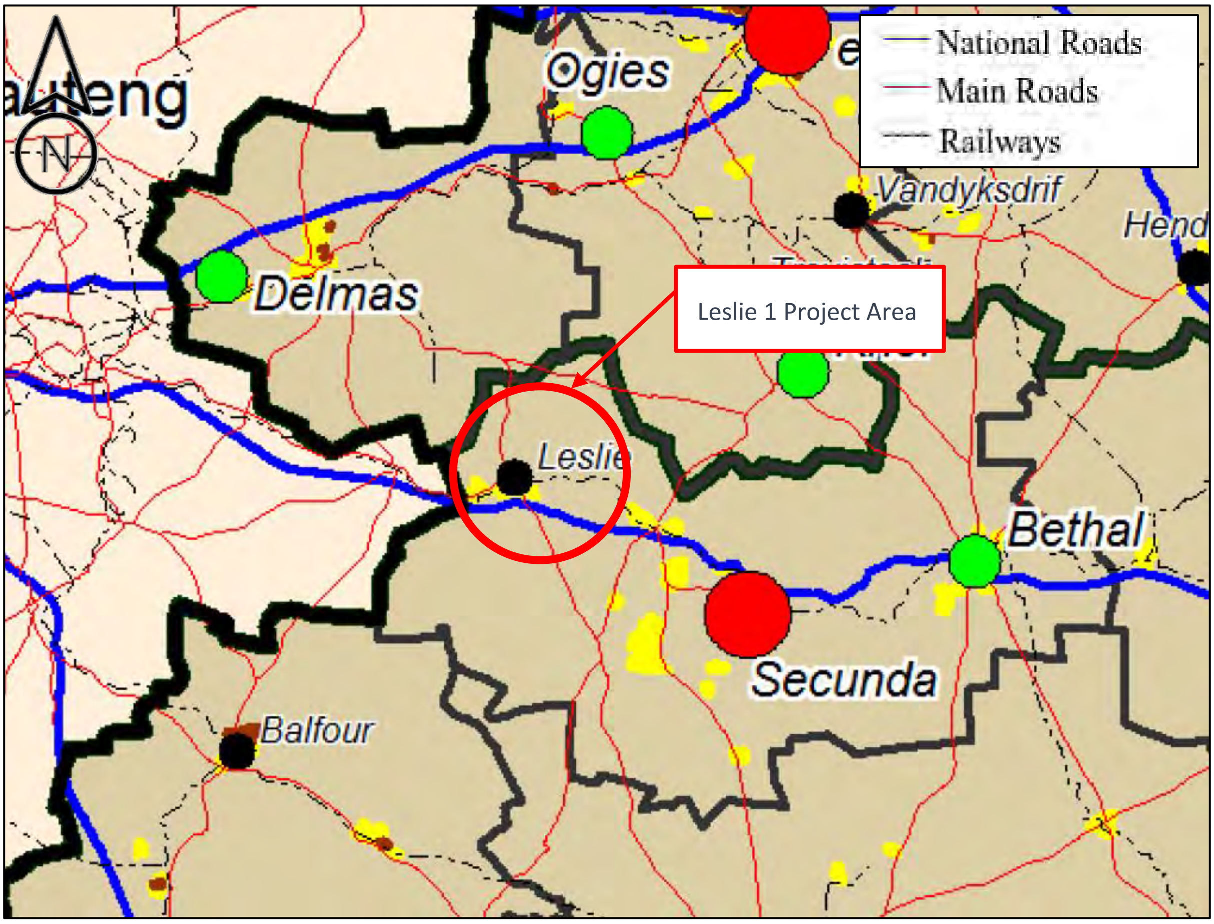


Figure 9-81: Road Hierarchy Plan

9.12.1.1 Strategic Road Network

Based on the Mpumalanga Province – Provincial Road Network Inventory – Strategic Network, 2016 (Figure 9-82) the following roads adjacent to the mining infrastructure fall within the 'Strategic Network':

❖ R50;
❖ R29 (Norda Street);
❖ R580; and

❖ Unnamed Road.

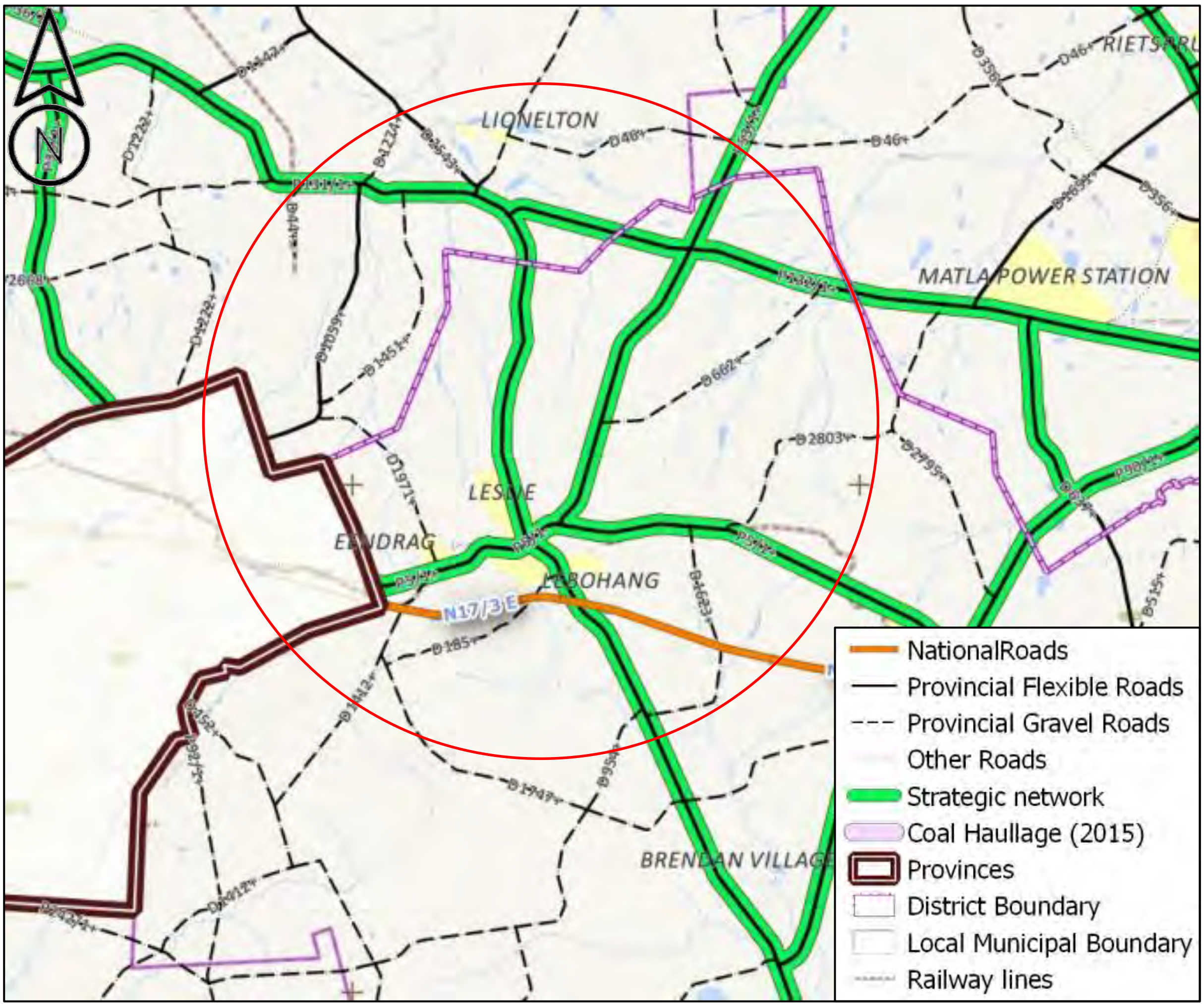


Figure 9-82: Strategic Road Network

9.12.1.2 Coal Haulage Routes

Based on the Mpumalanga Province – Provincial Road Network Inventory – Strategic Network, 2016 (Figure 9-83) the following roads adjacent to the mining infrastructure are coal haulage routes:

❖ N17;
❖ R50;
❖ R29 (Norda Street);
❖ R580; and
❖ Unnamed Road.

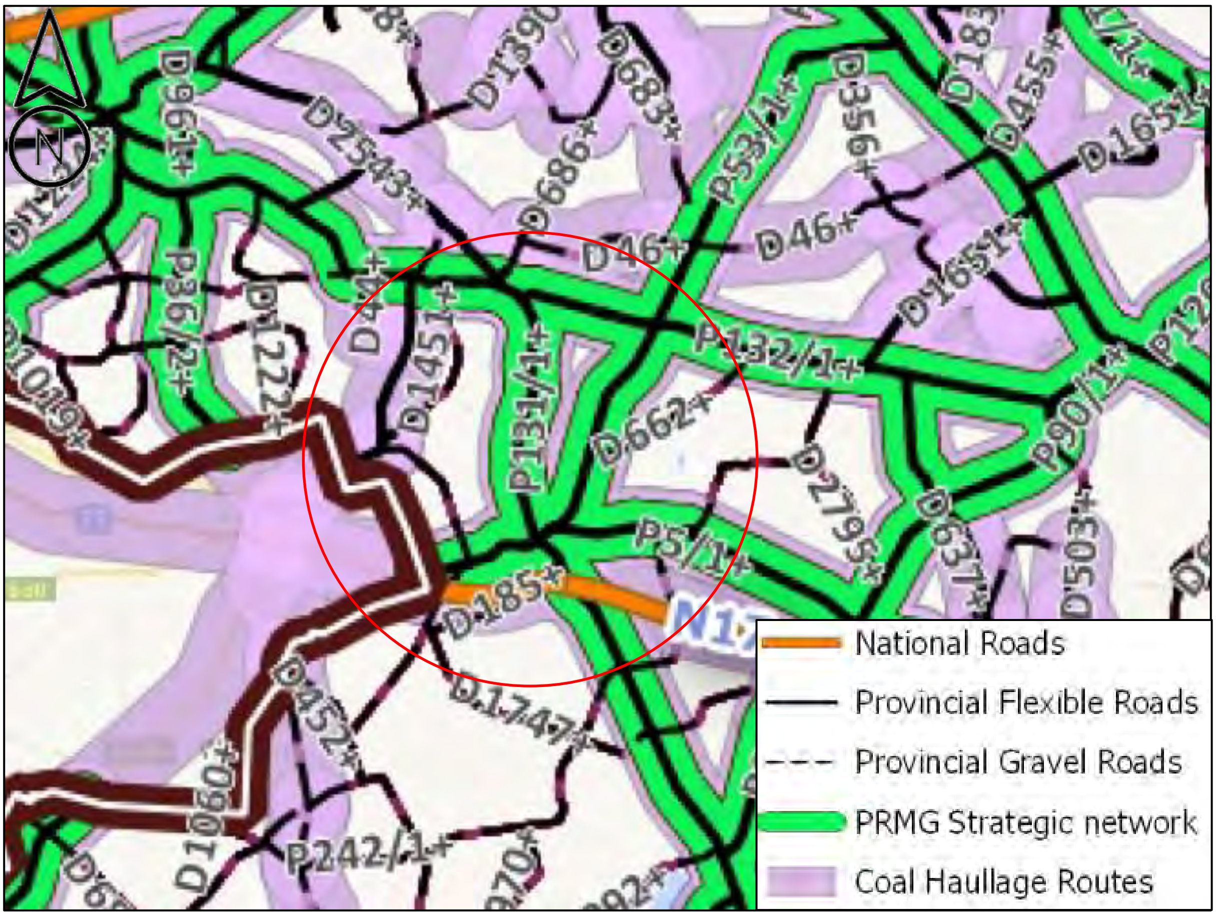


Figure 9-83: Coal Haulage Routes

9.12.1.3 Road Conditions

Based on the Mpumalanga Province - Provincial Road Network Inventory - Condition Index, 2015/2016 (Figure 9-84) the conditions of the road network adjacent to the mining infrastructure is as follows:

- R50: The condition of the R50 varies from "Very Good" condition at the southern side to "Fair" at the northern side.
- R29 (Norda Street): The R29 condition varies from "Good" to "Poor", where it continues from the provincial boundary of Gauteng Province; otherwise it is "Fair" towards the eastern side.
- R580: The R580 condition varies from "Fair" to "Very Poor".
- Unnamed Road: The Unnamed Road condition varies from "Poor" to "Very Poor".

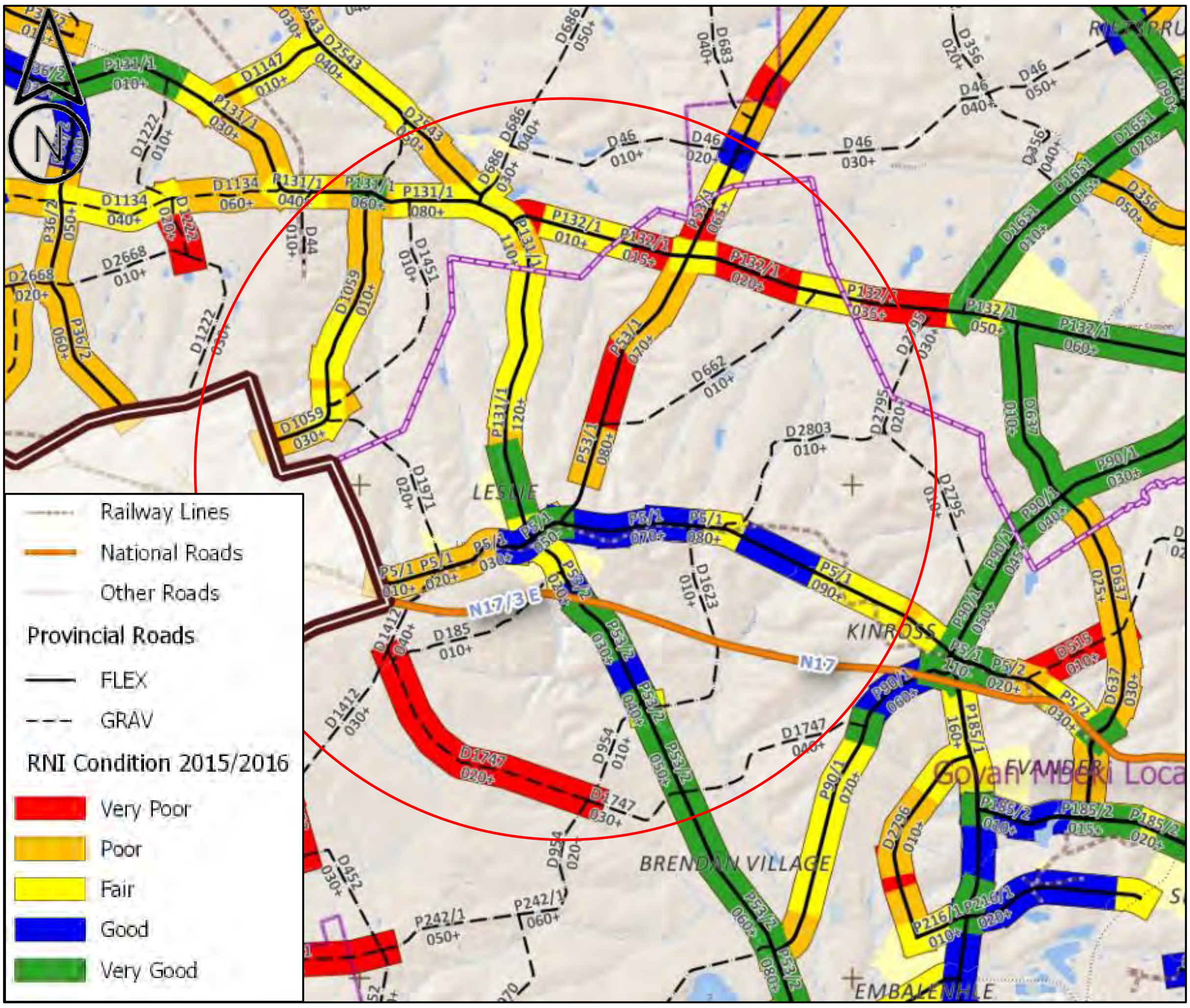


Figure 9-84: Road Conditions map

9.12.1.4 Planned road upgrades

The GSDM has identified potential development along the N17/N2 corridor between Leandra and Piet Retief. The map showing the extent of the development corridor is shown on Figure 9-85.

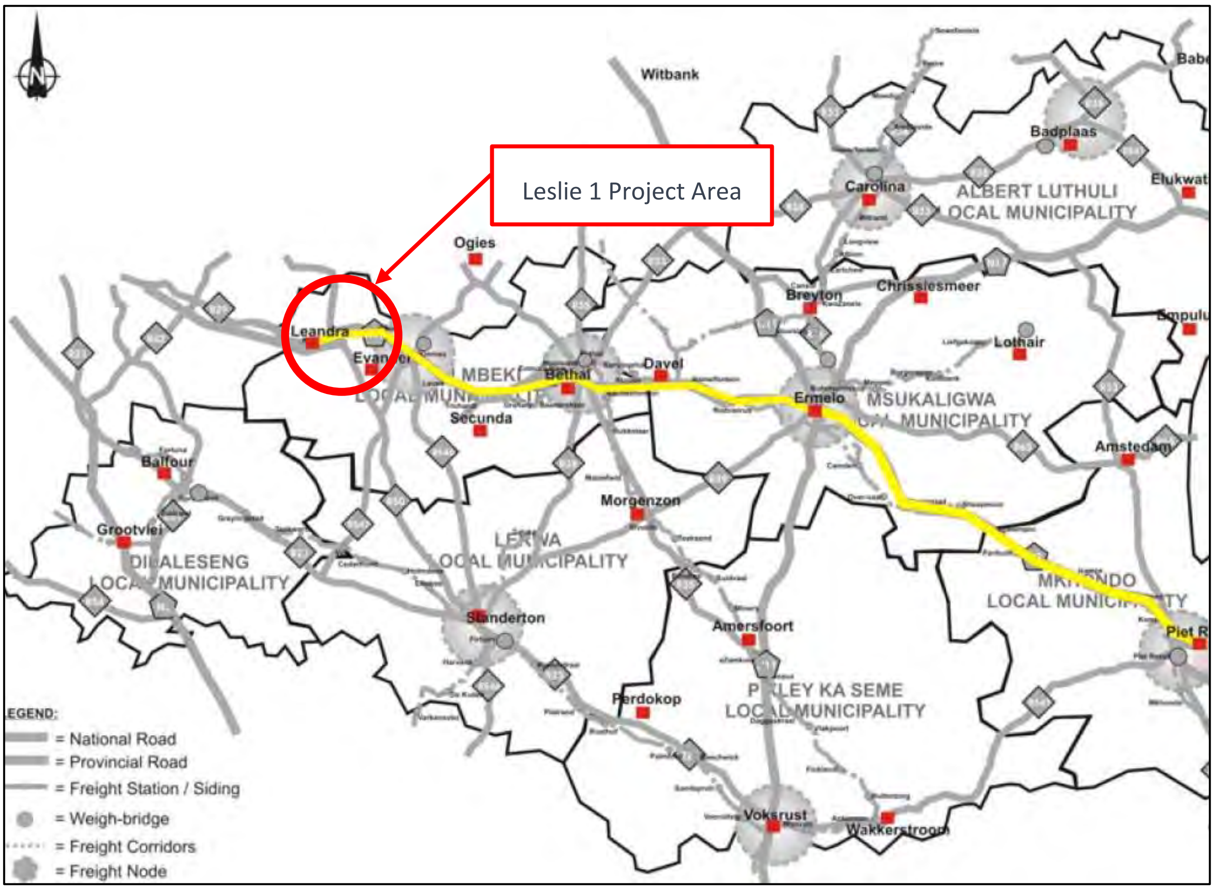


Figure 9-85: N17/ N2 Development Corridor

9.12.1.5 Public Transport

Based on the Govan Mbeki Spatial Development Framework, 2014-2034 public transport is road based and centres on two systems, namely bus transport and minibus taxi transport centred on mainly the urban centres and mines.

The low rural population densities within the municipality make public transport services in these areas uneconomical. The disadvantaged rural communities are not only the poorest and the farthest away from existing social facilities and economic opportunities, but are also the most immobile because of this problem.

Bus services

Mega Bus is concentrated around the work opportunities offered by Sasol and to provide subsidised public bus transport service from Bethal, Trichardt, Secunda, Evander, Embalenhle (Springbokdraai on drawing), Kinross and Leslie/Leandra.

Mega Bus (Unitrans Passenger (Pty) Ltd T/A Megan Bus & Coach) is operating services mainly around Secunda (Sasol) utilizing 101 buses of which approximately 77 are subsidized. The majority of routes operated by Mega Bus includes:

- Bethal/Secunda/Evander/Sasol
- Sasol Internal
- Embalenhle/Sasol
- Kinross/Evander/Sasol
- Leslie/Evander/Winkelhaak/Secunda/Sasol/Trichardt
- Secunda/Sasol

9.12.1.6 Traffic Volumes

The current 2018 peak hours at the key intersections where the mine trucks and personnel will potentially use are shown in Table 9-66.

Table 9-66: Morning and Afternoon Peak Hour Volumes for each Intersection

Intersections	AM Peak		PM Peak	
	Peak Hour	Traffic Volumes	Peak Hour	Traffic Volumes
R50/ R580	06:15 – 07:15	396	15:15 – 16:15	283
R50/ R29	07:00 – 08:00	877	16 :00 – 17:00	1345
N17/ R50 Off-ramp	06:00 – 07:00	171	16 :15 – 17:15	244
N17/ R50 On-ramp	06:00 – 07:00	149	16 :30 – 17:30	237

9.12.2 Specialist Assessment Methods

9.12.2.1 Site Investigations

A site visit was held on Thursday, 17 May 2017 to observe and confirm the layouts of the existing road geometry; existing pavement conditions; the signage; public transport and non-motorised transport (NMT) facilities; and traffic patterns.

9.12.2.2 Traffic Demand Estimation

Where elements of the transportation system within the study area have been identified that may be affected by traffic demand and may not meet capacity requirements, including environmental capacity requirements for residential and other sensitive areas, as specified in the Traffic Assessment Standards and Requirements Manual (COTO, 2012), traffic demand must be estimated for such elements.

The traffic demand was done for Leslie 1A only. It is anticipated that the access portal will be established in Year 1 (Y1), while the incline shaft and infrastructure will be established in the course of Y1 and Year 2 (Y2) at Leslie 1A. The first operation would commence at the Leslie 1A East-block. Production from the underground sections will commence during the course of Year 2 (Y2).

The second operation will be towards the west of the Leslie 1A block (West-block). The establishment of the portal will commence in Year 6 (Y6), and underground production will commence in Year 7 (Y7).

The Leslie 1 Project will relocate to Leslie 1C as the reserves in Leslie 1A reach a point of depletion. Thereafter the reserves of Leslie 1D, 1E and finally 1B will be extracted. The decline in production will commence in Year 32 (Y32) when the underground sections will reduce production as the reserve is depleted.

9.12.2.3 Capacity Analysis

In order to determine the expected traffic impact as a result of the proposed development, capacity analyses were carried out using the SIDRA Intersection 7.0 traffic engineering software program.

9.12.3 Specialist Findings

9.12.3.1 Access

Based on the South African Road Classification and Access Management Manual (COTO, 2012), the access spacing requirements are shown in Table 9-67.

Access to Leslie 1A will be gained from the following proposed access roads at a 4-way intersection:

- Access road for light vehicles only is to join the R50 to the West Block; and
- Access road for light and heavy vehicles is to join the R50 to the East Block.

Table 9-67: Access Requirements for Leslie 1A Access Roads

Road Name	COTO Requirements		Proposals		
	Class	Intersection spacing	Road Access	Spacing	Comment
R50	Class 2 Major arterial	800 m (± 15%)	4-way intersection Access to: ❖ West Block (for light vehicles only) ❖ East Block (for light and heavy vehicles)	± 5.5 km from R580	The proposed 4-way access roads to the West and East Blocks is adequate based on COTO requirements.

Access to Leslie 1C will be gained from the R50 via the proposed light and heavy vehicle access road, at a T-junction intersection.

Table 9-68: Access Requirements for Leslie 1C Access Roads

Road Name	COTO Requirements		Proposals		
	Class	Intersection spacing	Road Access	Spacing	Comment
R50	Class 2 Major arterial	800 m (± 15%)	T-junction access road for	± 1.4 km from R580	The proposed 4-way access roads to the

Road Name	COTO Requirements		Proposals		
	Class	Intersection spacing	Road Access	Spacing	Comment
			light and heavy vehicles		West and East Blocks is adequate based on COTO requirements.

9.12.3.2 Total Traffic

Leslie 1A

The trip distribution for mining staff is based on the locality of the close townships to the mining infrastructure within Govan Mbeki Local Municipality. All townships are located south of Leslie 1A, based on the existing taxi routes. It is rational to assume the trips will be travelling via the R29 to the R50.

Access to trucks will only be to the East Block. In 2029, once the West Block is in operation, the coal will be transported to the East Block via conveyor, where trucks will load. The total development trips for the is obtained by adding the truck trips with the staff trips together.

- 2022 TOTAL TRIPS (2022 HORIZON YEAR + 2022 TOTAL MINE TRIPS)
  - Based on the mining schedule, the East Block will start production and delivery to power stations in year 2022 (Y2).
  - The 2022 weekday morning and afternoon peak hour total trips were added to the 2022 projected future peak hour traffic volumes to obtain the 2022 total future (design) weekday morning and afternoon peak hour expected traffic volumes.
- 2027 TOTAL TRIPS (2027 HORIZON YEAR + 2022 TOTAL MINE TRIPS)
  - The 2022 weekday morning and afternoon peak hour total trips were added to the 2027 projected future peak hour traffic volumes to obtain the 2027 total future (design) weekday morning and afternoon peak hour expected traffic volumes.
- 2029 TOTAL TRIPS (2029 HORIZON YEAR + 2029 TOTAL MINE TRIPS)
  - Based on the mining schedule, the West Block will start production and delivery to power stations in year 2029 (Y7). Access to trucks will only be to the East Block. In 2029, once the West Block is in operation, the coal will be transported to the East Block via conveyor, where trucks will load for transportation.
  - The 2022 weekday morning and afternoon peak hour total trips were added to the 2027 projected future peak hour traffic volumes to obtain the 2027 total future (design) weekday morning and afternoon peak hour expected traffic volumes

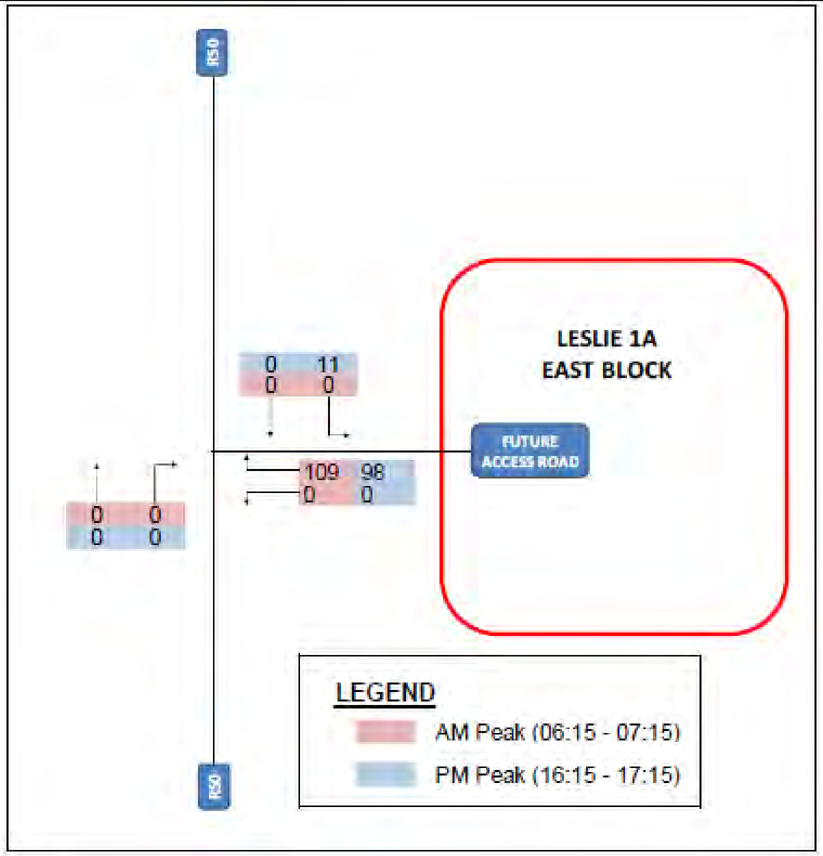
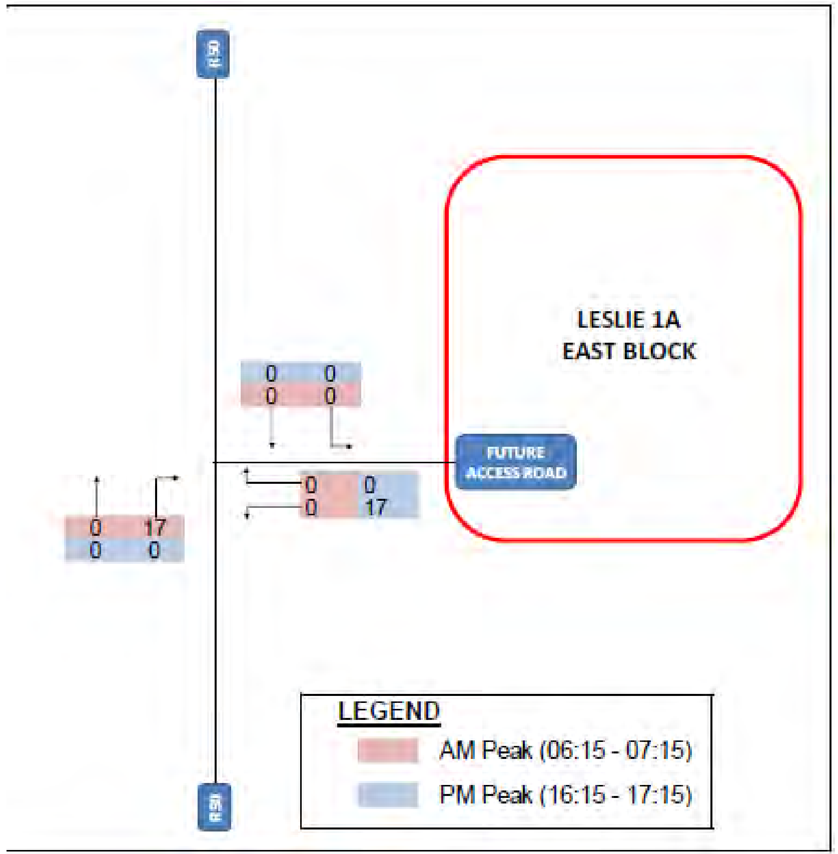
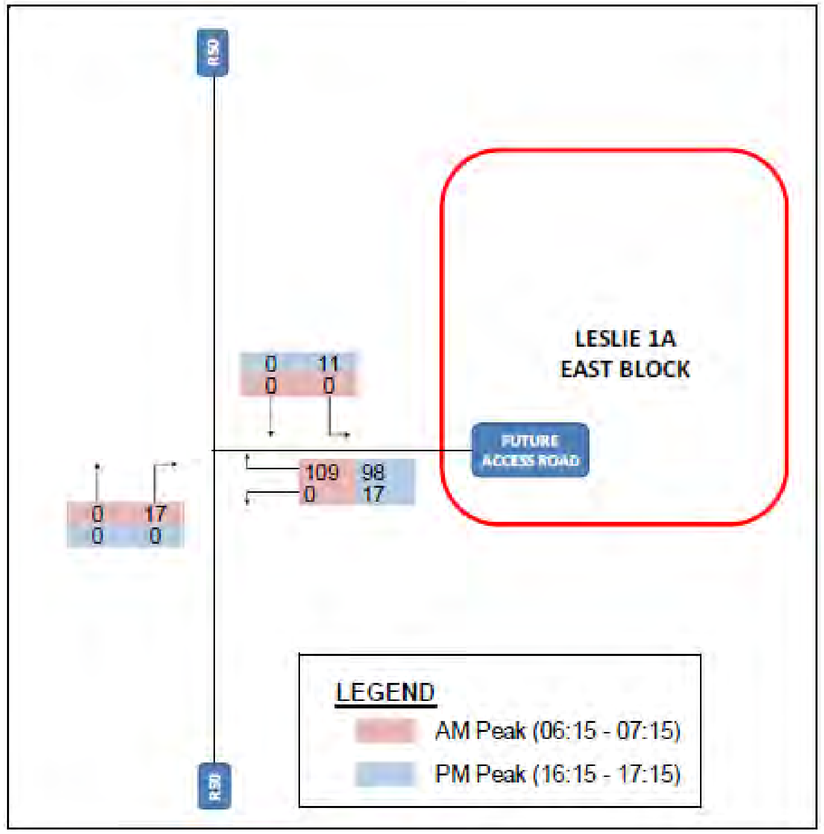
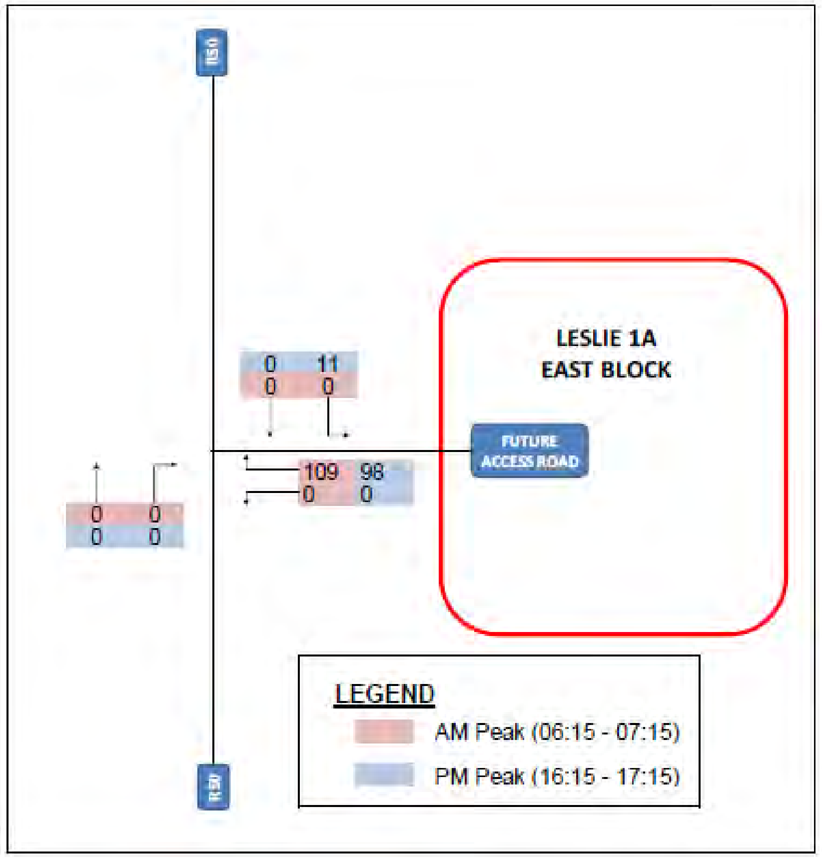
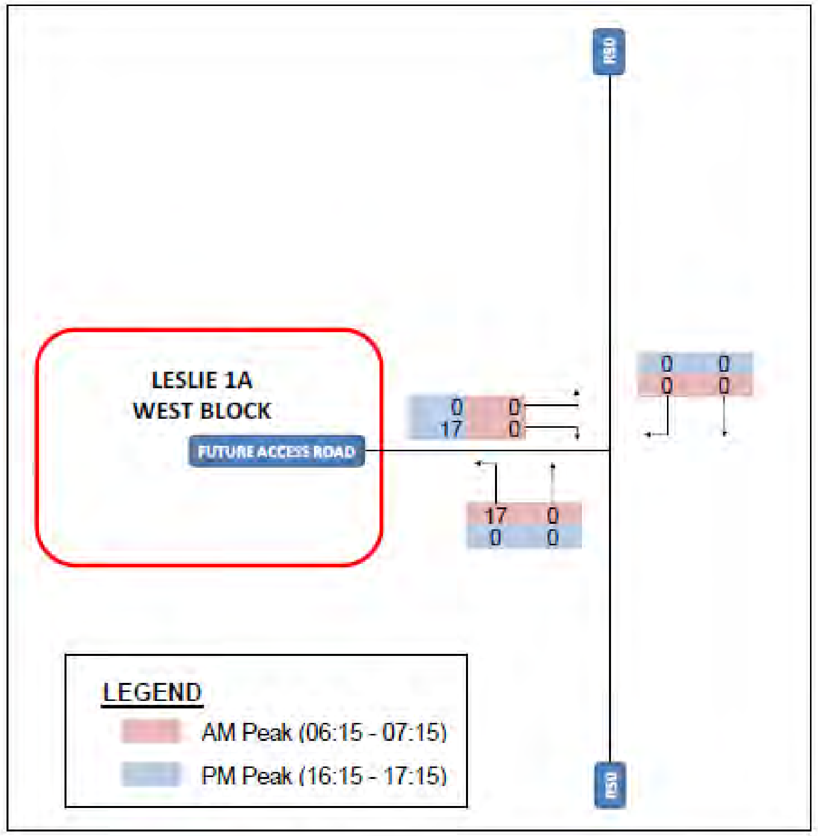
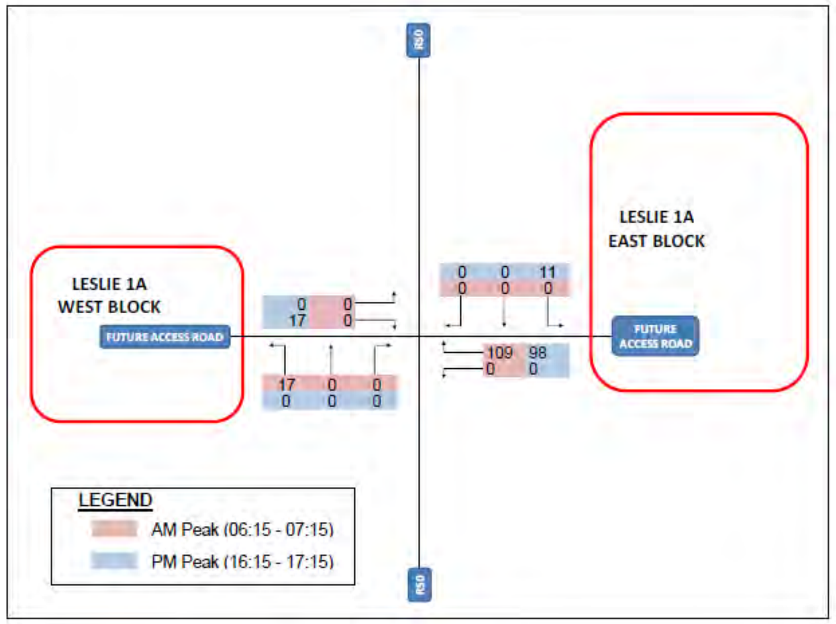
	Truck trips	Staff Trips	Total Trips
Year 2022			
Year 2029			

Figure 9-86: Development Trips for Leslie 1A

9.12.3.3 Capacity analysis

Leslie 1A

The following scenarios were analysed for this key intersection:

- 2022 total weekday morning and afternoon trips;
- 2027 total weekday morning and afternoon trips; and
- 2029 total weekday morning and afternoon trips.

Based on the results, the proposed accesses are adequate for the proposed mining development. Therefore, good operations can be expected.

Table 9-69: Performance summary of R50 Leslie 1A West Block Access

Scenario	Peak	v/c	Average Delay (sec)	LOS	Comments
2022 Total Traffic	AM	0.215	4.3	N/A*	The AM and PM performance of the access/ intersection is satisfactory
	PM	0.206	4.1	N/A*	
2027 Total traffic	AM	0.223	4.2	N/A*	The AM and PM performance of the access/ intersection is satisfactory
	PM	0.215	4.	N/A*	
2029 Total traffic	AM	0.266	4.5	N/A*	The AM and PM performance of the access/ intersection is satisfactory
	PM	0.250	4.4	N/A*	

*Note: N/A: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

9.12.4 Specialist Conclusions

The Traffic impact study indicates that:

- The proposed accesses are adequate for the proposed mining development.
- Based on the poor road conditions identified along the key roads network, a road rehabilitation is required by the Govan Mbeki Local Municipality or the affected Authority.
- Based on the status of the mining project, it is recommended that a secondary Traffic Impact Assessment report be conducted before commencement of the design of the roads and transport

related mining infrastructure, as well as an updated report prior to the start of Leslie 1B, 1C, 1D and 1E.

9.13 Heritage and Palaeontology

A Heritage Impact Assessment and Palaeontology Impact Assessment were undertaken by PGS Heritage for the Leslie 1 Project. The sections included herewith are extracted from these report and the full reports are provided in Appendix D12 and Appendix D13 respectively.

9.13.1 Environmental Status Quo

9.13.1.1 Archaeological History

The archaeological background is presented in Table 9-70 below.

Table 9-70: Archaeological Background

Date	Description
2.5 million to 250 000 years ago	The Earlier Stone Age (ESA) is the first phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates to approximately 1.5 million years ago. No Early Stone Age sites are known in the vicinity of the study area. However, this is probably due more to a lack of research on the surroundings of the study area rather than a lack of sites.
250 000 to 40 000 years ago	The Middle Stone Age (MSA) is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique. A Middle Stone Age site is known from Primrose Ridge in Germiston (Harcus, 1945), as well as two sites near Brakpan (Gaigher, 2013). However, no Middle Stone Age sites are known in the direct vicinity of the study area. However, this is probably due to a lack of research on the surroundings of the study area rather than a lack of sites.
40 000 years ago, to the historic past	The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. No Later Stone Age sites are known in the vicinity of the study area. However, this is in all likelihood rather due to a lack of research focus on the surroundings of the study area than a lack of sites.
AD 1450 – AD 1650	The Uitkomst facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the first Iron Age period to be identified for the surroundings of the study area. This facies can likely be dated to between AD 1650 and AD 1820. The decoration on the ceramics associated with this facies is characterised by stamped arcades, appliqué of parallel incisions, stamping, as well as cord impressions, and is described as a mixture of the characteristics of both Ntsuanatsatsi (Nguni) and Olifantspoort (Sotho). The Uitkomst facies (with the Makgwareng facies) is seen as the successor to the Ntsuanatsatsi facies. The Ntsuanatsatsi facies is closely related to the oral histories of

Date	Description
	the Early Fokeng and represents the earliest known movement of Nguni people out of Kwazulu-Natal into the inland areas of South Africa. In terms of this theory, the Bafokeng settled at Ntsuanatsatsi Hill in the present- day Free State Province. Subsequently, the BaKwena lineage broke away from the Bahurutshe cluster and crossed southward over the Vaal River to come in contact with the Bafokeng. As a result of this contact, a Bafokeng-Bakwena cluster was formed, which moved northward and became further 'Sotho-ised' by coming into increasing contact with other Sotho-Tswana groups. This eventually resulted in the appearance of Uitkomst facies type pottery which contained elements of both Nguni- and Sotho-Tswana speakers (Huffman, 2007). No sites associated with the Uitkomst facies are known from the surroundings of the study area.
AD 1700 – AD 1840	The Buispoort facies of the Moloko branch of the Urewe Ceramic Tradition is the next phase to be identified within the study area's surroundings. It is most likely dated to between AD 1700 and AD 1840. The key features on the decorated ceramics include rim notching, broadly incised chevrons and white bands, all with red ochre (Huffman, 2007). It is believed that the Madikwe facies developed into the Buispoort facies. The Buispoort facies is associated with sites such as Boschhoek, Buffelshoek, Kaditshwene, Molokwane and Olifantspoort (Huffman, 2007). No sites associated with the Buispoort facies are known from the surroundings of the study area.
AD 1821 – AD 1823	After leaving present-day KwaZulu-Natal, the Khumalo Ndebele (more commonly known as the Matabele) of Mzilikazi migrated through the general vicinity of the study area under discussion before reaching the central reaches of the Vaal River in the vicinity of Heidelberg in 1823 (www.mk.org.za). Two different settlement types have been associated with the Khumalo Ndebele. The first of these is known as Type B walling and was found at Nqabeni in the Babanango area of KwaZulu-Natal. These walls stood in the open without any military or defensive considerations and comprised an inner circle of linked cattle enclosures (Huffman, 2007). The second settlement type associated with the Khumalo Ndebele is known as Doornspruit and comprises a layout which, from the air, has the appearance of a 'beaded necklace'. This layout comprises long scalloped walls (which mark the back of the residential area) which closely surround a complex core, which in turn comprises a number of stone circles. The structures from the centre of the settlement can be interpreted as kitchen areas and enclosures for keeping small stock. It is important to note that the Doornspruit settlement type is associated with the later settlements of the Khumalo Ndebele, in areas such as the Magaliesberg Mountains and Marico, and represents a settlement under the influence of the Sotho with whom the Khumalo Ndebele intermarried. The Type B settlement is associated with the early Khumalo Ndebele settlements and conforms more to the typical Zulu form of settlement. As the Khumalo Ndebele passed through the general vicinity of the study areas shortly after leaving Kwazulu-Natal, one can assume that their settlements here would have conformed more to the Type B than the Doornspruit type of settlement. It must be stressed however that no published information could be found which indicates the presence of Type B sites in the general vicinity of the study area.

Date	Description
	No sites associated with this period of the archaeological history of the surroundings of the study area are presently known.
	 *King Mzilikazi of the Matabele. This illustration is by Captain Cornwallis Harris in c. 1838 (www.sahistory.org.za).*
1832	At this time, a Zulu impi of King Dingane moved through the general vicinity of the study area on their way to attack the Matabele of Mzilikazi, who were settled along the Magaliesberg Mountains (Bergh, 1999).
1836	The first Voortrekker parties started crossing over the Vaal River at this time. The earliest Voortrekker party to cross over the Vaal River was the one under the leadership of Louis Trichardt and Johannes Jacobus Janse van Rensburg. Although the exact route followed by the Trichardt-Janse van Rensburg party was not recorded, one suggestion is that they passed through the strip of land in-between the Bronkhorst Spruit in the west and the Wilge River to the east (Bergh, 1999).
1841 – 1850	These years saw the early establishment of farms by the Voortrekkers in the general vicinity of the study area (Bergh, 1999).
1899 – 1902	The South African War took place during this time. No events or activities during the war can be associated with the present study area. However, a number of such events and activities are known from the general vicinity. These will be briefly mentioned in the paragraphs below. Skirmishes or battles from the surrounding landscape include an action between a British force under the command Lieutenant-General J.D.P. French and a Boer commando of some 1 000 men on 23 July 1900. (Changuion, 2001). Another incident occurred during the early morning of 26 December 1900, when a section of the Heidelberg Commando of some 350 men attacked the town of Benoni, as well as some of the gold mines surrounding the town, including the Kleinfontein Mine. The attack was a success, and according to some eye witnesses resulted in 22 British casualties (eight killed and 14 wounded), as well as the capture of three prisoners by the Boer commando (Blake, 2012).

Date	Description
	It is also interesting to note that the Boer Commando used the farm Rietkol as a meeting place from where the attack on Benoni proceeded (Blake, 2012).
1984	During the 1980s, Leandra became a symbol of defiance during one of the most turbulent stages in South Africa's recent history. Forced removals were part and parcel of life for many township residents across the country during that period as a form of control over the people, and Leandra was no exception. Since the 1970s, the old Administration Board had made many attempts to forcibly move the residents of Leandra. While their latest attempt in the early 1980s had only been to move a portion of its residents, the majority of the people of Leandra stood up to the Administration board to halt these forced removals. Under the leadership of the Leandra Action Committee (LAC), the community had resisted these attempts to divide it, by demanding that the entire population be allowed to remain as is. On the 7th June 1984, the Leandra Community and LAC received a letter through their lawyers from the Ministry of Co-operation and Development that they had received a reprieve from the government allowing the community to remain whole. While objectively it was only a small victory, there is no doubt that this small incident could have added momentum to the fast growing movement across the country that eventually overthrew the Apartheid Regime (TRAC, 1985).

9.13.1.2 Previous Archaeological and Heritage Studies around the Study Area

An electronic web search was undertaken to locate information from previous studies and relevant archaeological and historical texts were also consulted. In this regard, the South African Heritage Resources Information System (SAHRIS) was especially helpful (see http://www.sahra.org.za/sahris) . The studies found are listed below:

- Kusel, U.S. 2010. Cultural heritage resources impact assessment for Harmony Gold, Evander. This assessment located memorial sites, initiation sites, burial grounds and structural remains dating from the relatively recent past.
- Van Vollenhoven, A.C. 2017. A report on a cultural heritage impact assessment for additional infrastructure at the Evander Gold Mine, Mpumalanga Province. This assessment located burial grounds and structural remains dating from the relatively recent past.
- Higgitt, N. 2014. Heritage statement for the Onverwacht Prospecting EMP, Onverwacht 97IS, 2629AC Evander, Kinross, Mpumalanga Province. This assessment located historical structures and burial grounds.
- Gaigher, S. 2011. Heritage impact assessment for three alternative sites for the relocation of the Devon Landfill Site. This assessment located no relevant heritage resources.

Spatial analysis findings

A spatial and landscape analysis of the study area was conducted through the analysis of historical maps, topocadastral maps and satellite imagery. The aim was to identify landscape forms, natural features and structures that potentially have heritage significance or have associated features and structures that have heritage significance.

- **Archival and Historic Maps of the Study Area and Surrounding Landscape**

A portion of the First Edition of the 2529DB Topographical Sheet is depicted below. The map was based on aerial photography undertaken in 1958 and was surveyed in 1965 and drawn in 1966 by the Trigonometrical Survey Office. The following observations can be made from the above-mentioned map:

- Several structures occur within the study area, all of which are representative of farming infrastructure.
- Possible heritage features are represented as "huts". Several of these occur in the study area.

For Leslie 1A, four huts can be seen on the eastern side of the area (yellow circles) while several structures and a cattle dipping station can be seen on the same side with a farming compound on the western side (green circles) (Figure 9-87).

For Leslie 1C, four huts can be seen distributed across the study area (yellow circle), as well a farming compound (green circle) (Figure 9-88).

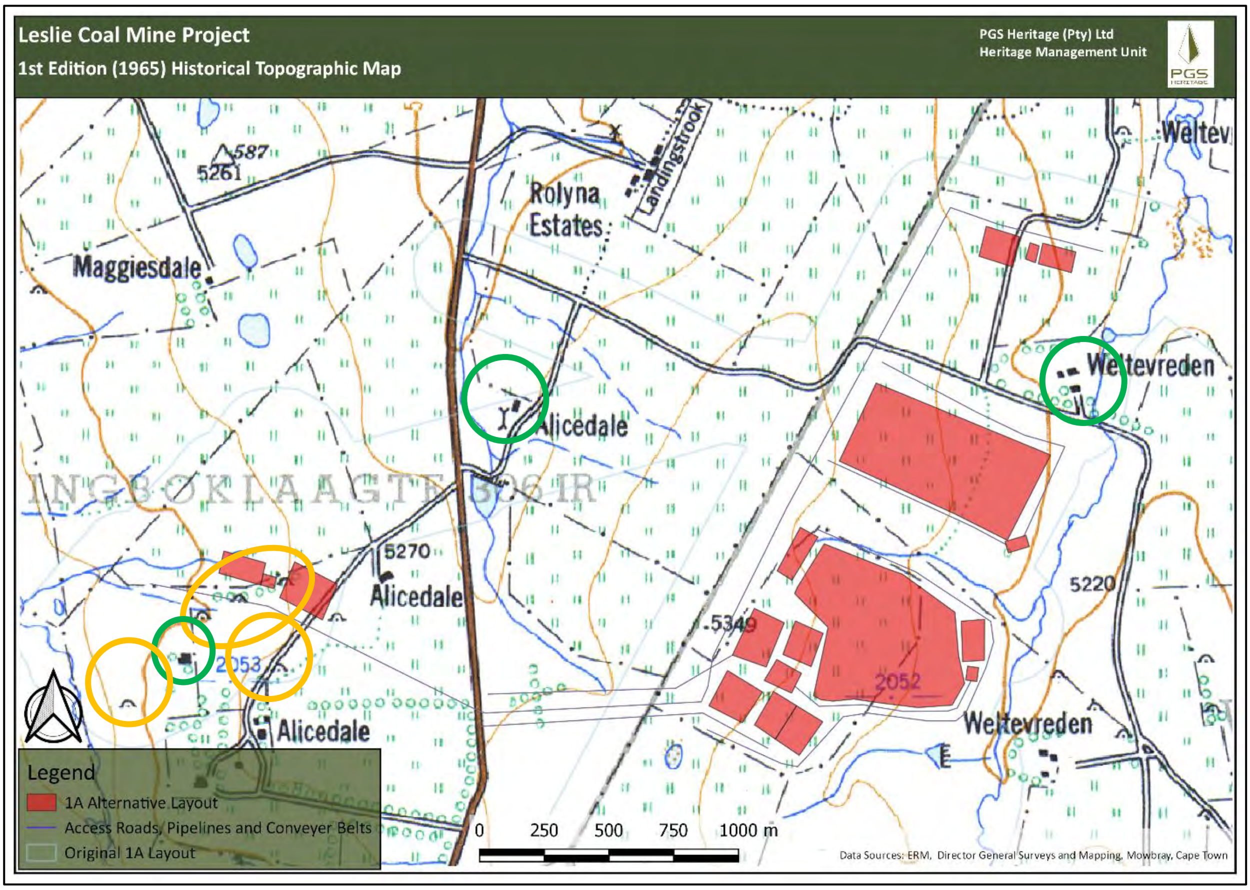


Figure 9-87: Enlarged section of study area 1A showing topographic map features.

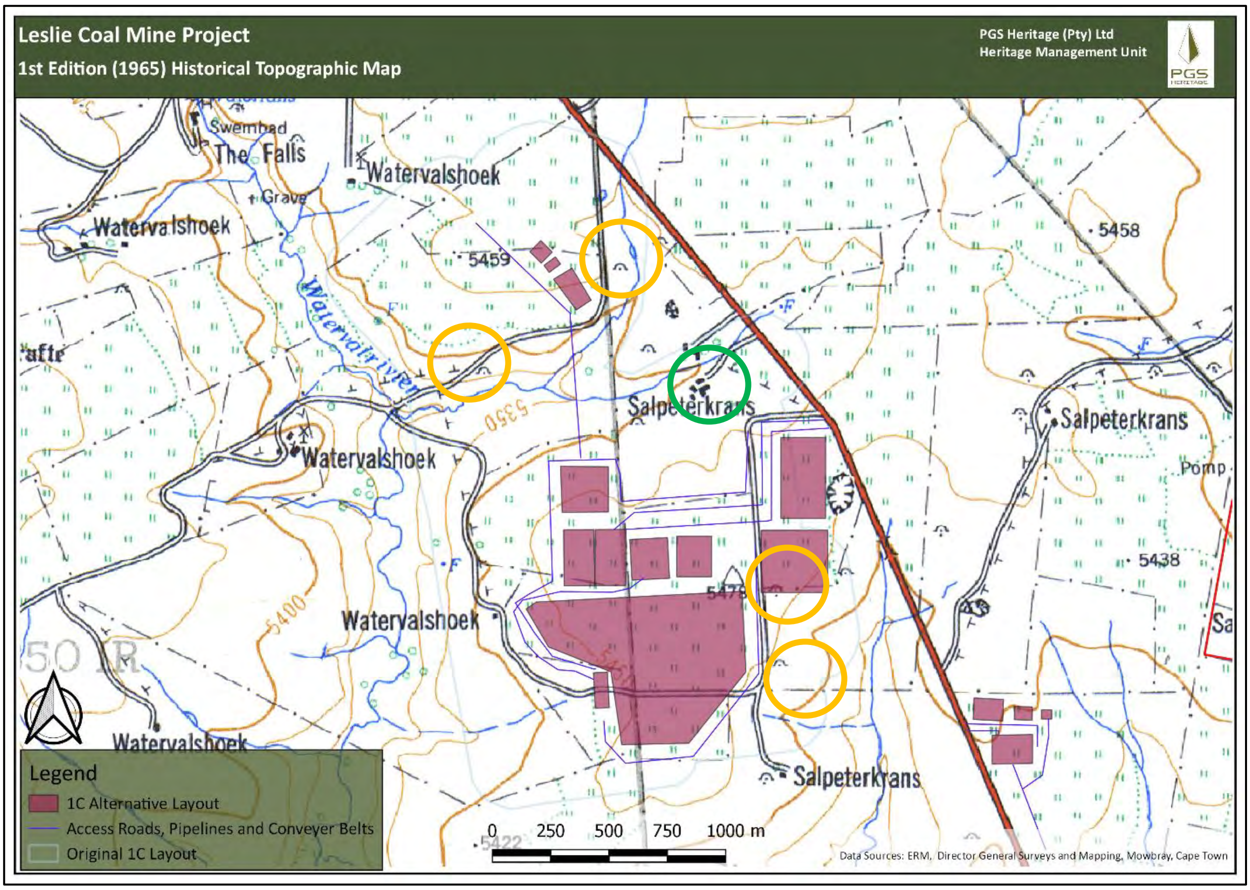


Figure 9-88: Enlarged section of study area 1C showing topographic map features.

❖ **Google Earth satellite imagery analysis**

After the analysis of the historical topocadastral maps had been completed, an analysis of available satellite imagery was undertaken. The aim was to identify man-made structures, as well as landforms that can possibly be associated with settlement patterns of historical people. These landforms guided the focussed fieldwork to assist in the identification of potential heritage resources. Attention was given to distinguish between man-made watering holes and naturally occurring watering holes, as the latter often have associated heritage resources and features (Figure 9-89 and Figure 9-90).

❖ **Heritage sensitivities**

The evaluation of the possible heritage resource finds and their heritage significance linked to mitigation requirements was linked to the types of landform. This enabled the development of a heritage sensitivity map. These landforms do not indicate “no-go” areas, but the possibility of finding heritage significant sites that could require mitigation work (Figure 9-91 and Figure 9-92).

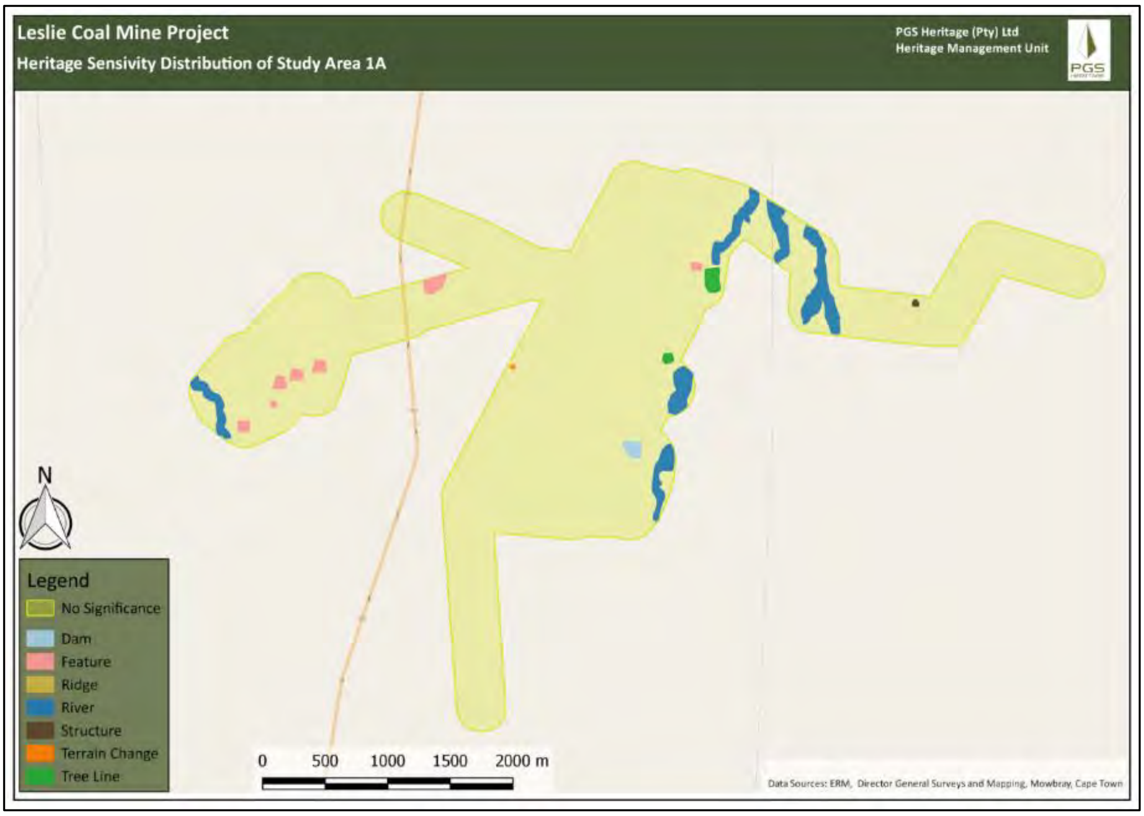


Figure 9-89: Correlation of landforms and structures identified from the aerial photographic analysis in study area 1A

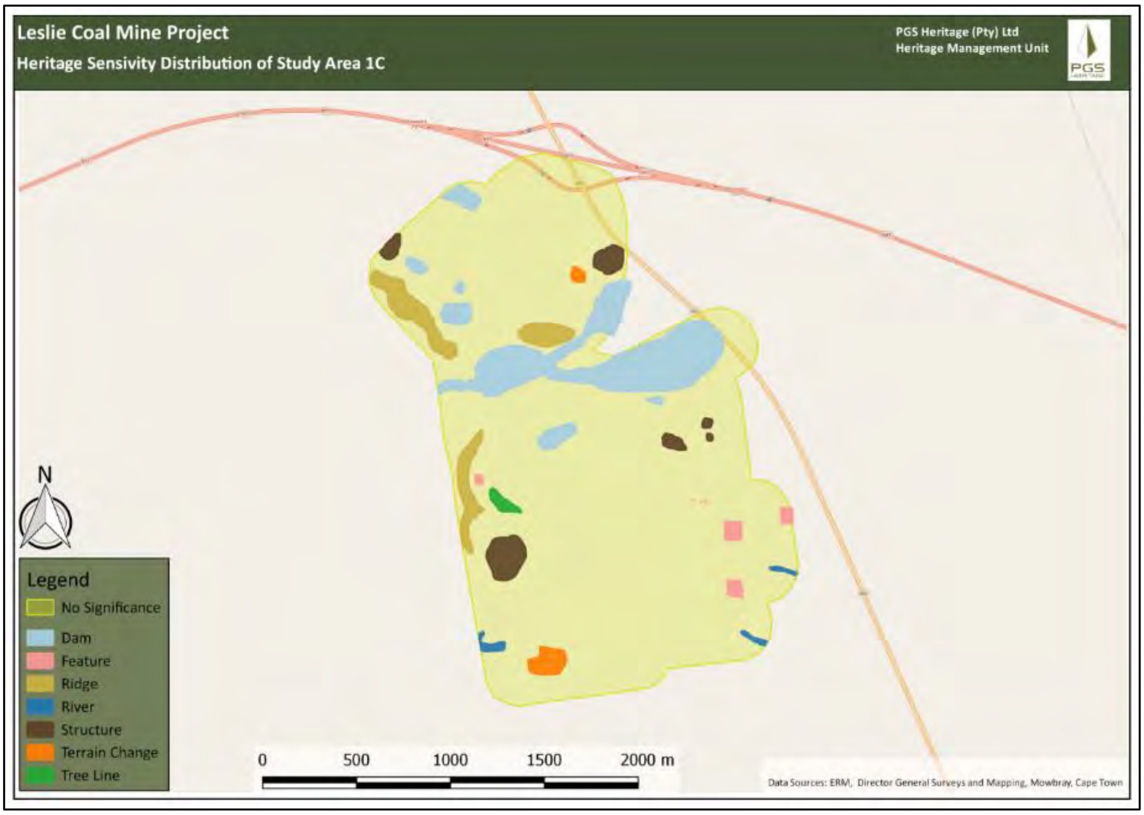


Figure 9-90: Correlation of landforms and structures identified from the aerial photographic analysis in study area 1C

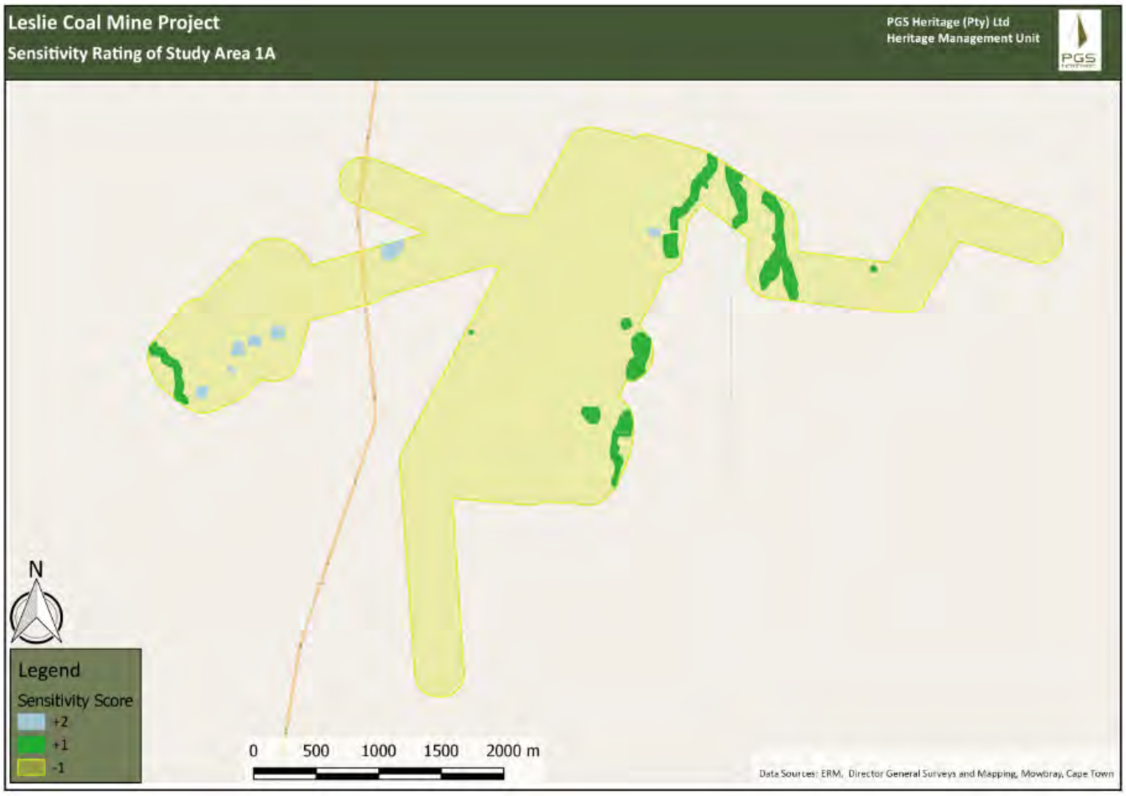


Figure 9-91 Heritage sensitivity score for Area 1A

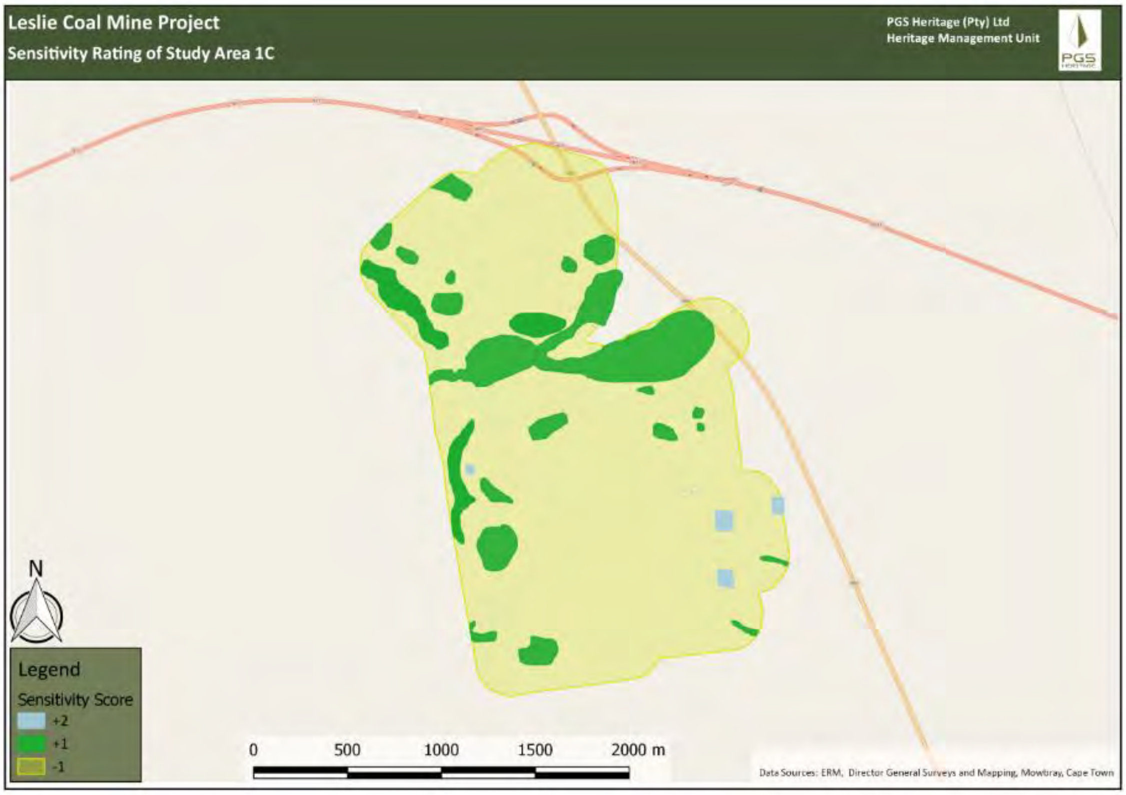


Figure 9-92: Heritage sensitivity score for Area 1C

- **Possible finds**

The evaluation of satellite imagery has indicated areas that may be sensitive from a heritage perspective. The analysis of the studies conducted in the area assisted in the development of the landform type to heritage find matrix.

9.13.1.3 Paleontological History

The proposed Leslie 1 mine development is entirely underlain by Permian aged sedimentary rocks of the Vryheid Formation, (Ecca Group, Karoo Supergroup) and Jurassic aged Karoo Dolerite.

Vryheid Formation

The Vryheid Formation (Ecca Group) is world renowned for the occurrence of coal beds formed by the accumulation of plant material over long periods of time. Bamford (2011) described numerous plant fossils from this formation (e.g. Azaniodendron fertile, Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Hirsutum sp., Scutum sp., Ottokaria sp., Estcourtia sp., Arberia sp., Lidgetonnia sp., Noeggerathiopsis sp., Podocarpidites sp as well as more than 20 Glossopteris species).

Bamford (2011) is of the opinion that only a small amount of data have been published on these potentially fossiliferous deposits and that most likely good material are present around coal mines and in other areas the exposures are poor and of little interest. When plant fossils do occur they are usually abundant. According to Bamford it is not feasible to preserve all the sites but in the interests of science these sites ought to be well documented, researched and the collected fossils must be housed in an accredited institution.

The Vryheid Formation is also characterised by its trace fossil assemblages of the non-marine Mermia Ichnofacies, insect fossils track ways, fish and small crustaceans. The Mesosaurus reptile may also be present

9.13.1.4 Stakeholder Engagement

The current stakeholder engagement process has identified three sets of graves and an initiation site located of the farm Watervalshoek. The one set of graves was confirmed during the fieldwork phase of the HIA, however the two other sets of graves and the initiation site fell outside of the purview of the study area and were not located during the fieldwork phase. Coordinates of these other sites are known and are represented.

9.13.2 Specialist Assessment Methods

The HIA process consists of three steps:

- Step I – Literature Review and initial site analysis: The background information to the field survey relies greatly on the Heritage Background Research, which was undertaken through archival research and evaluation of aerial photography and topographical maps of the study area.

- Step II – Physical Survey: A physical survey was conducted on foot through the proposed project area by two qualified archaeologists and heritage specialists (10-13th April 2018), aimed at locating and documenting sites falling within and adjacent to the proposed surface development footprints. A buffer area around the surface development footprint was also surveyed.
- Step III – The final step involves the recording and documentation of relevant heritage resources identified in the physical survey, the assessment of these resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

9.13.3 Specialist Findings

9.13.3.1 Archaeology

During the survey 28 heritage resources sites were identified. The identified sites are described in the table below (Table 9-71).

Figure 9-93: Distribution of heritage resources on Area 1A

Figure 9-94 - Distribution of heritage resources on Area 1B

Figure 9-95 - Distribution of heritage resources on Area 1C

Table 9-71: Heritage resources identified

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Infrastructure</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td>LES001</td><td>S26.29508°</td><td>E28.90688°</td><td>1A</td><td>Burial site consisting of a single grave that is apparently a child from a Jewish family according to the owner of the property, Mr Saaiman. However, the grave is marked with a cross, which is associated with Christianity. The grave is at least 50-60 years old as it existed when the owner's grandfather bought the farm. Site extent: 5x5m. Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.</td><td>High</td><td>GP.A</td></tr>
<tr><td colspan="7">
Burial site at LES001, single grave</td></tr>
<tr><td>LES002</td><td>S26.28972°</td><td>E28.90321°</td><td>1A</td><td>Burial ground consisting of 60-70 graves. It is still being visited by at least one family according to the property owner, Mr Saaiman. The burial ground is overgrown with vegetation and many of the headstones and dressings are deteriorated to varying degrees. There is also no demarcation or fencing present. The oldest grave with a known burial date is from 1958.
Site extent: 30x10m</td><td>High</td><td>GP.A</td></tr>
</table>

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Infrastructure</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td colspan="5">
Burial site at LES002, showing overgrown nature of burial ground</td><td colspan="2">
Example of headstone</td></tr>
<tr><td colspan="5">
Inscribed headstone at LES002</td><td colspan="2">
Inscribed head marker at LES002</td></tr>
</table>

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
LES003	S26.27931°	E28.91056°	1A	Burial ground consisting of 50-60 graves located between two maize fields. The burial ground is overgrown with vegetation and many of the headstones and dressings are deteriorated to varying degrees. There is also no demarcation or fencing present. The oldest grave with a known burial date is from the 1960s, while some of the graves are of more recent origin. **Site extent: 50x10m**	High	GP.A
 Burial site at LES003				 Burial site at LES003		
LES004	S26.29019°	E28.90572°	1A	The remains of an old brick structure with a concrete foundation, with a stone-and-brick structural addition behind it. Concrete and brick lintels are visible on both sections of the structure with iron bars on some of the windows. According to the farmer, the structure was allegedly utilised as some kind of jail. The structure has an unusual layout with most rooms leading straight out into the courtyard and no indoor passages. Some of the rooms are painted. It is possible that the structure was used for storage or perhaps even as a school. This site is visible on the 1st Edition 1965 topographic map therefore confirming that it is at least almost 60 years old. **Site extent: 30x30m**	Low	GP.B

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating

Front view of brick structure at LES004

Rear view of structure with stone-built addition at LES004

Iron bars in window LES004

Painted room LES004

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Infrastructure</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td>LES005</td><td>S26.29264°</td><td>E28.94217°</td><td>1A</td><td>Burial site consisting of a single grave. The grave has a granite headstone and dressing. The date of the grave is 1955. Site extent: 5x5m. Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.</td><td>High</td><td>GP.A</td></tr>
<tr><td colspan="7">
Single grave at LES005</td></tr>
<tr><td>LES006</td><td>S26.28640°</td><td>E28.94129°</td><td>1A</td><td>Burial site consisting of a single grave. Stone headstone (with no inscription) and dressing. Deterioration indicates that it is likely to be quite old. Size of the grave indicates it belongs to a child. Site extent: 5x5m Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.</td><td>High</td><td>GP.A</td></tr>
</table>

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
				 Burial site at LES006, single grave		
LES007	S26.28727°	E28.93728°	1A	Burial site with single grave having a granite headstone and dressing. The date of the grave is 1933. There is a possible second grave located immediately adjacent to this grave, but it is more likely to be the remains of an old dressing for this grave. **Site extent: 5x5m.**	High	GP.A

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Infrastructure</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td colspan="4">

Single grave at LES007</td><td colspan="3">
Remains of old dressing at LES007</td></tr>
<tr><td>LES008</td><td>S26.29019°</td><td>E28.93983°</td><td>1A</td><td>Burial ground consisting of five very old stone packed graves facing East to West. One of them has been disturbed by an animal burrow . Site extent: 15x5m. Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.</td><td>High</td><td>GP.A</td></tr>
</table>

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial site at LES008				 Example of one of the stone packed graves at LES008		
LES009	S26.29001°	E28.94002°	1A	Burial site consisting of a single grave. This is a stone packed grave like those at LES008, heavily overgrown with aloes. It could be of a similar age as it is situated only 30m to the NE of LES008. **Site extent: 5x5m.** *Outside of study area so mitigation impact is low, however, caution is still advised.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
				 Single grave at LES009		
LES010	S26.28404°	E28.96680°	1A	Burial ground consisting of 19 graves situated at the side of the Ogies Road, 250m South of the proposed access road on the Eastern side of study area 1A. Most of the graves have granite headstones and dressings. The oldest grave is dated 1942. **Site extent: 15x15m** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial ground at LES010						
LES011	S26.28100°	E28.91961°	1A	The remains of an old farmstead consisting of: a) a stone cattle kraal; b) a brick silo; c) a stone structure with multiple rooms; d) a derelict brick house with iron lintels; and e) a well-preserved sheep dipping station. This site is visible on the 1st Edition 1965 topographic map, therefore confirming that it is likely to be 60 years old. **Site extent: 100x100m.**	None	None
 a) Cattle kraal at LES011				 b) Brick silo at LES011		

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 c) Derelict brick structure at LES011			 d) Remains of stone structure at LES011		 e) Sheep dipping station at LES011	
LES012	S26.28024°	E28.93978°	1A	The site comprises an a) old brick structure with stone foundation which may have been a stable, with concrete troughs along the inner edges of the building; b) a stone-and-brick outbuilding; and c) a small 3-roomed brick house with concrete lintels. The site most likely dates to the 1930s due to the Imperial brick style and a stone foundation. This site is visible on the 1st Edition 1965 topographic map therefore confirming that it is likely to be 60 years old. **Site extent: 70x20m.**	Low	GP.B

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating

a) Brick stable at LES012

c) Concrete trough within stable at LES012

b) Stone-and-brick structure at LES012

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
LES013	S26.41222°	E28.94926°	1C	The site comprises relatively old agricultural infrastructure which is currently being utilised. The structures are of little heritage significance. **Site extent: 50x20m**	None	None
 Agricultural infrastructure at LES013						
LES014	S26.41823°	E28.95012°	1C	Burial ground consisting of 30-40 graves, that is still being visited as the surrounding grass has been cut. However, the portion of the burial ground on the other side of the fence is partially overgrown. The graves are mostly stone-packed, with a few having granite headstones and dressings. The oldest known grave is dated 1961. The burial ground is situated approx. 100m East of (outside) the southern portion of study area 1C. **Site extent: 15x10m** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial site at LES014				 Overgrown nature of a portion of the burial ground at LES014		
LES015	S26.32320°	E29.05077°	1B	Burial ground consisting of 20-30 graves, however, the number is not clear due to the heavily overgrown vegetation. At least one of the graves is still being visited. The graves are mostly stone-packed, with some graves having concrete headstones and dressings, and one having a granite headstone. The burial ground is situated close to the proposed shaft entrance of Area 1B. **Site extent: 30x5m.**	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating

Burial ground at LES015

Concrete headstones at LES015

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
LES016	S26.41745°	E28.93229°	1C	Burial site consisting of two graves situated within derelict brick walling. The graves are marked with wooden crosses and one has a marble dressing. The state of the burial ground indicates that it is quite old. According to Cobus Rolf, owner of the neighbouring properties, the graves belong to Johan Wasserman, a previous owner, who subsequently sold it to Aron Bogatsu. **Site extent: 10x10m.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial site at LES016				 One of the graves at LES016		
LES017	S26.41756°	E28.93251°	1C	The remains of several stone structures comprising an old colonial farmstead. The site consists of the remains of: a) two stone-built houses, one with sandstone cornerstones indicating historical age; b) a small circular stone pen; and c) a large rectangular stone cattle kraal (with two conjoined pens). **Site extent: 50x50m**	Low	GP.B

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 a) Remains of stone structure with sandstone cornerstones at LES017				 b) Remains of circular pen at LES017  c) Remains of stone cattle kraal at LES017		
LES018	S26.42055°	E28.94891°	1C	The remains of a stone structure, probably of colonial origin. Sitting 40m South East outside of the boundary of 1C. **Site extent: 20x10m.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	Low	GP.C

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Stone structure at LES018				 Stone structure at LES018		
LES019	S26.40471°	E28.93918°	1C	Burial ground consisting of 24 visible graves, that are mostly stone packed with a few graves having concrete headstones and dressings. The graves are not being visited. However, according to the farm owner, one belongs to an old woman who used to live in the farmstead nearby. The ages of the graves are unknown. **Site extent: 20x20m.**	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial site at LES019				 Burial site at LES019		
LES020	S26.40253°	E28.92926°	1C	A low stone wall built in front of a rock shelter. No visible signs of occupation within the shelter. According to the property owner Douglas Kelly, the wall was built by the previous farm owner. **Site extent: 10x5m.**	None	None

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Low stone wall in front of rock shelter LES020				 Different view of low stone wall at LES020		
LES021	S26.40392°	E28.94488°	1C	Burial site consisting of a single grave of a child with a concrete headstone. The grave is dated 1922. **Site extent: 5x5m.** *Outside of study area so mitigation impact is low however caution is still advised.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Single grave at LES021						
LES022	S26.40651°	E28.94081°	1C	Burial ground consisting of 8 graves. Some have granite dressings and headstones, others have concrete dressings and headstones, and some are stone packed with stone head markers. The oldest known grave is dated 1955. Some of the graves are still being visited. **Site extent: 15x10m.**	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Burial ground at LES022				 Oldest known grave at LES022		
LES023	S26.41190°	E28.93368°	1C	The remains of a stone cattle kraal**. Site extent: 35x15m.**	None	None

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Remains of old stone cattle kraal at LES023				 Detailed view of stone wall at LES023		
LES024	S26.41078°	E28.92712°	1C	Burial ground consisting of 15-20 graves, however the site is heavily overgrown so there could be 30 or more. The graves mostly have granite headstones and dressings, with a few made of concrete. The graves date to the early 1900s and according to Cobus Rolf, the cemetery was the original cemetery for the town of Leandra. The burial ground lies 450m West outside of the western boundary of 1C. **Site extent: 30x30m.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
	 Burial site at LES024			 One of the more visible graves at LES024		
LES025	S26.40547°	E28.93092°	1C	Four possible stone packed graves are situated about halfway along the line of the remains of a low, old stone wall running up the hill, according to Douglas Kelly, the farm owner. However, it was not possible to confirm the location due to the heavily overgrown nature of the grass. The graves should become visible if the grass is burned. **Site extent: 50x5m.** *The entire portion of the wall should be considered highly sensitive until the exact location of the graves is confirmed.*	High	GP.A

<table>
<tr><th>Site number</th><th>Lat</th><th>Lon</th><th>Infrastructure</th><th>Description</th><th>Heritage Significance</th><th>Heritage Rating</th></tr>
<tr><td colspan="7">
General environment within which LES025 lies, view looking up-hill along the remains of the stone wall following the direction of the blue arrow (on the left hidden by vegetation)</td></tr>
<tr><td>LES026</td><td>S26.28697°</td><td>E28.96350°</td><td>1A</td><td>An old culvert found outside the study area. Site extent: 5x5m. Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.</td><td>Low</td><td>None</td></tr>
</table>

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
 Old culvert at LES026						
LES027	S26.31545°	E29.02894°	1B	Burial ground consisting of 10-20 graves. The site is outside the study area. **Site extent: 15x5m.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
				 Burial ground at LES027		
LES028	S26.39790°	E28.92869°	1C	Burial site that is not affected by the development. This site was not visited due to being outside the study area however, we were notified of its existence by the property owner, Albertus Hanekom. **Site extent: Unknown.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes.*	High	GP.A
LES029	S26.311391 97° *Estimate	E28.9366631 8° *Estimate	1A	During the stakeholder engagement process, it was stated that several burials occur at this location on the farm Goedehoop 308 IR. This site was not visited due to being outside the study area. **Site extent: Unknown.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes. No photo as site was uncovered through stakeholder engagement process.*	High	GP.A

Site number	Lat	Lon	Infrastructure	Description	Heritage Significance	Heritage Rating
LES030	S26.323187 19 ° *Estimate	E28.9369317 3 ° *Estimate	1A	During the stakeholder engagement process, it was stated that several burials occur at this location on the farm Goedehoop 308 IR. This site was not visited due to being outside the study area. **Site extent: Unknown.** *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes. No photo as site was uncovered through stakeholder engagement process.*	High	GP.A
LES031	S26.310429 05 ° *Estimate	E28.9288751 3 ° *Estimate	1A	During the stakeholder engagement process, it was stated that the site of an Ndebele initiation school occurs at this location on the farm Goedehoop 308 IR. This site was not visited due to being outside the study area and due to cultural reasons from the stakeholders. *Outside of study area so mitigation impact is low, however caution is still advised if the development layout plan changes. No photo as site was uncovered through stakeholder engagement process.*	High	GP.A

Historical structure sites

A total of eight (8) historical structure sites were identified all of which (LES004, LES011, LES012, LES017, LES018, LES020, LES023, LES026) have low heritage significance.

Only sites LES013will be directly affected by the mining activity footprint (inclusive of the buffer zone) in Areas 1A and 1C of the proposed layout. The impact significance for these sites rated as MEDIUM negative before mitigation and with the implementation of the mitigation measures the impact significance is reduced to LOW negative.

Burial grounds

Nineteen burial grounds have been identified during the field work, with two burial sites identified during the stakeholder engagement process (LES029, LES030). Due to the social and cultural significance of burial grounds and graves, a high heritage significance is given to all these sites.

❖ Area 1A

Before the alterations to the infrastructure layout of area 1A, the impact of the proposed project on the burial grounds located at sites LES002, LES003, and LES007 was rated as having a HIGH negative significance before mitigation and with the implementation of mitigation measures as having a LOW negative significance. However, if Option 2 is chosen for the layout of area 1A, all the grave sites in proximity to 1A, LES001, LES002, LES003, LES005, LES006, LES007, LES008, LES009, LES010, LES029, LES030 should not be impacted on by mining activity as they occur outside the footprint area, however, caution is still advised as some of the sites (LES002 & LES007) are situated particularly close to the edge of the proposed layout.

❖ Area 1B

The impact of the proposed project on the burial ground at site LES015 is rated as having a HIGH negative significance before mitigation and with the implementation of mitigation measures as having a LOW negative significance. It is difficult to tell if this site is situated directly on the proposed layout for the 1B shaft entrance due to the resolution of the layout, but it is close enough to the shaft entrance and any probable access roads to the shaft entrance that a high impact rating is warranted.

❖ Area 1C

The sites LES014, LES016, LES019, LES021, LES022, LES024, LES025 and LES028 should not be impacted on by mining activity as they occur outside the footprint area, however, caution is still advised as some of the sites (LES019) is situated particularly close to the edge of the proposed layout.

Living heritage resources

The only living heritage site identified is site LES031 located near area 1A. This site is an Ndebele Initiation ceremony site and is rated as having a high significance. Depending on the local community, relocation /destruction of the site may be possible with stakeholder engagement and consent. The recommendation would be to allow the site to be retained in situ and avoided if possible, but mitigation or destruction may be possible (with stakeholder engagement). However, even though the site is located outside the proposed layout, the resulting mining activities might make access to this site difficult, thus a proper stakeholder engagement process will be necessary.

9.13.3.2 Palaeontology

According to the palaeontological sensitivity map accessed via the SAHRIS database, it is clear that the study areas fall within 'VERY HIGH', 'MODERATE' and 'INSIGNIFICANT' rated sensitivity zones. Even though there are 'MODERATE' and 'INSIGNIFICANT' ratings, the highest rating being 'VERY HIGH' will have to be adhered to and therefore a palaeontological field assessment will be required before development can continue (Figure 9-96). A Palaeontological Desktop Assessment was commissioned in order to confirm this assumption.

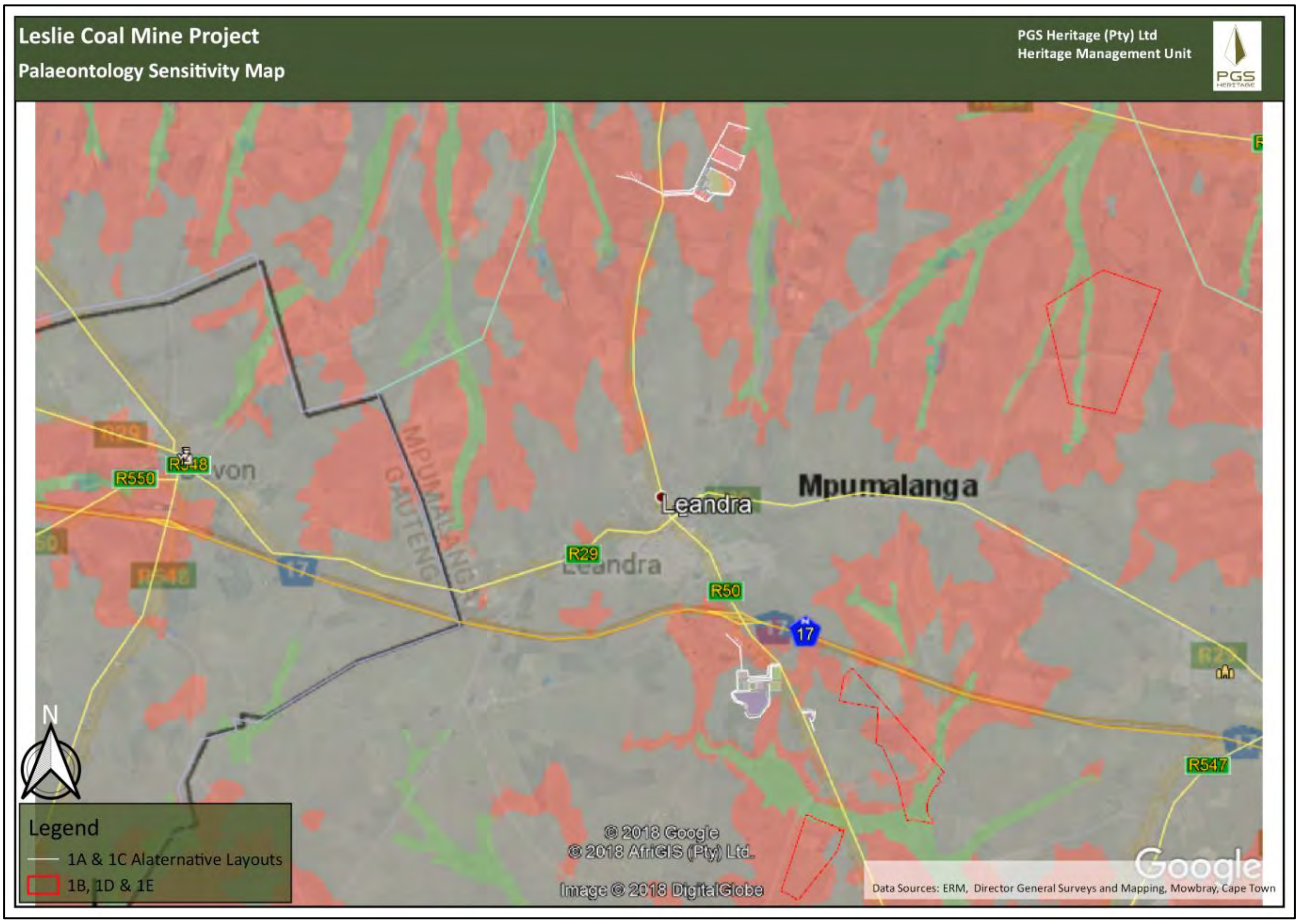


Figure 9-96: Palaeontological sensitivity map indicating that the study areas fall within VERY HIGH, MODERATE and INSIGNIFICANT sensitivity zones.

No significant fossils are expected to be found before deep excavation (>1.5m) are completed. Though, it is possible that significant fossils will be documented during excavations. The recording of fossils will enhance the knowledge of the Palaeontological Heritage of the development area (Butler 2018).

9.13.4 Specialist Conclusions

Since the proposed layout changes seem to avoid most of the heritage features within the original study area, except for a high significance feature (LES015) and a low significance feature (LES013), the impact significance before mitigation of the heritage resources would be HIGH negative. Implementation of the mitigation measures will maintain this impact at MEDIUM negative.

However, as portions of the updated infrastructure layouts have fallen outside of the purview of the original HIA study area, the potential of heritage resources in those portions that have not been surveyed have to be acknowledged. Therefore, until such time as those portions are surveyed, the impact significance on potential heritage resources in those areas have to be set at HIGH negative.

It is recommended that an EIA level palaeontology report will be conducted during deep excavation to assess the value and importance of fossils in the development area and the effect of the proposed development on the palaeontological heritage. This involves a Phase 1 field-based assessment by a professional palaeontologist.

It is the author's considered opinion that the overall impact on heritage resources after the implementation of the recommended mitigation measures is acceptably low and that the project can be approved from a heritage perspective.

9.14 Social

A Social Impact Assessment was undertaken by Kongiwe for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D14.

9.14.1 Environmental Status Quo

9.14.1.1 Provincial and District Overview

Table 9-72: Provincial and District Municipality socio-economic baseline at a glance

Description	Mpumalanga	Gert Sibande District Municipality
	Demographics	
Population size	**4 335 963** people	**1 135 409** people
Sex ratio	Females (50.7%) outnumber males (49.3%)	50.3% of the population are females and 49.3% constitute the male population.
Households	**1 238 861** households, **10.9%** Households are informal dwellings (shacks)	**333 811** households, **13.4%** Households that are informal dwellings (shacks)- about **25%** than the rate in Mpumalanga.
Household ownership	**68.%** Households fully owned or being paid off	**59.5%** Households fully owned or being paid off
Head of household	**8 563** households with heads under 18 years old	**2 088** households with heads under 18 years old

Description	Mpumalanga	Gert Sibande District Municipality
Percentage of people under the age of 18 years	39.1%	37.5%
Percentage of people over the age of 18 years	56.6%	57.7%
Percentage of people over the age of 65 years	4.3%	4.9%
Service Delivery		
Access to water services	**86.9%** have access to water- they get water from a regional or local service provider.	**88.8%** get water from a regional or local service provider.
Electricity	**81%** have electricity and **6.8%** have no access to electricity	**76%** have access to electricity and **9.6%** do not have access to electricity.
Toilet facilities	**45.4%** have access to flush or chemical toilets. **2.8%** have no access to any toilets	**66.6%** have access to flush or chemical toilets, **2.6%** have no access to any toilets.
Economics		
Employment	**37.5%** of the population is employed and **17.3%** not employed, **39.4%** of the population fall within the not economically active range.	**38.9%** of the population is employed, 29.7% of the population is unemployed.
Major industry	Manufacturing and mining	Manufacturing and agriculture
Education		
No formal education	11.3%	10.8%
Grade 12	36.1%	34.3%

Source: Community Survey 2016

9.14.1.2 Geographical and Historical Context

Govan Mbeki Municipality is situated in the south-western part of Mpumalanga, adjoining Gauteng in the south, approximately 150km east of Johannesburg and approximately 300km south west of Nelspruit. Govan Mbeki is one of 7 local municipalities under the jurisdiction of the Gert Sibande District Municipality. The municipality covers an area of approximately 2 958km^2 and has a population of approximately 480 000 people, most of whom reside in the various urban areas. The area can be described as mostly agricultural/rural, with 3 urban conglomerations situated within it, namely Leandra (Leslie, Lebohang, Eendracht) on the western edge, the Greater Secunda.

The site of the proposed Leslie 1 project is situated in Leandra, approximately 40 km from Secunda. The township is comprised of the former Eendrag and Leslie communities, the name Leandra is derived from the two words, Leslie and Eendrag.

This community was established in 1904 by people coming from different farms around the area and in 1909 black people were issued with freehold titles by the government (SA History online-25 May 2018). Leandra was established to fulfil a service centre role for either the mining and or agricultural sectors in the district (GMLM SDF, 2014-2034).

In the local study area, traditional governance is upheld by two traditional authorities (Mahlangu and Skosana), however the area is administered and governed by the Municipality. These traditional authorities also interact with government authorities, notably the Department of Cooperative Governance and Traditional Affairs and the Municipal Stakeholders forum.

9.14.1.3 Population and Ethnicity

According to the Community Survey 2016, Govan Mbeki has the largest population in the Gert Sibande District with a population size of 340 091 in 2016 compared to 294 538 in 2011. Govan Mbeki is the most prominently 2nd fastest growing population with an annual population growth rate of 3.10% in the whole of the Mpumalanga Province. The population grew on average by 3.1% between 2011 and 2016.

The population growth can be attributed to the fact that people migrate to the municipality seeking job opportunities as Govan Mbeki is considered to be one of the economical hub of Mpumalanga for job seekers. It is indicated in the IDP that a population growth of this proportion is likely to place strain on the existing backlogs and the municipality's ability to service the community effectively.

The existing population within the developed areas of Govan Mbeki (urban and rural) totals 34 0091 representing 108 894 households, at an average of 3.3 people per household and a population growth rate of 3.1 (IDP, 2018-2019). According to the IDP, it is anticipated that the current population trends are expected to continue and will result in dramatic changes in the age structure within the Municipality.

9.14.1.3.1 Ethnicity

The main ethnic groups include 86% of the population is made up of Black Africans, followed by Whites who make up 12% of the population. Coloureds, Indians/Asian make up a nominal share of the ethnic group.

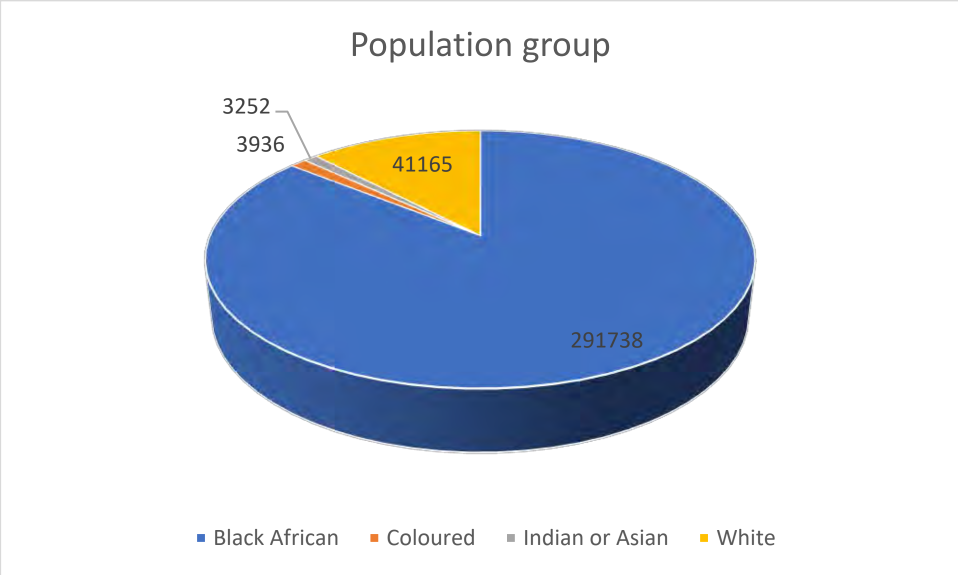


Figure 9-97: Population group (Source: Community survey 2016)

9.14.1.4 Gender ratio

Govan Mbeki has a slight imbalance between males and females. Males have consistently outnumbered females, the gender ratio in 2011 was 106.95 male per 100 females, which had changed to 108.45 males per 100 females in 2016. According to the IDP, the high number of males could be attributed to the beneficial employment opportunities, as more men living in Govan Mbeki seeking for job opportunities in the various industries across the district which are manufacturing, industrial and mining companies.

9.14.1.5 Dependency Ratio

Govan Mbeki's population is mainly composed of a working age population, which is defined by Statistics South Africa as the ages between 15 and 64. This is followed by dependants who are mainly individuals aged 14 years and younger, this group makes up 32,5% and the elderly constitute 4.2%.

9.14.1.6 Educational level

According to the Community Survey, 2016 76.3% have completed Grade 9 or higher which is about 10 percent higher than the rate in Gert Sibande (68.32%). 47.1% have matriculated about 20 percent higher than the rate in Gert Sibande (39.81%).

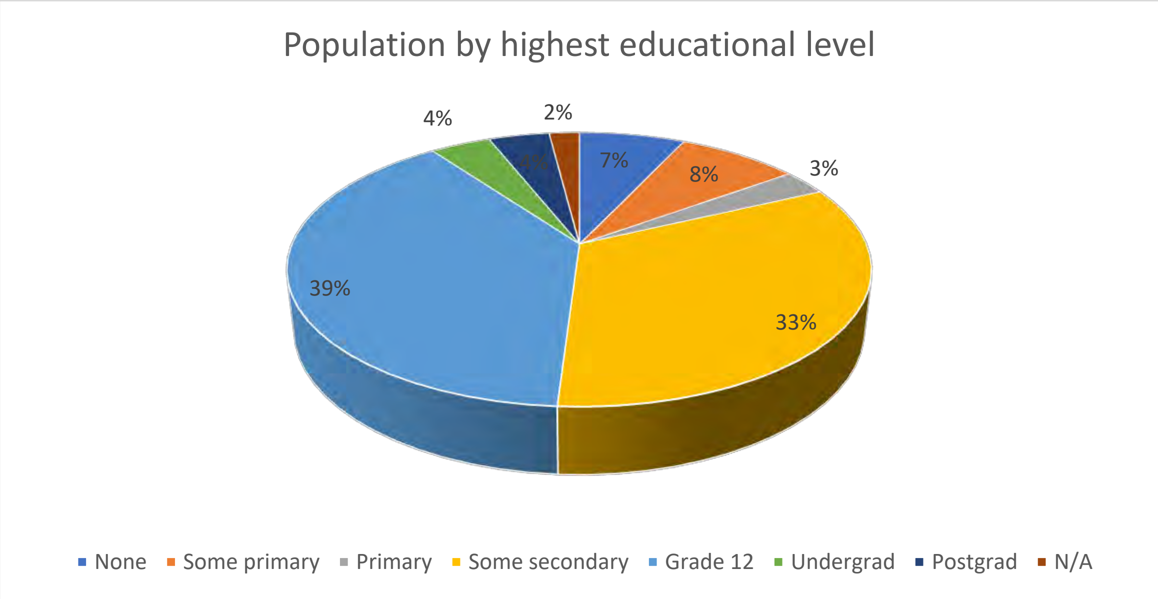


Figure 9-98: Population by highest educational level (Source: Community survey 2016)

9.14.1.7 Economy and livelihoods

The economy sector is dominated by the mining and manufacturing sectors. Mining is the highest contributor to economic growth (39%) followed by manufacturing at 24%. Mining is the largest sector within the Mpumalanga making up 26.4% of the Mpumalanga economy and the second largest in the district contributing 23.4% of the Gert Sibande District Municipal economy.

During the in-depth interviews it was indicated that some community members rely on subsistence farming, where they only produce enough to feed themselves and their families. Some of the directly affected communities were commercial farmers who provide employment opportunities for local community members.

Although the agricultural sector is one of the dominant sectors in Mpumalanga, its contribution towards the municipality is minimal. According to the SDF (2014-2034), agriculture is the smallest contributing sector in Govan municipal economy, it is reported to contribute 0.7% towards the municipal economy.

According a study conducted by the Bureau for Food and Agricultural Policy (2012), the decrease in agricultural activities could be attributed to the fact that there is an increased demand for arable land to pursue mining operations. It was estimated that an extensive portion of cultivated land will be lost to mining operations.

9.14.1.8 Employment status

48.5% of the population in Govan Mbeki is employed and about 17% is unemployed which is slightly higher that the rate in Gert Sibande. Figure 9-99 below gives an overview of the employment status within Govan Mbeki Local Municipality.

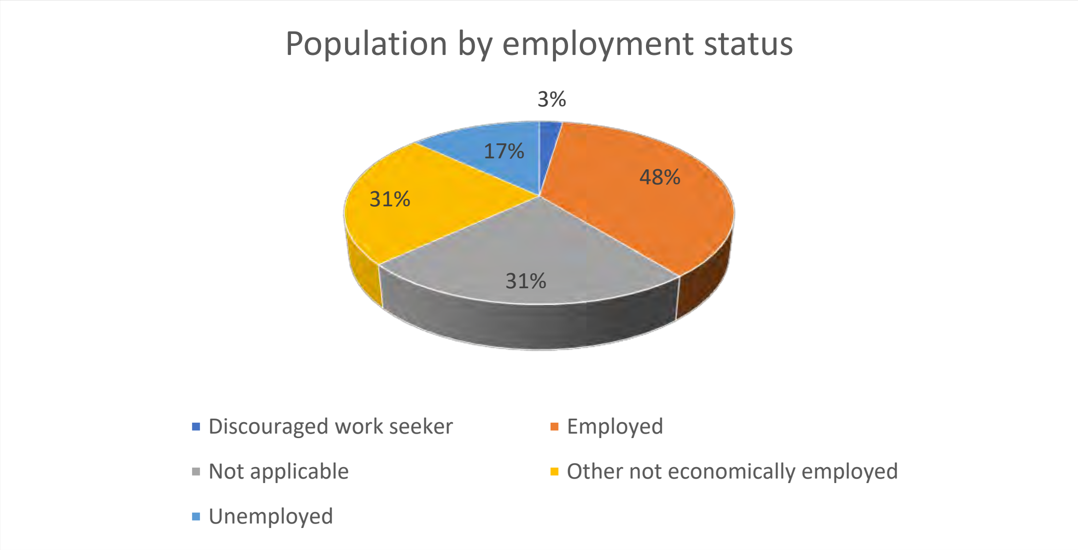


Figure 9-99: Population by employment status (Source Community Survey, 2016)

9.14.1.9 Household income

According to the IDP, approximately 62% of the employed population earn a salary between R1 and R38 400 annually, which sets the basis for a low paid labour force and high poverty rates in Govan Mbeki. Of the total number of households within Govan Mbeki, 56% fall within the poverty range. According to the Poverty Manual compiled by the Word bank (2005), a person is considered poor if his or her consumption or income level falls below some minimum level necessary to meet basic needs.

9.14.1.10 Vulnerable groups

For the purpose of this report, vulnerable groups refer to people living below the poverty line, child headed households, the elderly and the landless.

People living below the poverty line

A total of 56% of the population Govan Mbeki falls below the poverty line, which poses significant challenges when related to the quality of life of these households, not being able to afford school fess, lack of medical care, lack of food and lack of services (IDP).

The elderly

The elderly are generally recognised as being vulnerable. They are often dependent on the younger generations for assistance in meeting their basic needs (e.g. housing, water, food). They typically prefer their lifestyles to remain unchanged and are less likely to readily adapt to change.

Child headed households

According to Stats SA 2011, Govan Mbeki has the highest child headed households[14] within the Gert Sibande of whom mainly girls under the age of 17 are the headed households.

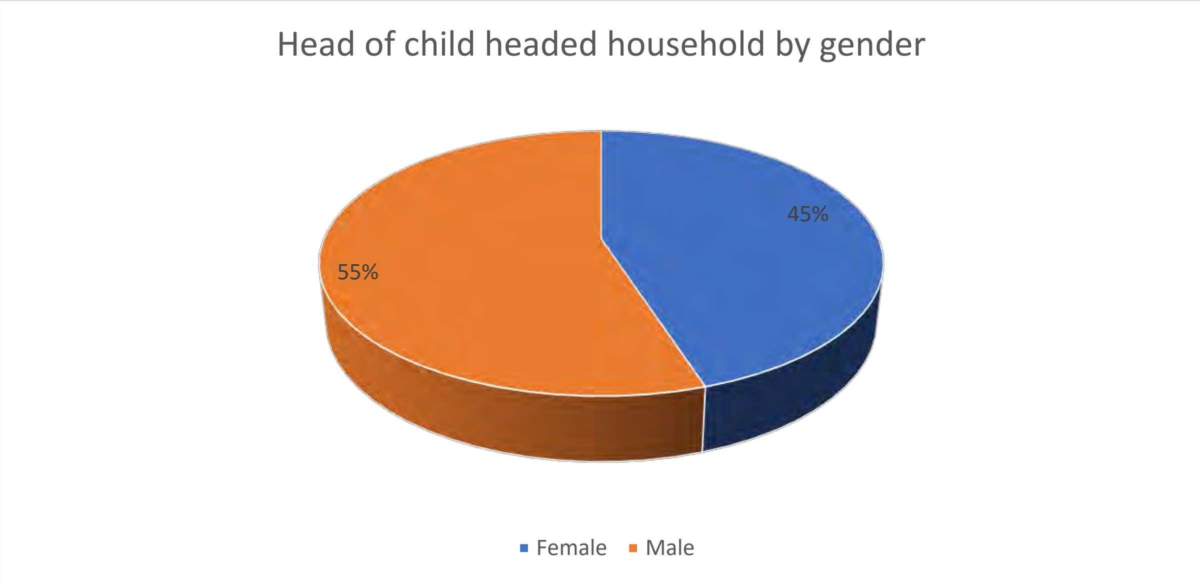


Figure 9-100: Child headed household by gender (Source Community Survey, 2016)

Landless individuals

Mntungwa (2014:7) points out that farm workers are possibly one of the most vulnerable groups in the labour market. Farm workers are characterised as workers who are largely unskilled, uneducated and rely heavily on farm employment to secure land security tenure that is tied up upon farm employment. Farm dwellers work and reside on the farms they work in together with their families. This means that there is a strong connection between farm employment and land security rights, this puts them in a vulnerable position.

9.14.1.11 Infrastructure

This section of the report will discuss the quality of infrastructure and an overview of key social services within the project area and a percentage of the population that has access to such services.

Water

The majority (97.7%) of the population get water from a regional or local service provider, 50% have access to piped water in their yard and 47% have access to water in their houses. Only 1% of the population rely on communal taps and 1% of the population get their water from a communal stand.

[14] Households headed by children under 18

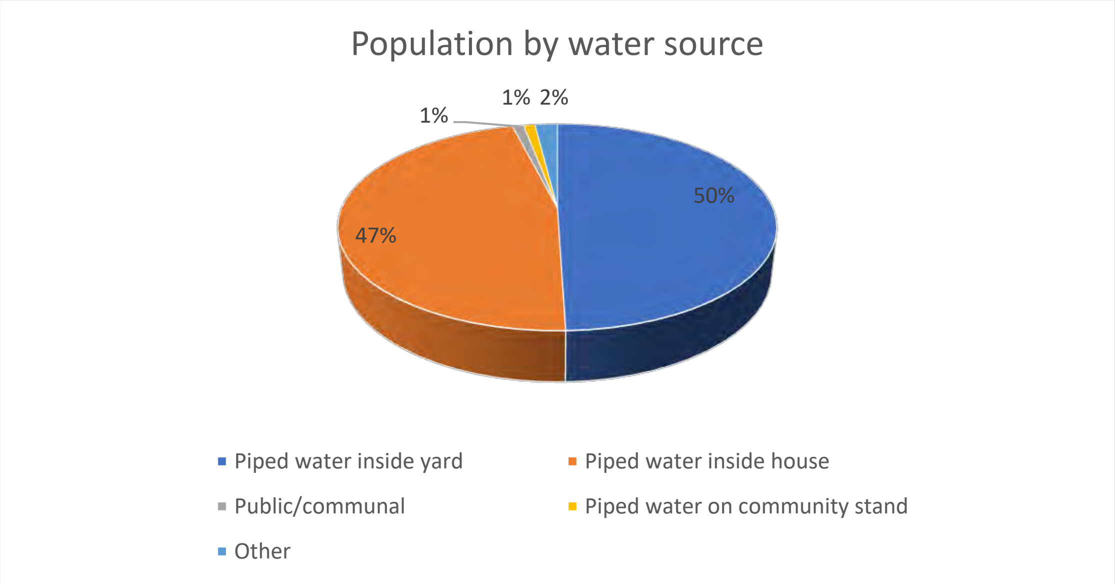


Figure 9-101: Population by water source (Source Community survey, 2016)

Electricity

76% of the households have access to electricity, this percentage has been gradually growing since 2001. Electrified households use electricity for lighting, heating and cooking. Although 76% of the households are electrified, the IDP 2018/2019 indicates that are challenges with electricity provision in some wards, there are challenges with trapping of electricity during the winter. Approximately 4.3% of the households do not have access to electricity. These households rely on other forms of energy such as candles, paraffin and firewood.

Toilet facilities

95.5% of the households have access to flush or chemical toilets, which is slightly higher compared to district level. Some households mainly within the informal settlement do not have access to flush or chemical toilets facilities.

Refuse disposal

86% of the households in Govan Mbeki Local Municipality get refuse disposal from a local authority, private company or community members at least once a month. In some areas it was reported that there seems to be a lack of consistent refuse removal resulting in the public dumping their domestic waste next to the roads. This poses significant consequences for environmental health and the visual state of the environment.

Figure 9-102: Picture of domestic waste dumped on the roadside.

Figure 9-103 below provides an indication of the refuse removal trends within Govan Mbeki.

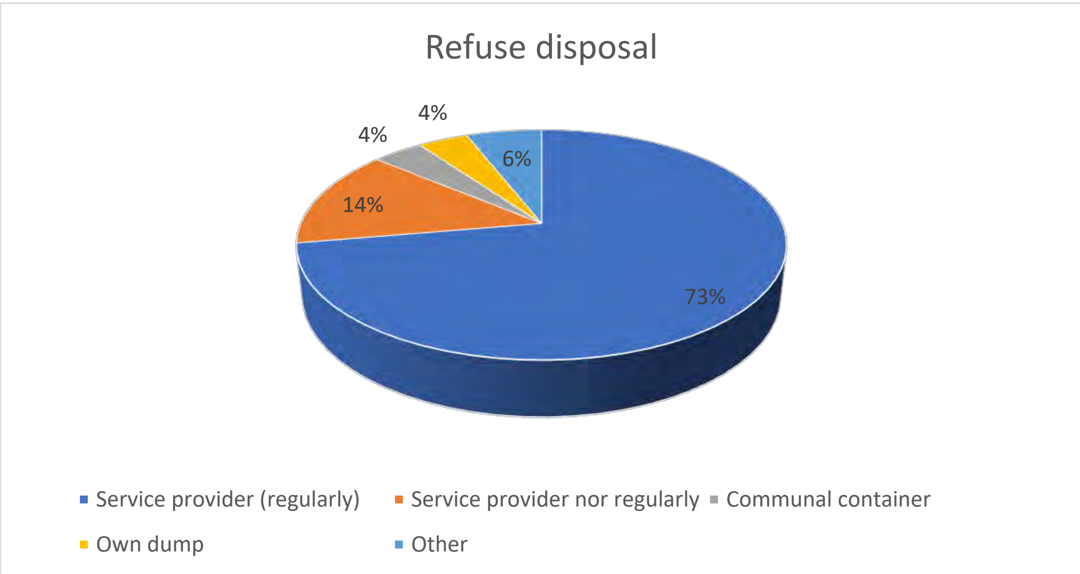


Figure 9-103: Population statistics by refuse removal (Source: Community survey, 2016)

Roads

In terms of road provision, the IDP 2018/2019 states that some areas the roads infrastructure and maintenance are poor, roads are in a dilapidated condition, have potholes and some tar roads need patching (SDF, 2014-2034). With regards to infrastructure the SDF (2014-2034) indicates that the most common challenges which relate to infrastructure and services can be summarised as follows:

- Sewage spillage;
- Dumping / pollution – landfill site / inadequate refuse removal;
- Road maintenance;
- Informal settlements.

9.14.1.12 Housing

According to the Community Survey 2016, there are approximately 108 892 households in Govan Mbeki. A total of 63% of the households live in formal houses, whilst 20.4% live in shacks and 10.6% live in a flat in the backyard. Only 2.1% of the population live in traditional houses. The IDP (2018-2019) has reported that the municipality is experiencing shortages of houses.

Figure 9-104: Types of houses within the study area

Household ownership

According to the Community Survey 2016, 56.5% of households are fully owned or being paid off. Table 9-73 below gives an indication of the tenure status.

Table 9-73: Household ownership (Source Community survey, 2016)

Description	Percentage
Owned and fully paid off	52.3%
Owned but not yet paid off	7.2%
Occupied rent free	11.1%
Rented from other (Municipal, social housing)	6.1%
Rented from private individual	15.3%

9.14.1.13 Land claims

The Department of Rural development and Land Reform (DRDLR), (Land Restitution Support from the Mpumalanga Land Claims Commission) has indicated that that there are land claims that have been lodged on some of the directly affected properties. The properties/farms listed below have land claims submitted.

- Watersvalshoek 350 IR, Portions 4, 13, 15 (RE), 16-21, 27, 28, 33, 34, 51, 52, 63, Re/11, Re/12 and Re/9;
- Brakfontein 310 IR, Portions 3, 12, 13, 15, 18, 19, 20 and 21; and
- Weltevreden 307 IR, Portions 3,4/RE, 5, 7-9, 12,13,15-18 and RE.

It should be noted that none of the abovementioned land claims have been finalised.

9.14.1.14 Key challenges within Govan Mbeki Local Municipalities

The following section provides a summary of key challenges experienced within the affected study area. The issues listed below are informed by the discussions held with various stakeholders (ie) Ward Councillors, Municipal Officials, landowners, farm workers and farm dwellers.

- Lack of employment opportunities;
- Limited skills;
- High poverty levels;
- Increased number of immigrants;
- Shortage of houses;
- Unplanned settlements;
- Aging infrastructure;
- Potholes;
- Environmental issues (leaking sewage; waste materials disposed on open spaces and roadside);
- Service delivery protest; and
- Teenage pregnancy which results in dropping out of school and increased low levels of higher education attainment.

In addition to the abovementioned, (Dlamini et al, 2016: 3) states that the community in Leandra has been encountering challenges which range from economic, environmental, social and spatial challenges. At a regional scale, like other lagging municipalities, Mpumalanga is faced with developmental challenges coupled with socioeconomic problems such as unemployment, job creation, education, HIV prevalence, basic service delivery, inequality, poverty, economic growth, sectorial dependency and economic distribution.

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

9.14.2 Specialist Assessment Methods

The SIA used both quantitative and qualitative data collection techniques. In terms of the quantitative data, data from Statistics SA was used to understand the local social circumstances of the proposed project area. In terms of the qualitative method focus group meetings and in-depth interviews were conducted to understand the affected communities' perceptions, how they view themselves and the environment around them. Data was collected as follows:

- Investigative site visit was undertaken in April 2018;
- Interviews with Ward Councillors, municipal officials, farmers, farm workers and farm occupiers conducted in April and May 2018;
- Statistics South Africa data;
- A literature review of the Integrated Development Plan, Spatial Development Framework;
- Scan and analysis of the Final Scoping Report, Leslie Coal Mine's SLP document, Comments and Responses Report and various specialist studies (Compiled by Kongiwe Environmental).

9.14.3 Specialist Findings

It is expected that the proposed Leslie 1 project will result in social changes which may positively and negatively affect communities within the study area. In terms of the social changes that have been assessed, the following social impacts are have been identified:

- Employment opportunities;
- Multiplier impacts on the local economy
- Change in movement patterns;
- Loss of agricultural land and infrastructure;
- Physical and economical displacement;
- Disturbance of cultural, spiritual and religious sites;
- Increased pressure on Municipal infrastructure;
- Increased social pathologies linked to influx of workers and job seekers;
- Increased nuisance factors and changed sense of place.

9.14.3.1 Employment opportunities

Employment opportunities include direct employment by the Project, indirect employment through the Project's suppliers, and induced employment generated through spending and associated job creation in the economy. Project related employment has the potential to considerably improve the livelihoods and income stability of future employees and their dependants. It is anticipated that the proposed project will create job opportunities for community members within the study area. Creation of employment opportunities is likely to occur during the construction phase. The study area is characterised by high unemployment rate with a majority of households living below the poverty line.

It should be taken into account that expectations regarding employment opportunities are very high, particularly among the youth within the study area.

9.14.3.2 Multiplier impacts on the local economy

The proposed project may result in several economic benefits for local communities through direct and multiplier effects stimulated by capital expenditure and construction activities. The mine is likely to generate contracts for the purchase of equipment and other goods and services. The majority of these contracts will be for specialist goods and services, which will be provided by businesses within the project area. Procuring of specialist goods and services will likely generate more opportunities for Small, Medium and Micro sized Enterprises (SMMEs), provided they are formalised and able to meet the procurement requirements as set out by the mine.

9.14.3.3 Loss of and/or Damage to Agricultural Land and Infrastructure

The proposed project will involve the development of surface and underground facilities. It is anticipated that the proposed project will not affect the existing surface activities (e.g. agriculture, residential, roads).

9.14.3.4 Physical and Economic Displacement

Physical displacement refers to a situation where people or households have to be moved to a different location to make way for project infrastructure or due to considerable risk to personal safety. The acquisition of land for the purpose of mining may leave farm workers displaced from their current accommodation, as well as their livelihood activities and source of income. The displacement and relocation of households causes social and psychological disruption to those involved. These households are considered to be vulnerable and are unlikely to have the means to relocate from their homes, re-establish their livelihoods and survive without intervention and significant support. ***Economic displacement*** refers to a loss of access to cultivated land or other livelihood resources.

This impact will occur at the commencement of the construction phase and it will persist for the life of the operation. It is possible that post-closure the land may be farmed again, and people will be employed and potentially housed on the land; however, it is unlikely that the same individuals will benefit.

9.14.3.5 Disturbance of cultural, spiritual and religious sites

The development and construction of the proposed mine will result in the disturbance of cultural, spiritual and religious significance. A number of graves and graveyards, farmsteads, cultural sites have been identified as part of the heritage study. During the investigative site visit some affected farm occupiers indicated that they have a cultural site which is significant to Ndebele speaking people who reside in the area. These sites are sacred and only accessible to men who have been initiated in accordance with the Ndebele tradition. Each clan (Ndzundzuna and Nala) has its own site, the purpose of this site is to facilitate *Ingoma. Ingoma* is a Ndebele tradition which refers to a traditional passage for Ndebele boys in their journey to entering the stage of manhood.

9.14.3.6 Increased Pressure on Municipal Services

Among the key challenges within Govan Mbeki are inadequate infrastructure and services, limited waste removal and degraded road infrastructure and informal settlements. The combined pressure resulting from the proposed project activities, workers, and the influx of job-seekers will exert additional pressure on infrastructure and services for the duration of the construction phase.

9.14.3.7 Increased Social Pathologies linked to Influx of Workers and Job Seekers

This impact deals with the influx of job seekers to the site during the construction phase. These job seekers, including those from area with the hope of securing employment. According to the Community Survey 2016, Govan Mbeki is the most prominently 2nd fastest growing population with an annual population growth rate of 3.10. it is anticipated that the migration patterns will increase since people are moving, seeking for better jobs opportunities. Based on the discussion with various stakeholders it was noted that there has been a significant influx resulting from people seeking job opportunities from the surrounding power stations and the petrochemical industry.

It is expected that when job seekers do not secure employment, the potential exists that they will contribute to problems experienced with informal settlement, pressure on existing resources, services and infrastructure.

The impact associated with an increase in social pathologies due to influx of job seekers is already present in the broader project area due to ongoing influx; additional mining developments mine will promote influx to continue. The impact is expected to commence during the pre-construction phase of the project as job-seekers migrate to the area. The impact will persist through the construction phase and into the operational phase; it is likely to be more intense during the construction phase when there are a greater number of workers and job-seekers. The most likely social pathologies that may occur which are linked to the influx of workers and job seekers include the following:

- An increase in disposable income within the proposed project area (among workers) could result in an increase in alcohol and drug abuse, increased incidences of prostitution and casual sexual relations. These activities could lead to an increased incidence of HIV/AIDS and increased numbers of teenage and unwanted pregnancies, which is an existing problem within Govan Mbeki. The increased prevalence of HIV/AIDS would affect contractors, employees, local residents and the families and sexual partners of anyone becoming infected in the proposed project area;
- Trespassing on surrounding properties and possible damage to property resulting in vandalism;
- General unrest may be further exacerbated as a result of increased pressure for resources, resentment towards those who secure employment and procurement opportunities as well as benefits from other projects (specifically if the beneficiaries are from outside the area).

9.14.3.8 Increased Nuisance Factors and Changed Sense of Place

The proposed project area is characterised by commercial farms (primarily crop farming and livestock farming), mines, and residential areas. The proposed surface infrastructure will be located on land that is currently used for agriculture; the area will be transformed due to the construction of the project's surface infrastructure. As a result of the proposed project activities, there will be an increase in the noise, air pollution, traffic and visual impacts resulting from the construction, operation and decommissioning/closure activities at the facility. The combined effect of the noise, air quality, visual and traffic impacts are likely to have a negative impact on the sense of place for some stakeholders. In addition, the influx of workers and job-seekers is likely to result in further disruptions to the sense of place through the generation of a range of nuisance factors.

9.14.4 Specialist Conclusions

The findings of this SIA indicate the proposed project has positive and negative potential impacts which range in significance. The construction and the operation of the proposed Leslie 1 project Positive impacts are mainly due to creation of employment opportunities, boosting of the local economy due to increased disposal income and contribution to the revenue for the GMLM. Negative impacts may be experienced due to loss of agricultural land, physical and economic displacement, disturbance of cultural/spiritual and religious sites, increased pressure on municipal infrastructure, increased social pathologies linked to influx of job workers and work seekers, increased nuisance factors and changed sense of place. In light of the SIA findings the following recommendations should be considered:

- It is recommended that the mitigation and management measures as contained in this SIA report be actively pursued and incorporated in the EMPr where applicable;
- Regular internal and external monitoring should be undertaken to ensure compliance with the Environmental and Social Management Plan; and
- In conclusion, it is recommended that the proposed project is approved based on the assurance that potential negative impacts on the receiving socio-economic environment will be mitigated and managed as far as possible, and that potential positive impacts are enhanced to ensure the greatest value.

9.15 Community Health

A Community Health Impact Assessment was undertaken by Nyara for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D15.

9.15.1 Environmental Status Quo

9.15.1.1 Country Health Profile

South Africa is a dynamic and complex country. A middle-income nation that has dedicated substantial resources to health and human capital investments, South Africa has a progressive Constitution that guarantees the right to health care and a vibrant civil society. National Health Insurance (NHI) is the central means by which the government aims to achieve universal coverage, under the principles of social solidarity and equity elaborated in the National Development Plan. To implement NHI, the government is revitalizing service delivery, changing the way that health services are financed, ensuring the provision of primary care, improving access to qualified human resources for health and ensuring the availability of quality assured medical products.

Life expectancy has increased due to innovations and rapid scale-up of HIV/AIDs and Tuberculosis (TB) treatment and care, and expanded access to immunizations. Life expectancy which incorporates the impact of AIDS increased from 52.1 years in 2005 to 61.2 years in 2014 (Statistics South Africa, 2014). The estimated national HIV prevalence among the general population aged 15 – 49 years has remained 17.3% since 2005 (Department of Health Strategic Plan 2014/15-2018/9). Two in three TB patients also are HIV positive. South Africa has one of the highest TB incidence rates in the world (834 per 100,000 populations). The treatment success rate for new and relapse cases registered in 2013 is 78% (Global TB Report 2015).

South Africa also contributes about 10.4% of the global burden of reported Multi-drug Resistant Tuberculosis (MDR-TB) initiated on treatment. A National DRTB Survey to ascertain the burden of DR-TB was made available in the first quarter of 2016. Diagnosis and management of drug resistant cases account for nearly half of the TB budget and treatment success rates are 49% for MDR-TB and 20% for XDR-TB (Global TB Report, 2015).

Progress in maternal and child health has been hindered by the HIV and tuberculosis epidemics and the performance of the health system. Efforts to accelerate prevention interventions are underway, including the prevention of maternal to child transmission of HIV. Important reductions have occurred in under-five and neonatal mortality (42 and 14 per 1000 live births (2013/14)), although these rates are higher in comparison with other countries of similar socioeconomic status. Maternal mortality ratios remain high, estimated at 269 deaths per 100 000 live births. Immunization remains critical to improving child health. The government currently has eleven antigens on its national immunization schedule, including rotavirus and Pneumococcal Conjugate Vaccine, which has markedly reduced child morbidity and mortality. A national HPV campaign was launched in March 2014.

Approximately two in five deaths are attributable to non-communicable diseases. Some 40% of mortality from non-communicable conditions among men occurred before the age of 60 years which is therefore considered premature. Second to non-communicable conditions is the burden of mortality and disability from violence and injuries. A rapid increase in motor vehicles has led to increases in road traffic accidents that now account for more than one-quarter of deaths due to injuries. For nearly two decades, tobacco-use declined because of strong legislation and policies to control tobacco consumption. The WHO FCTC was ratified in 2005. However, smoking rates are among the highest in the continent (21.5% in 2014). Harmful alcohol consumption is the third most important risk factor contributing to non-communicable diseases, injuries, and communicable diseases. Alcohol use is a major underlying factor in injuries and road traffic accidents. Patterns of harmful use exist among those who drink. Harmful and excessive alcohol consumption also contributes to non-communicable conditions and can also accelerate the progression of infectious diseases.

9.15.1.2 Provincial Health Profile

Air Pollution from Coal Mining and Coal Use in Mpumalanga

The proposed Leslie 1 Project falls within the declared Highveld Priority Area (HPA) for air quality. The Minister declared the HPA on 23 November 2007 as the second National Priority Area (Government Notice No. 1123, 2007). The Highveld area in South Africa is associated with poor air quality. Elevated concentrations of criteria pollutants occur due to the concentration of industrial and non-industrial sources (Held, 1996; DEAT, 2006). The draft midterm review of the 2011 HPA air quality management plan (AQMP) (DEA, 2015) showed that ambient concentrations of PM10 in Leandra were increasing, and that the annual average concentration of PM_{10} in Leandra was above the NAAQS of 40µg/m^3 for the year 2014 (air quality monitoring data is only available from the SAAQIS website for the Leandra monitoring station up to the end of 2014). This may be a significant risk to human health.

In November 2008, the DEAT declared the Mpumalanga Highveld a “pollution hotspot”, or a priority area for air quality management. It cited the 2004 NEDLAC “Dirty Fuels” study, according to which air pollution exposure related respiratory hospital admissions were predicted to be in the order of 8700 cases per year within the Mpumalanga Highveld region. This was the result of both ambient (outdoor) air quality and the burning of coal and wood indoors. The report’s authors predicted an increase in health costs if no action was taken in the area.

Health effects are prominent and acknowledged by the Mpumalanga provincial government. Officials in the Mpumalanga province have talked about “a definite trend towards increased lower respiratory tract infections in children under five years of age in Mpumalanga in the winter months”.

Over recent decades, a number of studies have drawn attention to higher than normal rates of respiratory disease and stunted growth in children. Children exposed to coal smoke from incomplete combustion coal processes (the case with most indoor use of coal) have an approximate ten times higher incidence of respiratory tract disease than comparable children not so exposed (Terblanche, 1994). There are indications of acid deposition (acid rain) on the Mpumalanga Highveld, but not yet proof that it is affecting soil and water quality (DEAT, 2006). Spontaneous combustion of coal discard heaps – and some working mines observed by the researchers - releases toxic compounds including carbon monoxide, carbon dioxide, methane, benzenes, toluenes and xylenes, as well as sulfur, sulfur compounds, salammoniac, arsenic, mercury and lead. Research published in 2007, identified these coal fire gas minerals as having “the potential to affect the health of mine workers and communities living near the coalfields” (Pone, et al, 2007).

Access to Basic Services

The 2011 Census (Figure 9-105) indicates that 15.4% of people don't have properly dwellings. The households with no running water are 12.6%, 141.1% with no access to improved sanitation, 13.5% with no access to electricity for lighting and 56.3% with no access to refuse removal by local authority or private company respectively.

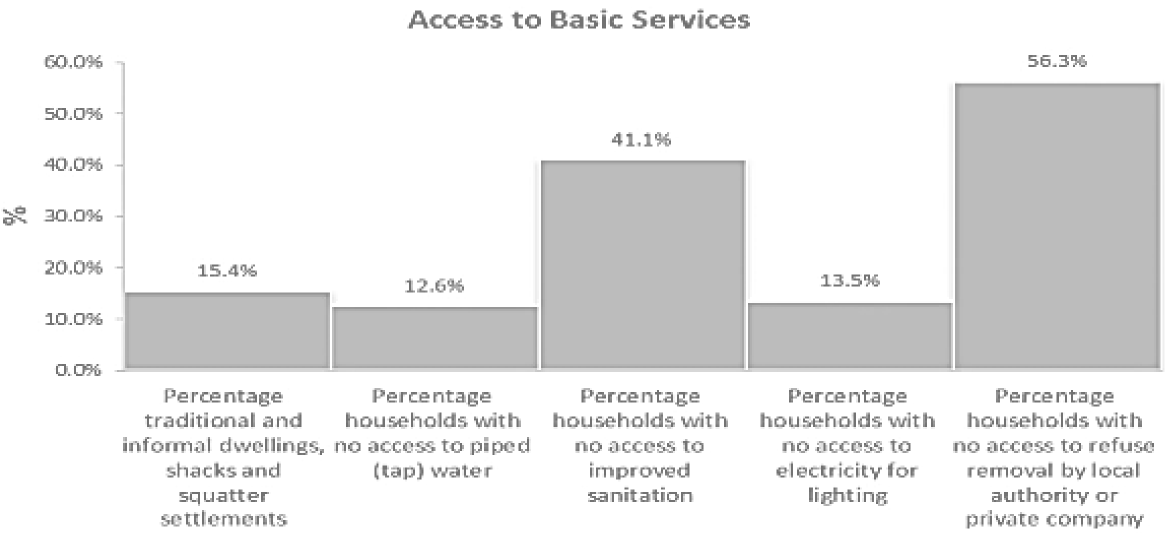


Figure 9-105: Social determinants of health for Mpumalanga Province

Epidemiological Profile

Mpumalanga Province like the rest of the country faces a quadruple burden of diseases. HIV and AIDS, Tuberculosis, high Maternal and Child Mortality, Non-Communicable Diseases and Violence and Injuries continue to take a toll on the Province's citizens. Compounding on these unfavourable conditions, are adverse socio-economic determinants such as poverty and inadequate access to essential services such as electricity, proper sanitation and access to potable water.

This quadruple burden of diseases is occurring in the face of a reasonable amount of health expenditure as a proportion of the GDP (Gross Domestic Product). Available evidence indicates that South Africa spends 8,7% of its GDP on health which is significantly more than any other country on the African continent however, the health outcomes are much worse than those of countries spending much less than South Africa. The South African health care system has been characterized as fragmented and inequitable due to the huge disparities that exist between the public and private health sectors about the availability of financial and human resources, accessibility and delivery of health services.

There is high inequity to provision of health care services with the majority of the population relying on a public health care system, relative to the private sector serving approximately 12% of the population. The distribution of key health professionals between the two sectors is also skewed for example, the doctor/patient ratio is as high as 1:4000 in the public sector while it is 1:250 in the private sector. The poor health outcomes can be attributed to several factors but are evidenced through a decline in life expectancy in the country.

Maternal and Child Mortality

Maternal mortality and morbidity in South Africa remains very high, and according to the Saving Mothers report (2011 - 2013), about 26.7% of cases, the death was thought to have been probably avoidable and in a further 32.8%, the death was considered possibly avoidable. The South African National Strategic Plan for a Campaign on Accelerated Reduction of Maternal and Child Mortality in Africa (CARMMA) states that these deaths are related to community, administrative and clinical factors.

The "Saving Mothers Report" (2011-2013) further states that the "big 5" causes of maternal deaths were non-pregnancy related infections (NPRI) (34.7%, mainly deaths due to HIV infection complicated by tuberculosis (TB), PCP and pneumonia), obstetric haemorrhage (15.8%), complications of hypertension in pregnancy (14.8%), medical and surgical disorders (11.4%) and pregnancy related sepsis (9.5%, includes septic miscarriage and puerperal sepsis). The data in the province shows a steady decline in the Maternal mortality ratio from 166.1 (2012) per 100 000 live births to 108 (2014) per 100 000 live births.

The vision is to continue to reduce maternal mortality through the implementation of Provincial Strategy on Reduction of Maternal and Child Mortality (2013), to address clinical factors, and Re-engineer Primary Health Care to improve some of community and Administration related factors and strengthen a functional referral system as responsive support system of hospitals.

According to the MDG Report (2013) Child under five mortality rates in sub-Saharan Africa were very high in 1990 due to the high rate of HIV/AIDS. However, in 2007, mortality rates in South Africa started to decline as several HIV prevention and treatment programmes were implemented. Owing to this decline in HIV infections and other factors, United Nations (UN) estimates show that under-5 mortality dropped between the years 2000 and 2011 from 74 to 47 per 1000 live births.

The trend in the province of the under-5 deaths has shown an upswing after years of steady downward trends. Child facility mortality rate increased from 5.5/1000 (2012/13) to 8.3 /1000 in 2014/15. Infant mortality also increased from 8.3/1000 (2012/13) to 12/1000. The Second Report of the Committee on Morbidity and Mortality in Children under 5 years (CoMMiC) (2014), reported that the cause of deaths of the under 5 had a quarter (25.3%) of the total reported deaths being due to neonatal causes, whilst gastroenteritis accounted for (15%) and acute respiratory infections (mostly pneumonia) (13%) Non-natural causes (6%), malnutrition (4%), congenital abnormalities (4%) and tuberculosis (2%)

HIV Prevalence

The HIV epidemic in the country has a profound impact on society, the economy as well as the health sector and contributes to a decline in life expectancy, increased infant and child mortality and maternal deaths as well as a negative impact on socio-economic development. The National Antenatal Sentinel HIV and Syphilis Prevalence Survey which is being conducted annually for the past 23 years, is being used as an instrument to monitor the HIV prevalence trends since 1990. Prevalence usually reflects the burden of

HIV on the health care system and changes (increases) may be the cumulative effect of many factors that may work individually or collectively to drive the epidemic.

In 2013, the Mpumalanga provincial HIV prevalence amongst antenatal women was 37.3%, a slight increase from 35.5% in 2012. This is the highest recorded figure so far in the province (Figure 9-106).

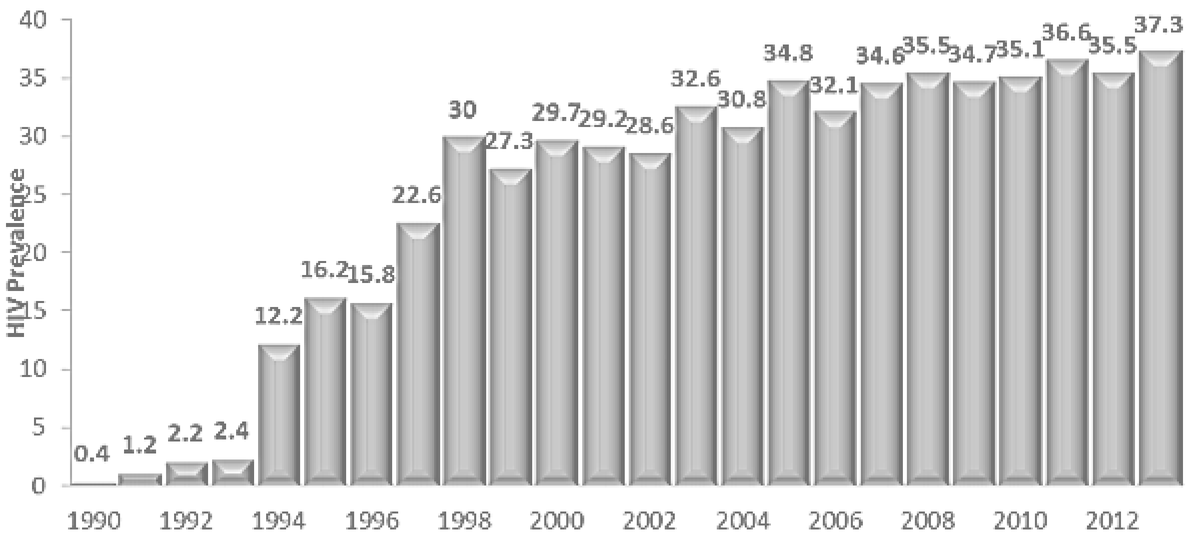


Figure 9-106: Mpumalanga HIV Epidemic Graph 1990 – 2013

In Mpumalanga, the age distribution of pregnant women who participated in the survey, ranged from 15 – 49 years old with some few outliers. The majority of the survey participants were teenagers and young women (15-24-year olds). In 2013, the HIV prevalence among 15-24-year olds (Millennium Development Goal 6, Target 7) is showing a slight increase from 23.9% in 2012 to 25.3% in 2013. HIV prevalence among the age group 15-19 also increased by 2% in 2013 from 14.3% in 2012 to 16.1% in 2013 (Figure 9-107).

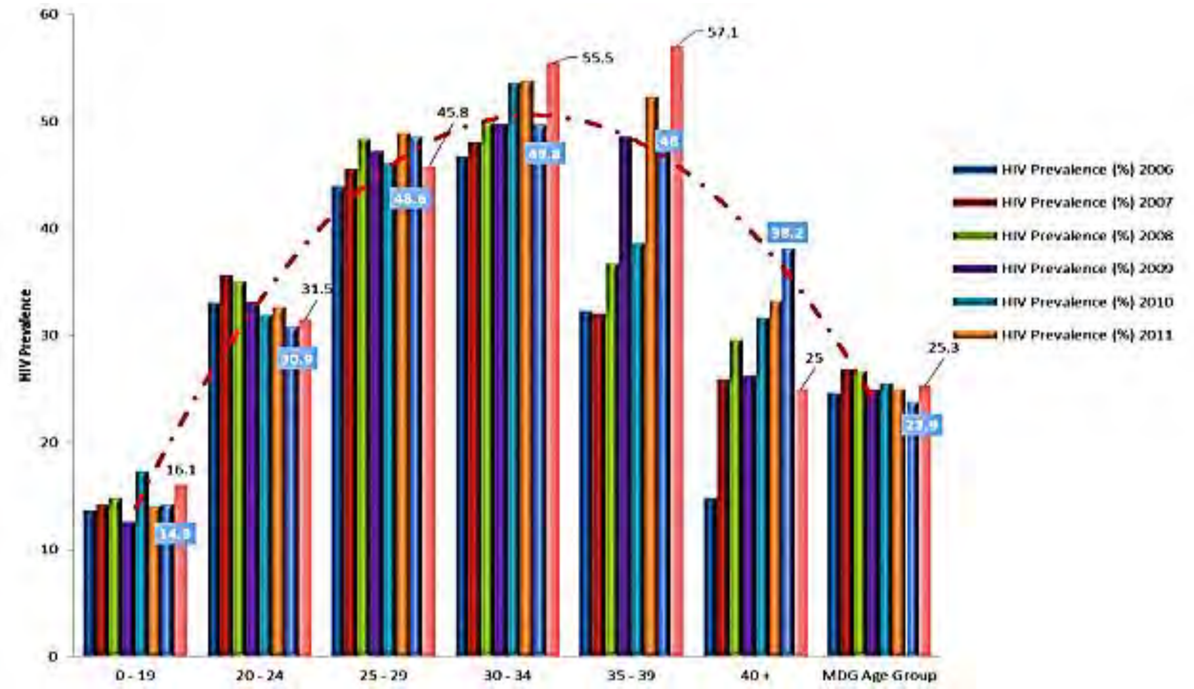


Figure 9-107: Mpumalanga HIV Epidemic Graph by Age group: 2006 – 2013

According to a research done by Deutsche Gesellschaft fur Internationale Zusammenarbeit (GIZ) in Mpumalanga Province HIV prevalence among farm workers has increased. There is no single factor causing the high rate of HIV/AIDS infection on some farming communities but a combination of factors such as multiple and concurrent partnerships, transactional sex, irregular use of condoms, untreated STI's and high level of sexual violence.

Tuberculosis Management

According to the World Health Organisation (WHO) estimates, South Africa ranks the third highest in the world in terms of the TB burden (i.e. after India and China) with an incidence that increased by 400% over the past 15 years. HIV is fuelling the TB epidemic with more than 60% of TB patients also living with HIV nationally.

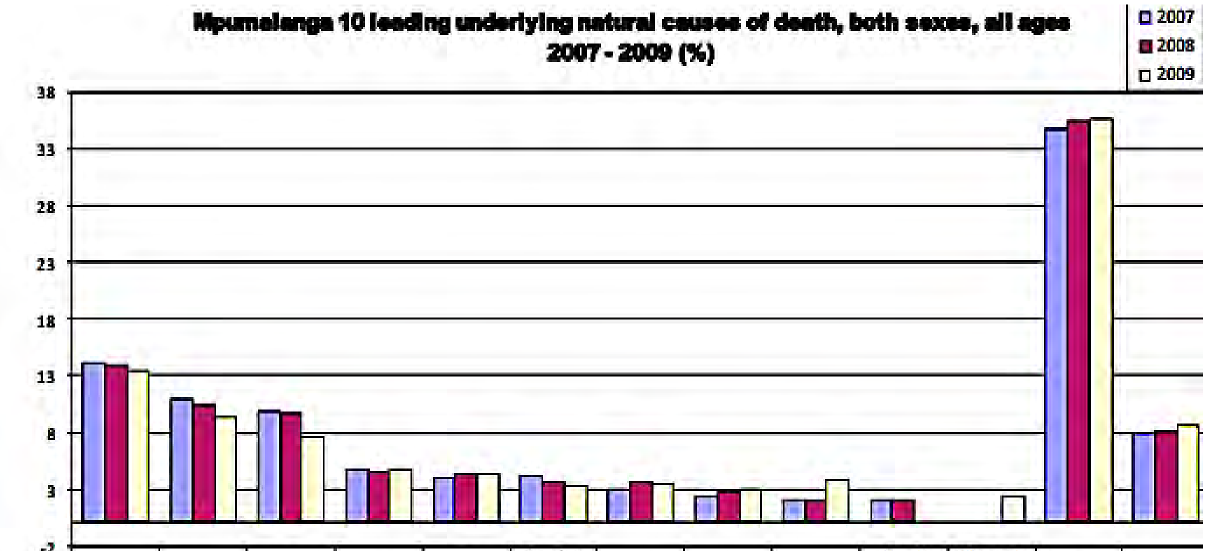
Tuberculosis is both a medical condition and a social problem linked to poverty-related conditions. Townships and informal settlement conditions are characterised by overcrowding and low-socio-economic status, all of which provide fertile ground for TB infection and disease. It is estimated that approximately 1% of the South African population develops TB disease every year. Due to late detection, poor treatment, management and failure to retain TB patients on treatment, drug resistant forms of TB (MDR-TB and XDR-TB) have increased significantly. The combination of TB, HIV and DR TB has led to a situation where TB is the number one common cause of death among infected South Africans.

Mortality

According to the "Findings of the Mortality and Causes of Death in South Africa Report, 2010" released by Statistics South Africa, tuberculosis continued to be the most commonly mentioned cause of death on death notification forms, as well as the leading underlying natural cause of death in the country however, the number of deaths has been decreasing since 2007.

Influenza and pneumonia were the second leading cause of death followed by intestinal infectious diseases, cerebro-vascular diseases and other forms of heart disease. HIV was the sixth leading cause of death in Mpumalanga in 2010.

The leading causes of death in the cohort of 15-49 years of age in Mpumalanga are Tuberculosis, Influenza and Pneumonia, Intestinal Infectious Diseases, Certain disorders involving the immune mechanism, with HIV as the fourth leading cause of death in this age group. Men are dying more from non-natural causes whilst females are dying mostly from natural causes.



	Tuberculosis	Influenza & Pneumonia	Intestinal Infectious Disease	Cerebrovascular Diseases	Other forms of Heart Disease	Disorders involving immune mechanism	Diabetes Mellitus	Hypertensive Diseases	HIV Disease	Chronic Lower Respiratory Disease	Other acute lower respiratory infections	Other Natural causes	Non Natural Causes
2007	14.1	10.9	9.9	4.7	4	4.1	2.9	2.3	2	2	0	34.9	8
2008	13.9	10.4	9.7	4.6	4.3	3.7	3.7	2.8	2.1	2.1	0	35.5	8.1
2009	13.4	9.4	7.6	4.7	4.4	3.2	3.5	3	3.8	0	2.4	35.8	8.7

Figure 9-108: Mpumalanga 10 Leading Underlying Natural Causes of Death, Both Sexes, All Ages 2007 – 2010

9.15.2 Specialist Assessment Methods

A standardised approach was considered for the community Health Impact Assessment (cHIA) to ensure that evidence-based recommendations supported the impact assessment. To ensure compliance with the IFC performance standards, and especially PS4, the methodology outlined in the Good Practice Note for HIA from the IFC, was adopted (IFC, 2009). The main elements of this are illustrated in Figure 9-108. These are also discussed briefly below so that the context of the HIA is understood.

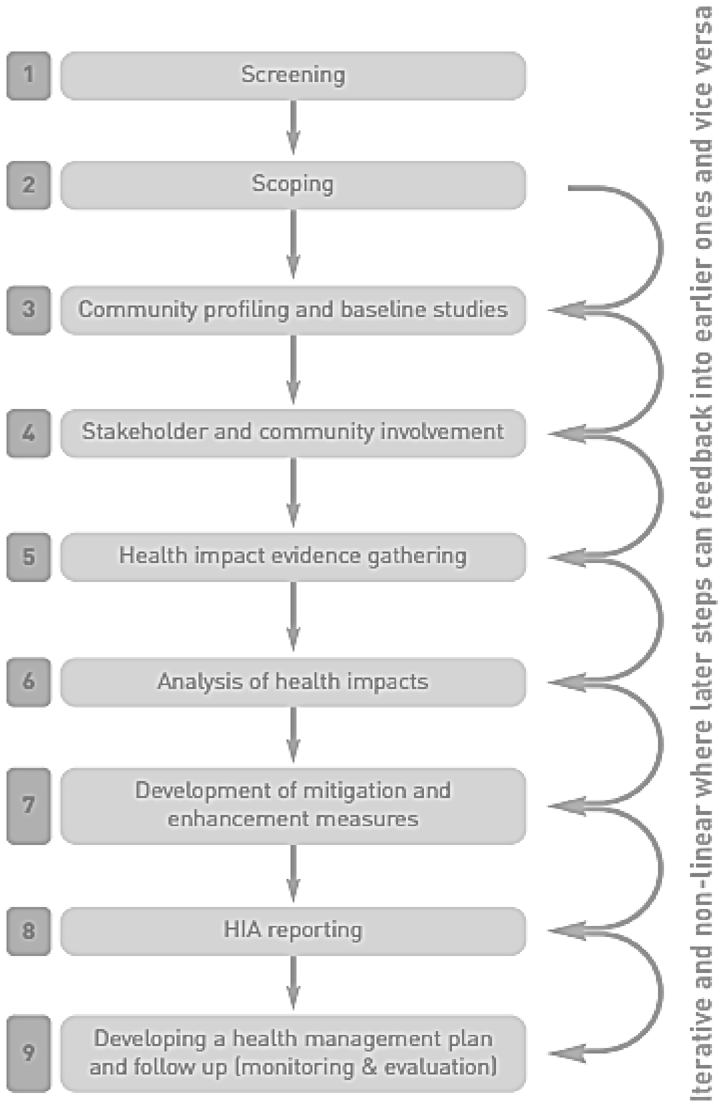


Figure 9-109: HIA Procedure

The framework that is commonly used for a cHIA follows a 6-step process (IFC, 2009):

- Screening (preliminary evaluation to determine the necessity of a HIA);
- Scoping (identifying the range of potential Project-related health impacts and defining the terms of reference for the HIA, based on published literature, local data and broad stakeholder consultation and how these may be influenced by the Project);
- Risk assessment (qualitative and quantitative appraisal of the potential health impacts in relation to defined communities and the Project development, including stakeholder participation);
- Appraisal and mitigation (development of a CHMP) based on the findings of the risk assessment);
- Implementation and monitoring (realisation of the CHMP including monitoring activities that allow for adaptation); and
- Evaluation and verification of performance and effectiveness (key step to analyse the HIA process as a whole).

This HIA aims to influence design and inform the construction, operation and decommissioning phases of the Project. As HIAs are dynamic iterative processes they do require flexibility in their methodologies and tools, so that they can be fit for purpose for different Projects.

9.15.3 Specialist Findings

9.15.3.1 EHA #1 Vector-Related Diseases

Vector-borne diseases are illnesses caused by pathogens and parasites in human populations. Distribution of these diseases is determined by a complex dynamic of environmental and social factors. Vector-related diseases may be present in the community, resulting from unmanaged water bodies and vectors drawn to waste, such as rats and mice.

While vector-borne diseases are not common in the study area, illegal dumping of waste (such as that illustrated in Figure 9-110) and the influx of people coupled with poor environmental management may lead to establishment of vector breeding sites in the study area, a situation that may lead to emergence and increase in the prevalence of vector-borne diseases, e.g. toxoplasmosis.

Figure 9-110: Illegal dumping on the outskirts of Leslie

During active operational periods, the proposed Leslie 1 Coal Mining Project may create new breeding sites for key mosquito vectors which would significantly increase the vector-borne disease risk. In addition, existing water bodies, such as surface-water environmental-control dams or new reservoirs, may become magnets for local community members and increase the risks of injury, including accidental drowning. In addition, water storage facilities require careful environmental engineering (for example, shoreline slopes and vegetation control) to prevent development of vector breeding sites. During construction and operations phases, tires, drums, and other containers may become significant breeding sites for mosquitoes. The consequences for this are:

- Potential new breeding sites for mosquito vectors
- Increase in the vector-borne disease risk

9.15.3.2 EHA #2 Communicable Diseases Linked to Housing Design

Housing design is crucial because poor planning results in congestion, overcrowding of people and improper sanitation, all of which when combined form the fundamental requirements for the perfect breeding ground for many diseases. Research conducted in Sri Lanka, Costa Rica and Philippines showed a positive correlation between poorer housing and an increased death rate among children (Phillips, 1990).

Communicable diseases are spread from one person to another or from an animal to a person. The spread of such diseases often happens via airborne viruses or bacteria, but also through blood or other bodily fluid. The terms infectious and contagious are also used to describe communicable diseases.

To have "healthy housing" it is necessary that the following elements are adequately addressed: shelter, water supply, sanitation, solid waste, wastewater, overcrowding, indoor air pollution, food safety, vectors of disease, as well as aspects related to transport, and shopping facilities (WHO 1997). Coughs in children were identified as a common health problem in Leslie.

Based on the key informant interview it was clear that most households live in a brick structure (often RDP type, some even almost squatter like housing) or traditional structures on individual properties (with more than one house on the respective property) or one house on a separate stand/property. Most of the houses in Leslie are traditional brick or mud structures either with a tiled roof or corrugated iron roof. Based on the FGD at Leslie Township, overcrowding is a problem. According to the information collected from FGDs, TB is the most common respiratory disease in the PACs as it was reported, by the majority, to being one of the most common illnesses in their communities. Respondents stated that asthma was one of the three most important illnesses in their communities.

Figure 9-111: Common type of housing in Leslie

Figure 9-112: Housing structures in Leslie

Diseases that may be intensified due to mining include: conjunctivitis, respiratory tract diseases, vector borne diseases such as schistosomiasis and STDs such as HIV/AIDS. Acute conjunctivitis is attributed to high dust particles, smoke or chemical content in the air. With surface mining, dust and other chemicals are regularly dispersed in the air, which could lead to acute conjunctivitis. Similarly, respiratory tract diseases such as tuberculosis (TB) and silicosis may spread more quickly in mining areas. Sneezing or coughing, the most common means of producing airborne TB bacilli, is common among miners as they are exposed to dust and chemicals in the air created by mining activities.

Tuberculosis is a contagious infection caused by Mycobacterium tuberculosis. Although all the organs in the human body are susceptible to TB, the lungs are the primary organs that are most commonly affected.

TB usually affects the young, poor and the immunocompromised individuals (those already suffering from diseases such as HIV/AIDS, which weakens the immune system). Since TB is spread through the air, it transmits easily in crowded environments. Miners work in close proximity to each other in an enclosed environment such as an underground mine, which allows the TB bacteria to spread easily.

Transmission of Communicable Diseases due to Overcrowding

An influx of large groups of workers can also lead to overcrowded conditions where air-borne diseases such as TB, influenza and meningitis can spread easily. This in-migration can also lead to the introduction of new infections to remote areas where local communities have little or no natural immunity to them.

About 70% of households live in formal dwelling/ house or brick/ concrete block structure within the municipality while 10% live in traditional dwelling or structure made of traditional matter. This 10% may be households living in rural areas. There is still, however, 4% living in informal settlements and a further 6% living in informal dwelling/ shack in the backyard.

The existing environmental health needs related to housing is based on observation and reports from the SIA. During the rainy season, cooking with wood is likely to occur indoors which can increase the incidence of respiratory infections, especially in children (WHO, 2011). Studies in some African countries have found the odds of developing Acute Respiratory Infections (ARIs) are more than twice likely if biomass fuels are burnt inside a household compared to using cleaner fuel. Moreover, studies have also shown that about half of the prevalence of active ARIs in adults aged over 20 years can be attributed to smoke from cooking fuels. In addition to this the general environmental health and sanitary conditions in most of the communities was poor as waste collection and management was inadequate. It can be assumed that personal hygiene is often lacking. While these are all existing social circumstances (generally related to poverty) that the proposed Leslie 1 Mining Project does not influence, these might play a synergistic (or indirect) role in influencing negative health impacts but also present an opportunity to measure improvements in the quality of life of residents.

Influx/in-migration to the area has been mentioned as a potential impact in the SIA. The project has the potential to attract outsiders and returning families. These factors need to be addressed in an influx management plan as monitoring of overcrowding will be important.

Respiratory tract infections, from a viral and bacterial origin are important to consider. This can include seasonal influenza and pandemic strains that the local communities may be unaware of due to their isolation. Vulnerable groups in these communities, especially the elderly and those with underlying disease, are particularly susceptible as their immune systems are often weakened. Any management plans for respiratory diseases by the proposed Leslie 1 Coal Mining Project must consider community health as this may affect business continuity and reputation, where the project runs the risk for being blamed for disease outbreaks, especially with movements of people in and out of area.

The current capacity of the health care services to manage TB is efficient. The link with HIV is a growing problem nationally and might eventually have a project impact. This increases the challenge in monitoring for any negative impact related to increased transmission from the disease. The proposed Leslie 1 Mining Project will inherit this as well as the poor socioeconomic and housing conditions as described above.

TB has been described as a major concern in the surveyed communities. The underground nature of the mine increases the risk for occupational exposure from inhalable dust that may contain crystalline silica. There are clear links between TB and silicosis from the workplace; however, this has mainly been reported from the underground mines in South Africa. There is however a potential for this type of exposure and it will thus need to be managed as part of the Project's occupational health and safety programme. Entrained dust from vehicles may pose a risk to communities in a similar way. TB may also present a major risk amongst workers who originate from areas where TB is more prevalent. The presence of the multidrug-resistant (MDR-TB) strain from these sources is also important as these can be introduced into communities that have not been exposed to these strains before. If the semi-skilled construction work-force is supported by third-country nationals, then it will be vital to assess the burden of disease in these locations and the potential risks from the incoming workforce.

No skin diseases were reported from the FGDs.

Hostel accommodation and camps are commonly constructed to house project workers. This can bring with it a range of risks and opportunities in relation to health and wellbeing e.g. water supply, sanitary installations, ventilation and the control of infectious diseases – especially for FiFo (Fly in Fly out) operations. The influx of workers can also create pressures on existing housing leading to higher land and house prices, higher rents, housing shortages for existing residents, and overcrowding.

The proposed Leslie 1 Mining Project per se is unlikely to have a major impact related to communicable diseases if these are mitigated effectively.

9.15.3.3 EHA #3 Veterinary Medicine and Zoonotic Issues

This EHA refers to diseases affecting animals (e.g. bovine tuberculosis, swinepox, avian influenza) or that can be transmitted from animal to human (e.g. rabies, brucellosis, Rift Valley fever, Lassa fever, leptospirosis, etc.). A zoonotic disease is a disease that can be passed between animals and humans. Zoonotic diseases can be caused by viruses, bacteria, parasites, and fungi. These infectious diseases of animals have different modes of transmission. In direct zoonosis the disease is directly transmitted from animals to humans through media such as air (influenza) or through bites and saliva (Rabies). In contrast, transmission can also occur via an intermediate species (referred to as a vector), which carry the disease pathogen without getting infected.

There may be several people with animals entering the area during influx. If people cannot afford preventative measures for animals, there may be an increase in the zoonotic disease risk such as rabies infections. No information on the current state of zoonotic diseases is available for the area. However, an influx of people who bring in animals, may lead to an increase in zoonotic diseases.

No zoonotic issues were identified during FGDs. It is however, important to remain cognizant that an increase in domestic animals may increase the risk for zoonotic diseases. Leslie Coal Mine would have to implement mitigation measures if these arose due to the Project.

9.15.3.4 EHA #4 Sexually-Transmitted Infections, Including HIV/AIDS

All respondents in the FGDs reported to having heard about HIV/AIDS. With numerous respondents across the PACs stating that HIV/AIDS is a serious problem in their communities it is clear to see that HIV/AIDS has affected all levels of these communities – from the youth to the elderly. All four interviewed healthcare personnel listed HIV/AIDS as one of the top five most common illnesses that they treat. All health facilities have the ability to diagnose HIV and stock ARVs.

Condoms are readily available within the communities. They are available for free at health facilities and they are also available in public toilets, shops, 'spazas', schools and shebeens. There is little stigma associated with buying condoms, although some women stated that they sometimes feel shy to take free condoms from public places and that it was the responsibility of the men to acquire condoms.

There are regular HIV awareness campaigns within the communities. It was observed that there is good knowledge of HIV transmission and prevention measures. Most members of the communities also have a good attitude towards people with HIV, none of the respondents voiced discriminatory attitudes towards HIV positive people. Information collected during focus group discussions shows that a large proportion of respondents know the two main ways to prevent HIV, namely condom use and having one uninfected sexual partner.

HIV/AIDS: Knowledge, Attitude and Behaviour

With numerous respondents across the PACs stating that HIV/AIDS is a serious problem in their communities it is clear to see that HIV/AIDS has affected all levels of these communities. While the others asserted that HIV/AIDS is not a serious problem in their communities as nurses and NGOs educate the population about this disease, and therefore expect that everyone should have knowledge on this disease, results prove that the general levels of awareness and consistent knowledge on the disease and preventive behaviours is relatively poor.

There are low levels of stigma in the communities with associated discrimination as many individuals were willing to purchase food from someone who they knew was HIV positive. In addition, the majority of the respondents from both Leslie and Eendracht would keep their HIV positive family member's status a secret. Apart from this being attributable to a general respect for their family member's privacy, part of this is due to the poor levels of knowledge and beliefs. Traditional, cultural and religious beliefs make it difficult to inform behavioural change information. It is felt that the more rural communities simply don't have access to adequate information about HIV and AIDS, and the high levels of illiteracy also makes behavioural change communication somewhat challenging.

Information collected during the FGDs shows that a large proportion of respondents know the two main ways to prevent HIV, namely condom use, abstaining and having one uninfected sexual partner (monogamy, that is, being faithful).

Transmission of STIs and HIV/AIDS

HIV/AIDS and STI are existing public health challenges both nationally and within the immediate proposed Project area. Although, the HIV prevalence in the proposed Leslie 1 Mining Project area is currently low, it is still a public health concern. STIs, if present and untreated, have been found to increase the risk of transmission of HIV, if one partner is infected. HIV's link with TB and its importance has been discussed above.

Influx and/or movement of labour into the proposed Leslie 1 Coal Mining Project area will pose an increased risk for STIs. There will be more disposable income, either as a direct or indirect consequence of the project. Although there will not be any accommodation on site as it is planned to use local labour, commercial sex workers are still likely to establish in Leandra, where newly employed men from the local community may be vulnerable to opportunistic sexual liaisons. The likely effect of the project employing a number of relatively well-paid employees may also increase the risk for transactional sex. Economic upliftment and settlement in the project area may also lead to the adoption of "urban" values and lifestyle changes, which may also play a role in casual sexual engagement.

The improved economic status of the area and the influx of new people, living away from their families, can also lead to an increased risk of sexually transmitted infections such as HIV/AIDS, gonorrhoea and chlamydia. Major outbreaks of infectious diseases can have a devastating effect not only on communities, but on the viability of a mining project such as the proposed Leslie 1 Mining Project.

Women and young girls are extremely vulnerable and have limited negotiating power for safe practices and family planning. Gender based sexual violence is not as common but there is very little support for any victims. It is important to recognise the role gender plays in sexuality and its effects on HIV transmission and prevention.

HIV/AIDS should be considered a major risk for the project and the community and interventions should be implemented on a broad base in the workforce and the community.

9.15.3.5 EHA #5 Soil, Water and Waste-Related Diseases

Adequate provision of water and sanitation services is a critical public health infrastructure. Safe drinking water and adequate sanitation is a necessity for good health, as households without safe water and proper sanitation systems are more vulnerable to water borne diseases. Government water schemes provide most households within the local study area with piped water; however, a considerable number of households still depend on groundwater resources for domestic and agricultural use. Communities are almost totally dependent on piped ground water abstracted from boreholes by pumps. Data on ground water resources indicates that there are water shortages, especially during the dry season, in the area.

Water scarcity in the area prevents local water supply schemes to provide sustainable and reliable water to most rural communities.

Table 9-74: Water Service Delivery Statistics

	2015/16	2014/15	2013/14	2012/13	2011/12
Blue Drop Score	n/a	n/a	77.22	n/a	77.50
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No
Number of households and non-domestic customers to which provided	101 197	101 197	89 521	88 881	87 474
Number of domestic households/delivery points	101 197	101 197	86 600	86 600	85 193
Inside the yard	95 665	95 665	85 059	85 059	83 652
Less than 200m from yard	2 786	2 786	1 541	1 541	1 541
More than 200m from yard	2 746	2 746	0	0	0
Domestic households with access to free basic service	8 394	8 394	20 391	22 523	68 788

The availability of sanitation facilities not only improves the dignity of people, but also promotes their health. Areas without proper sanitation systems give rise to water-borne diseases like cholera and diarrhoea. The field visit indicated that the majority of households do not have access to adequate sanitation services. Some residents of Leslie construct their own pit latrines, often of poor standard. In the FGD the majority of the respondents used pit latrines and Ventilated Improved Pit-latrine (VIP) toilets in their own yards. Homes in Eendracht have adequate sanitation facilities (flush toilets) inside their houses and yards. Households in the PACs generally obtain their drinking water from taps in their homes, as well as “Jojo tanks”.

Table 9-75: Solid Waste Services Delivery Statistics

	2015/16	2014/15	2013/14	2012/13	2011/12
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No
Number of households and non-domestic customers to which service is provided	68 215	68 215	61 554	61 554	60 794
Domestic households with access to free basic service	8 394	8 394	20 391	19 918	60 789

Figure 9-113: Inadequate refuse removal by the Local Municipality

Surface Water Findings

Hydrospatial (Pty) Ltd was appointed by Kongiwe to undertake a surface water assessment study for the proposed Leslie 1 Coal Mining Project. Surface water quality sampling was conducted in the wet season during the site investigation on 4 and 5 April 2018.

The surface water quality results with potential impacts to human health are summarised below:

- Faecal coliforms exceeded the guideline limit for irrigation at all sampling points, as well as the guideline limit for livestock watering at all sampling points except SW1 and SW5. Faecal coliforms are bacterial indicators of faecal pollution from humans and warm-blooded animals. They are primarily used to indicate the presence of bacterial pathogens such as Salmonella spp., Shigella spp. Vibrio cholerae, Campylobacter jejuni, Campylobacter coli, Yersinia enterocolitica and pathogenic E. coli. The highest faecal coliform counts occurred at the sampling points located along the Waterval River, with excessively high counts in excess of 100 000 occurring at SW4 and SW2. High counts also occurred at SW8 and SW10, downstream of the Leandra WWTW;
- Orthophosphate exceeded the RQO limits at SW2, SW3 and SW4 along the Waterval River. This is also likely to be from sewage from the settlement of Lebohang, as discussed previously. Orthophosphate was also high at SW7, located directly downstream of the Leandra WWTW.

Similarly, the exceedance of sodium at SW4, as well as the elevated levels at SW2, SW3 and SW7, are also likely to be as a result of the abovementioned sources;

- Manganese was within the RQO limits, but exceeded the guideline limits for irrigation at SW1, SW2, SW3 and SW8. Manganese was highest at SW2 and SW4, suggesting that runoff and sewage from Lebohang may be the cause.

What this means for Human Health

Coliforms are bacteria that are always present in the digestive tracts of animals, including humans, and are found in their wastes. They are also found in plant and soil material. The most basic test for bacterial contamination of a water supply is the test for total coliform bacteria. Total coliform counts give a general indication of the sanitary condition of a water supply.

- Total coliforms include bacteria that are found in the soil, in water that has been influenced by surface water, and in human or animal waste.
- Fecal coliforms are the group of the total coliforms that are considered to be present specifically in the gut and feces of warm-blooded animals. Because the origins of fecal coliforms are more specific than the origins of the more general total coliform group of bacteria, fecal coliforms are considered a more accurate indication of animal or human waste than the total coliforms.
- Escherichia coli (E. coli) is the major species in the fecal coliform group. Of the five general groups of bacteria that comprise the total coliforms, only E. coli is generally not found growing and reproducing in the environment. Consequently, E. coli is considered to be the species of coliform bacteria that is the best indicator of faecal pollution and the possible presence of pathogens.

In general, increased levels of faecal coliforms provide a warning of failure in water treatment, a break in the integrity of the distribution system and possible contamination with pathogens. When levels are high there may be an elevated risk of waterborne gastroenteritis. As suggested in the Surface Water Report, the presence of faecal coliform in aquatic environments may indicate that the water has been contaminated with the faecal material of humans or other animals. Faecal coliform bacteria can enter rivers through direct discharge of waste from mammals and birds, from agricultural and storm runoff, and from human sewage (Doyle, 2006).

The health effects of exposure to disease-causing bacteria, viruses, and parasites in drinking water area varied. The most common symptoms of waterborne illness include nausea, vomiting, and diarrhoea. Infants, the elderly, and those with compromised immune systems may suffer more severe effects. In extreme cases some pathogens may infect the lungs, skin, eyes, nervous system, kidneys, or liver and the effects may be more severe, chronic, or even fatal (Brunswick, year unknown).

Groundwater Findings

Irene Lea Environmental and Hydrogeology cc (iLEH) were appointed by Kongiwe to conduct the Groundwater Impact Assessment for the proposed Leslie 1 Mining Project. A hydrocensus was conducted across the proposed Leslie 1 mining area during April 2018 and included the proposed mining footprint areas and adjacent properties and concentrated on identifying existing boreholes to enhance the knowledge of the groundwater systems and current groundwater use.

Based on the water quality results the following conclusions pertaining to health were drawn:

- Nitrate – Boreholes Brak26 and Goed16 yielded high nitrate concentrations (26 to 28 mg/L); potentially because of human and irrigation activity in the area. All samples with high nitrate concentrations should be checked for bacteriological contamination. This has acute health effects (SANS Drinking water standards). A source of nitrate in natural water results from the oxidation of plant and animal debris and of animal and human excrement.

Methaemoglobinaemia: The toxicity of nitrate to humans is mainly attributable to its reduction to nitrite. The major biological effect of nitrite in humans is its involvement in the oxidation of normal Hb to metHb, which is unable to transport oxygen to the tissues. The reduced oxygen transport becomes clinically manifest when metHb concentrations reach 10% of normal Hb concentrations and above; the condition, called methaemoglobinaemia, causes cyanosis and, at higher concentrations, asphyxia. The normal metHb level in humans is less than 2%; in infants under 3 months of age, it is less than 3%.

Carcinogenicity: Nitrite was shown to react with nitrosatable compounds in the human stomach to form N-nitroso compounds. Many of these N-nitroso compounds have been found to be carcinogenic in all the animal species tested, although some of the most readily formed compounds, such as N-nitrosoproline, are not carcinogenic in humans. The Nnitroso compounds carcinogenic in animal species are probably also carcinogenic in humans. However, the data from a number of epidemiological studies are at most only suggestive. The endogenous formation of N-nitroso compounds is also observed in several animal species, if relatively high doses of both nitrite and nitrosatable compounds are administered simultaneously. Thus, a link between cancer risk and endogenous nitrosation as a result of high intake of nitrate and/or nitrite and nitrosatable compounds is possible (Speijers et al., 1989; FAO/WHO, 1996, 2003a, b).

Several reviews of epidemiological studies have been published. No convincing evidence was found of an association between gastric cancer and the consumption of drinking-water in which nitrate concentrations of up to 45 mg/l were present. No firm evidence was found at higher levels either, but an association could not be excluded because of the inadequacy of the data available. Studies that have assessed the effect of nitrate from sources other than vegetables, such as the concentration in drinking water or occupational exposure to nitrate dusts, have not shown a protective effect against gastric cancer risk. For other types of cancer, there are no adequate data with which to establish any association with nitrite or nitrate intake (Gangolli et al., 1994; Möller, 1995; FAO/WHO, 1996).

Other effects: Congenital malformations have been related to high nitrate levels in drinking-water in Australia; however, these observations were not confirmed. Other studies also failed to demonstrate a relationship between congenital malformations and nitrate intake (WHO, 1985b; ECETOC, 1988; Manassaram et al., 2007).

Studies relating cardiovascular effects to nitrate levels in drinking-water gave inconsistent results (WHO, 1985b).

Possible relationships between nitrate intake and effects on the thyroid have also been studied. It is known that nitrate can competitively inhibit iodine uptake, as with similar anions. However, what is known to occur in the laboratory may not result in adverse effects in human populations under normal circumstances of exposure. In addition to effects of nitrate on the thyroid observed in experimental animal studies and in livestock, epidemiological studies revealed indications for an antithyroid effect of nitrate in humans. If dietary iodine is available at an adequate range (corresponding to a daily iodine excretion of 150–300 μg/day), the effect of nitrate is likely to be weak, with a tendency to zero. The nitrate effect on thyroid function may be strong if a nutritional iodine deficiency exists simultaneously (Höring, Nagel & Haerting, 1991; Höring, 1992).

Hettche (1956a, b) described an association between high nitrate concentrations in drinking-water and goitre incidence. As well, Höring & Schiller (1987), Sauerbrey & Andree (1988), Höring, Nagel & Haerting (1991), Höring (1992) and van Maanen et al. (1994) found that inorganic nitrate in drinking-water is associated with endemic goitre.

Diarrhoea

Diarrhoea is usually a symptom of gastrointestinal infection and can be caused by a variety of bacterial, viral and parasitic organisms. Diarrhoea control and prevention takes place at different levels, including vaccination against rotavirus and measles, early and exclusive breastfeeding for at least the first 6 months (preferably 2 years), vitamin A supplementation, hand washing with soap, improved water quality and sanitation.

Table 9-76: Sewerage and Sanitation Service Delivery Statistics

	2015/16	2014/15	2013/14	2012/13	2011/12
Green Drop Score	n/a	n/a	n/a	0	0
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No
Number of households and non-domestic customers to which provided	94 717	94 717	69 181	61 792	60 042
Number of households using:					
Flush toilet - public sewerage	89 997	89 997	57 126	57 126	57 126
Flush toilet - septic tank	1 508	1 508	456	456	431
Ventilated pit latrine	3 114	3 114	2 725	2 725	2 485
Bucket system	0	0	0	0	0
Other	0	0	8 776	1 485	0
Domestic households with access to free basic service	8 394	8 394	20 391	22 523	60 042

During FGDs, diarrhoea was identified as one of the diseases with a significant burden within the community, especially amongst children under five years of age. The disease is said to be especially common among children in Leslie as they have higher chances of playing in contaminated or unclean water.

No cases of cholera were reported during FGDs.

Figure 9-114: Living conditions in Leslie with the pit latrine clearly visible

Mining projects can potentially change these exposures by adding or removing substances in the air, water and/or soil. Some of the substances that may be added can remain in the environment and/or the food chain for decades after the closure of a project (e.g. mercury, pesticides), and therefore may have transgenerational health impacts.

<u>Water and Sanitation</u>

Access to clean water and good sanitation are a fundamental determinant of health and can be positively or negatively affected by mining and metals projects. Projects can be heavy users of local water and can also release materials into existing water sources. Similarly, projects can place pressures on existing sanitation and water supply systems because of the increase in population in the area.

Influx may also play a role in availability of water due to increased demand, which may ultimately negatively affect water quality. Water-borne diseases such as diarrhoea are currently not very common but where it occurs, are linked to contaminated water and poor sanitary conditions. Water-washed diseases such as eye and skin infections are common. These are linked to poor hygiene.

Coal mining poses a significant threat to the integrity of aquifers, which may be hydrologically connected to other groundwater-dependent ecosystems including farm dams, bores and rivers. Water from coal mines must be disposed of and waste material is often held within the surface lease of a mine, introducing a risk of contamination of human food sources. Pollution of the environment can also occur through windblown dust during transportation, where coal is washed and at export ports.

The proposed Leslie 1 Coal Mining Project might have the following direct impacts on water in the area:

- ❖ Potential contamination with hydrocarbons and chemicals during construction and operations.

The indirect impacts will be:

- ❖ In-migration into the area, especially in Leslie and Eendracht. Pressure on existing limited services in terms of water supply and sanitation could dramatically increase the risk of water-related diseases; and
- ❖ Unplanned developments may influence environmental health conditions and further contaminate surface water bodies.

There is limited local data on basic water and sanitation practices or burden of disease linked to specific water and sanitation indicators. As the potential for the project to be accused of polluting the water bodies in the surrounding communities from plant or domestic water exists, it is important to establish firm baselines for mitigation. Water and sanitation are significant existing needs in the communities and if Leslie Coal Mine supports any related initiatives they should be linked to specific indicators to measure impact.

Due to influx into the area and the indirect pressure it will cause on available sanitation services, the proposed Leslie 1 Coal Mining Project is likely to have an impact on the sanitation situation in the area. However, improving the sanitation situation is likely to have major beneficial impacts in the communities and improve their overall quality of life.

During active construction periods, the Project may create new breeding sites for key mosquito vectors which would significantly increase the vector-borne disease risk. Water storage facilities require careful environmental engineering to prevent development of vector breeding sites. During construction and operation phases, tyres, drums, and other containers may become significant breeding sites for mosquitoes, with subsequent increased nuisance.

Groundwater quality may be impacted during construction as a result of localised hydrocarbon spills that may occur at workshops and yellow metal (earth moving equipment, named after the branded Caterpillar colour) parking areas, or hydrocarbon storage zones. Another potential risk to groundwater quality at the site is domestic waste generated by construction contractors and client staff.

An increase in income earned during construction and operational phases of the Project may improve the ability to afford basic environmental health services through increased access to such services and ability to pay for better services. This may result in a decline in cases of soil, water and sanitation-related diseases. However, with uncontrolled influx and human settlement, this may worsen over time.

9.15.3.6 EHA #6 Food- and Nutrition-Related Issues

This category includes health outcomes and determinants related to food security, dietary choices, and the consumption of subsistence foods. The key health outcomes considered are nutrient levels, malnutrition or improvements in nutrient intake, and the subsequent increases or decreases in related diseases. The key determinants include diet composition, food security, and the consumption of subsistence foods.

Food security means having enough food to fully meet basic needs at all times. According to the Food and Agricultural Organization of the United Nations, "Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (FAO, 2001). At present, there are no known acute shortages of major dietary components (e.g., proteins, carbohydrates, grains, fruits, or vegetables) in any of the potentially affected communities. Food security is an important consideration in understanding potential health impact of development Projects. This EHA is affected by influx of people resulting in increased demand for food.

Mining projects can increase the range, quality and amount of food available, leading to improved nutrition and positive health and well-being impacts. However, projects can also reduce access to traditional food sources by, for example, using agricultural land for other purposes or increasing the demand, and therefore prices, of locally grown food. There may also be risks associated with increased availability and affordability of manufactured food products that are high in fat, salt and sugar. Obesity and micronutrient deficiencies can co-occur when calorie intake is high, and the food eaten is low in essential vitamins and minerals.

Based on the FGDs, food shortage is not a serious problem in the area. A few respondents stated that malnutrition was a problem. This was for both children and also the elderly as vulnerable groups. Much of this was linked to poverty in the communities. Malnutrition is linked to poverty and food security issues, as the population cannot afford basic foodstuffs. Poor feeding practices related to poor education and illiteracy may worsen the existing situation.

Maize meal, porridge or mieliepap ('pap') was listed the most prominent staple food eaten in the PACs with all respondents mentioning this food as their staple diet. Beans, cabbage, potatoes, rice, samp and tinned fish were also listed as commonly consumed foods.

There were no reported deaths by malnutrition or other nutritional disorders in Leslie or Leandra. Information on the clinical visit for these conditions was not available at the time of the visit, but incidence was reported as generally low and not likely related to involuntary nutritional limitations.

<u>Changes in Income and Expenditure Consumption</u>

New projects have significant potential to alter underlying levels of community and household income positively (IFC, 2009). These potential positive effects may have a profound impact on a variety of health performance indicators for all populations in a community (for example, children under age 5, women of reproductive age, elderly, and so on). Conversely, projects can trigger significant inflation, impacting both food and housing in surrounding communities. Significant food inflation can adversely impact existing vulnerable groups, with negative consequences on individual and community level health performance indicators.

Significant food inflation can make recruitment and retention of healthcare workers and teachers extremely difficult for local communities. Significant and sudden changes in income can have a marked effect on alcohol usage and subsequent gender violence. Workforce education and training are potential key mitigation activities.

Increased revenues coupled with careful planning and checks and balances have the potential to make significant contributions to the progressive realisation of internationally protected economic, social and cultural rights. However, without transparency, good governance including channels for complaints and remedies (grievance mechanisms), and plans for inclusive growth, large foreign investments into natural resources may translate into huge profits for a few and harmful impacts for local communities most directly affected.

The Project may influence nutritional indicators in the study area through the following direct and indirect (the majority) factors:

Water Quality and Quantity

The water-related impacts of the proposed Leslie 1 Coal Mining Project are described in the above Section (EHA #5) and other specialist reports. Changes in flows and high levels of erosion may reduce the normal agricultural yields of the community. Mitigation measures are planned to address these impacts but the indirect effects of nutrition are very important to consider not only in the immediate Project area but also in larger rivers that are seasonally utilised for agricultural purposes. No significant changes in agricultural and subsistence practices are expected.

Influx

This can influence nutrition in a number of ways including:

- Lack of available land to cultivate food crops. There is a dependency on subsistence farming in the area and this is linked to access to land. Migrants settling in different areas may not have access to land which might influence food security.
- Unplanned developments in the area may limit the land available for agricultural purposes. Poor planning might lead to erosion which might eventually reduce the quality of soils and lead to poor crop yields.
- Supply and demand may create food inflation and make vulnerable groups more susceptible to escalating food prices in the Project area.

Change of Livelihoods and Practices

This can influence nutrition in a number of ways including:

- It is likely that youth in the area will abandon farming in search of alternative sources of employment, specifically with the Project. This impacts farming activities as the labour required to assist in the preparation and planting season is not available which can have a negative impact on agricultural production and exacerbate food shortages or surpluses that the family require to procure other services. This may also erode the practice of farming as the skills are not passed over the next generation which can further impact food security in the long term.

- As a result of economic upliftment, the community might move from a culture of growing food to buying food. These will most likely be refined products or the adoption of a more westernised diet. A reduction in physical exertion may also result as a result of changing livelihoods. Ironically, the final result could be an increased incidence of obesity and eventually non-communicable diseases (NCD).

9.15.3.7 EHA #7 Accidents/ Injuries

This category contains health outcomes and determinants related to accidents and injuries. The key outcomes considered are increases and decreases in intentional and unintentional injuries with fatal and nonfatal results. The key determinants in this category include items such as the presence of law enforcement, traffic patterns, alcohol involvement, distance to emergency services, and the presence of prevention programs.

This project area is located within an area with existing road networks. The N17 is a National Road, offering road network connectivity to the wider surrounding areas. The Proposed Project sites are transacted by the R50 (north-south). The N17 National Highway cuts directly though the top of Leslie 1C.

Accidents and injuries were commonly reported in both FGDs. Road traffic accidents (RTA) are the not very common in the communities. Gender-based violence and crime related injuries such as assault are more common. There is a strong link to alcohol in domestic violence and motor vehicle accidents. RTA could increase even more with the further development of the proposed Leslie 1 Mining Project as the area is likely to see an increase in the number and size of vehicles travelling in and around the Project area (transport of goods and personnel). An increase of trucks would result in road degradation, as the R50 is not in good state at the moment. The roadworthiness of the vehicles, the lack of driving skills will be a major hazard moving forward. At present domestic transport is mainly by taxi (microbus) and pedestrian. Some residents of Leslie have their own/ private vehicles.

Gender Based Violence

Gender-based violence and crime-related injuries such as assault are more common. There is a strong link to alcohol in domestic violence and motor vehicle accidents.

The accidents and injuries health effect category describes changes to fatal and non-fatal injury statistics that can be either intentional (e.g., suicide, homicide, assault, and self-harm) or unintentional (e.g., motor vehicle crashes and falls).

Physical Injuries

The proposed Leslie 1 Coal Mining Project may provide employment opportunities which are relatively safe and well-managed compared with other options available to many workers, particularly in developing countries, and can reduce work-related injuries in the population overall. However, project-related accidents, poorly controlled use of explosives or chemicals, equipment failure and truck movement can all potentially lead to physical injuries in local communities. If not well managed during decommissioning phase, the proposed Leslie 1 Coal Mining Project may also pose injury risks, for example via falls, cave-ins, drowning, land slips and derelict buildings. The proposed Leslie 1 Coal Mining Project may also affect injury rates indirectly through the social and economic changes they bring about. They may reduce the risk of violence in the community by providing gainful employment for young men, and by increasing the overall wealth of a community. However, the influx of large groups of, generally, male workers can sometimes lead to social unrest which may include violence and sexual assault.

Unfortunately, fatal and severe traumatic injuries continue to occur in mining and often have a profound impact on morale. Post-traumatic stress disorders sometimes develop in witnesses, colleagues and managers.

<u>**Road traffic accidents and other accidental injuries**</u>

The impact of increased road traffic on air quality has already been discussed, but there are other potential health impacts associated with site related transport that may need to be considered. Higher volumes of traffic on rural roads may result in an increase in road traffic accidents an increase in traffic related noise and the potential for longer journey times for local people. This may also contribute to increased anxiety and stress, which, as previously discussed, is also detrimental to health. Whilst the individual health risks of air pollution are relatively small, the public health consequences are considerable (Kunzli et al 2000).

The proposed Leslie 1 Coal Mining Project would increase the number of commercial motor vehicles (e.g., coal trucks and other vehicles) on the roads, which could potentially produce a small increase in accidents and injuries in the region. In general, changes in this health impact are expected to be negative, resulting in an increase in morbidity and mortality outcome data.

The proposed Leslie 1 Coal Mining Project may lead to increased traffic loads on primary and access roads and has thus the potential to increase the number of traffic accidents. The proposed Leslie 1 Mining Project may influence accidents and injuries to other road users and pedestrians in the following direct ways:

- ❖ Transport of goods and personnel to service the needs of the proposed Leslie 1 Coal Mining Project. This can include long-distance truck hauling and use of light duty vehicles. The state of roads in Leandra is relatively bad. Sections of the road are completely destroyed by potholes. The roads are busy and un-roadworthy vehicles and poor driving practices are common;
- ❖ Transport of staff at shift changes in buses to their home in different communities; and
- ❖ Light vehicle traffic to support the general requirements of the proposed Leslie 1 Mining Project.

The proposed Leslie 1 Coal Mining Project may influence accidents and injuries in the following indirect ways:

- Improvement in the local economy and the ability to buy motorised forms of transport. Use of safety devices and adherence to common road laws is likely to be inadequate/ not the norm with the potential for increased accidents;
- Social influences in the community. These may be associated with influx and a change in the social cohesion and traditional structures in the local communities. These have the potential to result in internal conflicts; and
- Increased use of alcohol and potentially drugs due to increased disposable income. This may also influence the social cohesion and may contribute to crime and violence.

9.15.3.8 EHA #8 Exposure to Potentially Hazardous Materials, Noise and Malodours

During the field visit, it was apparent to the HIA Specialist that numerous households still use wood and coal (open fire) for cooking and heating that may cause a risk from indoor air pollution and associated respiratory health concerns in Leslie. As waste removal from households also seems to be a challenge, many households burn waste that can emit harmful by products especially with plastics. Figure 9-113 illustrates refuse which according to respondents had been sitting there for over two days. “The municipality is always on strike and they leave the dirt here for us” said one of the respondents. Just on the outskirts of Leslie are illegal and uncontrolled dump sites which can contaminate water supplies and present unhygienic conditions .

Dust generation in the project area is principally a result of traffic of vehicles on unpaved roads in the area. It was also observed that the residents of Leslie sweep their entire yards with grass/ straw brooms. This is done with no dust suppression and generates a lot of dust.

Table 9-77: Electricity Service Delivery Statistics

	2015/16	2014/15	2013/14	2012/13	2011/12
Is the municipality responsible to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality have infrastructure to provide?	Yes	Yes	Yes	Yes	Yes
Does the municipality actually provide?	Yes	Yes	Yes	Yes	Yes
Is the service outsourced/commercialised?	No	No	No	No	No
Number of households and non-domestic customers to which provided	72 360	72 360	72 160	67 914	65 268
Domestic households with access to free basic service	9 893	9 893	20 391	13 470	49 801

Both general and hazardous waste will be generated on the proposed Leslie 1 Mining Project site. These wastes will need to be handled, separated, stored and disposed of according to their classification.

Figure 9-115: Pollution over Leslie at around 4pm as some people begin evening cooking routine

Figure 9-116: Illegal dumping and litter at Leslie

Air Quality Findings

Gondwana Environmental Solutions International was appointed by Kongiwe Environmental (Pty) Ltd to undertake an Air Quality Impact Assessment (AQIA) for the proposed construction and operational activities associated with the proposed Leslie 1 Mining Project. The main objective of the AQIA is to determine the potential impact of emissions from the construction and operational activities associated with the proposed Leslie 1 Mining Project on ambient air quality in terms of the criteria air pollutants and dust fallout.

Heavy construction is a source of dust emissions that may have a substantial temporary impact on local air quality. Building and road construction are two examples of construction activities with high emissions potential. However, dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions.

The most significant pollutant that is generated from a coal mine and related beneficiation activities is particulate matter (PM). Particulate matter with an aerodynamic diameter of less than 2.5 micrometres (µm) ($PM_{2.5}$) and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) are criteria pollutants and are therefore subject to legislated control. Particulate emissions will be generated from stripping of topsoil and overburden, materials handling operations, vehicle entrainment from roads and crushing and screening activities on site. There will also be wind erosion of PM from coal stockpiles, overburden and waste tips and exposed areas of the sites. In coal mining, spontaneous combustion can occur in areas such as stockpiles, underground workings, waste dumps and backfill areas. This would be a significant source of toxic air pollution (including sulphur dioxide, oxides of nitrogen, hydrogen sulphide and carbon monoxide). For the purposes of the modelling in this project, it was assumed that all necessary mitigation measures will be put in place to prevent spontaneous combustion from occurring.

The modelling results indicated that, under worst-case conditions, even with mitigation measures in place, the Leslie 1A mining operations are likely to lead to the 24-hour NAAQS being exceeded up to 5.5 km from the above-ground mining activities. This will affect farmsteads and the Springboklaagte mining area and may be a health risk to people living in those areas (4 exceedances are permissible).

The Leslie 1C modelling results indicated that, even with mitigation measures in place on the roads and elimination of the CHPP, worst-case conditions may lead to the 24-hour NAAQS being exceeded over the residential areas of Lebohang. This is a significant health risk to people living in those areas (4 exceedances are permissible, but ambient concentrations are already high).

The emissions from the proposed Leslie 1 Project will have a cumulative effect together with emissions from other large emitters of particulate matter in the area; and there is a significant health risk related to exceeding the PM_{10} and $PM_{2.5}$ National Ambient Air Quality Standards on the residents of Lebohang, Leslie and Eendracht.

Noise

Noise is also a factor to consider and the health impacts of noise are well described at both a physical and psycho-social level in the Noise Impact Assessment. Noise and vibration are noted as potential environmental risks due to the nature of the Project's operations. The WHO published a set of guidelines relating to community noise, including potential sources, quantification and potential effects (WHO 1999). Potential health effects identified include hearing loss or loss of hearing sensitivity, sleep disturbance, cardiovascular and physiological effects, mental health effects and behavioural effects, including poor performance by school children (Stansfield and Matheson 2003, WHO 1999, Health Evidence Bulletins 1999). Environmental noise has also been found to be responsible for interference with communication, cognitive performance and annoyance (Stansfield and Matheson 2003, WHO 1999). Stansfield and Matheson (2003) concluded that the effects of environmental noise are strongest for categories linked to quality of life (or the wider determinants of health in the context of HIA) as opposed to illness (or bio physical factors).

From an occupational health perspective, noise-induced hearing loss (NIHL) begins gradually and progressively gets worse. Problems with this disease include loss of the ability to communicate and reduced response to environmental and occupational noise and danger. In the mining environment, the effects of NIHL can be deadly in specific work situations. Bise (2001) listed several factors that influence occupational hearing loss. These factors include the following:

- Age of employee.
- Pre-employment hearing impairment.
- Diseases of the ear.
- Sound pressure level of the noise.
- Length of daily exposure.
- Duration of employment.
- Ambient conditions of the workplace.
- Employee lifestyle outside the workplace.

EAR was contracted by Kongiwe to determine the potential noise impact on the surrounding environment due to the proposed Leslie 1 Mining Project. The area has a varied soundscape and based on the sound measurement data, it can be summarized that the locations further than 1,000 m from the N17 and R50 roads would be relatively quiet, with faunal noises being dominant sounds. Locations closer to these roads may have higher ambient sound levels due to a combination of faunal and anthropogenic (road traffic) noises. Locations within approximately 500 m from the N17 road (200 m for the R50) have significantly higher ambient sound levels, mainly due to road traffic noises. Based on the measurement data collected, an acceptable noise rating typical of a sub-urban noise district is assumed.

The physical effect of hearing loss and impairment due to noise exposure is not a community health risk but will certainly be an important workplace occupational health consideration. The noise levels required to induce hearing loss only occur at levels above 85 dB(A) which would be intolerable for any community. Noise annoyance can however lead to stress-related impacts on health and general well-being and may also have an influence on mood, performance, fatigue and cognition. Sleep can be disturbed by noise levels as low as 35 dB(A).

Local communities may already be exposed to low background levels of potentially hazardous materials (e.g. dust, particulate matter, heavy metals) that can be associated with health problems such as respiratory illnesses, skin diseases, organ damage, circulatory problems, birth defects, cancers and neurological disorders.

The negative health effects of coal mining in the Project Region are wide-ranging though not extensively documented. Many health effects can be directly correlated with toxic agents released into the soil, air, and groundwater by mining activity, but are also related to the social environment of Mpumalanga, including limited economic opportunities.

Exposures and environmental health determinants as a result of the project will be covered in a number of specialist reports. These include air quality, water, noise and soil studies. Air quality and odours have been addressed in detail in the Air Quality Report.

The impact assessment conducted by EARES used the noise emission characteristics of typical mining equipment, taking a precautionary approach to considering the worst-case scenarios. Conceptual noise propagation models were developed for various scenarios as described in the Noise Report. There are a number of receptors staying on, or very close to the proposed mining infrastructure, and it is assumed that these receptors will be relocated before mining starts. If they are not moved, this will result in a noise impact of high significance. The output of the modelling highlighted a potential for a noise impact of medium significance due to day and night-time construction activities, especially at the Leslie 1C section. This is due to the number of occupied dwellings located within 1 000 m from the proposed mining activity.

While there is a risk of a noise impact, the impact can be mitigated and reduced, with the magnitude of the reduction depending on the options selected as well as how the operation is managed. The proposed Leslie 1 Coal Mining Project will not introduce potential fatal flaws in terms of acoustics. With the selection of the required mitigation options, projected noise levels can be managed. If not mitigated, this will result in a noise impact of high significance during the operational phase. There is a potential noise impact of medium significance during the critical night-time operational phase. Measures are available and proposed that may assist in reducing noise levels and the probability of a noise impact occurring.

Diesel Particulate Matter

Diesel particulate emissions are of special concern, particularly the size fraction up to 2.5 microns, known as $PM_{2.5}$. This size of particle is able to be respired deep into the lungs. $PM_{2.5}$ from all sources has been implicated in numerous diseases ranging from cardiopulmonary disease to cognitive decline to cancer.

The deleterious impact on human health is incontrovertible (WA DOE 2008, California Air Resources Board 1998). Diesel engines are of particular concern as sources of particulate matter, as they typically produce $PM_{2.5}$ at a rate about twenty times greater than from gasoline (petrol) engines (WA DOE 2008, California Air Resources Board 1998).

- **Health Impacts of DPM: Cancer**

  Studies show an association between exposure to diesel exhaust and lung cancer (Bhatia, 1998), as well as cancers of the bladder and soft tissues (Guo et al., 2004). Several extensive and detailed reviews have been conducted on the body of literature relating long-term exposure to diesel exhaust particles and lung cancer (California EPA, 1998; USEPA, 2002; Cohen and Nikula, 1999). In addition, over forty studies conducted among those populations exposed to diesel exhaust have found increased rates of lung cancer associated with diesel exhaust particles exposure (as cited in Cohen and Nikula, 1999). Occupational studies conducted in railroad workers and truck drivers have consistently found increased lung cancer risk, even after adjusting for comorbidities such as smoking (Bofetta, 2001). The impact of DPM on cancer risk must be considered in the decision-making process for the proposed Leslie 1 Coal Mining Project.

❖ **Health Impacts of DPM: Cardiac and Pulmonary**

Although cancer risk is understandably of great concern to the public, cardiac and respiratory effects of diesel exposure have an even larger public health impact because they cause death and illness for a greater number of people. DPM can exacerbate asthma and emphysema, induce heart attacks and strokes, and has been associated with congenital heart abnormalities. According to a landmark study by Pope et al (2002), each 10 ug/m3 increase in DPM was associated with a 6% increase in cardiopulmonary mortality. In a follow-up to this study, Pope et al (2004) demonstrated that their previously observed increase in cardiopulmonary mortality was largely driven by increases in cardiovascular, as opposed to pulmonary mortality. In this follow-up study, a 10 ug/m3 increase in $PM_{2.5}$ was associated with a 12% increase in mortality due to 'all cardiovascular disease plus diabetes' and an 18% increase in mortality due to 'ischemic heart disease'. Further epidemiological investigations have revealed that these estimates are likely largely underestimating the effect of PM2.5 due to inadequate exposure characterization. Published in the New England Journal of Medicine, Miller et al. (2007) utilized a novel exposure characterization method and reported from the Women's Health Study that a 10 ug/m3 increase in $PM_{2.5}$ was associated with a 76% increase in death due to cardiovascular disease.

It is well understood that ambient air pollution and fine ambient particulate matter strongly contribute to disease burden and death, but it has been less clear as to how much an individual's living proximity to a major roadway or direct $PM_{2.5}$ source influences health risks. An individual's exposure to $PM_{2.5}$ is dependent on where he/she lives and works and that this strongly influences health outcomes. Van Hee et al. (2009) demonstrated that living close to a major roadway was a strongly associated with left ventricular hypertrophy, an important marker of cardiovascular disease and a strong predictor of heart failure and mortality. Additional work by this group has demonstrated an individual's exposure to $PM_{2.5}$ impairs how well blood vessels dilate and how well the heart functions, providing a basis for our understanding of previously observed increases in mortality (Van Hee et al. 2011, Krishnan et al. 2012).

There are very specific physiological effects with DPM exposure. A recent study by Cosselman et al (2012) showed that diesel exhaust exposure, to healthy human volunteers, rapidly increases systolic blood pressure (SBP). In their study, SBP increased within 15 minutes of being exposed to dilute diesel exhaust and reached a maximum increase in SBP within one hour. Additional work utilising controlled diesel exhaust exposures to human volunteers has revealed that these acute exposures results in impairment in blood vessel function and alters blood coagulability15, both of which are extremely deleterious effects and increase the risk of acute cardiovascular events such as heart attack and stroke (Mills et al. 2005, 2007, and Törnqvist et al. 2007). Fitting with these findings, epidemiological investigations have consistently demonstrated that acute increases in PM2.5 result in an increased risk of heart attack (Peters et al. 2001).

In addition to cardiovascular risk, cerebrovascular effects and risk of stroke associated with $PM_{2.5}$ exposure has been investigated. Research published in the Archives of Internal Medicine (2012) examines,

[15] Coagulation (also known as clotting) is the process by which blood changes from a liquid to a gel, forming a blood clot. It potentially results in haemostasis, the cessation of blood loss from a damaged vessel, followed by repair.

for the first time, the risk of acute, short term exposures to $PM_{2.5}$ as a key factor in triggering stroke, often within hours of exposure.

Blasting

Blast Management & Consulting (BM&C) was contracted as part of the EIA to perform an initial review of possible impacts with regards to blasting operations in the proposed Leslie 1 Coal Mining Project.

Explosives used in the mining environment are required to be oxygen balanced. Oxygen balance 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 and carbon monoxide are particular undesirable. These fumes present themselves as 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.

Fumes, vapours, and gases are usually invisible. The effects of a toxic chemical on the human body may be either acute or chronic. Acute (short-term) effects show up immediately or soon after exposure to the chemical. They may be minor, like nose or throat irritation, or they could be serious, like eye damage or passing out from chemical vapours. What all these effects have in common is that they happen right away. Chronic (long-term) effects may take years to show up. They are usually caused by regular exposure to a harmful substance over a long period of time. These effects are usually permanent. Factors contributing to undesirable fumes are typically: poor quality control on explosive manufacture, damage to explosive, lack of confinement, insufficient charge diameter, excessive sleep time, water in blast holes, incorrect product used or product not loaded properly and specific types of rock/geology can also contribute to fumes.

Symptoms and health effects of breathing carbon monoxide (CO) can cause headache, dizziness, vomiting, and nausea. If CO levels are high enough, you may become unconscious or die. Exposure to moderate and high levels of CO over long periods of time has also been linked with increased risk of heart disease. People who survive severe CO poisoning may suffer long-term health problems. Nitrous oxide is a gas with several legitimate uses, but when inhaled it can make people feel euphoric and relaxed. This happy feeling has led to it being nicknamed 'laughing gas'. Some people also experience hallucinations. However, there is a risk of death as a lack of oxygen can occur when using nitrous oxide.

Hazardous Chemicals

Coal dust has also been a serious hazard in mining, causing coal workers' pneumoconiosis or 'black lung' and chronic obstructive pulmonary disease. This can be controlled by dust suppression, ventilation and respiratory protection. Vigilance is, however, required to maintain effective control.

Diesel particulate exposures occur in underground mines because of diesel powered mobile equipment[16], such as LHDs. Diesel particulate is a probable human carcinogen and several epidemiological studies from other industries suggest there is an excess risk of lung cancer. Control measures include the use of low sulphur diesel fuel, engine maintenance and mine ventilation.

Coal dust and methane gas explosions in underground coal mines remain a serious risk requiring comprehensive monitoring and management. Some underground coal mines also have problems with carbon dioxide and hydrogen sulphide gas.

9.15.3.9 EHA #9 Social Determinants of Health

The social determinants of health refer to the conditions in which people are born, grow, live, work and age. These circumstances are shaped by the distribution of money, power and resources at global, national and local levels (WHO, 2013). These circumstances are shaped by the distribution of money, power, access, and resources at global, national, state, regional, and local levels. The social determinants of health are mostly responsible for health inequities –the unfair and avoidable differences in health status seen within and between countries. This category reviews outcomes and determinants related to mental health, maternal and child health, substance use, social exclusion, psychosocial distress, historical trauma, family dynamics, economic status, educational status, social support systems, and employment status.

Mental health, or behavioural health, is considered a critical component of overall health and is linked to physical health and well-being for persons of all ages. Mental health includes reactions to stress and depression and problems with emotions. Substance misuse such as alcohol, tobacco or other drugs is not only an important health determinant but also closely linked to mental health (Prince et al., 2007). The use of the drug 'nyaope[17]' as well as marijuana which was reported (during the FGDs) have been linked to mental illness. These practices are also associated with crime, prostitution and domestic violence. Several respondents admitted that most members of their communities drink a lot of alcohol, especially during the weekends and at the end of the month when individuals have received their wages, salaries or social grants. The key health personnel validated this by asserting that alcohol and drug abuse was a definite contributor of disease.

The bottle store and 'shebeen' was full to capacity on a weekday afternoon, before 5pm (which is generally considered the time employed people would leave work) and on a rainy day. This suggests that alcoholism is a serious problem in the Leslie community.

[16] Leslie Coal Mine will not drill, blast and haul from CMs will be by electric shuttle cars.

[17] Nyaope is a street drug that has allegedly come into widespread use in South Africa. It is famous for allegedly containing antiretroviral drugs for HIV.

Figure 9-117: Local bottle store in Leslie

According to the Social Impact Assessment Report (Kongiwe, 2018), the community in Leandra has been encountering challenges which range from economic, environmental, social and spatial challenges. At a regional scale, like other with various lagging municipalities, Mpumalanga is faced with developmental challenges coupled with socio-economic problems such as unemployment, job creation, education, HIV prevalence, basic service delivery, inequality, poverty, economic growth, sectorial dependency and economic distribution.

Health-seeking Behaviour

Individual health-related behaviour (manner in which people choose a health provider and at which stage of an illness) is influenced by many factors, including political, socio-cultural, economical, educational, personal and environmental. Each factor depends on various underlying variables, of which some weigh more than others. The collusion of all these variables will result in certain behaviour of a specific individual at a specific time point. Culture and spirituality influence health seeking behaviour. People may believe that western medicine may be effective in curing their ailments, but their conviction is that mystical causes have also intervened; this obliges them to combine visits to the health care facilities with visits to traditional healers[18].-

There are two main types of health care-seeking behaviour studies. The first analyses barriers to care that lie between the patients and the services. According to MacKian (2003), the second type investigates the process of health care seeking. This involves identification of pathways to the formal health care system, often commencing with home care and traditional healers and extending to the formal system, pathways differing according to the presenting condition.

Several factors may influence health care use, including supply and demand. On the supply side, there is the availability of health care services, the cost of care, the technology and equipment available, the quality of management and the attitude of staff. On the demand side, there are the individual and

18 But see Section 8.10 below

household characteristics, perceptions and beliefs in the community, affordability (treatment, transport, and daily income), decision-making responsibility, accessibility and prioritisation. All these factors need to be considered as they may become barriers to utilisation of formal healthcare services. Without this understanding, any behavioural change efforts may not be effective.

Wilkinson (2001) reviewed health-seeking behaviour studies carried out in Cambodia in the 1990s for the WHO. He defined a number of concepts that are fundamental to the understanding of health-seeking behaviour:

- Access: determines whether patients are aware of services and are able to reach them within an acceptable time;
- Utilisation: refers to the rate and pattern of use of services;
- Demand for service: equates with health behaviour, that is, whether a patient becomes interested in using a service in the first place or adopts healthy practices;
- Perceptions of quality of care: can act as either a motivator or a barrier to service utilisation; closely linked to demand, access and utilisation; and
- Beliefs: provide a rationale for health-seeking behaviour. The widespread resort to ineffective, costly and apparently irrational health-seeking behaviour had to be set in the context of traditional belief systems about the aetiology[19] of disease and how one gets well.

There is good health-seeking behaviour in the Project area. None of the respondents from either Leslie or Eendracht admitted to consulting with traditional healers. Distance to healthcare facilities was not listed as an issue as the Lebohang Community Health Centre is within walking distance from each corner of Leslie. Affordability is not an issue as all public health services are free – patients do not have to pay for medical services, consultation or for medicine.

During FGDs, female respondents generally reported that they always take their children to a health facility whenever they have a recurring cough or fever. In addition, respondents claimed that all mothers take their children for vaccinations, as well as for regular weighing and measuring.

Influx Management

When the proposed Leslie 1 Coal Mining Project triggers significant migration (labourers, extended families, service providers, and so on) to the proposed Leslie 1 Coal Mining Project area, it can pose potential significant impacts to surrounding communities. These impacts may occur, to varying degrees, across all phases of the proposed Leslie 1 Coal Mining Project (preconstruction, construction, operations, and decommissioning). A strong interaction and mixing among local workers, imported specialty workers, and expatriates can facilitate the spread of respiratory disease, including the production of explosive epidemics that can pass back and forth between the proposed Leslie 1 Coal Mining Project and the community. In addition, food-borne epidemics are significant and can spread back and forth between the proposed Leslie 1 Coal Mining Project worksite and the community via food handlers or petty traders.

[19] Aetiology refers to the study of causation, or origination. The word "aetiology" is mainly used in medicine, where it is the science that deals with the causes or origin of disease, the factors which produce or predispose toward a certain disease or disorder.

The proposed Leslie 1 Coal Mining Project faces the risk of unforced or voluntary migration, where it is assumed that migrants would be acting out of a rational self-interest as the motivating factor for moving. Often, if people are leaving behind adverse home conditions, they are migrating because of perceived opportunity rather than any specific guarantee of a job, particularly if a member of their extended family is already resident in the area (IFC, 2009). Migration is expected to yield positive benefits for the individual migrant (and his/her household), whether through remittance of incomes or settlement in the new location. In some circumstances, a significant migrant population may exist prior to project arrival, including artisanal and small-scale miners (IFC, 2009).

In-migration may have a wide range of negative impacts on the communities within close vicinity to the proposed Leslie 1 Coal Mining Project site of influence. These negative impacts include including negative impacts on the environment; public infrastructure, services and utilities; the local and regional economy; livelihood strategies; public health; the social and cultural environment, and; legacy issues. These community-level impacts may directly and indirectly affect the proposed Leslie 1 Coal Mining Project.

From a community health perspective, migrant workers introduce infectious diseases and social problems. These may be mitigated through pre-employment health checks and treatment. Implement HIV and TB control program.

The pattern of labour-based and economic in-migration typically follows project demand for labour (IFC, 2009). In the case of the proposed Leslie 1 Coal Mining Project, the construction phase has the highest workforce requirements. As the proposed Leslie 1 Coal Mining Project moves from construction to operational phase, and requires a smaller and more stable workforce, recently arrived migrants may move on as employment opportunities decrease and the disposable income of the local population declines.

Furthermore, the expected influx of people and increased income may result in illegal substances being available more freely. It is difficult to speculate whether the prevalence of tobacco smoking and or substance abuse may increase due to the presence of the proposed Leslie 1 Coal Mining Project. However, it is likely that it will increase as there will be an increase in the number of young people with more than adequate incomes, who will be in a position to afford these commodities. Leslie Coal Mine may be in a position to conduct substance-abuse prevention education programs in the workplace and within the already affected (by alcohol) communities.

In-migration can generate a range of positive environmental, social, and health impacts, including:

- Increased links to mainstream economy
- Increased local skills-base
- Business-development opportunities
- Employment-creation
- Increased local labour pool
- Opening of new markets for local products and services
- Increased accessibility and availability of goods and services
- Alternative livelihood opportunities

- Improved local wage- and income-levels (including opportunities for local sourcing and higher prices obtainable for local products)
- Increased individual, household, and community-empowerment stemming from increased income and wealth
- Improved local training and skills-development opportunities
- Monetisation of remote rural economies, improving purchasing-power and increasing trade
- Opportunities to build community organizational structures
- Improved information and communication
- Improved water and sanitation
- Improved access to and expansion of infrastructure, public services and utilities (health, education, waste management, electricity, water supplies, telecommunications)
- Increased attention and input by government authorities, NGOs, etc.

Change in Number of Households Living Below the Poverty Line

Living below the poverty line is also an important determinant of health status. Poverty can be associated with decreased access to health care and increased disparities in health outcomes. In general, the mine would produce a positive impact on poverty status for a small number of people employed at the Leslie 1 Project site. Like other social determinants of health, the overall health effects of this small change in unemployment would confer some health benefits. Positive social impacts include the increase in job opportunities and access to services.

Education Levels and Unemployment

The level of educational attainment in a household can influence community health. Economic status may create a powerful context for human health and improved income is generally thought to be associated with improved community health outcomes. While there are many indicators used to assess economic status, the HIA reports median household income, employment, and the percentage of households living below poverty levels.

With mining being a major industry in Mpumalanga, it is expected that a sufficient number of the unemployed will have appropriate skills to qualify them for at least semi-skilled positions at the mine. Those that are less skilled may be more suited to manual labour such as earthworks and road construction. During the construction process potential candidates can also be identified to receive skills training for future (secondary economy) opportunities.

This means that local communities can potentially take maximum advantage of employment opportunities to be created by the proposed mine. However, it may not be possible to employ and train individuals from the local population in time for construction or operation, due to the level of skills required not being available locally. Leslie Coal Mine may be forced to make use of skilled migrant workers, as training required may be too complex and time-consuming. A situation like this may pose a risk of xenophobia as the local population may feel threatened.

Change in Educational Attainment

Higher levels of educational attainment are associated with positive health outcomes such longer lifespans and decreased risk for cardiovascular disease, cancer, and lung disease. In general, the proposed Leslie 1 Mining Project is expected to exert a positive change to this health impact. Economic influx into the area will likely draw families that can support local schools.

Gender-based Violence, Alcohol and Drugs

Gender-based violence occurs commonly and is often related to substance abuse. Substance abuse influences many health outcomes such as accidents and injuries. Substance abuse includes illegal drugs (e.g., marijuana, 'nyaope20' etc.), alcohol addiction, and binge drinking. Women and young girls are often the most vulnerable. Drug and alcohol abuse are currently a major problem and these have the potential to increase during the lifespan of the proposed Leslie 1 Mining Project.

Influx of people and increased income may result in illegal substances being available more freely. It is difficult to speculate whether the prevalence of tobacco smoking and or substance abuse will increase due to the presence of the proposed Leslie 1 Coal Mining Project. However, it is likely that it will increase as there will be an increase in the number of young people with decent incomes, who will be able to afford these.

Social Cohesion and Well-being

There are a number of social challenges in the area. These are associated with culture, poverty, lifestyle practices, lack of opportunity and influence from past conflicts. However, perceptions of well-being are not likely to be as developed as those in the developed world in certain communities. Lifestyle is expected to be significantly affected. Subsistence farming and land tenure which are vital parts of the livelihood structure and an integral part of the culture may no longer remain so.

Alcohol-use was found to be common in the area with reports of drug abuse (especially marijuana) also reported. These lifestyle practices are often the root cause of social challenges.

It is not the intention of the HIA to address social issues in detail as this will be covered in more detail in the SIA. However, it is important to recognise the well-being and perceptions on quality of life have both a social and health basis. The proposed Leslie 1 Mining Project has the potential to maintain and create health impacts and inequalities that exist at the local level if these are not recognized. While these challenges were present at baseline and are generally the responsibility of the host government and local authorities, a number of factors related to the proposed Leslie 1 Mining Project's development should be considered.

- **Expectations from the proposed Leslie 1 Coal Mining Project**

[20] Nyaope is a street drug that has allegedly come into widespread use in South Africa. It is famous for allegedly containing antiretroviral drugs for HIV

The expectations of the proposed Leslie 1 Mining Project both from the local authorities and the community are high. Furthermore, the expectation for the proposed Leslie 1 Coal Mining Project to support a range of social and development initiatives is significant.

- **Influx**

  This has the potential to alter the social fabric in the area and erode traditional values with a mixture of different cultures. Competing for limited resources may also have an impact on general health and well-being.

9.15.3.10 EHA #10 Cultural Health Practices

Culture and traditional values play a very important role in the local communities. The Zulu people place a large emphasis on traditional values and practices and this relates to health care and health-seeking behaviour. The community members' beliefs in their health as influenced by spiritual powers is an interesting notion of physical health and illness quite different from the Western perception hereof. It cannot be exclusively said how the respondents perceive physical and spiritual purposes of using the plants (i.e. whether physical illness is seen as physical irrespective of its cause).

Although one may be aware that medical pluralism, combining both biomedical and traditional medicine, is practiced in many South African households, respondents in both Leslie and Eendracht did not want to comment much on personally using the services of sangomas[21] - "yes, they are there, but we do not use them" said a resident from Eendracht. Another resident from Leslie made a comment that although some people go to the sangoma, everyone meets at church on Sundays. Sangomas and Inyangas are the providers in traditional medicine in the communities surrounding the Project area.

In healthcare literature, religion and spirituality are most of the time used interchangeably, although they have quite different meanings (Miller & Thorensen, 2003). Spirituality is defined in individual terms, characterized by experiences involving meaning, connectedness, and transcendence, whereas religion is defined in communal terms, characterized by institutionalized practices and beliefs, membership and modes of organization (Pesut, Fowler, Taylor, Reimer-Kirkham & Sawatzky, 2008; Miller & Thorensen, 2003). Thus, whereas spirituality is understood at the level of the individual, religion is more of a social phenomenon, and as such is included in the more overarching concept of spirituality.

The difficulty in conceptualizing spirituality/religion comes from the multi-dimensionality of these concepts (Miller & Thorensen, 2003) and extends to the problem of how exactly spirituality/religion influence health. This, in turn, emphasizes the fact that there are multiple interpretations of how spirituality/religion influences health and a number of pathways through which this happens. Four most prominent such pathways have been proposed: health behaviours (through prescribing a certain diet and/or discouraging the abuse of alcoholic beverages, smoking, etc., religion can protect and promote a healthy lifestyle), social support (people can experience social contact with co-religionists and have a web

[21] Although sangoma is a Zulu term that is colloquially used to commonly describe all types of Southern African traditional healers, there are differences between practices: an inyanga is concerned mainly with medicines made from plants and animals, while a sangoma relies primarily on divination for healing purposes and might also be considered a type of fortune teller.

of social relations that can help and protect whenever the case), psychological states (religious people can experience a better mental health, more positive psychological states, more optimism and faith, which in turn can lead to a better physical state due to less stress) and 'psi' influences (supernatural laws that govern 'energies' not currently comprehended by science but possibly understandable at some point by science). It is because spirituality/religion influence health through these pathways, they act in an indirect way on health (Oman & Thorensen, 2002).

No collaboration between healthcare facilities and traditional healers was noted.

The potential influx of people may result in an increase in the existing number of unregistered medical practices. More people are practicing and using traditional medicine which may contribute to reducing the health burden if they are trained and knowledgeable.

Conversely, these practices may include traditional healers who may obtain plants in (possibly) contaminated areas. An increase in the prevalence of malpractice by traditional healers may occur if the burden of disease increases due to a lack of health facilities or if there are more people with an increased income. Unscrupulous practices may result in negative health impacts.

9.15.3.11 EHA #11 Health Systems Issues

This category considers health outcomes and determinants related to healthcare access and healthcare infrastructure. Important outcomes include the increase or decrease in the number of medical evacuations, clinics or hospital visit trends, health expenditures, and medication usage. Health determinants may include distance to health facilities, mobile clinics, the presence of community health workers, and the frequency of physician visits to the area/ clinics.

The health care infrastructure in the district and municipal area is relatively well served. The infrastructure was observed as sound. Although the majority of the respondents were happy with the quality of services they receive from Lebohang Community Health Centre, some individuals were unhappy with these services. They attributed their dissatisfaction to a lack of skilled staff to support the daily functioning of the facilities; the operating times of the facilities; a general disregard and lack of respect for patients (by the nurses); long queues; and overcrowding.

Key health personnel mentioned a shortage of staff, especially in the form of doctors. This creates service delivery challenges and often results in long waits for patients, and places increased stress on the current medical staff. Staff shortages were also reported at the clinic level and this associated with equipment, consumables and limited documentation storage/filing methods, mean that these services do not function optimally. A mobile clinic, shown in Figure 9-118 was observed parked at Lebohang Community Health Centre.

Figure 9-118: Mobile clinic at Lebohang Community Health Centre

The Project relevant healthcare facilities are Ermelo Hospital which is the District Hospital, Bethal Provincial Hospital (where clinics, including Lebohang, refer patients seeking higher medical care/assistance), and Lebohang Community Health Centre. These facilities coupled with some Home-Based Care organisations are briefly introduced below:

Ermelo Hospital is a government/public organisation. They are a provincial facility providing a comprehensive health care service which includes maternity, HIV and TB-related treatment, care and support services. They are an accredited antiretroviral (ARV) treatment initiation and on-going treatment site and serve daily meals to inpatients. A social worker is available to help people apply for social grants, identity documents and birth certificates. They provide home-based care services for sick people and support for their vulnerable family members. In addition, they provide assessments and referrals for people with mental health issues. Their free medical male circumcision (MMC) campaign is capacitated by Right to Care. They perform medical male circumcisions (MMC) at the facility. Ermelo Hospital is open 24 hours a day, 7 days a week. Services are free of charge.

The Witbank Hospital is a government/ public organisation. They are a provincial facility providing a comprehensive health care service which includes maternity, HIV, AIDS and TB-related treatment, care and support services. This facility is an accredited ARV treatment initiation and on-going treatment site that also serves daily meals to inpatients. A social worker is available to help people apply for identity documents, birth certificates and social grants. Witbank Hospital provides home-based care services for terminally and chronically ill patients. They also provide assessments and referrals for people with mental health issues. Medical male circumcisions are performed at this facility. The hospital is open 24 hours a day, 7 days a week and their services are free of charge.

The Bethal Hospital is a (provincial facility) government/ public organisation which provides comprehensive health care service which includes HIV and TB-related treatment, care and support services. They are an accredited ARV treatment initiation and on-going treatment site. They refer patients to Witbank Provincial Hospital or Ermelo District Hospital for further treatment. They also serve daily meals to inpatients and give nutritional supplements to outpatients. A social worker is available to help people apply for social grants, identity documents and birth certificates. This facility also has a dietitian on site. As with other provincial hospitals, they provide assessments and referrals for people with mental health issues. Their free MMC campaign is capacitated by Right to Care and they perform medical male circumcisions. The facility is open 24 hours a day, 7 days a week and their services are free of charge.

The Lebohang Community Health Centre is a government/ public organisation. They are a provincial primary health care facility providing HIV and TB-related treatment, care and support services. They have a community oriented primary health care programme that monitors and proactively works towards the improved health and wellbeing of families in the Leandra rea. They are also an accredited antiretroviral (ARV) treatment initiation and on-going treatment site. They refer patients to Bethal Hospital if they require further treatment. A social worker is available once a month to help people apply for identity documents, birth certificates and social grants. They also have a doctor on site every day. The Lebohang Community Health Centre distributes fortified porridge to underweight patients as well as malnourished TB and HIV patients. In addition to this, they provide home-based care services for sick people and support for their vulnerable family members. They also provide assessments and referrals for people with mental health issues. Their free medical male circumcision (MMC) campaign is capacitated by Right to Care. They perform medical male circumcisions (MMC) every two weeks at this clinic. They also provide maternity services for pregnant women which includes short-term admissions for up to 6 hours post-delivery. They also offer youth, men and LGBTI friendly services. The facility is open 24 hours a day, 7 days a week. Services are free of charge.

Leandra Home-Based Care is a community-based (CBO), non-profit organisation (NPO). They provide home-based care services for terminally ill people and support for their vulnerable family members. They bathe the patients, cook for them, clean their houses and ensure that they adhere to their treatment regimens. When they have vegetables available from their garden, they distribute them to sick and needy people. Homework assistance, a meal per day and physical activities are provided to school-going orphans as well as other vulnerable children and youth. Life skills' training is also provided for the youth. The Leandra Home-Based Care runs awareness workshops on medical male circumcisions (MMC), TB and HIV. They refer survivors of abuse and rape for assistance. They also help people apply for identity documents, social grants and birth certificates before referring them to the relevant government departments. They are open from 09:00 to 14:00, Monday to Friday. They also offer services to assist with abuse, rape and domestic violence survivor support services are free of charge.

The Ekuthuleni Home-Based Care is a community-based (CBO), non-profit organisation (NPO). They provide home-based care services for sick people and support for their vulnerable family members. They bathe them, cook for them, clean their houses and ensure that they adhere to their treatment regimens. In addition, they also assist school-going orphans and vulnerable children with their homework and do physical activities with them. They also provide them with one meal a day and as well as food parcels to the needy once a month. Once a week they run a support group for orphans and vulnerable children. The

Ekuthuleni Home-Based Care serves the community of Govan Mbeki and surrounding municipalities. This facility is open from 09:00 to 16:00, Monday to Friday and their services are free of charge.

Emergency Services

The Municipal Disaster Risk Management Plan is designed to establish the framework for implementation of the provisions of the Disaster Management Act, 57 of 2002, as well as the related provisions of the Municipal Systems Act, 32 of 2000.

The purpose of the Municipal DRM Plan is to outline policy and procedures for both the proactive hazard and risk assessment, followed by disaster prevention (if possible), risk reduction, preparedness and the re-active disaster response, relief and rehabilitation phases of Disaster Risk Management. Disaster Management is the function assigned to the district municipalities as per legislation (Disaster Management Act 57 of 2002). It is estimated that the District is served by 37 police stations. These are fairly effectively distributed throughout the municipal area, with the highest concentration of stations coinciding with the areas experiencing higher population densities, namely Govan Mbeki, Chief Albert Luthuli, and Mkhondo.

These services are legislated under various pieces of legislation such as the Fire Services Act, Act 99 of 1987, National Veld and Forestry Fire Act, Act 101 of 1998, National Building Regulations and Building Standards Act, Act 103 of 1997, Hazardous Substances Act, Act 15 of 1973 as amended, Occupational Health and Safety Act, Act 85 of 1993 to highlight just a few.

The key issues facing the disaster management unit include the lack of fully operational disaster management centre and vast rural areas which make the provision of effective services difficult, concentration of industries surrounded by residential suburbs, climate change, large number of informal settlements and insufficient of safety awareness and education. In addition, climate change also presents a number of challenges which are linked to global impact such as increased temperatures, extreme weather events (flooding and drought) and climate vulnerability. The location of the municipality and its large manufacturing and mining sectors makes it vulnerable to various forms of disasters.

According to the District Municipality Spatial Development Framework, the challenges of improving the response time to emergency services are:

- Inadequate response vehicles and equipment.
- The review and development of disaster policy framework, disaster management plans and contingency plans for LMs as well as GSDM.

The number of Fire Stations and/or Disaster Management Centres, in the district still needs to be determined, but the following issues in this regard have been listed in the GSDM IDP:

- Additional Infrastructure and Rescue vehicles required for capacity building and preparedness.
- Construction of a Fire Station/Satellite Disaster Management Centre in Dr Pixley ka Isaka Seme LM.
- Construction of District Disaster Management Centre in Ermelo.

- Establishment of Communication centre in Satellite Disaster Management Centre.
- Medium Pump Urban Fire Truck for Dr Pixley ka Isaka Seme LM.
- Mobile Command Vehicle for District Disaster Management Centre.
- Rapid Response Vehicle that is NFPA/SABS Standards compliant for Dr Pixley ka Isaka Seme LM Fire Station.

Health systems strengthening

There are several Healthcare facilities within the proposed Leslie 1 Coal Mining Project area with one of these being the Lebohang Community Health Centre. However, the capacity of these facilities remains a challenge. There are also a few NGOs such as the Nu-Stat and USAID which support health infrastructure and health system-strengthening programs.

In terms of proposed Project impacts, influx may create increased demand for what is already a scarce resource. This has the potential to create tension.

Health information management is generally good in the health facilities that surround the proposed Leslie 1 Coal Mining Project. This data is limited by the fact that diagnostics and human resource capacity is basic. However, it serves as the best form of health surveillance for the monitoring of health impacts if supported and managed well. Strategic investment in local health facilities can support this.

The proposed Leslie 1 Coal Mining Project has the potential to impact on the national/local health service infrastructure and delivery mechanisms in the following ways:

- Employment of skilled staff

  The entire Project will employ a large number of people during construction. This may reduce during the operational stage of the proposed Leslie 1 Coal Mining Project's life cycle but will nevertheless require a large number of medical staff to support the clinical care and the occupational health requirements of the proposed Leslie 1 Coal Mining Project. While the proposed Leslie 1 Mining Project has a local employment responsibility, it needs to be very cautious when employing medical staff as skilled staff is in short supply in Leandra. If large numbers of skilled staff leave the public sector to support the proposed Leslie 1 Coal Mining Project this may have a significant detrimental impact on local care.

- In-migration

  Additional in-migration into Leandra and ultimately, Leslie is likely to significantly exceed the capacity of what are already limited facilities. There is minimal institutional capacity to support this potential growth either from a planning, budget or a delivery perspective. In-migration will be addressed in more detail in the SIA.

- Health service delivery capacity and expectations on the proposed Leslie 1 Coal Mining Project

There is minimal institutional capacity to support the local health service delivery. Therefore, the local health authorities will look to private partners or donors for assistance where possible, and as the proposed Leslie 1 Coal Mining Project is so visible in the area, may look to it to plan, finance and even deliver health service on their behalf. Therefore, it is essential that any interventions must be done in partnership with the local and national authorities so as not to be seen as a pure aid support package. The proposed Leslie 1 Coal Mining Project must not assume the role of the government but deliver on its mandate to improve the quality of lives in the area.

- Healthcare funding

  This extends into the element discussed above but also considers the potential inability to attract donor agency funding to the proposed Leslie 1 Coal Mining Project area. As health needs extend to so many other areas of the country, there is a risk that donors and NGOs bypass the PACs in their budget and interventions due to the perception that the proposed Leslie 1 Coal Mining Project will be in a position to fund and support any required programmes. This may reduce the potential to extend programmes and promote their sustainability.

- Health service inequalities

  There is a potential for inequalities between different communities as a result of Project supported health initiatives. It is logical that the proposed Leslie 1 Coal Mining Project supports health services in the more impacted communities, but this has the potential to cause inequality in populations or communities who do not benefit.

  The present and likely future medical service is likely to be the best equipped and staffed primary health care centre in the area for the foreseeable future.

9.15.3.12 EHA #12 Non-Communicable Diseases

This category includes health outcomes and determinants related to chronic disease. Important outcomes include increases or decreases in mortality and morbidity rates of cancer, cardiovascular and cerebrovascular diseases, diabetes, respiratory diseases, and mental health disorders. Many NCDs can be prevented by reducing common risk factors such as tobacco use, harmful alcohol use, physical inactivity and eating unhealthy diets. Key determinants for chronic diseases may include smoking rates, rates of alcohol and drug abuse, physical activity levels, presence of recreation centres, as well as cancer screening rates.

The term NCDs refers to a group of conditions that are not mainly caused by an acute infection, result in long-term health consequences and often create a need for long-term treatment and care. These conditions include cancers, cardiovascular disease, diabetes and chronic lung illnesses. Many other important conditions are also considered NCDs, including injuries and mental health disorders.

The chief chronic conditions observed in Leandra include chronic diseases such as hypertension, diabetes and stroke. Several respondents in Leslie reported that hypertension and diabetes are very common in their community.

Mental Health

Mental health refers to a broad array of activities directly or indirectly related to the mental well-being of a person. It is related to the promotion of well-being, the prevention of mental disorders, and the treatment and rehabilitation of people affected by mental disorders (WHO 2013). Mental health is a major consideration, as it relates to the community's perception of well-being and sense of place. FGD respondents reported that mental illnesses are not very prevalent in Leslie and Leandra as a whole.

Access to jobs, income, goods and services can enhance mental health and well-being and reduce stress. Having a sense of control over one's life is crucial for mental well-being, so mining and metals projects can improve mental health by reducing poverty, increasing self-esteem and empowering local communities. However, if not well managed, the disruption and uncertainty brought on by a new project can increase worry, stress, and feelings of powerlessness. If the price of local housing, food and other services increases as a result of the project, the financial stress on low income families can be great. The visual impact on the environment and the lighting, odour and noise associated with mining and metals projects can also affect mood, heighten stress levels and lead to sleep disturbance. Lack of job security may also lead to stress amongst employees and dependants, particularly well-being when the project only provides short term employment contracts or when the project nears closure.

Physical Activity Levels

Consistent physical activity is an important indicator of future non-communicable diseases risk, particularly cardiovascular disease risk. Moderate physical activity is defined as some activity that causes an increase in breathing or heart rate (30 or more minutes a day, 5 or more days per week). Vigorous physical activity is defined as some activity that causes a large increase in breathing or heart rate (20 or more minutes a day, 3 times or more a week) (Newfields, 2014). All of the residents in Leslie and the majority of the residents interviewed in Eendracht reported that they do not participate in leisure time physical activities such as jogging or exercise.

The proposed Leslie 1 Mining Project may bring changes that affect people's lifestyles (e.g. diet, level of physical activity, smoking, alcohol and drug consumption) that increase or decrease their risk of chronic illnesses such as heart disease, diabetes, and cancer and can also affect the mental health status of the local population. This can be through increased incomes as well as the increased availability of tobacco, alcohol and narcotic drugs. Alongside infectious diseases, cardiovascular diseases (heart disease and strokes) are one of the leading causes of death, ill health and disability worldwide. Even small changes in these chronic disease risk factors can have significant long-term effects on local community health and well-being.

The potential increase in chronic disease risk factors may be at least partially minimized through support for NGOs and local health and social care services in delivering health promotion that emphasises moderation and the long-term adverse effects of substance abuse; and working with the local police service to regulate black market economies and what may be legally sold to workers.

The proposed Leslie 1 Coal Mining Project will in all likelihood enhance the socio-economic conditions in the area, either through direct or cumulative benefits. As the proposed Leslie 1 Coal Mining Project starts to improve health programs in the area through direct or indirect means, it is hoped that it will also contribute to increasing life expectancy in the area. The short-term effects may be an increased spending-ability and adoption of more western sedentary lifestyle and diet. With prosperity and an organised settlement may come a degree of urbanism with associated changes in values and behaviour, which predisposes the community to an increase in lifestyle-related diseases such as obesity, hypertension, diabetes, dental caries and some forms of cancers. This may place an additional burden on the local health care facilities that may not have an ability and capacity to diagnose and appropriately manage these conditions.

The proposed Leslie 1 Coal Mining Project will employ a number of permanent and temporary workers. Diet and lifestyle will need to be monitored[22] in this sector as they will have access to increased incomes and potentially free meals on the proposed Leslie 1 Coal Mining Project site. The following potential impacts from NCDs on the workforce will need to be considered:

- High costs associated with absenteeism due to ill health;
- Loss of trained or skilled people from the workforce as a result of disease. This will result in higher operational costs due to the need to retrain or recruit replacement staff; and
- Impact on the family unit with potential social and behavioural impacts.
- In terms of the significance of the proposed Leslie 1 Mining Project on surrounding communities, the following potential risk factors may have to be considered:
- Reduction in traditional lifestyle and values;
- Social and environmental factors that increase stress and unhealthy behaviours; and
- Increased pressure on existing health care facilities that only practice limited preventive health care.

These conditions are chronic in nature and difficult to predict at the local level. The cumulative impacts of the economic upliftment at the local-, county- and country-level will need to be considered and as such the impacts cannot solely be ascribed to the proposed Leslie 1 Mining Project. Mitigation and management at the local level is however important.

9.15.4 Specialist Conclusions

Leslie Coal Mine needs to consider the existing health needs of the PACs they will be operating within as these existing health needs are present regardless of the proposed Leslie 1 Mining Project and represent

[22] Diet and lifestyle monitoring can take place through education on nutrition and encouragement of 'self-monitoring'. Self-monitoring is a useful way to keep yourself on track with healthy eating and exercise habits. The goal is to help you become more aware of the behaviours that are holding you back from better health. Some common ways to self-monitor include keeping food diaries; exercise logs and regular self-weighing.

the current health status of the community. The proposed Leslie 1 Mining Project will also need to consider the future health impacts that it (the proposed Leslie 1 Mining Project) may exert on these PACs.

This HIA has outlined the significant changes on the health status of the local communities that may be instigated by the proposed Leslie 1 Mining Project. An attempt has been made to give a comprehensive outlook of the baseline health status of the proposed Leslie 1 Mining Project site (where possible) and also to understand and prioritise future Project health impacts, based on the available evidence. Mitigation and management measures have been recommended and it is advised that these measures are incorporated into the overall environmental and social management plan for the proposed Leslie 1 Mining Project.

An impact assessment has been undertaken, which has employed both qualitative and quantitative research methods and incorporated consultation with and participation of PACs. It is the author's opinion that due process has been followed. Where impacts have been found to be potentially significant, various mitigation measures to manage and monitor the impacts of the proposed Leslie 1 Mining Project have been proposed.

Adequate mitigation measures are expected to reduce the significance of almost all negative impacts although not always to acceptable levels, while positive health effects can be created through the implementation of associated enhancement measures. The recommended mitigation measures must be implemented to manage the impacts and ensuring compliance with current legislative requirements. Lastly, it is recommended that Leslie Coal Mine inaugurates relationships with other institutions (e.g. government or NGOs) involved in local and regional healthcare development and social upliftment so as to maximise the benefits of its contribution to the overall health status of the community.

If the Project is granted environmental authorisation, it is recommended and advised that, on safety and health grounds, both the Project proponent and the competent authority should:

- Prohibit or restrict the use of certain hazardous practices, processes or substances in underground coalmines; or
- The applicant should provide advance notification and authorization before any such restricted practices, processes and substances are used; or
- Specify categories of workers who, for reasons of safety and health, are not allowed to use specified processes or substances, or are allowed to use them but only under conditions prescribed in accordance with national laws or regulations.

It is recommended that the Project is allowed to proceed on the assumption that the environmental, social and health management commitments are adhered to.

9.16 Climate Change

A Climate Change Impact Assessment was undertaken by Prometium for the Leslie 1 Project. The sections included herewith are extracted from **this** report and the full report is provided in Appendix D16.

9.16.1 Environmental Status Quo

9.16.1.1 Climate Change in South Africa

The impacts of climate change on South Africa have been summarised in the Long Term Adaptation Scenarios (LTAS) study which was executed by the Department of Environmental Affairs in 2012. However, significant progress has been made in South Africa since the LTAS in terms of the local generation of detailed regional climate futures for the country. The most recent modelling was conducted for South Africa's Third National Communication (Department of Environmental Affairs, 2017). Some of the salient points from the LTAS which are still relevant are:

- Air temperatures in South Africa have increased at least 50% more than the global annual average of 0.65°C over the last five decades. This is raising the possibility that in a world of more than 2°C average temperature change, South Africa could experience changes of over 3°C.
- Sustained warming and increasing rainfall variability over the short term (next decade) will have increasingly adverse effects on key sectors of South Africa's economy in the absence of effective adaptation responses. Early impacts will largely be felt by the poor and vulnerable groups in society.

A key feature of the projected climate change futures of South Africa, as per the Third National Communication, is that temperatures are to increase drastically under low mitigation scenarios. For the far-future period of 2080-2099, temperature increases of more than 4°C are likely over the entire South African interior, with increases of more than 6°C plausible over large parts of the western, central and northern parts. Such increases will also be associated with drastic increases in the number of heat-wave days and very hot days, with potentially devastating impacts on agriculture, water security, biodiversity and human health.

Wetter conditions are projected for the central part of the country both in the near (2015 – 2035) and mid (2040 – 2060) future. However far (2080 – 2099) future projections indicate general drying over the whole of South Africa. These rainfall changes can be seen in the figure below.

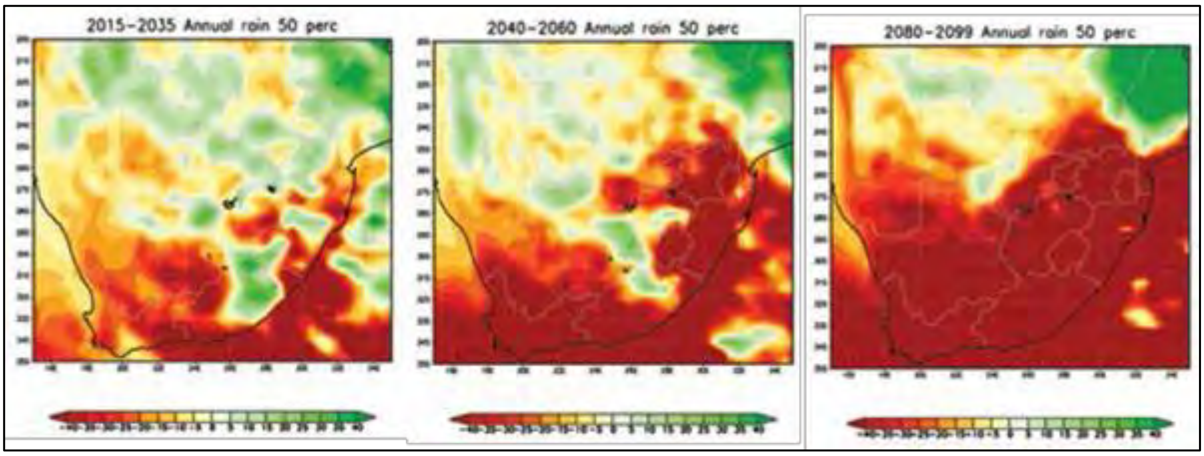


Figure 9-119: Projected change in the average annual rainfall (mm) over South Africa for the time periods 2015–2035; 2040–2060 and 2080–2100 relative to 1970–2005 under low mitigation (Department of Environmental Affairs, 2013)

9.16.1.2 Climate Change in Mpumalanga and Gauteng

There is limited downscaled modelling specific to the Govan Mbeki Local Municipality, in which the proposed Leslie 1 Coal Mine will fall. The modelling for the Mpumalanga Province is used as a proxy as the project is on the border between Mpumalanga and Gauteng. In addition, key factors with regards to climate change in Gauteng have been considered. Climatic changes in Gauteng could influence spatial, economic, social and environmental patterns in areas such as Leandra, which is on the border of the two provinces.

The updated modelling from the draft Third National Communication indicates two possible narratives for the Mpumalanga province. The province may plausibly experience a hotter dryer future with temperature increases as large as 6°C (under low mitigation) or a warmer future with temperature increases up to 4°C and more frequent intensive wet spells, such as flash floods (under high mitigation). This change in climatic parameters could also increase in the frequency of occurrence of heat-wave days and high fire-danger days (Department of Environmental Affairs, 2017).

The following table (Table 9-78) provided an overview of the projected changes as a result of climate change related to Mpumalanga.

Table 9-78: Climatic hazards in provinces and projected changes in climate as a result of climate change and climate variability (Department of Science and Technology and CSIR, 2017)

Province	Current hazards	Projected changes in climate and extreme weather events
Mpumalanga	Excessive rainfall and flooding, hail storms, windstorms, fires and outbreak of diseases	❖ Increase in average temperature of 1– 2° C in the near future ❖ Decrease in the number of days with frost ❖ Increase in the annual number of very hot days by 20–40 days ❖ Decrease in annual rainfall up to 40 mm ❖ Experience both wetting and drying ❖ Increase in the number of extreme rainfall events-hailstorms, damaging winds, thunderstorms and flooding ❖ More drier years

The extreme event in terms of rainfall and temperature will negatively impact on the vulnerability of the agricultural sector within the Govan Mbeki Local Municipality, especially in terms of longer term agricultural growth potential. In addition, these events will increase the vulnerability of communities directly or indirectly reliant on either the formal or informal part of the agricultural sector. The most recent South African Risk and Vulnerability Atlas indicates a high reliance on subsistence agriculture within and around the Leandra area (Department Science and Technology, National Research Foundation and South Africa Environmental Observation Network, 2018).

To maintain water security and prevent flooding of the project and surrounding communities, buffering mechanisms have to be designed into the development of the proposed Leslie 1 Coal Mine. These mechanisms could include rainwater harvesting and wetland restoration.

9.16.1.3 Other Potential Climate Change Dimensions relevant to the Leslie 1 Coal Mine

Other potential climate change risks are those that relate to climate change, but cannot be classified as physical or regulatory risks. Other such risks can include:

- ❖ Reputational risk, especially concerning negative perceptions of the general public or investors;
- ❖ Changes in consumer behaviour relating to customer preferences for products/services;
- ❖ Induced changes in human and cultural environments (for example, migration and cultural changes);
- ❖ Fluctuating socio-economic conditions (Mpumalanga relies heavily on the balance between mining and agricultural land);
- ❖ Increasing humanitarian demands, as climate change impacts are experienced.

South Africa and the Mpumalanga Province have an economically divided society due to a number of socio-economic disparities. As a result, its population is characterized by a vulnerable majority. The vulnerable majority are more exposed to climate change impacts and may pose risks to mining companies, either through migration of workforces or increased humanitarian demands.

9.16.2 Specialist Assessment Methods

The carbon footprints for both the construction and operational phases of the project presented in this assessment have been guided by the ISO/SANS 14064-1 (2006) standard. This standard specifies principles and requirements at the organization level for the quantification and reporting of historical figures of greenhouse gas emissions and removals. The principles of this standard have in this analysis been applied to the project as an organisation to the calculation of the future greenhouse gas emissions of the proposed project.

The basic principles of SANS 14064-1 aim to ensure that the greenhouse gas information presented within a carbon footprint is a true and fair account. These principles include:

- Relevance: Selecting all the greenhouse gas sources, greenhouse gas sinks, greenhouse gas reservoirs, data and methodologies that are appropriate.
- Completeness: Including all the greenhouse gas emissions and removals relevant to the proposed project.
- Consistency: Enable meaningful comparisons to be made with other greenhouse gas related information.
- Accuracy: Reducing bias and uncertainties as far as is practical.
- Transparency: Disclosing sufficient and appropriate greenhouse gas related information to allow intended users to make decisions with reasonable confidence.

Following the SANS 14064-1, the carbon footprint of the power plant's direct combustion emissions was developed through the following process:

- Setting the boundaries of analysis;
- Identifying the greenhouse gas sources inside the boundary;
- Establishing the quantification method that will be applied;
- Selecting or developing greenhouse emission and removal factors; and
- Calculating the greenhouse gas emissions.

The Greenhouse Gas Protocol's Corporate Accounting and Reporting Standard was also used in addition to the SANS 14064-1 standard as a guide in the calculation of the carbon footprint presented in this study.

9.16.3 Specialist Findings

The Leslie 1 Coal Mine's greenhouse gas emissions determine its contribution to global climate change. The impact of the project is analysed in terms of global emissions, South Africa's National Greenhouse Gas Inventory, the grid trajectory, and the project alternatives.

9.16.3.1 Impact of project emissions on South Africa's National Greenhouse Gas Inventory and Climate Change

The Leslie 1 Coal Mine's lifetime greenhouse gas emissions are summarised in Table 9-79 below. The emissions are grouped into direct and indirect sources for both the construction and operational phases of the plant's lifetime.

Table 9-79: Summary of the greenhouse gas emissions calculated for the proposed Leslie 1 Coal Mine

Construction Phase	Annual Emissions	Cumulative Emissions
Construction Phase		
Direct emissions (scope 1)	3 tCO_2e/year	5 tCO_2e
Energy indirect emissions (scope 2)	900 tCO_2e/year	1800 tCO_2e
Other indirect emissions (scope 3) – upstream	66 000 tCO_2e/year	140 000 tCO_2e
Operational Phase		
Direct emissions (scope 1)	73 000 tCO_2e/year	2.5 million tCO_2e
Indirect emissions (scope 2)	75 000 tCO_2e/year	2.6 million tCO_2e
Other indirect emissions (scope 3) – Combustion in South Africa	4.5 million tCO_2e/year	158 million tCO_2e

Based on the estimated greenhouse gas emission that the mine will generate and assuming a mine lifetime of 35 years, the proposed Leslie 1 Coal Mine is expected to have direct emissions approximately 2.5 million tonnes CO_2e over its lifetime. However, the greenhouse gas emissions from the combustion of fuel (coal) dwarf the emissions from all other sources and this is highlighted in Figure 9-120 below.

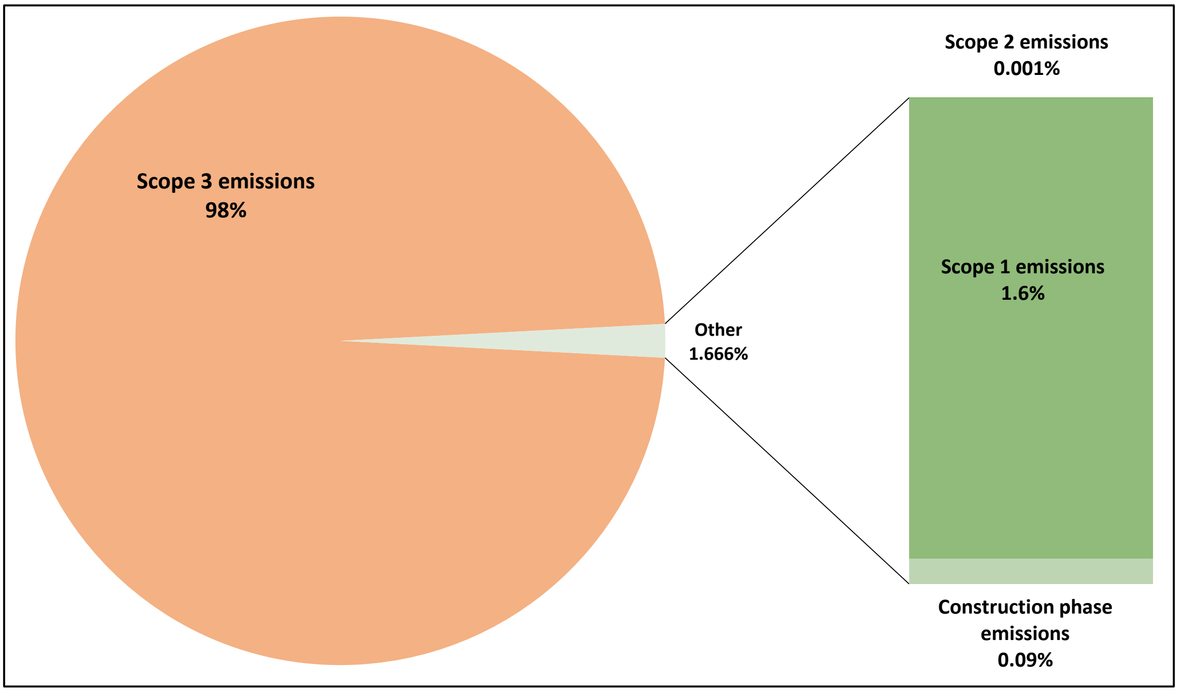


Figure 9-120: Distribution of lifetime GHG emissions (226 000 tCO2e) from the proposed Leslie 1 Coal Mine.

Once operational the Leslie 1 coal mine will be required to report its direct emissions from coal mining and handling (IPCC code: 1B1a Coal mining and Handling) to the Department of Environmental Affairs. Coal mining is also a listed production process for mandatory Pollution Prevention Plans in accordance with the National Pollution Prevention Plans Regulations under the National Environmental Management Act: Air Quality.

Considering South Africa's most recent Greenhous Gas National Inventory Report 2000-2010 (2014) the proposed Leslie 1 Coal Mine's annual emissions (scope 1 & 2) would account for 0.03% of South Africa's national emissions (excluding sinks from forestry and other land use). If the emissions associated with the combustion of coal is included, then it would account for 0.86% of the national emissions.

South Africa's Intended Nationally Determined Contribution (INDC) submitted in Paris in 2015 sets out a national emissions trajectory up to 2050. South Africa's emissions are expected to peak between 2020 and 2025, plateau for approximately a decade and decline in absolute terms thereafter. Based on this trajectory the project's total annual emissions (direct and indirect) would remain within a range of 0.68% - 1.05% of national emissions over the period between 2025 and 2030. With national emissions forecast to decline after 2035, the plant could account for 0.97% - 1.96% of national emissions if it is still operational in 2050.

In addition to the INDC, the figure below outlines the carbon dioxide emissions constraint considered in the base case of the draft Integrated Resource Plan (IRP) Update from November 2016 (Department of Energy, 2016). In line with Government policy to reduce greenhouse gas emissions, the IRP update applies the moderate decline annual constraints as an instrument to reduce national emissions. This might change in the future in line with the Department of Environmental Affairs mitigation system and climate change act.

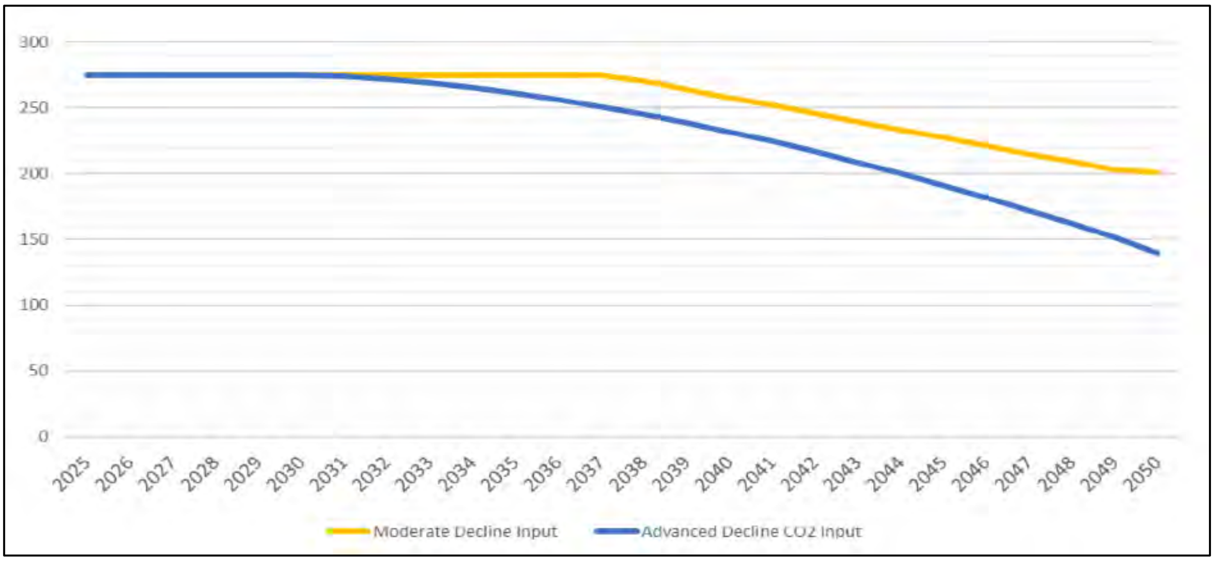


Figure 9-121: The moderate and advanced emissions decline trajectory 2015 - 2050.

Anthropogenic climate change as a global phenomenon is caused by the accumulated greenhouse gas emissions from global emitting sources. The greenhouse gas emissions from the proposed Leslie 1 Coal Mine, when considered in isolation, are unlikely to have any specific significant impact on global climate change. The specific greenhouse gas emissions from the mine cannot be attributed directly to any particular climate change effects. Despite this there is a collective responsibility to address the global challenge of climate change and each actor has an individual responsibility to minimise its own negative contribution to the issue. As such, the environmental impact of the project can be considered in terms of its contribution to national greenhouse gas emissions.

As a single source the impact of the proposed Leslie 1 Coal Mine's greenhouse emissions during operation is considered to be minor in magnitude due to its 0.03% contribution to national emissions. In 2015, South Africa's national emissions (490 million tCO_2e) contributed 1.45 % towards global emissions of 33.83 billion tCO_2e.

It is certain that the combustion of coal will produce greenhouse gas emissions and that the greenhouse gas emissions will contribute to the national inventory and climate change which will negatively affect the world's population. Based upon these criteria the proposed Leslie 1 Coal Mine is likely to have an impact with a medium to high significance score. The duration that greenhouse gases are assumed to remain in the atmosphere renders the impact effectively irreversible with the impacts of anthropogenic climate change in many cases resulting in the irreversible loss of resources.

The context within which the EIA reporting requirements were developed have yet to be applied to greenhouse gas emissions that have a global impact. For this reason, a materiality threshold was defined. The magnitude of a project is considered major if the emissions are equivalent to 0.1% (34 million tCO_2e based on 2015 figures of global emissions) and minor if below 0.01% (3.4 million tCO_2e based on 2015 figures) of global emissions.

9.16.3.2 Project impact in the South African national context

The analysis of the direct and indirect emissions of the project shows that the combustion of coal, as an indirect emission for the project, has the biggest impact on global climate change. A causal chain analysis of the project however shows that the emissions associated with the combustion of the coal will occur in South Africa whether the project is implemented or not. This is due to the fact that the amount of coal combusted is determined by the Integrated Resource Plan (IRP). The implementation of this project, or not, will in all probability not change the amount of electricity generated from coal in South Africa. The amount of coal will be determined by the specifications of the IRP, as mandate in the Electricity Regulation Act.

Recent analysis has shown that limiting the opening of new coal mines has the effect of pushing up the price of coal and increasing the profits of large coal mining companies. This is due to the fact that attempts to limit the supply of coal, without addressing the demand for coal creates artificial shortages. In a country like South Africa, where the supply of electricity is strictly regulated, limitation of the coal supply will not reduce emission, but rather increase the profits of the coal mining companies that are in operation. See the illustrative causal chain in Figure 9-122 below.

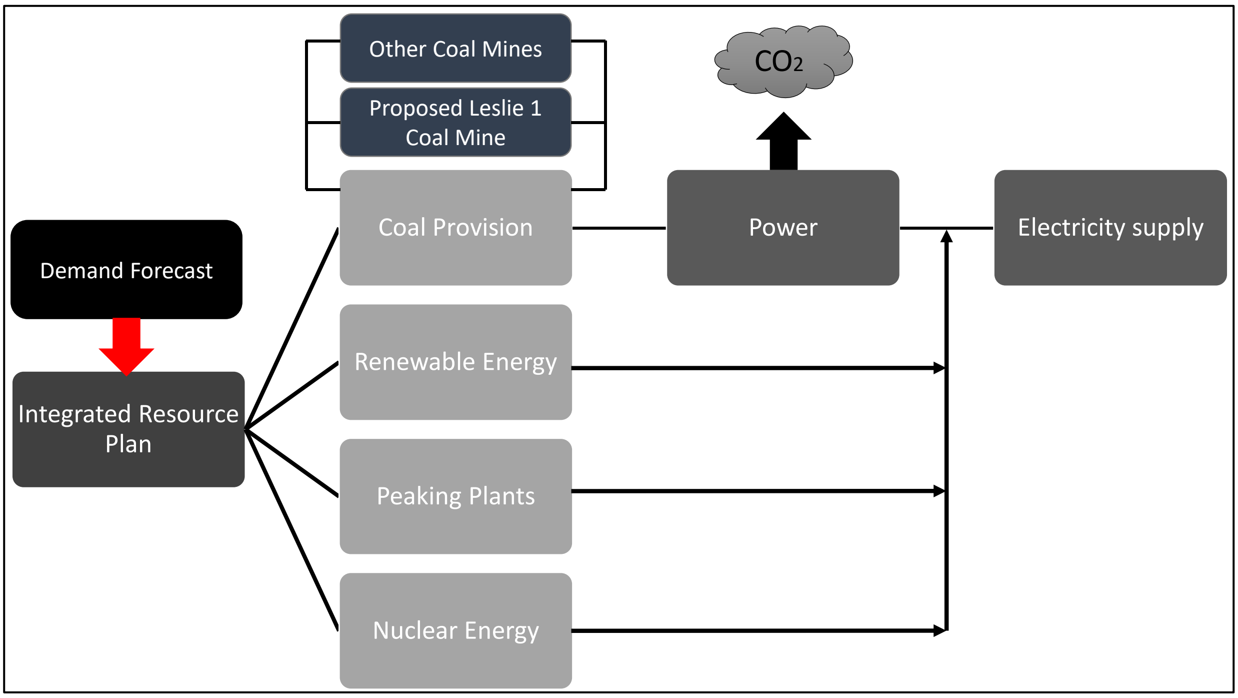


Figure 9-122: A high-level causal chain assessment of the South African energy sector

Any attempts to reduce the emissions from the combustion of coal should be directed at a restatement of the IRP, and not at the implementation of this specific project.

9.16.3.3 Impact of Climate Change on the Project

The proposed Leslie 1 Mine faces a number of climate change related risks across core operations, its value chain and broader network for both a globally mitigated emissions scenario and a globally unmitigated emissions scenario. The risks are classified as either low or high depending on the emissions scenario. Physical risks are higher and transitional risks are lower under an unmitigated emissions scenario. In such an unmitigated scenario the global temperatures are expected to increase by 6 °C which could for example increase the risk of heat stress (Table 9-80).

Typically, physical risks are lower and transitional risks are higher under a mitigated emissions scenario that aims to keep temperature increases at 2°C or below. The mitigated emissions scenario is supported by the Paris Agreement and will be achieved as countries set ambitious Nationally Determined Contributions (NDC). As countries work towards compiling their Nationally Determined Contributions, additional regulations may be put in place to limit emissions from fossil fuel intensive industries or encourage renewable energy development.

Table 9-80: Scenario analyses for the proposed Leslie 1 Coal Mine.

Risks	Baseline scenario with no greenhouse gas mitigation by global community	Scenario with mitigation to limit temperatures below 2°C
Core Operations – Leslie 1 Coal Mine		
Heat stress	High Risk	Low Risk
Drought	High Risk	Low Risk
Regulatory obligations	Low Risk	High Risk
Value Chain – Leslie 1 Coal Mine Value Chain		
Disrupted supply chain	High Risk	Low Risk
Regulatory obligations	Low Risk	High Risk
Broader Network – Govan Mbeki Local Municipality and Gert Sibande District		
Heat stress	High Risk	Low Risk
Community vulnerability	High Risk	Low Risk
Water supply disruptions	High Risk	Low Risk

9.16.4 Specialist Conclusions

This study considered two perspectives in terms of climate change and the proposed Leslie 1 Coal Mine. The first was the impact of the project on climate change. The second was the impacts of climate change on the project. In both perspectives, the physical and transitional risks were considered.

In terms of the proposed Leslie 1 Coal Mine's impact on climate change, the mine will generate emissions both through its direct operations, and there will be emissions associated with the combustion of the coal mined. It is estimated that the emissions associated with the operation of the mine will be approximately 2.5 million tonnes CO_2e over its lifetime of 35 years. This coal will be sold and the emissions associated with the combustion of the coal downstream will however be in the order of 160 million tonnes CO_2e.

The operational greenhouse gas emissions of the mine are therefore insignificant when compared to the downstream combustion of the coal produced by the mine. The opening, or not, of this mine will however not impact on the overall combustion of coal in the electricity sector in South Africa, as the generation of electricity from coal is prescribed by the Integrated Resource Plan (IRP). The IRP determines how much electricity will be generated from what fuel or energy sources and is the responsibility of the Department of Energy.

It is the specialist's opinion that this specific project should not be judged on the basis of the downstream emissions from the combustion of coal, as the opening of the mine, or not, does not have an impact on the amount of coal combusted. The impact of the project on climate change can only be mitigated if the IRP is changed. The DMR, in the approvals process of this mine, should engage with the Department of

Energy with respect to limiting the greenhouse gas emissions resulting from the implementation of the IRP. If this cannot be done, then greenhouse emissions should not be a reason to stop the project.

It is important to note that the project proponent, AOL, has made significant public statements about its commitment to combat climate change. The most significant of these is the “Aiming for A” resolution passed in the company’s Annual General Meeting of 2016. In this resolution the shareholders require of the management of Anglo American to review the company’s portfolio for climate risk. The analysis presented in this report highlights the climate change risks of the proposed project, specifically the risk of stranded assets and the broader community. It is our opinion that the opening of a new coal mine is contrary to the “Aiming for A” resolution.

In the comments raised to date by I&APs three key issues have been highlighted in terms of climate change: water, dust and the sustainability of agriculture. The long-term sustainability of groundwater sources within the immediate region were specifically raised by numerous stakeholders. Under drier and hotter conditions, water sources will become increasingly threatened. This will not only impact the mine’s operation, but also the surrounding land uses. Agriculture plays an important role in the GMLM economy. The proposed mining site is surrounded by predominantly agricultural practices, ranging from commercial to subsistence-based practices. Groundwater sources as well as the potential impact of infrastructure development or dust, could impact both commercial and subsistence-based livelihoods. Hotter and drier conditions, coupled with the construction of infrastructure or the operational aspects such as coal transport, could increase the risk for increased dust.

In terms of the broader network, communities within the GMLM are both very exposed and highly sensitive to climate change. The biggest climate change risks associated with the proposed Leslie 1 Coal Mine broader network lies in the areas of mining rehabilitation and community vulnerability. There are a large number of socially vulnerable groups within the local municipality. Climate change impacts could exacerbate the vulnerability of these groups and worsen existing social challenges.

Such social pressures, coupled with a high regional economic dependency on the proposed Leslie 1 Coal Mine, will impact the mine’s work force as well as AOL’s reputation. To maintain its social license to operate we recommend that the impact of climate change on the mine’s broader network be explicitly addressed in the mine’s Social and Labour Plan. The Social and Labour Plan should include skills development and diversification and appropriate climate change adaptation. In addition, efforts to protect and re-establish regional vegetation will play an important role in ensuring community resilience. Eco-system services contribute towards community-based climate change adaptation. Therefore, the proposed Leslie 1 Coal Mine’s Social and Labour Plans should consider the “food and feed’ functions of the local eco-systems to address food security and subsistence-based farming within the region.

Linked to the above is land rehabilitation. Land plays a critical role in post mine life sustainability. Pro-active planning for land restoration and rehabilitation, within the context of climate change, is critical to ensure the future integration of land into existing spatial economies and supporting sustainable development trajectories. Changing climatic parameters such drought and flash floods could constrain the land rehabilitation process. As such we recommend that the rehabilitation and mine closure plans must clearly address climate change risks and mitigation measures to optimise land for a variety of potentially viable post-mine life land uses.

In conclusion, the proposed Leslie 1 Coal Mine will produce greenhouse gas emissions that will contribute to anthropogenic climate change and its ensuing impacts. The extent, duration and probability of the plant's greenhouse gas emissions impacts on climate change will be minor. Furthermore, the overall significance from the single source coal mines' impact during construction and operational phases, on global emissions and thus climate change is rated as medium to high. This is however subject to the consideration of community vulnerability and long terms rehabilitation within the context of further mine planning.

10 Impact Assessment

10.1 Methodology for assessing the significance of Environmental Impacts

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance. As read within the DWS's Best Practice Guideline: G4 – Impact Prediction, there are three basic components that define an impact (or a risk). Figure 10-1 represents the relationship between these three components and their influence on the significance of a certain impact of a project.

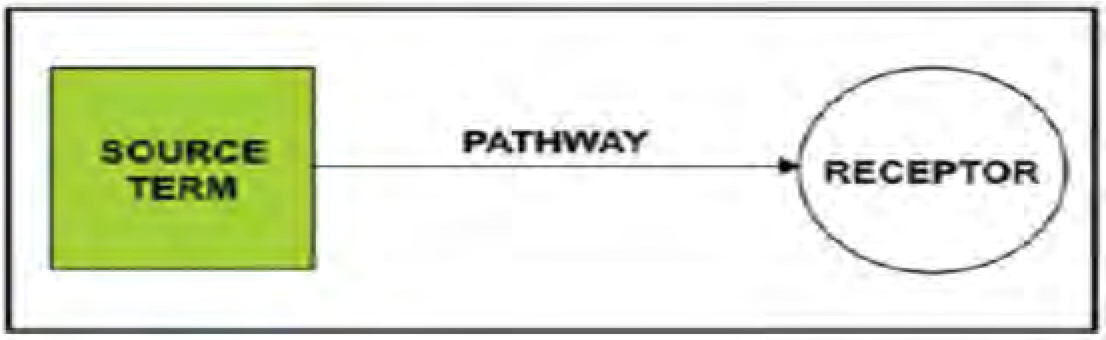


Figure 10-1: Impact prediction model

The impact significance rating system is presented in Table 10-1, Table 10-2 and Table 10-3, and involves three parts:

- **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale/ population and duration;
- **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from **Part B**) and the probability of occurrence.

10.1.1 Part A: Defining Consequence in Terms of Magnitude, Duration and Spatial Scale

Use these definitions to define the consequence in Part B.

Table 10-1: Consequence Rating Methodology

IMPACT CHARACTERISTICS	DEFINITION	CRITERIA
Magnitude	Major -	Substantial deterioration or harm to receptors; receiving environment has an inherent value to stakeholders; receptors of impact are of conservation importance; or identified threshold often exceeded

IMPACT CHARACTERISTICS	DEFINITION	CRITERIA
	Moderate -	Moderate/measurable deterioration or harm to receptors; receiving environment moderately sensitive; or identified threshold occasionally exceeded
	Minor -	Minor deterioration (nuisance or minor deterioration) or harm to receptors; change to receiving environment not measurable; or identified threshold never exceeded
	Minor +	Minor improvement; change not measurable; or threshold never exceeded
	Moderate +	Moderate improvement; within or better than the threshold; or no observed reaction
	Major +	Substantial improvement; within or better than the threshold; or favourable publicity
Spatial scale or population	Site or local	Site specific or confined to the immediate project area
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic
	National/ International	Nationally or beyond
Duration	Short term	Up to 18 months.
	Medium term	18 months to 5 years
	Long term	Longer than 5 years

10.1.2 Part B: Determining Consequence Rating

Rate consequence based on definition of magnitude, spatial extent and duration.

Table 10-2: Consequence Rating Methodology

			SPATIAL SCALE/ POPULATION		
			Site or Local	**Regional**	**National/ international**
MAGNITUDE					
Minor	**DURATION**	**Long term**	Medium	Medium	High
		Medium term	Low	Low	Medium
		Short term	Low	Low	Medium
Moderate	**DURATION**	**Long term**	Medium	High	High
		Medium term	Medium	Medium	High
		Short term	Low	Medium	Medium

			SPATIAL SCALE/ POPULATION		
			Site or Local	Regional	National/ international
Major	DURATION	Long term	High	High	High
		Medium term	Medium	Medium	High
		Short term	Medium	Medium	High

10.1.3 Part C: Determining Significance Rating

Rate significance based on consequence and probability.

Table 10-3: Significance Rating Methodology

		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Medium	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

10.2 Impacts and Cumulative Impacts identified for the Leslie 1 Project

This Subchapter serves to provide insight on the major positive, negative and cumulative impacts associated with the development of the Leslie 1 Project. The potential impacts are discussed per environmental feature/ aspect. For more detail please refer to the specialist study contained in the appendices.

10.2.1 Soil, Land Capability and Agricultural Potential

10.2.1.1 Construction Phase

Table 10-4: Soil horizon impact assessment matrix before and after mitigation

Impact Description	Disturbance of in situ horizon organisation due to stripping and stockpiling of topsoil	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Major -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	High
Probability	Definite	Definite
Significance of Impact	High	High
Mitigation	The only mitigation for this impact is to keep the surface disturbance footprint as small as possible. However, horizon inversion/disturbance is a permanent impact.	
Cumulative Impact	No	

Table 10-5: Soil fertility impact assessment matrix before and after mitigation

Impact Description	Loss of soil fertility through impacts on nutrient cycles due to stripping and stockpiling of topsoil	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -
Duration	Long Term > 5 years	Medium Term > 18 months < 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Definite
Significance of Impact	**High**	**Medium**
Mitigation	Soil nutrient cycles can somehow be maintained by revegetation of topsoil stockpiles and through proper ecological land rehabilitation	
Cumulative Impact	No	

Table 10-6: Soil compaction impact assessment matrix before and after mitigation

Impact Description	Soil compaction due to vehicle traffic and construction infrastructure	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Definite
Significance of Impact	**High**	**Medium**
Mitigation	The project footprint should be kept as small as possible. Traffic should be restricted to haul roads only. Topsoil stripping and stockpiling should not be conducted during wet periods, soil moisture should be below a pre-determined level.	
Cumulative Impact	No	

Table 10-7: Arable land impact assessment matrix before and after mitigation

Impact Description	Loss of arable land capability as a result of soil stripping and construction of infrastructure	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Major -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	High
Probability	Definite	Definite
Significance of Impact	**High**	**High**
Mitigation	Current soil rehabilitation techniques are not able to restore the current arable land capability and the loss is therefore permanent	
Cumulative Impact	Yes	

Table 10-8: Wetland impact assessment matrix before and after mitigation

Impact Description	Loss of wetland land capability as a result of soil stripping and construction of infrastructure	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Unlikely
Significance of Impact	**High**	**Low**
Mitigation	Avoid wetland areas and do not include in areas of surface disturbance	
Cumulative Impact	No	

Table 10-9: Land use impact assessment matrix before and after mitigation

Impact Description	Change in land use from agriculture to mining	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Major -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	High
Probability	Definite	Definite
Significance of Impact	**High**	**High**
Mitigation	Keep the project surface footprint as small as possible	
Cumulative Impact	Yes	

10.2.1.2 Operational Phase

Table 10-10: Soil compaction impact assessment matrix before and after mitigation

Impact Description	Soil compaction	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Definite
Significance of Impact	**High**	**Medium**
Mitigation	Restrict traffic to the demarcated areas and existing haul roads	
Cumulative Impact	No	

Table 10-11: Soil pollution impact assessment matrix before and after mitigation

Impact Description	Soil chemical pollution	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -

Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Definite
Significance of Impact	**High**	**Medium**
Mitigation	Manage surface water run-off around the coal loading and storage facilities. Use topsoil stockpiles as berms along the road and around the infrastructure areas to prevent pollution from the site from spreading into surrounding crop fields	
Cumulative Impact	No	

10.2.1.3 Decommissioning and Closure Phase

Table 10-12: Soil compaction impact assessment matrix before and after mitigation

Impact Description	Soil compaction	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Definite
Significance of Impact	**High**	**Medium**
Mitigation	Restrict traffic to areas where decommissioning is taking place as well as existing haul roads	
Cumulative Impact	No	

10.2.2 Surface Water

10.2.2.1 Construction Phase

Table 10-13: Significance rating of construction impact 1

NATURE OF IMPACT 1: The removal of vegetation will expose soils to water erosion that may lead to a deterioration in water quality of surrounding surface water in terms of increased TSS and turbidity		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	Local
Duration	Short term (construction phase period)	Short term (construction phase period)
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Significance of Impact	**Medium**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	

NATURE OF IMPACT 1: The removal of vegetation will expose soils to water erosion that may lead to a deterioration in water quality of surrounding surface water in terms of increased TSS and turbidity
Residual impacts ❖ None foreseen
Mitigation measures • Temporary erosion control measures that reduce flow velocity (e.g. runoff berms) should be implemented around construction areas; • Clearance of vegetation must be limited as far as possible; and • Water quality sampling must be implemented upstream and downstream of construction sites.

Table 10-14:Significance rating of construction impact 2

NATURE OF IMPACT 2: Lay down of impermeable areas is likely to result in increased velocity in surface water runoff, that may lead to erosion and consequent increase in TSS of surface water resources		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	Local
Duration	Short term (construction phase period)	Short term (construction phase period)
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Significance of Impact	**Medium**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ None foreseen		
Mitigation measures • Measures (energy dissipaters, detention dams, swales, etc.) that reduce flow velocity from impermeable areas should be implemented. The goal of all stormwater management should be that the post-development runoff is the same or does not exceed the pre-development runoff; • Impermeable areas must not be constructed unnecessarily; and • Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.		

Table 10-15 Significance rating of construction impact 3

NATURE OF IMPACT 3: Changes in the topography are likely to result in an alteration in surface water drainage patterns leading to erosion and a consequent increase in TSS of surface water resources		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	Local
Duration	Short term (construction phase period)	Short term (construction phase period)
Magnitude	Moderate	Minor

NATURE OF IMPACT 3: Changes in the topography are likely to result in an alteration in surface water drainage patterns leading to erosion and a consequent increase in TSS of surface water resources		
Consequence	Medium	Low
Probability	Possible	Possible
Significance of Impact	**Medium**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ None foreseen		
Mitigation measures • Stormwater management measures around the shaft, dumps, plant area, etc. as proposed under section 5. must be implemented; and • Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.		

10.2.2.2 Operational Phase

Table 10-16: Significance rating of operational impact 1

NATURE OF IMPACT 1: The excavation of the shaft portals and the implementation of the SWMP will result in a loss of contributing catchment area to stream flows		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	No mitigation
Duration	Long term	No mitigation
Magnitude	Minor	No mitigation
Consequence	Medium	Medium
Probability	Definite	No mitigation
Significance of Impact	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Although the shafts will be infilled at closure, it is unlikely that the entire shaft area that was excavated will be backfilled. This will remain an impact post mine closure.		
Mitigation measures • No mitigation.		

10.2.2.3 Closure Phase

Table 10-17: Significance rating of closure impact 1

NATURE OF IMPACT 1: Loosening of soil during demolition of infrastructure and rehabilitation processes is likely to be washed into nearby surface water resources leading to deteriorated water quality		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	Local
Duration	Short term (construction phase period)	Short term (construction phase period)
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Significance of Impact	**Medium**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ None foreseen		
Mitigation measures • Stormwater management structures should be left in place until rehabilitation is complete; • Temporary erosion control measures that reduce flow velocity (e.g. runoff berms) should be implemented around rehabilitation activities; and • Water quality monitoring must continue upstream and downstream of the Mine for at least five years post mine closure and rehabilitation.		

10.2.2.4 Cumulative Impacts

Table 10-18: Cumulative impact rating for surface water quality

NATURE OF IMPACT: The establishment of the three proposed mines in the vicinity of Leandra, has the potential to cumulatively impact on the surface water quality of the area, specifically on pH, TDS and metal concentrations		
	Before Mitigation	**After Mitigation**
Spatial Scale	Regional	Local
Duration	Long term	Long term
Magnitude	Major	Moderate
Consequence	High	Medium
Probability	Possible	Possible
Significance of Impact	**High**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	

NATURE OF IMPACT: The establishment of the three proposed mines in the vicinity of Leandra, has the potential to cumulatively impact on the surface water quality of the area, specifically on pH, TDS and metal concentrations	
Irreplaceable loss of resources:	No
Can impacts be enhanced:	Yes
Residual impacts ❖ Possible that residual impacts can occur in the long term.	
Mitigation measures • Effective stormwater management that captures and contains all runoff from mine impacted areas; • Treatment of decant water by effective passive or active treatment methods; and • Water quality monitoring upstream and downstream of mining activities.	

Table 10-19: Cumulative impact rating for surface water quantity

NATURE OF IMPACT: Loss of surface water quantity as a result of seepage into underground voids and subsidence		
	Before Mitigation	**After Mitigation**
Spatial Scale	Local	Local
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	Medium	Medium
Probability	Possible	Possible
Significance of Impact	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Possible that residual impacts can occur in the long term.		
Mitigation measures • Prevention of underground mining beneath watercourses; and • High extraction mining (pillar mining) should be prevented.		

10.2.3 Groundwater

Table 10-20: Drawdown impacts rating. (0-1 m)

Impact Description	Lowering of groundwater levels due to mine dewatering: Borehole falling in the 0 – 1 m drawdown zone	
	Before Mitigation	**After Mitigation**
Spatial Scale	Local	Local
Duration	Long-term	Long-term
Magnitude	Minor -	Minor -
Consequence	Medium	Medium
Probability	Unlikely	Unlikely

Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Reversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater levels may take more than 100 years to recover post closure		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater levels in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a loss of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Adjust the mine plan and surface layout to avoid areas with shallow groundwater tables, including wetlands.		

Table 10-21: Drawdown impacts rating. (1-5 m)

Impact Description	Lowering of groundwater levels due to mine dewatering: Borehole falling in the 1 – 5 m drawdown zone	
	Before Mitigation	**After Mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Minor -	Minor -
Consequence	Medium	Medium
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Reversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater levels may take more than 100 years to recover post closure		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater levels in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a loss of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Adjust the mine plan and surface layout to avoid areas with shallow groundwater tables, including wetlands.		

Table 10-22: Drawdown impacts rating. (5-10 m)

Impact Description	Lowering of groundwater levels due to mine dewatering: Borehole falling in the 5 –10 m drawdown zone

	Before Mitigation	After Mitigation
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Moderate -	Moderate -
Consequence	Medium	Medium
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Reversible in the long-term	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater levels may take more than 100 years to recover post closure		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater levels in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a loss of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Adjust the mine plan and surface layout to avoid areas with shallow groundwater tables, including wetlands.		

Table 10-23: Drawdown impacts rating. (>10 m)

Impact Description	Lowering of groundwater levels due to mine dewatering: Borehole falling in the >10 m drawdown zone	
	Before Mitigation	**After Mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Major -	Major -
Consequence	Major	High
Probability	Possible	Possible
Calculated Significance Rating	**High**	**High**
Impact Status:	Negative	Negative
Reversibility:	Reversible in the long-term (100 years)	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater levels may take more than 100 years to recover post closure		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater levels in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a loss of groundwater to private user, the Applicant must supply the user with an equal water resource.		

❖ Adjust the mine plan and surface layout to avoid areas with shallow groundwater tables, including wetlands.

Table 10-24: Groundwater quality impacts rating (250 – 500 mg/L SO_4 impact zone).

Impact Description	Contamination of groundwater: Boreholes in the 250 – 500 mg/L SO_4 impact zone	
	Before Mitigation	**After Mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Minor -	Minor -
Consequence	Medium	Medium
Probability	Unlikely	Unlikely
Calculated Significance Rating	Low	Low
Impact Status:	Negative	Negative
Reversibility:	Reversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater contamination will continue post closure over the long-term		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater quality in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a loss of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Develop sound surface runoff management plans to ensure that all dirty runoff is contained and diverted to the PCDs. ❖ Ensure that PCDs are designed to contain all dirty water generated to prevent overflows and spillages.		

Table 10-25: Groundwater quality impacts rating (500 – 1 000 mg/L SO_4 impact zone).

Impact Description	Contamination of groundwater: Boreholes in the 500 –1 000 mg/L impact zone	
	Before Mitigation	**After Mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Moderate -	Moderate -
Consequence	Medium	Medium
Probability	Possible	Possible
Calculated Significance Rating	Low	Low
Impact Status:	Negative	Negative
Reversibility:	Reversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts		

❖ Groundwater contamination will continue post closure over the long-term	
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater quality in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a contamination of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Develop sound surface runoff management plans to ensure that all dirty runoff is contained and diverted to the PCDs. ❖ Ensure that PCDs are designed to contain all dirty water generated to prevent overflows and spillages.	

Table 10-26: Groundwater quality impacts rating (>1 000 mg/L SO_4 impact zone).

Impact Description	Contamination of groundwater: Boreholes in the >1 000 mg/L impact zone	
	Before Mitigation	**After Mitigation**
Extent	Local	Local
Duration	Long-term	Long-term
Magnitude	Major -	Major -
Consequence	High	High
Probability	Possible	Possible
Calculated Significance Rating	High	High
Impact Status:	Negative	Negative
Reversibility:	Reversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Groundwater contamination will continue post closure over the long-term		
Mitigation measures ❖ Identify all boreholes within each mining area, as well as in a 3 km radius of the boundary of each mining area prior to the commencement of any mining. ❖ Monitor groundwater quality in all boreholes falling in this zone. Plan for and provide sufficient budget to implement the groundwater monitoring programme before any mining starts. ❖ Should monitoring results indicate a contamination of groundwater to private user, the Applicant must supply the user with an equal water resource. ❖ Develop sound surface runoff management plans to ensure that all dirty runoff is contained and diverted to the PCDs. ❖ Ensure that PCDs are designed to contain all dirty water generated to prevent overflows and spillages.		

10.2.4 Biodiversity

10.2.4.1 Construction Phase

<u>Biodiversity</u>

Table 10-27: Construction Phase Impacts on biodiversity

Impact Description	Loss of areas classified as CBA and wetlands of importance	
	Before Mitigation	**After Mitigation**

Extent	National / International	National / International
Duration	Long term >5 years	Long term >5 years
Magnitude	Major	Severe
Consequence	High	High
Probability	Definite	Possible
Calculated Significance Rating	**High**	**High**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Avoid CBA areas and implement buffer zones.		

Table 10-28: Construction Phase Impacts on biodiversity

Impact Description	Loss of area of plant endemism Loss of Endangered & Vulnerable habitat	
	Before Mitigation	**After Mitigation**
Extent	National / International	National / International
Duration	Long term >5 years	Long term >5 years
Magnitude	Major	Moderate
Consequence	High	Medium
Probability	Definite	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Avoid areas of remaining indigenous vegetation, restrict infrastructure areas to brownfield areas only. ❖ Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones.		

Table 10-29: Construction Phase Impacts on Flora

Impact Description	Loss of plant species of conservation importance Encroachment of alien invasive plant species	
	Before Mitigation	**After Mitigation**
Extent	National / International	National / International
Duration	Long term >5 years	Shirt term
Magnitude	Major	Moderate
Consequence	High	Medium
Probability	Definite	possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Avoid areas in which plant species of conservation concern occur; ❖ If some areas cannot be avoided implement rescue of plant species of conservation concern.		

Table 10-30: Construction Phase Impacts on Fauna

Impact Description	Loss of habitat for species of conservation concern Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)	
	Before Mitigation	**After Mitigation**
Extent	National / International	National / International
Duration	Long term >5 years	Long term >5 years
Magnitude	Major	severe
Consequence	High	High
Probability	Definite	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	yes	

Mitigation measures

- Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones.
- Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones;
- Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during construction.

Aquatic

Table 10-31: Construction Phase Impacts on Aquatic Biodiversity

Impact Description	Alteration of catchments hydrology and water quality deterioration in the Vaal and Olifants Water Management Area as a result of site clearing for surface infrastructure, construction of surface infrastructure and underground access portals (shafts) and the placement of waste (overburden) and topsoil stockpiles.	
	Before Mitigation	**After Mitigation**
Extent	Site or Local	Site or Local
Duration	Long-term > 5 years	Long-term > 5 years
Magnitude	Moderate -	Moderate -
Consequence	Medium	Medium
Probability	Definite	Unlikely
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative impact	Yes	

Mitigation measures

- Erosion Risk Assessment and Management Plan
- The establishment of a clearly marked buffer zone
- Compilation of a stormwater management plan
- Careful management of vegetation removal and sedimentation control

Wetland

Table 10-32: Construction Phase Impacts on Wetlands

Impact Description	Destruction of wetland systems	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term > 5 years	Long term > 5 years
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Minimise footprint area of infrastructure.		

Table 10-33: Construction Phase Impacts on Wetland water yields

Impact Description	Loss / reduced catchment water yield	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term > 5 years	Long term > 5 years
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Definite	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative impact	Yes	
Mitigation measures ❖ Minimise footprint area of infrastructure. ❖ Avoid wetland areas and adhere to recommended buffer areas.		

Table 10-34: Construction Phase Impacts on Wetlands

Impact Description	Increase in suspended solid concentrations	
	Before Mitigation	**After Mitigation**
Extent	Site or Local	Site or Local
Duration	Medium Term > 18 months < 5 years	Medium Term > 18 months < 5 years
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative impact:	-	
Mitigation measures		

- Implement phased vegetation clearing to minimise the extent of bare areas.
- Concurrent rehabilitation.
- Separate clean and dirty water.
- Implement best practice storm water management.
- Stay clear of the recommended buffer zones.

Table 10-35: Construction Phase Impacts on Wetlands

Impact Description	Contamination of surface water resources from the on site mixing, fuelling and use of machines and vehicles and erosion of the cleared footprint areas.	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Medium Term > 18 months < 5 years	Short term
Magnitude	Major	Minor
Consequence	Medium	Low
Probability	Possible	possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	

Mitigation measures

- Separate clean and dirty water.
- Implement best practice storm water management.
- No cleaning of vehicles, machines and equipment in water resources.
- Servicing of machines, vehicles and equipment in designated areas.
- Storage of potential contaminants in bunded areas.
- All contractors must have spill kits available and be trained in the correct use thereof.

Table 10-36: Construction Phase Impacts on Wetlands

Impact Description	Loss of species diversity due to disturbances caused by noise, traffic, machines and human movement	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term > 5 years	Short term
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	

Mitigation measures

- Minimise footprint area of infrastructure.
- Make use of existing access routes.
- Avoid wetland areas and adhere to buffer areas.

- Minimise noise disturbance.
- Implement dust suppression.
- Implement waste management.

Table 10-37: Construction Phase Impacts on Wetlands

Impact Description	Change in species abundances as a result of the introduction of "pests" and weeds into the area.	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Medium term	Medium term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	

Mitigation measures

- Minimise footprint area of infrastructure.
- Make use of existing access routes.
- Avoid wetland areas and adhere to buffer areas.
- Minimise noise disturbance.
- Implement dust suppression.
- Implement waste management.

Table 10-38: Construction Phase Impacts on Wetlands

Impact Description	Loss of wetland systems as a result of the construction of underground mine (shaft)	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or Local
Duration	Long term	Short term
Magnitude	Minor	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	

Mitigation measures

- Sinkholes are likely to occur in such areas which might drain wetlands in some cases. Stay well clear of such areas (if present) and ensure that the layout of components that directly impact upon the surface stay clear of the recommended buffer zones. A rock engineering report is recommended for further mitigation measures.

Table 10-39: Construction Phase Impacts on Wetlands

Impact Description	Loss of wetland systems as a result o the construction of associated infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Medium term
Magnitude	Major	Minor
Consequence	High	Low
Probability	Definite	Posssible
Calculated Significance Rating	**High**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Avoid wetland areas and adhere to recommended buffer areas.		

Table 10-40: Construction Phase Impacts on Wetlands

Impact Description	Loss of sub-surface flows as a result of the construction of associated infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Major	Major
Consequence	High	High
Probability	Possible	Possible
Calculated Significance Rating	**High**	**High**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ The loss of sub-surface flows is imminent. A hydropedology study is recommended to further improve mitigation and recommendations.		

10.2.4.2 Operational Phase

Biodiversity

Table 10-41: Operational Phase Impacts on Flora

Impact Description	Encroachment of alien invasive plant species due to the operation of underground mining activities	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Short term
Magnitude	Moderate	Minor
Consequence	High	Low

Probability	Definite	Possible
Calculated Significance Rating	**High**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		
❖ Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive species on cleared areas.		

Table 10-42: Operational Phase Impacts on Fauna

Impact Description	Loss of species of conservation concern and their habitat due to the operation of underground mining activities.	
	Before Mitigation	**After Mitigation**
Extent	National / International	Regional
Duration	Long term	Long term
Magnitude	Major	Minor
Consequence	High	Medium
Probability	Definite	Possible
Calculated Significance Rating	**High**	**Moderate**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		
❖ Mitigation measures can be added to infrastructure such as powerlines to avoid bird impacts; ❖ Monitoring impacts of operational activities on fauna so that adaptive management practices can be implemented if required; ❖ Implement speed control measures on all roads to prevent road kill; ❖ Restrict access to high biodiversity areas (drainage lines, wetlands etc.) in the vicinity of mining operations. ❖ Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during operation.		

Aquatic

Table 10-43: Operational Phase Impacts on Aquatic Biodiversity

Impact Description	Alteration of catchments hydrology and water quality deterioration in the Vaal and Olifants Water Management Area due to the operation of surface infrastructure (roads, conveyors, offices, coal wash plants and workshops) and the storage of Run of Mine Coal	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term >5 years	Long term >5 years
Magnitude	Moderate	Moderate
Consequence	Medium	Medium
Probability	Definite	Unlikely
Calculated Significance Rating	**Medium**	**Low**

Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	

Mitigation measures

- Erosion Risk Assessment and Management Plan
- The establishment of a clearly marked buffer zone
- Compilation of a stormwater management plan
- Careful management of vegetation removal and sedimentation control

Table 10-44: Operational Phase Impacts on Aquatic Biodiversity

Impact Description	Water quality deterioration in the Vaal and Olifants Water Management Area due to the storage of coal mineral discard. Alteration of catchments hydrology and water quality deterioration in the Vaal and Olifants Water Management Area due to the storage of contaminated water in Pollution Control Dam's (PCD's) and active underground mining.	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Major	Major
Consequence	High	High
Probability	Definite	Unlikely
Calculated Significance Rating	**High**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	

Mitigation measures

- Erosion Risk Assessment and Management Plan
- The establishment of a clearly marked buffer zone
- Compilation of a stormwater management plan
- Careful management of vegetation removal and sedimentation control

Wetland

Table 10-45: Operational Phase Impacts on Wetlands

Impact Description	Destruction of wetland systems due to the operation of underground mine	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Long term	Short term
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Unlikely	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	

Mitigation measures

- The operation of underground mines is unlikely to have a direct impact on wetlands.

Table 10-46: Operational Phase Impacts on Wetlands

Impact Description	Reduced catchment water yield due to the operation of the supporting infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	High	Medium
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Minimise the footprint area of supporting infrastructure. Any loss of surface water to the catchment must be quantified, and mitigation options to re-introduce water in a safe and environmentally friendly way must be assessed.		

Table 10-47: Operational Phase Impacts on Wetlands

Impact Description	Loss of sub-surface flows due to the operation of the supporting infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	High	Medium
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ The loss of sub-surface flows is imminent. A hydropedology study is recommended to further improve mitigation and recommendations.		

Table 10-48: Operational Phase Impacts on Wetlands

Impact Description	Increased in suspended solid concentrations due to the operation of the supporting infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Medium Term	Medium Term
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**

Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		

- Separate clean and dirty water.
- Implement best practice storm water management.

Table 10-49: Operational Phase Impacts on Wetlands

Impact Description	Mine water discharge from dewatering of underground mining area due to the operation of underground mine	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Medium Ter,
Magnitude	Moderate	Moderate
Consequence	High	Medium
Probability	Possible	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		

- Contain waste water in a PCD.
- Contaminated water must not be discharged into the watercourses.
- Clean and dirty water must be separated.
- This water could be looked at for treatment and then re-introduced to mitigate losses to the catchment water hydro-dynamics.

Table 10-50: Operational Phase Impacts on Wetlands

Impact Description	AMD and salinization from the operation of ROM and overburden stockpiles	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Medium term
Magnitude	Major	Moderate
Consequence	High	Medium
Probability	Possible	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		

- The introduction of oxygen and water should be limited as much as possible for these systems.
- Specific amelioration should additionally be applied for the overburden stockpile.
- Impermeable layers, seepage pumps and other mitigation measures should be part of the stockpile layout.

Table 10-51: Operational Phase Impacts on Wetlands

Impact Description	Contamination of surface- and ground water from the operations of the wash plant and the Eskom plant	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Medium term	Medium term
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Proper drainage systems should be part of this layout. ❖ Clean and dirty water should be separated, and continued monitoring should be involved to monitor possible contamination. ❖ The surface and groundwater reports must be considered for further mitigation measures.		

10.2.4.3 Closure and Decommissioning Phase

Biodiversity

Table 10-52: Closure Phase Impacts on Flora

Impact Description	Further impacts due to the spread and/or establishment of alien and/or invasive species due to decommissioning activities, including removal of infrastructure and rehabilitation of waste stockpiles.	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	High	Medium
Probability	Definite	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Implementation of alien invasive plant management plan needs to be continued during decommissioning to prevent the growth of invasive species on rehabilitated areas; ❖ Rehabilitation of site with indigenous vegetation that occurs in the vicinity of Project area.		

Table 10-53: Closure Phase Impacts on Fauna

Impact Description	Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust, poaching and noise) dur to the

	decommissioning activities, including removal of infrastructure and rehabilitation of waste stockpiles.	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Short term
Magnitude	Major	Moderate
Consequence	High	Medium
Probability	Definite	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed.		

Aquatic

Table 10-54: Decommissioning and Closure Phase Impacts on Aquatic Biodiversity

Impact Description	Alteration of catchments hydrology and water quality deterioration in the Vaal and Olifants Water Management Area as a result of the Removal of infrastructure and Rehabilitation of waste stockpiles	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Major	Major
Consequence	High	High
Probability	Possible	Unlikely
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures ❖ Removal of infrastructure and rehabilitation ❖ Re-establishment of natural vegetation ❖ Erosion control		

Table 10-55: Post-Closure Phase Impacts on Aquatic Biodiversity

Impact Description	Water quality deterioration in the Vaal and Olifants Water Management Area as a result of AMD decant, Seepage from permanent waste stockpiles, and Subsidence of undermined areas	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Major	Major
Consequence	High	High
Probability	Definite	Unlikely

Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	Yes	
Mitigation measures		
❖ Water monitoring and management of pollution plumes and possible decant		

Wetland

Table 10-56: Closure Phase Impacts on Wetland

Impact Description	Restored catchment water yield due to Backfill of voids, removal of infrastructure	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Medium term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures		
❖ All voids must be backfilled, and surface infrastructure must be removed from the site. Compacted areas must be ripped (perpendicularly) to a depth of 300mm. ❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Any gullies or dongas must also be backfilled. ❖ The area must be shaped to a natural topography. ❖ Trees (or vegetation stands) removed must be replaced. ❖ No grazing must be permitted to allow for the recovery of the area. ❖ Attenuation ponds may be created in channels to retain water in the catchment		

Table 10-57: Closure Phase Impacts on Wetland

Impact Description	Rehabilitated topography and surface flow dynamics due to Backfill of voids	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Medium term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures		
❖ All voids must be backfilled, and surface infrastructure must be removed from the site. ❖ Compacted areas must be ripped (perpendicularly) to a depth of 300mm		

❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Any gullies or dongas must also be backfilled. ❖ The area must be shaped to a natural topography

Table 10-58: Closure Phase Impacts on Wetland

Impact Description	**Increased in suspended solid concentrations due to Backfill of void, and shaping of catchment area due to**	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Medium term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures ❖ Decommission cut-off berms and drains last. ❖ Debris must be placed in preferential flow paths. ❖ Compacted areas must be ripped (perpendicularly) to a depth of 300mm. ❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Any gullies or dongas must also be backfilled. ❖ The area must be shaped to a natural topography		

Table 10-59: Closure Phase Impacts on Wetland

Impact Description	Restoration of shallow recharge due to Backfill of voids	
	Before Mitigation	**After Mitigation**
Extent	Regional	Site or local
Duration	Medium term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures ❖ The mining of the hard plinthic layer is not likely to be restored (by means of a "plug"), and this recharge will be lost. Mitigation is therefore not possible.		

Table 10-60: Closure Phase Impacts on Wetland

Impact Description	Contamination of surface water resources due to the Degradation of soil resources by means of vehicle transportation causing leaks and compaction	
	Before Mitigation	**After Mitigation**

Extent	Site or Local	Regional
Duration	Medium Term	Medium term
Magnitude	Moderate	Minor
Consequence	Medium	Low
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures		

- Ensure vehicles and machines are maintained and serviced off-site.
- Implement concurrent rehabilitation, applying a proven seed mix to rehabilitated and bare areas.
- Debris must be placed in preferential flow paths.

Table 10-61: Closure Phase Impacts on Wetland

Impact Description	**AMD discharge from mine areas**	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Medium term
Magnitude	Major	Minor
Consequence	High	Low
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures		

- Determine the likelihood of AMD, and proactively implement measures to prevent or reduce this.
- Priority would be to ensure the treatment of this water to suitable standards for aquatic ecology.
- Rehabilitation of the area and shaping of the topography must minimise the ingress of water into the mining area.
- Additionally, measures must also be considered to implement constructed wetlands at likely decant areas, and the planting of tree reduce groundwater recharge.

Table 10-62: Closure Phase Impacts on Wetland

Impact Description	**Improving soil quality from the Ripping of compacted areas**	
	Before Mitigation	**After Mitigation**
Extent	Site or Local	Site or local
Duration	Medium Term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Possible	Possible
Calculated Significance Rating	**Low**	**Low**
Impact Status:	Negative(-)	Negative(-)
Cumulative:	-	
Mitigation measures		

❖ Monitor the footprint area to make note of compacted areas. These areas should be ripped, ameliorated and revegetated.

10.2.4.4 Cumulative Impacts

Aquatic

Table 10-63: Cumulative Impact of the Proposed Project

Impact Description	Water and Habitat Quality Deterioration in the Olifants and Vaal Water Management Area	
	Cumulative impact should the project not go ahead	**Cumulative impacts should the project go ahead**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major	Major
Consequence	High	High
Probability	Definite	Definite
Calculated Significance Rating	High	High
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Mitigation measures • Project specific mitigation actions • Salt load investigation for the Olifants and Vaal Water Management Areas in line with respective catchment management strategies.		

The cumulative impact to the local aquatic ecology prior to the project go-ahead was rated as high. The impact after the go-ahead will remain high due to baseline catchment wide modifications. Despite the go-ahead of the Proposed Project, it is unlikely that catchment wide modification will cease and therefore a high rating after the project go-ahead was derived.

An important consideration for cumulative regional scale impacts includes the assessment of the salt loading potential of the anticipated Acid Mine Drainage should it enter into the Vaal or Olifants Water Management Area. It is likely salt loads in the watercourses will be altered should this occur. This modification will have an influence on the management decisions for water resource objectives.

10.2.5 Air Quality

The following table provides a framework for the anticipated major impacts associated with the Proposed Project.

Table 10-64: Activities and related atmospheric emissions identified for the operational phase of the proposed Leslie 1 Project

Emission	Source	Activity
Generation of TSP, PM_{10} and $PM_{2.5}$	Materials handling operations	Soil removal by shovel and truck.
		Overburden removal by shovel and truck.
		Offloading of topsoil and overburden.
		Conveyor transfer points.
		Tipping onto waste rock stockpile.
		Loading of coal into crushers.
		Tipping of ore from crushers onto storage piles.
		Stockpiling of product.
	Vehicle activity on unpaved roads	Haul trucks transporting topsoil to stockpiles.
		Haul trucks transporting overburden/waste from the mine to waste rock dumps or stockpiles.
		Haul trucks transporting coal from the CHPP off site.
	Wind erosion	Soil storage piles.
		Waste/overburden rock dumps.
		Conveyors.
		Coal storage piles.
	Crushing and screening	Crushing and screening activities.
NO_2	Vehicle activity	Tailpipe emissions from haul vehicles, and vehicles for mine personnel movement.
SO_2	Vehicle activity	Tailpipe emissions from haul vehicles, and vehicles for mine personnel movement.
SO_2, NO_X, H_2S, CO	Spontaneous combustion	Stockpiles, underground workings and waste dumps.

Table 10-65: Air Quality Impact Assessment Matrix before and after mitigation Leslie 1A

Impact Assessment Matrix Leslie 1A Year 4 and Year 6	
Impact Description	Mining activities cause the emission of particulate matter into the air, thus increasing existing ambient air concentrations of criteria pollutants (both PM_{10} and $PM_{2.5}$) at receptors.
Acceptable rating level	**PM_{10}** • 24-hour Average Concentrations: National Ambient Air Quality Standard of 75µg/m³ • Annual Average Concentrations: National Ambient Air Quality Standard of 40µg/m³ **$PM_{2.5}$** • 24-hour Average Concentrations: National Ambient Air Quality Standard of 40µg/m³

	• Annual Average Concentrations: National Ambient Air Quality Standard of 20µg/m^3	
Activity	**Before Mitigation**	**After Mitigation (Mitigation measures implemented on all unpaved haul roads, conveyor transfer points and on crushing and screening activities at the CHPP)**
Magnitude	**Moderate negative:** Exceedances of the NAAQS are predicted over farmsteads and the Springboklaagte Colliery which may be a health risk to people living in those areas (4 exceedances are permissible).	**Moderate negative:** Even with mitigation measures in place, worst-case conditions may lead to the NAAQS being exceeded over farmsteads, which may be a health risk to people living in those areas (4 exceedances are permissible).
Duration	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of mining activities taking place (more than 5 years).	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of mining activities taking place (more than 5 years).
Spatial Scale	**Local:** Worst-case conditions may lead to the NAAQS being exceeded over long distances (up to 7 km) from the above-ground mining activities.	**Local:** With mitigation measures in place, worst-case conditions may lead to the NAAQS being exceeded over long distances (up to 5.5 km) from the above-ground mining activities.
Consequence	**Medium**	**Medium**
Probability	**Definite:** There are rural areas beyond the prospecting right area that are predicted to exceed the annual average NAAQS (No exceedances are permissible). Furthermore, under worst-case conditions, exceedances of the 24-hour NAAQS are probable over farmsteads and the Springboklaagte Colliery.	**Definite:** There are rural areas beyond the prospecting right area that are predicted to exceed the annual average NAAQS (No exceedances are permissible). Furthermore, even with mitigation measures in place, under worst-case conditions, exceedances of the 24-hour NAAQS are probable over farmsteads and the Springboklaagte Colliery.
Significance of Air Quality Impact	**Medium**	**Medium**
Mitigation	Modelled: Either chemical or wet suppression on haul roads. Mitigation of both crushing and screening at the CHPP. Recommended: Use of conveyor belts for on-site transport of materials as much as possible and implementation of rail transport for off-site transportation if feasible.	
Cumulative Impact	Emissions from Leslie 1A are predicted to increase ambient concentrations of PM_{10} and $PM_{2.5}$ up to 25% of the NAAQS over the residential areas of Leandra under worst-case conditions. This indicates that air quality impacts will be increased in these areas due to the cumulative effect of the combined emissions of all sources in the area.	

Table 10-66: Air Quality Impact Assessment Matrix before and after mitigation at Leslie 1C

Impact Assessment Matrix Leslie 1C

Impact Description	Mining activities cause the emission of particulate matter into the air, thus increasing existing ambient air concentrations of criteria pollutants (both PM_{10} and $PM_{2.5}$) at receptors.	
Acceptable rating level	**PM_{10}** • 24-hour Average Concentrations: National Ambient Air Quality Standard of 75µg/m^3 • Annual Average Concentrations: National Ambient Air Quality Standard of 40µg/m^3 **$PM_{2.5}$** • 24-hour Average Concentrations: National Ambient Air Quality Standard of 40µg/m^3 • Annual Average Concentrations: National Ambient Air Quality Standard of 20µg/m^3	
Activity	**Before Mitigation**	**After Mitigation (Mitigation measures implemented on all unpaved haul roads, conveyor transfer points and on crushing and screening activities at the CHPP/elimination of the CHPP)**
Magnitude	**Major negative:** Worst-case conditions may lead to the 24-hour NAAQS being exceeded over the residential areas of Lebohang, Leslie and Eendracht. This is a significant health risk to people living in those areas (4 exceedances are permissible, but ambient concentrations are already high).	**Major negative:** Even with mitigation measures in place and elimination of the CHPP, worst-case conditions may lead to the 24-hour NAAQS being exceeded over the residential areas of Lebohang. This is a significant health risk to people living in those areas (4 exceedances are permissible, but ambient concentrations are already high).
Duration	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of mining activities taking place (more than 5 years).	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of mining activities taking place (more than 5 years).
Spatial Scale	**Local:** Worst-case conditions may lead to the 24-hour NAAQS being exceeded over long distances (up to 8 km) from the above-ground mining activities.	**Local:** With mitigation measures in place, worst-case conditions may lead to the 24-hour NAAQS being exceeded over long distances (up to 4.5 km) from the above-ground mining activities
Consequence	High	High
Probability	**Definite:** There are rural areas beyond the prospecting right area that are predicted to exceed the annual average NAAQS (No exceedances are permissible). Furthermore, under worst-case conditions, exceedances of the 24-hour NAAQS are probable over the residential areas of Lebohang, Leslie and Eendracht.	**Definite:** There are rural areas beyond the prospecting right area that are predicted to exceed the annual average NAAQS (No exceedances are permissible). Furthermore, even with mitigation measures in place, under worst-case conditions, exceedances of the 24-hour NAAQS are probable over the southern parts of Lebohang.
Significance of Air Quality Impact	High	High
Mitigation	Modelled: Either chemical or wet suppression on haul roads. Mitigation of both crushing and screening at the CHPP / Elimination of the CHPP.	

	Recommended: Use of conveyor belts for on-site transport of materials as much as possible and implementation of rail transport for off-site transportation if feasible. Elimination of the CHPP if feasible. Locate the above-ground mining activities further south.
Cumulative Impact	There are several large emitters of particulate matter in the area, thus background ambient air concentrations are expected to be elevated. This indicates that air quality impacts will be increased in the residential areas of Lebohang, Leslie and Eendracht due to the cumulative effect of the combined emissions of all sources in the area.

10.2.6 Noise

10.2.6.1 Construction Phase

The significance of the potential noise impacts are defined in Table 10-67 for the daytime scenario for Leslie 1A, while Table 10-68 defines the significance of the potential noise impact for the night-time scenario for Leslie 1A.

Table 10-67: Impact Assessment: Construction Activities at Leslie 1A – daytime scenario

Activity:	Numerous simultaneous construction activities during the day	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,D}$ of 50 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Daytime noise levels are expected to be higher than typical ambient sound levels at NSD23, especially when the topsoil dump is developed close to this receptor. **Major negative**	Daytime noise levels may be audible to the closest NSD. **Minor negative**
Duration	Noise levels will be high for a portion of the construction phase. **Short Term**	Noise levels will be high for a portion of the construction phase. **Short Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**
Consequence of Noise Impact	**Medium**	**Low**
Probability	Daytime ambient sound levels were more than 60% of the measurements, less than 50 dBA (KLPLTAS01) and around 40% in the 50 – 55 dBA range. It is **possible** that the closest NSD will hear and be disturbed by the noises from construction activities. **Possible**	Daytime ambient sound levels were more than 60% of the measurements, less than 50 dBA (KLPLTAS01) and around 40% in the 50 – 55 dBA range. It is **possible** that the closest NSD will hear and be disturbed by the noises from construction activities. **Unlikely**
Significance of Noise Impact	**Low**	**Low**

Degree of Confidence	**High**
Cumulative	No
Mitigation:	Significance of the noise impact is Low and no additional mitigation measures are required.

Table 10-68: Impact Assessment: Construction Activities at Leslie 1A – night-time scenario

Activity:	Numerous simultaneous construction activities at night	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,N}$ of 40 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Night-time noise levels are expected to be significantly higher than typical ambient sound levels at NSD23, and expected to be higher than ambient sound levels at NSD20. Noises might be audible at NSD21, 22, 24, 25, 30 and 34. **Major negative**	Night-time noise levels might be audible at the closest NSD. **Minor negative**
Duration	Noise levels will be high for a portion of the construction phase. **Short Term**	Noise levels will be high for a portion of the construction phase. **Short Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	Mining activities are unlikely to impact on the ambient sound levels further than 1 000 m from the activity at night, though the mining activities might be audible up to 2 000m during quieter periods. **Site or Local**	Mining activities are unlikely to impact on the ambient sound levels further than 1 000 m from the activity at night, though the mining activities will be audible up to 2 000m during quieter periods. **Site or Local**
Consequence of Noise Impact	**Medium**	**Low**
Probability	Night-time ambient sound levels were less than 40 dBA for more than 65% of the measurements and less than 45 dBA for most of the measurements at location KLPLTAS01. It is **definite** that the NSD23 will hear the noises and be disturbed by the noises from construction activities. It is possible that **NSD20** be affected. **Definite**	Night-time ambient sound levels were less than 40 dBA for more than 65% of the measurements and less than 45 dBA for most of the measurements at location KLPLTAS01. With appropriate mitigation measures, it is **unlikely** that the closest receptors be impacted by high noise levels. **Unlikely**
Significance of Noise Impact	**Medium**	**Low**
Degree of Confidence	**High**	
Cumulative	No	

Mitigation:	❖ Minimise night-time construction activities closer than approximately 700m from the closest potential noise-sensitive receptors if the activities is not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm). ❖ Minimise the use of simultaneous construction activities closer than 1 000m when operating at night. Ensure that equipment is fitted with the correct and appropriate noise-abatement measures. ❖ Eliminate the use of equipment that generates an impulsive noise when operating within 1,000m of potential receptors. Also see section 9.1.

The significance of the potential noise impacts for the Leslie 1C mine are defined in Table 10-69 for the daytime scenario and Table 10-70 for the night-time scenario.

Table 10-69: Impact Assessment: Construction Activities at Leslie 1C – daytime scenario

Activity:	Numerous simultaneous construction activities during the day	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,D}$ of 50 dBA.	
	Before Mitigation	**After Mitigation**
Magnitude	Daytime noise levels are expected to be higher than typical ambient sound levels at NSD01, 02, 03 and 07 and could be at disturbing levels. **Major negative**	Daytime noise levels may be clearly audible and potentially disturbing to the closest NSD at times. **Major negative**
Duration	Noise levels will be high for a portion of, to the full duration of the construction phase. **Medium Term**	Noise levels will be high for a portion of the construction phase. **Short Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	The project will not impact on the ambient sound levels further than 1 000 m from the activity during the day. **Site or Local**	The project will not impact on the ambient sound levels further than 1 000 m from the activity during the day. **Site or Local**
Consequence of Noise Impact	**Medium**	**Medium**
Probability	Daytime ambient sound levels were more than 70% of the measurements, less than 50 dBA (KLPLTAS03) and 44% of the time, less than 50 dBA at KLPLTAS04. It is generally quieter than 55 dBA at these locations. It is **definite** that the closest NSD will hear and be disturbed by the noises from construction activities. **Definite**	Daytime ambient sound levels were more than 70% of the measurements, less than 50 dBA (KLPLTAS03) and 44% of the time, less than 50 dBA at KLPLTAS04. It is generally quieter than 55 dBA at these locations. It is **possible** that the closest NSD will hear and be disturbed by the noises from construction activities. **Possible**
Significance of Noise Impact	**Medium**	**Medium**
Degree of Confidence	**High**	
Cumulative	No	

Mitigation:	Unless the closest receptors are relocated (NSDs 02, 03, 07 and 16), there is a possibility that noise levels will be high at some time during the construction phase. Mitigation may reduce the noise level, duration of impact as well as the probability of a noise impact occurring, but, due to the proximity of the closest receptors the significance of a noise impact would remain medium.

Table 10-70: Impact Assessment: Construction Activities at Leslie 1C – night-time scenario

Activity:	Numerous simultaneous construction activities at night	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,N}$ of 40 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Night-time noise levels are expected to be higher than typical ambient sound levels at NSD01, 02, 03, 07, 08 and 13. The noise levels could be disturbing, especially if an impulsive component is present in the noise. **Major negative**	Night-time noise levels may be audible to the closest NSD at times. **Minor negative**
Duration	Noise levels will be high for a portion of, to the full duration of the construction phase. **Medium Term**	Noise levels will be high for a portion of the construction phase. **Short Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	Due to the topography, mining activities may impact on the ambient sound levels further than 1 000 m from the activity at night. The noises may be audible up to 2 000m during quieter periods. **Regional**	Due to the topography, mining activities may impact on the ambient sound levels further than 1 000 m from the activity at night. The noises may be audible up to 2 000m during quieter periods. **Regional**
Consequence of Noise Impact	**Medium**	**Medium**
Probability	Night-time ambient sound levels were more than 73% of the measurements, less than 40 dBA at KLPLTAS03, a location quite far from the N17 and R50. Modelling indicated that the roads could impact on the ambient sound levels up to 1 000m away from the roads. Even with the impact from the existing road traffic, it is considered **definite** that the closest NSD will hear and be disturbed by the noises from construction activities. **Definite**	Night-time ambient sound levels were more than 73% of the measurements, less than 40 dBA at KLPLTAS03, a location quite far from the N17 and R50. Modelling indicated that the roads could impact on the ambient sound levels up to 1 000m away from the roads. With mitigation it is **possible** that the closest NSD will hear and be disturbed by the noises from construction activities. **Possible**
Significance of Noise Impact	**Medium**	**Medium**
Degree of Confidence	**High**	
Cumulative	No	

Mitigation:	❖ Minimise night-time construction activities closer than approximately 700m from the closest potential noise-sensitive receptors if the activities are not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm). ❖ Minimise the use of simultaneous construction activities closer than 1,000m when operating at night. Ensure that equipment is fitted with the correct and appropriate noise-abatement measures. ❖ Eliminate the use of equipment that generates an impulsive noise when operating within 1 000m of potential receptors.

10.2.6.2 Operational Phase

The significance of the potential noise impacts are defined in Table 10-71 for the daytime scenario. Table 10-72 define the significance of the potential noise impact for the night-time scenario using the same criteria.

Table 10-71: Impact Assessment: Operational Activities – daytime scenario at Leslie 1A

Activity:	Numerous simultaneous operational activities during the day	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,D}$ of 50 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Operational activities in the vicinity of the Leslie 1A section are unlikely to significantly impact on ambient sound levels. Daytime noise levels may be audible at the closest NSD. **Minor negative**	Operational activities in the vicinity of the Leslie 1A section are unlikely to significantly impact on ambient sound levels. Daytime noise levels may be audible at the closest NSD. **Minor negative**
Duration	Noise levels may be higher for the duration of the project. **Long Term**	Noise levels may be higher for the duration of the project. **Long Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**
Consequence of Noise Impact	**Medium**	**Medium**
Probability	Daytime ambient sound levels were more than 60% of the measurements, less than 50 dBA (KLPLTAS01) and around 40% in the 50 – 55 dBA range. It is **unlikely** that the closest NSD will hear and be disturbed by the noises from the operational activities. **Unlikely**	Daytime ambient sound levels were more than 60% of the measurements, less than 50 dBA (KLPLTAS01) and around 40% in the 50 – 55 dBA range. It is **possible** that the closest NSD will hear and be disturbed by the noises from the operational activities. **Unlikely**

Significance of Noise Impact	**Low**	**Low**
Degree of Confidence	**High**	
Cumulative	Yes	
Mitigation:	Significance of the noise impact is Low and no additional mitigation measures are required.	

Table 10-72: Impact Assessment: Operational Activities – night-time scenario at Leslie 1A

Activity:	Numerous simultaneous operational activities at night	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,N}$ of 40 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Night-time noise levels are expected to be slightly higher than typical ambient sound levels at NSD23. Noises might be audible at NSD23, 30 and 34 during quieter periods. **Minor negative**	Night-time noise levels are expected to be slightly higher than typical ambient sound levels at NSD23. Noises might be audible at NSD23, 30 and 34 during quieter periods. **Minor negative**
Duration	Noise levels may be higher for the duration of the project. **Long Term**	Noise levels may be higher for the duration of the project. **Long Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	Mining activities are unlikely to impact on the ambient sound levels further than 1 000 m from the activity at night, though the mining activities might be audible up to 2 000m during quieter periods. **Site or Local**	Mining activities are unlikely to impact on the ambient sound levels further than 1 000 m from the activity at night, though the mining activities will be audible up to 2 000m during quieter periods. **Site or Local**
Consequence of Noise Impact	**Medium**	**Medium**
Probability	Night-time ambient sound levels were less than 40 dBA for more than 65% of the measurements and less than 45 dBA most of the measurements at location KLPLTAS01. It is **possible** that the NSD23 will hear the noises and be disturbed by the noises from construction activities. It is possible that **NSD20** be affected. **Possible**	Night-time ambient sound levels were less than 40 dBA for more than 65% of the measurements and less than 45 dBA most of the measurements at location KLPLTAS01. With appropriate mitigation it would be possible to reduce the noise levels at **NSD20** to prevent the noise level to be disturbing. **Unlikely**
Significance of Noise Impact	**Medium**	**Low**
Degree of Confidence	**High**	
Cumulative	Yes	
Mitigation:	❖ Locate the plant and associated infrastructure further than 700m from NSD20.	

	❖ Develop the waste dump or a topsoil dump between NSD20 and the mining portal and plant infrastructure to ensure that the line of sight is broken between this NSD and noise-generating mining infrastructure.

The potential significance of noise impacts are estimated in Table 10-73 (daytime) and Table 10-74 (night-time). It must be noted that there are a number of receptors that stay within the potential impact zone due to noise from road traffic.

Table 10-73: Impact Assessment: Operational Activities – daytime scenario at Leslie 1C

Activity:	Numerous simultaneous operational activities during the day	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,D}$ of 50 dBA.	
	Before Mitigation	**After Mitigation**
Magnitude	Daytime noise levels are expected to be slightly higher than typical ambient sound levels at NSD02. The level might be disturbing. **Moderate negative**	Daytime noise levels are expected to be slightly higher than typical ambient sound levels at NSD02. **Minor negative**
Duration	Noise levels may be higher for the duration of the project. **Long Term**	Noise levels may be higher for the duration of the project. **Long Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**
Consequence of Noise Impact	**Medium**	**Medium**
Probability	Daytime ambient sound levels were more than 70% of the measurements, less than 50 dBA (KLPLTAS03) and 44% of the time, less than 50 dBA at KLPLTAS04. It is generally quieter than 55 dBA at these locations. It is **possible** that NSD02 will hear and may be disturbed by the noises from operational activities (mainly hauling activities). **Possible**	Daytime ambient sound levels were more than 70% of the measurements, less than 50 dBA (KLPLTAS03) and 44% of the time, less than 50 dBA at KLPLTAS04. It is generally quieter than 55 dBA at these locations. It is **possible** that NSD02 will hear and may be disturbed by the noises from operational activities (mainly hauling activities). **Possible**
Significance of Noise Impact	**Medium**	**Medium**
Degree of Confidence	**High**	
Cumulative	Yes	
Mitigation:	❖ If viable, the haul road could be relocated further than 200m from NSD02 (moved further south, passing between waste rock dump and the co-disposal dump). ❖ Develop a berm between NSD02 and the haul road.	

Table 10-74: Impact Assessment: Operational Activities – night-time scenario at Leslie 1C

Activity:	Numerous simultaneous operational activities at night	
Impact Description:	Increased total noise levels in the area, changing existing ambient sound levels at receptors	
Acceptable Rating Level	Sub-urban area. Use $L_{Req,N}$ of 40 dBA	
	Before Mitigation	**After Mitigation**
Magnitude	Night-time noise levels are expected to be higher than typical ambient sound levels at NSD02, 03, 07 and 13. **Major negative**	Night-time noise levels may be clearly audible to the closest NSD at times. **Moderate negative**
Duration	Noise levels may be higher for the duration of the project. **Long Term**	Noise levels may be higher for the duration of the project. **Long Term**
Extent ($\Delta L_{Aeq,D}$>7dBA)	Mining activities will not impact on the ambient sound levels further than 1,000 m from the activity at night. The noises may be audible up to 2,000m during quieter periods. **Site or Local**	Mining activities will not impact on the ambient sound levels further than 1,000 m from the activity at night. The noises may be audible up to 2,000m during quieter periods. **Site or Local**
Consequence of Noise Impact	**High**	**Medium**
Probability	Night-time ambient sound levels were more than 73% of the measurements, less than 40 dBA at KLPLTAS03, a location quite far from the N17 and R50. Modelling indicated that the roads could impact on the ambient sound levels up to 1,000m away from the roads. Even with the impact from the existing road traffic, it is considered **possible** that the closest NSD (such as NSD02 and 07) will hear and be disturbed by the noises from operational activities. **Possible**	Night-time ambient sound levels were more than 73% of the measurements, less than 40 dBA at KLPLTAS03, a location quite far from the N17 and R50. Modelling indicated that the roads could impact on the ambient sound levels up to 1,000m away from the roads. With mitigation it is **possible** that the closest NSD will hear and be disturbed by the noises from construction activities. **Possible**
Significance of Noise Impact	**High**	**Medium**
Degree of Confidence	**High**	
Cumulative	Yes	
Mitigation:	The potential noise impact of high significance is due to the potential noise level at NSD02 and NSD07. The following measures will reduce the noise level or the probability of a noise impact occurring: ❖ If viable, the haul road could be relocated further than 200m from NSD02 (moved further south, passing between waste rock dump and just north of the co-disposal dump); ❖ Develop a berm between NSD02 and the haul road; ❖ Minimize night-time operational activities within 500m of NSD02 at the waste rock and the co-disposal dump;	

	❖ If viable, construct the dumps approximately 700m from the closest potential noise-sensitive receptors if the activities are not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm); ❖ Remove topsoil to reduce the level of the plant infrastructure in terms of the surrounding surface level; ❖ Increase the height of the topsoil berm between NSD07 and mining infrastructure.

10.2.6.3 Decommissioning and Closure Phase Noise Impact

Final decommissioning activities will have a noise impact lower than either the construction, operational or first stage decommissioning phases. This is because decommissioning activities normally take place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a smaller risk for a noise impact, typically less than the noise impacts associated with the construction phase.

10.2.7 Blasting and Vibration

10.2.7.1 Construction Phase

Table 10-75: Ground vibration impacts on roads impact assessment matrix before and after mitigation

Impact Description	Ground vibration impacts on roads	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Moderate negative	Minor negative
Duration	Short Term < 18 months	Short Term < 18 months
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Low
Probability	Definite	Possible
Significance of Air Quality Impact	**Medium**	**Low**
Mitigation	❖ Reduce charge mass per delay ❖ Changed or re-define blast design ❖ Site location changes or road diversion	
Cumulative Impact	No	

Table 10-76: Fly rock impacts on houses impact assessment matrix before and after mitigation

Impact Description	Fly rock Impact on houses	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major negative	Major negative
Duration	Short Term < 18 months	Short Term < 18 months
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Possible	Possible
Significance of Air Quality Impact	**Medium**	**Medium**
Mitigation	❖ Stemming control and audit ❖ Use proper stemming materials	

	❖ Re-design blasts ❖ Re-locate households
Cumulative Impact	No

Table 10-77: Fly rock impacts on roads impact assessment matrix before and after mitigation

Impact Description	Fly rock Impact on roads	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major negative	Moderate negative
Duration	Short Term < 18 months	Short Term < 18 months
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Low
Probability	Definite	Possible
Significance of Air Quality Impact	**Medium**	**Low**
Mitigation	❖ Stemming control and audit ❖ Use proper stemming materials ❖ Re-design blasts	
Cumulative Impact	No	

10.2.7.2 Operational Phase

The operation of the underground workings will be done mechanically with continuous miners. No specific influences for drilling and blasting is applicable.

10.2.7.3 Closure Phase: Impact Assessment and Mitigation Measures

During the closure phase no mining, drilling and blasting operations are expected. It is uncertain if any blasting will be done for demolition. If any demolition blasting will be required, it will be reviewed as civil blasting and addressed accordingly.

10.2.8 Visual

10.2.8.1 Construction Phase

Table 10-78: Potential visual construction Impacts on vegetation

Impact Description	Loss of vegetation / Loss of visual screening due to site clearance	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	Short Term < 18 months	Short Term < 18 months
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Low
Probability	Definite	Definite
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Clearly define areas to be cleared.	

	❖ Do not clear past designated areas. ❖ Retain natural vegetation outside of clearance zone
Cumulative Impact	Yes

Table 10-79: Potential visual construction Impacts on air quality

Impact Description	Dust generated from site clearance	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	Short Term < 18 months	Short Term < 18 months
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Low
Probability	Definite	Definite
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Implement daily dust suppression and pave roads where possible to avoid transport related dust pollution	
Cumulative Impact	Yes	

Table 10-80: Potential visual construction Impacts on visual

Impact Description	Soil stripping and topsoil stockpiling	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	Medium Term > 18 months < 5 years	Medium Term > 18 months < 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Definite
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Vegetate and maintain stockpiles to the recommended minimum height.	
Cumulative Impact	Yes	

Table 10-81: Potential visual construction Impacts on visual

Impact Description	Visual intrusion to the scenic view due to Construction of surface infrastructure, construction sites, Mobilisation of excavators for construction	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	*Medium Term > 18 months < 5 years*	*Medium Term > 18 months < 5 years*
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Definite
Significance of Impact	**Medium**	**Medium**

Mitigation	❖ Use material with colours that will visually blend with the natural environment ❖ Screen construction sites with mesh fence covers (in natural green colour). ❖ Screening of mobile equipment might not be possible either than to screen the whole construction site via fence cover
Cumulative Impact	Yes

Table 10-82: Potential visual construction Impacts on soil

Impact Description	loss of topography of the area	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	*Medium Term > 18 months < 5 years*	*Medium Term > 18 months < 5 years*
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Definite
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Remove minimum amount of existing topsoil as possible and only remove where necessary. ❖ All soil stripping should be done according to the soils management guidelines as prescribed by soil scientist. ❖ Place soils as close as possible to the access portal and avoid relocation.	
Cumulative Impact	Yes	

10.2.8.2 Operational Phase

Table 10-83: Potential visual Operational Impacts on vegetation

Impact Description	Removal of vegetation	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	*Medium Term > 18 months < 5 years*	*Medium Term > 18 months < 5 years*
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Possible
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Only remove vegetation within the designated boundary	
Cumulative Impact	Yes	

Table 10-84: Potential Visual Operational Impacts on visual

Impact Description	Change in the topography of the site	
Activity	**Before Mitigation**	**After Mitigation**

Magnitude	Major -	Moderate
Duration	Medium Term > 18 months < 5 years	Medium Term > 18 months < 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Possible
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Place topsoil and subsoil stockpiles on the edge of the site boundary to create visual screening into the access portal. ❖ Revegetate stockpiles to avoid erosion.	
Cumulative Impact	Yes	

Table 10-85: Potential Visual Operational Impacts on visual

Impact Description	Visual intrusion on the scenic view as a result of the co-disposal discard dumps and ROM stockpile	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Medium
Probability	Definite	Possible
Significance of Impact	High	**Medium**
Mitigation	❖ Place Co-disposal Discard Dump behind topsoil stockpile ❖ Keep ROM stockpile to the minimum height recommended	
Cumulative Impact	Yes	

Table 10-86: Potential Visual Operational Impacts on the Night Sky

Impact Description	Light pollution at night	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Moderate
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Regional	Regional
Consequence	High	Medium
Probability	Definite	Posible
Significance of Impact	High	Medium
Mitigation	❖ Keep lighting to minimum. ❖ Direct light downwards to avoid illumination to the sky. ❖ Use motion light sensor to avoid lighting unused places.	
Cumulative Impact	Yes	

Table 10-87: Potential Visual Operational Impacts on topography

Impact Description	Loss of natural slope and contour line	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Moderate -	Moderate
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Medium
Probability	Definite	Possible
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Encourage concurrent rehabilitation. ❖ Employ surveyor when shaping the subsoil and topsoil	
Cumulative Impact	Yes	

Table 10-88: Potential Visual Operational Impacts on visual

Impact Description	Topsoil erosion and drainage pattern	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Moderate -	Minor -
Duration	Medium Term > 18 months < 5 years	Medium Term > 18 months < 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	Medium	Low
Probability	Definite	Possible
Significance of Impact	**Medium**	**Low**
Mitigation	❖ Revegetate soon after stockpiling to avoid erosion and a drainage patterns forming on the stockpile.	
Cumulative Impact	Yes	

Table 10-89: Potential Visual Operational Impacts on visual

Impact Description	Visual intrusion by dust due to Coal transportation	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Minor -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or Local	Site or Local
Consequence	High	Low
Probability	Possible	Possible
Significance of Impact	**High**	**Low**
Mitigation	❖ Revegetate soon after stockpiling to avoid erosion and a drainage patterns forming on the stockpile.	

Cumulative Impact	Yes

Table 10-90: Potential Visual Operational Impacts on visual

Impact Description	Visual intrusion by dust due to Truck hauling on the roads and queuing on the loading bay	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Minor -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Regional	Regional
Consequence	High	Low
Probability	Definite	Possible
Significance of Impact	**High**	**Low**
Mitigation	❖ Avoid long queueing of trucks in the loading bay	
Cumulative Impact	Yes	

10.2.8.3 Closure and Decommissioning Phase

Table 10-91: Potential closure and decommissioning visual Impacts on topography

Impact Description	loss of natural slope and topography as a result of removal of infrastructure and of berms, removal of ROM stockpile, Co-disposal Discard Dump	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Minor -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or local	Site or local
Consequence	High	Medium
Probability	Definite	Possible
Significance of Impact	**High**	**Medium**
Mitigation	❖ Dismantle and remove all infrastructure. ❖ Revegetation and rehabilitation plan in consultation with landscape architect / botanist. ❖ Remove all berms and revegetate all disturbed areas ❖ Reshape and create a gentle slope which is free- draining to meet the final land use or land capability commitments and water management objectives	
Cumulative Impact	Yes	

Table 10-92: Potential closure and decommissioning visual Impacts on topography

Impact Description	loss of natural slope and topography as a result of Underground access portal	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Major -	Minor -
Duration	Long Term > 5 years	Long Term > 5 years

Spatial Scale	Site or local	Site or local
Consequence	High	Medium
Probability	Definite	Possible
Significance of Impact	**High**	**Medium**
Mitigation	❖ Backfill and reshape with a surveyor. ❖ Reshape to create a gently-slope which is free-draining topography	
Cumulative Impact	Yes	

Table 10-93: Potential closure and decommissioning visual Impacts on topography

Impact Description	Landform stability	
Activity	**Before Mitigation**	**After Mitigation**
Magnitude	Modertae -	Minor -
Duration	Long Term > 5 years	Long Term > 5 years
Spatial Scale	Site or local	Site or local
Consequence	Medium	Medium
Probability	Definite	Possible
Significance of Impact	**Medium**	**Medium**
Mitigation	❖ Institute a rehabilitation monitoring program with a rehabilitation specialist	
Cumulative Impact	Yes	

10.2.8.4 Cumulative impacts

This assessment of cumulative visual effects deals with the effects of a proposed development interacting with the effects of other development currently available in the area. (SNH, 2012: 4) defines cumulative effects as the additional changes caused by a proposed development in conjunction with other similar developments or as the combined effect of a set of developments, taken together. This is to recognise that the overall combined landscape and visual effects of a number of similar developments concentrated in one area may be greater than the sum of the effects from the same developments if considered individually.

The project as a whole would be adding five new underground mines to the region over a LOM of 35 years. This will create a new precedent and bring notable change in the landscape, sense of place and visual scenery of the immediate proposed site as well as the region. Currently, between Leslie 1A and Leslie 1C is the town of Leandra and the township Lebohang. There is evidence of town decay with desolate-looking buildings across the town and a mixture of the informal and formal settlement patterns in the township area. Due the addition of the new mining developments, it may bring an influx of people looking for employment opportunities which may add to the already existing informal settlement along the R50 and /or due to the economic improvement brought about by the developments, there may be upgrades to the settlement and housing patterns and the buildings in town. The possibility of addition of more people and upgrading of the town may change the sense of place from the rural sense of place to an industrial/ mining area.

In addition, the majority of the coal mines are concentrated on the southeast of the Proposed Project in the towns Evander where Sasol's Secunda mines and chemical refinery are also located. On the north eastern side of the proposed mining area is the Eskom power station Matla with its colliery next to the Kriel colliery Kendal PowerStation which is located approximately 22km directly north of the proposed Leslie 1 project can been seen in the horizon from the site. On the western side travelling on the R50 mine excavations, overburden dumps and infrastructure are prominent on the flat terrain of the area. Although rehabilitation is anticipated to occur, the landscape will have a new view depending on the success rate of the rehabilitation and post mining landcover. With this not being the only project anticipated for this area, the change in the sense of place and scenery of the area is inevitable.

10.2.9 Traffic

10.2.9.1 Construction Phase

Table 10-94: Construction phase traffic impacts

Impact Description	Added traffic on the road network as a result of Construction materials being transported to site and Employees and labourers transported to/ from site	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Medium term	Medium term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Definite	Definite
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Cumulative:	No	
Mitigation measures ❖ Vehicles to adhere to traffic laws ❖ Mine to motivate local authority to upgrade main roads. This can be done in conjunction with other mines in the area. ❖ Mine to investigate providing bulk transport for employees		

Table 10-95: Construction phase traffic impacts

Impact Description	Dust will increase with increased traffic flow along gravel roads	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Short term	Short term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Definite	Possible
Calculated Significance Rating	**Medium**	**Low**

Impact Status:	Negative	Negative
Cumulative impact	No	
Mitigation measures ❖ Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		

Table 10-96: Construction phase traffic impacts

Impact Description	**Construction of access roads**	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Moderate	Moderate
Consequence	Low	Low
Probability	Definite	Definite
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Residual impacts ❖		
Mitigation measures ❖ Access roads to be tarred and maintained. ❖ Ensure 4-way stops are constructed for ease of access.		

10.2.9.2 Operational Phase

Table 10-97: Operational phase traffic impacts

Impact Description	Added traffic on the road network as a result of Coal haulage to/ from site; and mine staff to/from site	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	Medium	Medium
Probability	Definite	possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Cumulative impact	Yes	
Mitigation measures ❖ Vehicles to adhere to traffic laws ❖ Mine to investigate providing bulk transport for employees		

Table 10-98: Operational phase traffic impacts

Impact Description	Dust will increase with increased traffic flow along gravel roads	
	Before Mitigation	**After Mitigation**

Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Minor	Minor
Consequence	Medium	Medium
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Cumulative impact	No	
Mitigation measures ❖ Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).		

Table 10-99: Operational phase traffic impacts

Impact Description	Noise levels affecting sensitive areas including residential areas as a result of Coal haulage to/ from site; and mine staff to/from site	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Major	Minor
Consequence	High	Medium
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative	Negative
Cumulative impact	Yes	
Mitigation measures ❖ Speed limits to be kept low, and define routes away from residential areas.		

10.2.9.3 Closure and Decommissioning Phase

Table 10-100: Closure phase traffic impacts

Impact Description	Added traffic on the road network as a result of decommissioning activities	
	Before Mitigation	**After Mitigation**
Extent	Regional	Regional
Duration	Medium term	Medium term
Magnitude	Minor	Minor
Consequence	Low	Low
Probability	Definite	Unlikely
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative	Negative
Cumulative impact	No	
Mitigation measures ❖ Road network able to support additional trucks.		

10.2.10 Heritage and Palaeontology

Nineteen burial grounds have been identified during the field work, with two burial sites identified during the stakeholder engagement process (**LES029, LES030**). Due to the social and cultural significance of burial grounds and graves, a high heritage significance is given to all these sites.

The impact of the proposed project on the burial grounds located at sites LES002, LES003, and LES007 is rated as having a HIGH negative significance before mitigation and with the implementation of mitigation measures as having a LOW negative significance. The remaining sites, LES001, LES005, LES006, LES008, LES009, LES010, LES029, LES030 should not be impacted on by mining activity as they occur outside the footprint area, however, caution is still advised as some of the sites (LES005, LES006, LES008, LES009) are situated particularly close to the edge of the proposed layout.

Area 1B

The impact of the proposed project on the burial ground at site LES015 is rated as having a HIGH negative significance before mitigation and with the implementation of mitigation measures as having a LOW negative significance. It is difficult to tell if this site is situated directly on the proposed layout for the 1B shaft entrance due to the resolution of the layout, but it is close enough to the shaft entrance and any probable access roads to the shaft entrance that a high impact rating is warranted.

Area 1C

The impact of the proposed project on the burial grounds at sites LES019, LES022 and LES025 is rated as having a HIGH negative significance before mitigation and with the implementation of mitigation measures as having a LOW negative significance. The remaining sites LES014, LES016, LES021, LES024 and LES028 should not be impacted on by mining activity as they occur outside the footprint area, however, caution is still advised as some of the sites (LES014, LES016, LES021) are situated particularly close to the edge of the proposed layout.

Impact on living heritage resources

The only living heritage site identified is site LES031 located near area 1A. This site is an Ndebele Initiation ceremony site and is rated as having a high significance. Depending on the local community, relocation /destruction of the site may be possible with stakeholder engagement and consent. The recommendation would be to allow the site to be retained in situ and avoided if possible, but mitigation or destruction may be possible (with stakeholder engagement). However, even though the site is located outside the proposed layout, the resulting mining activities might make access to this site difficult, thus a proper stakeholder engagement process will be necessary.

Impact on Palaeontological Resources

According to the palaeontological sensitivity map accessed via the SAHRIS database, the study areas fall within 'VERY HIGH', 'MODERATE' and 'INSIGNIFICANT' rated sensitivity zones. Even though there are 'MODERATE' and 'INSIGNIFICANT' ratings, the highest rating being 'VERY HIGH' will have to be adhered to and therefore a palaeontological field assessment will be required before development can continue.

10.2.10.1 Construction Phase

Table 10-101: Construction Phase Heritage Impacts

Impact Description	Endangerment of graves at LES015 Unknown nature of heritage resources on un-surveyed portions of updated layout footprint	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Major	Minor
Consequence	High	Medium
Probability	Possible	Unlikely
Calculated Significance Rating	**High**	**Low**
Impact Status:	Negative	Negative
Cumulative impact	No	
Mitigation measures ❖ Demarcate sites with a 50-metre buffer and avoid them. If this is not possible a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations		

Table 10-102: Construction Phase Heritage Impacts

Impact Description	**Destruction of historical structures LES013**	
	Before Mitigation	**After Mitigation**
Extent	Site or local	Site or local
Duration	Long term	Long term
Magnitude	Moderate	Minor
Consequence	Medium	Medium
Probability	Possible	Unlikely
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative	Negative
Cumulative impact	No	
Mitigation measures ❖ Demarcate sites with a 50-metre buffer and avoid them. If this is not possible a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations		

10.2.10.2 Operational Phase

Table 10-103: Operational phase Heritage Impacts

Nature of the impact: Impact on palaeontology

	Impact Rating Without Mitigation	Impact Rating With Mitigation
Extent	Site o Local	Local
Duration	Long term	Long term
Magnitude	Major	Minor
Consequence	High	Medium
Probability	Definite	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative	Negative
Can impacts be enhanced:	Yes	
Residual impacts ❖ The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience.		
Mitigation measures ❖ The EAP and ECO must be informed that a Very High Palaeontological Sensitivity is allocated to the whole study area. ❖ A Phase 1 PIA document and "Chance Find Protocol" must be completed during the first month of excavation. These recommendations must be incorporated in the EMPr of this project.		

10.2.10.3 Closure and Decommissioning Phase

No impacts were identified in this phase.

10.2.11 Social

10.2.11.1 Construction Phase

Table 10-104: Construction phase employment opportunities impact rating

Nature of the impact: Employment opportunities		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Moderate +	Major +
Probability	Definite	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience.		

Mitigation measures
❖ Establish targets for the employment and training; ❖ Adopt recruitment strategies that ensure local people are given employment preference; ❖ Effective implementation of training and skills development initiatives; ❖ The recruitment process has to be transparent and equitable.

Table 10-105: Construction phase economic multiplier impact rating

Nature of the impact: Multiplier impacts on the local economy		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Low +	Major +
Probability	Definite	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
Reversibility:	N/A	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Developed local economy;		
Mitigation measures ❖ Preference should be given to capable subcontractors who based within the local municipal area ; and ❖ Align skills development to build capacity of SMMEs;		

Table 10-106: Construction phase community development impact rating

Nature of the impact: Community development through LED projects		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Minor +	Major +
Probability	Possible	Definite
Calculated Significance Rating	Low	High
Impact Status:	Positive	Positive
Reversibility:	N/A	
Irreplaceable loss of resources:	N/A	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Improved economic development; ❖ Increased capacity to develop and maintain livelihood strategies		
Mitigation measures ❖ Conduct needs assessments to understand local demand and community priorities ❖ Ensure that there is stakeholder buy-in;		

❖ Aligning LED projects with those of other development role-players- focus on projects that empower vulnerable groups within the study area. ❖ Consider partnering with local government to work together and set common goals and objectives for the communities; ❖ Ensure that LED projects included in the SLP are sustainable post mining operations-this should reduce the negative impacts post mine closure.

Table 10-107: Construction phase change in movement patterns impact rating

Nature of the impact: Change in movement patterns		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate -	Minor -
Probability	Definite	Definite
Calculated Significance Rating	Medium	Medium
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	N/A	
Can impacts be enhanced:	No	
Residual impacts ❖ Altered sense of place and breakdown of existing social networks		
Mitigation measures ❖ Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; ❖ Leslie Coal Mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked.		

Table 10-108: Construction phase displacement impact rating

Nature of the impact: Physical and economic displacement		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Medium term
Magnitude	Major -	Moderate
Probability	Possible	Possible
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Irreversible, impact cannot be reversed for the affected household	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts		

- Displaced farm workers;
- Loss of livelihoods.

Mitigation measures

- Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment.
- A Resettlement Action Plan and associated Livelihood Restoration Plan may be required.
- Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement.
- Implement a Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances.

Table 10-109: Construction phase cultural impact rating

Nature of the impact: Disturbance of cultural, spiritual and religious sites

	Impact Rating Without Mitigation	Impact Rating With Mitigation
Extent	Local	Local
Duration	Long term	Medium term
Magnitude	Major -	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	
Irreplaceable loss of resources:	Marginal loss	
Can impacts be enhanced:	No	

Residual impacts

- Restricted or limited access to spiritual sites/grave yards.

Mitigation measures

- Ensure that the community is included in decisions regarding cultural, spiritual and religious sites;
- Establish specific clan landowner protocols for activities that have spatial proximity to known sacred sites.
- Recommendations as indicated in the heritage impact assessment study should be implemented

Table 10-110: Construction phase pressure on municipal services impact rating

Nature of the impact: Increased pressure on municipal services

	Impact Rating Without Mitigation	Impact Rating With Mitigation
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major-	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	

Irreplaceable loss of resources:	Yes, strain on infrastructure and services is likely to persist.
Can impacts be enhanced:	No
Residual impacts ❖ Strain on the existing infrastructure which is already inadequate.	
Mitigation measures ❖ To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; ❖ To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; ❖ To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Project; and ❖ To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders.	

Table 10-111: Construction phase social pathologies impact rating

Nature of the impact: Increased social pathologies linked to influx of workers and job seekers		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major -	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	
Irreplaceable loss of resources:	This impact can result in consequences that will have irreplaceable losses of a physical and psychological nature.	
Can impacts be enhanced:	No	
Residual impacts ❖ The impact may be reversible over time as workers and job-seekers leave the area, consequences such as HIV/AIDS and unwanted pregnancies will be permanent.		
Mitigation measures ❖ Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about the Project; ❖ Consider establishing clear rules and regulations for access to the mine area and the surrounding areas. The mine must work closely with the local South African Police Services and establish standard operating procedures for the control and removal of loiterers. ❖ It should be noted that Leslie Coal Mine has no control over activities related to workers' behaviour, however It is recommended that HIV/AIDS campaigns are conducted within the affected area.		

Table 10-112: Construction phase nuisance factor impact rating

Nature of the impact: The increase in nuisance factors and associated changed sense of place will be negative, and direct as a result of project activities, and indirect as a result of migrant job-seekers		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**

Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Low**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced:	No	
Residual impacts ❖ Altered sense of place		
Mitigation measures ❖ Minimise all nuisance factors such as noise, air quality, traffic, and visual-Implement all mitigation measures as specified in the relevant specialist studies; ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.		

10.2.11.2 Operational Phase

Table 10-113: Operational phase employment opportunities impact rating

Nature of the impact: Employment opportunities		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate +	Major+
Probability	Possible	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ The residual impacts associated with the creation of employment and business opportunities and training during the operational phase is that it benefits the local economy; ❖ Acquired transferable skills that could potentially be used with other businesses		
Mitigation measures ❖ If possible a training and skills development programme for the local workers should be initiated prior to the operational phase. ❖ Effective implementation of training and skills development initiatives; ❖ Recruitment should be formalised and co-ordinated through the Department of Labour- avoid appointments at the gate of the mining operation.		

Table 10-114: Operational phase economic multiplier impact rating

Nature of the impact: Multiplier impacts on the local economy		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Minor +	Major +
Probability	Possible	Definite
Calculated Significance Rating	Low	High
Impact Status:	Positive	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Local suppliers will have gained experience and exposure to meeting standards of quality and scale that could be transferrable to business opportunities		
Mitigation measures ❖ Preference should be given to capable subcontractors who based within the local municipal area ; and ❖ Measures recommended to maximise benefits from local employment, skills and economic development.		

Table 10-115: Operational phase community development impact rating

Nature of the impact: Community development through led projects		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Minor +	Major +
Probability	Possible	Definite
Calculated Significance Rating	Low	High
Impact Status:	Positive	Positive
Reversibility:	N/A	
Irreplaceable loss of resources:	N/A	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Developed local economy; ❖ Increased capacity to develop and maintain livelihood strategies		
Mitigation measures ❖ Maximise benefits from local employment, skills and economic development; ❖ Consider partnering with local government to work together and set common goals and objectives for the communities; ❖ Ensure that LED projects included in the SLP are sustainable post mining operations-this should reduce the negative impacts post mine closure		

Table 10-116: Operational phase change in movement patterns impact rating

Nature of the impact: Change in movement patterns		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Minor -	Moderate -
Probability	Definite	Definite
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	N/A	
Irreplaceable loss of resources:	N/A	
Can impacts be enhanced:	No	
Residual impacts ❖ Altered sense of place and breakdown of existing social networks		
Mitigation measures ❖ Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; ❖ Leslie should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked.		

Table 10-117: Operational phase displacement impact rating

Nature of the impact: Physical and economic displacement		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major -	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Irreversible, impact cannot be reversed for the affected households	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Displaced farm workers; ❖ Loss of livelihoods.		
Mitigation measures ❖ Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment. ❖ A Resettlement Action Plan and associated Livelihood Restoration Plan may be required. ❖ Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement. ❖ Implement the Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances.		

Table 10-118: Operational phase cultural impact rating

Nature of the impact: Disturbance of cultural, spiritual and religious sites		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	*Major -*	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	
Irreplaceable loss of resources:	Marginal loss	
Can impacts be enhanced:	No	
Residual impacts: ❖ Restricted or limited access to spiritual sites/grave yards.		
Mitigation measures ❖ Ensure that the community is included in decisions regarding cultural, spiritual and religious sites; ❖ Recommendations as indicated in the heritage impact assessment study should be implemented		

Table 10-119: Operational phase pressure on municipal services impact rating

Nature of the impact: Increased pressure on municipal services		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major-	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	
Irreplaceable loss of resources:	Yes, strain on infrastructure and services is likely to persist.	
Can impacts be enhanced:	No	
Residual impacts ❖ Strain on the existing infrastructure which is already inadequate.		
Mitigation measures ❖ To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; ❖ To work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; ❖ To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Project; and ❖ to make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders.		

Table 10-120: Operational phase social pathologies impact rating

Nature of the impact: Increased social pathologies linked to influx of workers and job seekers		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Medium term	Medium Term
Magnitude	Major -	Moderate -
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partly reversible	
Irreplaceable loss of resources:	This impact can result in consequences that will have irreplaceable losses of a physical and psychological nature.	
Can impacts be enhanced:	No	
Residual impacts ❖ The impact may be reversible over time as workers and job-seekers leave the area, consequences such as HIV/AIDS and unwanted pregnancies will be permanent.		
Mitigation measures ❖ Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about the Project; ❖ Consider establishing clear rules and regulations for access to the mine area and the surrounding areas. The mine must work closely with the local South African Police Services and establish standard operating procedures for the control and removal of loiterers. ❖ Maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders.		

Table 10-121: Operational phase nuisance factor impact rating

Nature of the impact: The increase in nuisance factors and associated changed sense of place will be negative, and direct as a result of project activities, and indirect as a result of migrant job-seekers		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Medium-	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	

Can impacts be enhanced:	No
Residual impacts ❖ Altered sense of place.	
Mitigation measures ❖ To minimise all nuisance factors such as noise, air quality, traffic, and visual; ❖ Implement all mitigation measures as specified in the relevant specialist studies; ❖ To make available, maintain and effectively implement a grievance/complaints register that is easily accessible to all neighbours and affected stakeholders; ❖ To liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	

10.2.11.3 Decommissioning Phase

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

The closure of the mine will result in the termination of procurement contracts associated with operations. This may have significant implications for businesses that have become dependent on the mine. It is expected that there will be a moderate negative impact on the affected population during closure.

Closure of the Project is expected to significantly reduce economic development and diversification. Some people will have increased capacity to continue to develop and maintain livelihood strategies while others may struggle with the transition. As such, it is expected that there will be a moderate to major negative impact on the affected population during closure.

During the decommissioning and closure phases, it is possible that the land will be rehabilitated and continue in some form of agricultural land. As such, new farm workers may be employed and potentially housed on the land.

During the decommissioning and closure phases, it is likely that workers will remain in the area as they may seek employment locally and are likely to have established networks and become connected after a long period of time. Given the high levels of uncertainty regarding the actions of people or nature of the socio-economic environment, it is not possible to assess this project phase.

During the decommissioning and closure phases, the majority of the Proposed Project aspects that resulted in a changed sense of place will no longer exist, the community is likely to have adapted to the existence of migrants in the area. Given the high levels of uncertainty regarding the actions of people or nature of the future socio-economic environment, it is not possible to assess this project phase; however, it is expected that the impact will largely be mitigated.

10.2.11.4 Cumulative Impacts

There are various mine related projects which are currently being undertaken and some are currently being investigated in the area. This includes Evander Gold Mines Prospecting activities, Sasol and South 32 mining developments. The presence of these developments will increase the environmental and social impacts.

From a social perspective, some of the most significant cumulative impacts relate to the following aspects:

- The cumulative impacts associated with the creation of employment and business opportunities and training during the construction phase, are that there is an opportunity for employment seekers to improve their skills;
- The cumulative impacts associated with the influx of job seekers include the long-term impacts on family structures and social networks of communities. In the case of HIV/AIDS or unwanted pregnancies the impacts might be permanent and have permanent cumulative impacts on the affected individuals, families and the community;
- An influx of workers (direct) and job-seekers (indirect) may lead to increased pressure on infrastructure and services and an increase in social pathologies. Leslie Coal Mine should make every effort to discourage influx by communicating early and widely that local residents will be given preference for employment. Leslie Coal Mine must ensure that it collaborates with the relevant local authorities and mining operations to identify and actively participate in initiatives/ projects to improve capacity where required. While the potential impacts linked to influx can have negative consequences, this is a common and anticipated phenomenon that cannot be a reason for preventing further development; and
- An increase in direct project nuisance factors; namely, noise, air pollution, traffic and visual disturbances could further impact negatively on the sense of place for some receptors. Implementation of suitable mitigation measures will be proposed to reduce and manage these nuisance factors.

10.2.12 Community Health

It should be noted that only the impacts relevant to the Project have been assessed in the section below. In this instance, EHA #1 (vector-related diseases) and EHA #3 (veterinary medicine and zoonotic diseases) have been discussed but have not been evaluated and rated as, during the field visit and analysis, these EHAs were deemed immaterial in the PACs.

10.2.12.1 EHA #2: Acute Respiratory Infections and Respiratory Effects from Housing

Table 10-122: Communicable diseases impact rating

EHA #2 Communicable Diseases Linked to Housing Design		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes –impact can result in the loss of human life.	
Can impacts be enhanced:	No	

Residual impacts

- Change in the rates of respiratory diseases such as influenza and pneumonia
- Influx during active operational periods of the Leslie 1 Project may lead to an increase in prevalence of respiratory illnesses if household is overcrowded
- Loss of income due to retrenchment (during decommissioning phase of the Project may lead to loss of income may result in more people in a house, exacerbating the prevalence of respiratory diseases
- Increasing prevalence of respiratory health outcomes, including TB

Mitigation measures

- Support community-based information campaigns related to TB symptoms and the need to seek care. The campaign should address the risk of co-infection between HIV and TB;
- Influx management and advice with regards to town planning to prevent overcrowding; and
- Develop partnerships to support the community-based TB control programs in conjunction with the DoH and any NGOs. This needs to include case detection, management and surveillance activities under the national TB program policy and strategy.

10.2.12.2 EHA #4: Sexually Transmitted Infections, including HIV/AIDS

Table 10-123: STI impact rating

EHA #4: Sexually Transmitted Infections, including HIV/AIDS		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Regional	Regional
Duration (	Long Term > 5 years	Long Term > 5 years
Magnitude	Major -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative	
Reversibility:	Irreversible	
Cumulative:	Yes	

EHA #4: Sexually Transmitted Infections, including HIV/AIDS		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Irreplaceable loss of resources:	Yes –irreversible loss of human life.	
Can impacts be enhanced:	No	

Residual impacts

- Change in the rates of STI such as gonorrhoea, chlamydia, Hepatitis C, and HIV.
- Increasing the number of orphans and child headed households
- The likely effect of the project employing a number of relatively well-paid employees may also increase the risk for transactional sex
- Loss of income during closure and decommissioning phase of the Project may cause people to get involved in prostitution

Mitigation measures

- Develop a HIV/AIDS policy that incorporates both the workplace and community considerations;
- Develop an integrated HIV management program that considers both the workplace and the community. TB and STI must be integrated into this;
- Support (financial or otherwise) NGO groups active in the area on gender-based sexual violence; and
- Support community-based condom distribution centres. These should be linked to other initiatives and not be run in isolation.

10.2.12.3 EHA #5: Soil-, Water- and Waste-related Diseases

Table 10-124: Soil, water and waste related diseases impact rating

EHA #5: Soil-, Water- and Waste-related Diseases		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Regional	Regional
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Major -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative	
Reversibility:	Irreversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	

Residual impacts

- Influx of people may put a burden on water and sanitation infrastructure –change in % of households served with water and sanitation services
- Potential contamination with hydrocarbons and chemicals during construction and operations
- Unplanned developments may influence environmental health conditions and further contaminate surface water bodies
- Increase in income improves ability to afford basic environmental health services. This may result in a decline in cases of soil, water and sanitation-related diseases

Mitigation measures

- Groundwater and surface water quality must be monitored;
- Restrict access to project-created water bodies;
- Conduct baseline water and sanitation studies;

EHA #5: Soil-, Water- and Waste-related Diseases		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
❖ Ensure proper disposal of human waste generated from the project; and ❖ Ensure proper waste management.		

10.2.12.4 EHA #6: Food and Nutrition-Related Issues

Table 10-125: Food and nutrition impact rating

EHA #6: Food and Nutrition-Related Issues		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
***Extent** (Local, Regional, International)*	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partially reversible	
Cumulative:	No	
Irreplaceable loss of resources:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Change in regional food cost expressed as a % of median household income ❖ Influx of people may result in food inflation, increasing food deprivation, nutrition-related diseases ❖ Poor food hygiene and quality of food services may increase food-related illnesses ❖ Long-term food inflation may increase food deprivation, nutrition-related effects, affecting especially vulnerable groups such as children and marginalised groups ❖ More consumption of fast food related to increased income may increase non-communicable (lifestyle) diseases		
Mitigation measures ❖ Reduce project-related communicable diseases that may impact nutrition; ❖ Food inflation management as part of social program – meat, fruit and vegetables remain expensive items, but lower bread and cereal prices offer relief. Perhaps Leslie Coal Mine may assist in training selected individuals to bake bread on a semi-commercial scale and sell from their homes, or assist in the establishment community gardens growing fruits and vegetables; and ❖ Support local procurement of food items in combination with incentives to increase local production.		

10.2.12.5 EHA #7: Accidents/Injuries

Table 10-126: accidents and injuries impact rating

EHA#7: *Accidents/Injuries*		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Regional	Regional
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Major -	Minor -
Probability	Possible	Possible

EHA#7: *Accidents/Injuries*		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Calculated Significance Rating	High	**Medium**
Impact Status:	Negative	
Reversibility:	Irreversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes –irreversible loss of human life.	
Can impacts be enhanced:	No	
Residual impacts ❖ Change in morbidity and mortality data related to commercial motor vehicle (CMV) traffic on roadways related to the Leslie 1 Mining Project and coal transport. ❖ Change in morbidity and mortality data related to non-commercial motor vehicle crashes.		
Mitigation measures ❖ Engage the Local Municipality and interested and affected parties to assist with programmes targeted at improving traffic management and road safety in the study area; ❖ Develop a clear policy for the management of emergencies or accidents in the community as a direct result of the projects activities; ❖ Support with local safety and security as addressed in these specialist studies.		

10.2.12.6 EHA #8: Exposure to Potentially Hazardous Materials, Noise and Malodours

Table 10-127: Hazardous materials exposure impact rating

EHA #8: Exposure to Potentially Hazardous Materials, Noise and Malodours		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Change in morbidity and mortality data from poor air quality events (exceedances) through exacerbation of chronic respiratory diseases, or cardiovascular diseases ❖ Pollutants and emissions released by construction and operational activities may increase the prevalence of related respiratory illnesses and water related illnesses ❖ Influx of people into the area may increase domestic activities, including the use of domestic fuel, pesticides resulting in increased air pollution and associated Increases in the prevalence of related respiratory illnesses		
Mitigation measures ❖ Conveyor belts should be used instead of haul trucks for the on-site transport of materials and rail transport should be used for off-site transport of ROM coal, thus reducing the use of haul trucks by the mines to an absolute minimum.		

EHA #8: Exposure to Potentially Hazardous Materials, Noise and Malodours		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**

- All coal processing should be moved off site for Leslie 1C, and if possible, also for Leslie 1A.
- A comprehensive mitigation programme should be implemented on any remaining haul roads.
- If off-site rail transport is used together with on-site conveyor belts at Leslie 1A, and the coal processing plant is kept, all possible mitigation measures must be undertaken to limit the emissions of PM2.5 and PM10 from the coal processing plant.
- A comprehensive, continuous air quality monitoring programme must be undertaken to ensure that mitigation measures are applied at all times to keep ambient air concentrations of PM10 and PM2.5 within the NAAQS over residential areas;
- Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective;
- Environmental noise monitoring;
- Develop and implement a Storm Water Management Plan; and
- Undertake groundwater and surface water monitoring.

10.2.12.7 EHA #9: Social Determinants of Health

Table 10-128: Social health determinants impact rating

EHA #9: Social Determinants of Health		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Regional	Regional
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Major -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**High**	**Medium**
Impact Status:	Negative	
Reversibility:	Partially Irreversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	Positive impacts such as employment gain can be enhanced	

Residual impacts

- Change in morbidity and mortality data related to psychosocial distress such as depression, anxiety, substance abuse, and changes to family structure.
- Change in median household income
- Change in unemployment
- Change in the percentage of households living below poverty line
- Change in educational attainment
- Increase in xenophobia, violence, crime, prevalence of substance abuse and gender violence resulting from an influx of individuals without appropriate social infrastructure
- With the expected population growth and influx of job seekers, who may bring their families along, household size may increase resulting in overcrowding
- Construction workers and an influx of national and international people in search of economic opportunities are expected to put enormous pressure on the South African Police Services and immigration control

EHA #9: Social Determinants of Health		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
❖ Increase in psychosocial problems, including depression as a result of retrenchment at decommissioning phase ❖ A positive impact on poverty status for a small number of people employed at the Leslie 1 Project site ❖ Influx of people and increased income may result in illegal substances being available more freely		
Mitigation measures ❖ Social management plans and recommendations as part of the SIA; ❖ Reduce substance-abuse and improve social cohesion; ❖ Supporting education programs with a gender equity focus; ❖ Plan for mine closure; ❖ Identify and support vulnerable groups; and ❖ Support graduate training programs for the youth in the community		

10.2.12.8 EHA #10: Cultural Health Practices

Table 10-129: Cultural health practices impact rating

EHA #10: Cultural Health Practices		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	No	
Cumulative:	No	
Irreplaceable loss of resources:	Yes – Unscrupulous practices by traditional healers may result in loss of human life.	
Can impacts be enhanced:	No	
Residual impacts ❖ More people are practicing and using traditional medicine which may contribute to reducing the health burden if they are trained and knowledgeable ❖ Negative health outcomes		
Mitigation measures ❖ Develop a disease-prevention plan that involves traditional healers.		

10.2.12.9 EHA #11: Health Systems Issues

Table 10-130: Health system impact rating

EHA #11: Health Systems Issues		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -

EHA #11: Health Systems Issues		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Partially reversible	
Cumulative:	Yes	
Irreplaceable loss of resources:	Yes –increased pressure on infrastructure and services is expected to continue	
Can impacts be enhanced:	No	
Residual impacts ❖ Change in ratio of people to health care providers ❖ Change in time needed for emergency response ❖ Influx of people resulting in overburdened health facilities with inadequate health service ❖ Overburdened community health facilities, inadequate health service resulting from more people in the area		
Mitigation measures ❖ Influx management and supporting health facilities to cope with the increased population if related to project; and ❖ Support community volunteer programs through expansion of the community-based peer health educator group.		

10.2.12.10 EHA #12: Non-Communicable Diseases

Table 10-131: Non-communicable diseases impact rating

EHA #12: Non-Communicable Diseases		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent	Site or Local	Site or Local
Duration	Long Term > 5 years	Long Term > 5 years
Magnitude	Moderate -	Minor -
Probability	Possible	Possible
Calculated Significance Rating	**Medium**	**Medium**
Impact Status:	Negative	Negative
Reversibility:	Irreversible	
Irreplaceable loss of resources:	Yes	
Cumulative:	No	
Can impacts be enhanced:	No	
Residual impacts ❖ Change in mortality and morbidity data due to non-communicable diseases. ❖ Influx of people with chronic diseases putting a burden on health service delivery ❖ Behavioural changes at the household level such as alcohol use, smoking, or dietary changes that may contribute to a rise in non-communicable disease outcomes affecting health service delivery ❖ Social and environmental factors that increase stress and unhealthy behaviours		

EHA #12: Non-Communicable Diseases		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Mitigation measures ❖ Support health education programs as part of a community-based peer health educator program; ❖ Support the local healthcare personnel with training on disease-management programs and the recognition of NCD symptoms and management thereof; ❖ Support healthcare facilities with diagnostic medical hardware, where feasible.		

10.2.12.11 Cumulative Impacts

Cumulative impacts are contextual and encompass a broad spectrum of impacts at different spatial and temporal scales (IFC, 2013) i.e. cumulative impacts can result from individually minor but collectively significant activities taking place over a period of time (Dutta, et al., 2012). These are not new types of impacts but recognition that impacts from individual projects and activities can combine together in time and space. In some cases, cumulative impacts occur because a series of projects of the same type are being developed. In other cases, cumulative impacts occur from the combined effects over a given resource of a mix of different types of projects; for example, the development of a mine site, access roads, transmission lines, and other adjacent land uses.

The following cumulative impacts are expected:

- ❖ The cumulative impacts associated with the influx of job seekers include the long-term impacts on family structures and social networks of communities. In the case of HIV/AIDS or unwanted pregnancies the impacts might be permanent and have permanent cumulative impacts on the affected individuals, families and the community;
- ❖ An influx of workers (direct) and job-seekers (indirect) may lead to increased pressure on infrastructure and services and an increase in social pathologies. Leslie Coal Mine should make every effort to discourage influx by communicating early and widely that local residents will be given preference for employment. Leslie must ensure that it collaborates with the relevant local authorities and mining operations to identify and actively participate in initiatives/ projects to improve capacity where required. While the potential impacts linked to influx can have negative consequences, this is a common and anticipated phenomenon that cannot be a reason for preventing further development;
- ❖ An increase in direct project nuisance factors; namely, noise, air pollution, traffic and visual disturbances could further impact negatively on the sense of place for some receptors. Implementation of suitable mitigation measures has been proposed by the relevant specialist to reduce and manage these nuisance factors
- ❖ The other mines may contribute to the pollutant load on surface water systems. These changes may be substantial, affecting the regional water quality, though some mitigation is possible with practicable management systems. Changes in surface water quality impacts on the health various surface water users –drinking and recreational users. The development of the proposed Leslie 1 Coal Mining Project may place pressures on existing sanitation and water supply systems because of the anticipated increase in population in the area.

- Ground water extraction at other mines may affect groundwater availability in the area. The change may be substantial, extend regionally, affect many people, and may be cumulative in nature causing an overall shortage of drinking water as majority of the healthcare facilities and settlements depend on borehole water.
- With regards to noise and vibration, some of Leslie, Eendracht and the surrounding settlements s will be exposed to noise from the operations of various machines on the mine and trucks on the road. Extraction and transport operations of other mines will affect some the receptors. Though blasting will be carried out at other mines, the effects are not synergistic. With modern blasting technologies, the effects are likely to be small, localised, easy to mitigate, and non-cumulative.
- Changes in income level; education; health care; change in existing cultural pattern; alteration of location or distribution of human population in the area; change in housing.
- Potential health hazards; risk of accidents from explosion, release of oil, radioactive materials, toxic substances etc.

10.2.13 Climate Change

Table 10-132: Summary of the climate change impacts of the estimated GHG emissions from the proposed Leslie 1 Coal Mine during the construction phase.

Nature: The Greenhouse gas emissions produced as a result of constructing the proposed Leslie 1 Coal Mine contribute to the global phenomenon of anthropogenic climate change. Numerous global changes are likely to manifest as a consequence of climate change, although none that can be attributed directly or indirectly to the specific greenhouse gas emissions of any individual source, such as the proposed Leslie 1 Coal Mine. The annual emissions from the construction of mine represent less than 0.01% of global emissions (based on 2015 figures) and less than 0.01% of South Africa's National Greenhouse Gas Inventory (based on 2010 figures).

	Without Mitigation	With Mitigation
Spatial Scale	National/International	National/International
Duration	Permanent	Permanent
Magnitude	Minor -	Minor -
Probability	Definite	Definite
Significance	**Medium**	**Medium**
Status of impact	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	-

Mitigation: The major mitigation action related to the Leslie 1 Coal Mine is the selection of mining method. In this regard the proposed Leslie 1 Coal Mine has selected underground mining as mining method which, in comparison to open pit mining, is a much less emission intensive option.

Cumulative impacts: The emissions from the project are cumulative with the emissions from the construction of other coal mines in the area. Due to the global scope of climate change and the long durations that greenhouse gas emissions are expected to remain in the atmosphere, the emissions from the construction phase of the mine are globally cumulative in their impact. Climate change is likely to be accelerated and sustained as emissions accumulate in the atmosphere.

Residual risks: The risks associated with climate change will still be prevalent even with efforts to mitigate the project's greenhouse gas emissions during the construction phase. This is due to the vast number of other

sources of greenhouse gas emissions around the world, and the specific concentration of coal mining activities, both current and planned, within the Mpumalanga Region. .

Table 10-133: Summary of the climate change impacts of the estimated GHG emissions from the proposed Leslie 1 Coal Mine during the operational phase and combustion of coal.

Nature: The Greenhouse gas emissions produced as a result of both the mine and the coal combustion contribute to the global phenomenon of anthropogenic climate change. Numerous global environmental changes are likely to manifest as a consequence of climate change, although none that can be attributed directly to the specific greenhouse gas emissions of any individual source, such as the proposed Leslie 1 Coal mine. The annual emissions from the operational phase of the mine only represent less than 0.001% of global emissions (based on 2015 figures) and 0.03% of South Africa's National Greenhouse Gas Inventory (based on 2010 figures). The emissions from the combustion of the coal will add an additional 4.5 million tonnes of CO2e to the mine's direct emissions which would then equate to approximately 0.014% of global emissions.

	Without Mitigation	With Mitigation
Spatial Scale	National/International	National/International
Duration	Permanent	Permanent
Magnitude	Minor + (Combustion Major +)	Minor +
Probability	Definite	Definite
Significance	High	High
Status of impact	Negative	Negative
Reversibility	None	None
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	-

Mitigation: The proposed coal mine would need to mitigate its greenhouse gas emissions to reduce its contribution to national emissions and climate change. The report discusses options for mitigating the power plant's greenhouse gas emissions which primarily involve hybridising the power plant by substituting the source of thermal energy away from coal towards more carbon neutral sources. However, the project's major source of emissions relates to the downstream combustion of coal. The sale and the use of coal in Eskom power station is governed by the Integrated Resource Plan and is not a result of this project.

Cumulative impacts: The emissions from the project are cumulative with the emissions from other greenhouse gas emitting installations globally. As with the surrounding coal mines the emissions from the project will contribute to South Africa's national greenhouse gas inventory. Due to the global scope of climate change and the long duration that carbon emissions are expected to remain in the atmosphere, the greenhouse gas emissions from the power plant are globally cumulative in their impact. Climate change is likely to be accelerated and sustained as emissions accumulate in the atmosphere.

Residual risks: The risks associated with climate change will still be prevalent even with efforts to mitigate the project's greenhouse gas emissions. This is due to the large amount of accumulated greenhouse gas in the atmosphere and the vast number of other sources of greenhouse gas emissions around the world.

10.3 Assessment of each Identified Impact and Risk

The potential impacts per activity and per phase are detailed in the following sections of this Subchapter below.

10.3.1 Soil, Land Capability and Agricultural Potential

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Soil	Stripping of topsoil and stockpiling it	Disturbance of in situ horizon organisation	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Keep the surface disturbance footprint as small as possible.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Soil	Stripping of topsoil and stockpiling it	Loss of soil fertility through impacts on nutrient cycles	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Soil nutrient cycles can somehow be maintained by revegetation of topsoil stockpiles and through proper ecological land rehabilitation	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Soil	Vehicle traffic and construction of infrastructure	Soil compaction	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ The project footprint should be kept as small as possible. ❖ Traffic should be restricted to haul roads only. ❖ Topsoil stripping and stockpiling should not be conducted during wet periods. ❖ Soil moisture should be below a pre-determined level.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium
Soil	Trucks and equipment on site and waste generation by construction activities	Soil chemical pollution	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Proper soil contamination prevention measures as outlined in the Soil Management Plan.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Soil	Vegetation clearance exposing soil surface to energy of wind and water movement	Soil erosion	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Control soil erosion through the use of geotextiles and revegetation of exposed soil surfaces where possible.	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Land capability	Soil stripping and construction of infrastructure	Loss of arable land capability	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Current soil rehabilitation techniques are not able to restore the arable land capability and the loss is therefore permanent	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Land capability	Soil stripping and construction of infrastructure	Loss of grazing land capability	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Rehabilitation of land can restore the grazing capacity to a large extent.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium
Land capability	Soil stripping and construction of infrastructure	Loss of wetland land capability	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	-	❖ Avoid wetland areas as far as possible and do not include in areas of surface disturbance.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Land use	Establishment of mining infrastructure	Change in land use from agriculture to mining	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Keep the project surface footprint as small as possible.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Operation																
Soil	Daily traffic on haul roads especially trucking of coal from site	Soil compaction	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Restrict traffic to the demarcated areas and existing haul roads.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium
Soil	Dust from coal stockpiles and transporting of coal cause soil pollution and acidification. Trucks and equipment on site and waste generation by construction activities	Soil chemical pollution	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	-	❖ Manage surface water run-off around the coal loading and storage facilities. ❖ Use topsoil stockpiles as berms along the road and around the infrastructure areas to prevent pollution spreading into surrounding crop fields	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Soil	Areas that remain unvegetated during operations are at risk of soil erosion	Soil erosion	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Use geo-textiles and contours to prevent and minimise soil erosion from exposed surfaces	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium
Decommissioning and Closure																
Soil	Heavy vehicle traffic to remove infrastructure from site and return topsoil	Soil compaction	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Restrict traffic to areas where decommissioning is taking place as well as existing haul roads	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium
Soil	Possible oil and fuel spills from vehicles and	Soil chemical pollution	*Moderate -*	*Medium Term > 18*	*Site or Local*	Medium	*Possible*	Medium	-	❖ Check vehicles and equipment entering the site	*Minor -*	*Short Term <*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
	equipment used for decommissioning			*months < 5 years*						for oil and fuel leaks and inspect site for possible spillages		*18 months*				
Post- Closure																
Soil	Areas where revegetation has not been successful will be exposed to wind and water energy	Soil erosion	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Conduct regular monitoring and use geo-textiles to protect bare soil surfaces or alternative seed mixes to establish vegetation cover	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

10.3.2 Surface Water

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Surface water Quality	Vegetation removal	The removal of vegetation will expose soils to water erosion that may lead to a deterioration in water quality of surrounding surface water in terms of increased TSS and turbidity	*Moderate -*	*Short Term < 18 months*	*Regional*	Medium	*Possible*	Medium	-	❖ Temporary erosion control measures that reduce flow velocity (e.g. runoff berms) should be implemented around construction areas; ❖ Clearance of vegetation must be limited as far as possible; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Surface water quality	Impermeable areas	Lay down of impermeable areas is likely to result in increased velocity in surface water runoff, that may lead to erosion and consequent	*Moderate -*	*Short Term < 18 months*	*Regional*	Medium	*Possible*	Medium	-	❖ Measures (energy dissipaters, detention dams, swales, etc.) that reduce flow velocity from impermeable areas should be implemented. The goal of all stormwater	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		increase in TSS of surface water resources								management should be that the post-development runoff is the same or does not exceed the pre-development runoff; ❖ Impermeable areas must not be constructed unnecessarily; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.						
Surface water quality	Topography changes	Changes in the topography are likely to result in an alteration in surface water drainage patterns leading to erosion and a consequent increase in TSS of surface water resources	*Moderate -*	*Short Term < 18 months*	*Regional*	Medium	*Possible*	Medium	-	❖ • Stormwater management measures around the shaft, dumps, plant area, etc. as proposed under section 5 must be implemented; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Operation																

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Surface water quantity	Excavation of the shaft portals and implementation of a SWMP (closed system) around the plant area and dumps	Loss of contributing catchment area to stream flows	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Definite*	Medium	-	❖ No mitigation.	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Definite*	Medium
Surface water quality	The establishment of the three proposed mines in the vicinity of Leandra	Surface water quality impact	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Effective stormwater management that captures and contains all runoff from mine impacted areas; ❖ Treatment of decant water by effective passive or active treatment methods; and ❖ Water quality monitoring upstream and downstream of mining activities.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Surface water quantity	Seepage into underground voids and subsidence	Loss of surface water quantity	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Prevention of underground mining beneath watercourses; and ❖ High extraction mining (pillar mining) should be prevented.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Decommissioning and Closure																
Surface water quality	Loosening of soil during demolition of infrastructure and rehabilitation processes	Erosion and consequent increase in TSS of surface water resources leading to deteriorated water quality	*Moderate -*	*Short Term < 18 months*	*Regional*	Medium	*Possible*	Medium	-	❖ Storm water management structures should be left in place until rehabilitation is complete; ❖ Temporary erosion control measures that reduce flow velocity (e.g. runoff berms) should be implemented around rehabilitation activities; and	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										❖ Water quality monitoring must continue upstream and downstream of the Mine for at least five years post mine closure and rehabilitation.						

10.3.3 Groundwater

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Groundwater quantity	Site clearing and infrastructure development	Establishment of hard surface areas during infrastructure and road construction reduces recharge to the shallow weathered aquifers due to increased runoff.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	No	❖ Implement a surface water management plan to minimise the volume of dirty water produced thereby reducing the probability of contamination of groundwater from infiltration of dirty surface water. ❖ The hard surfaces on site will increase runoff, but the collection of this water for use on site will reduce the need to pump water from boreholes or the municipal supply; can be used for e.g. watering of gardens, wash bays and dust suppression. ❖ Restrict areas that must be cleared of vegetation to the minimum. ❖ Allow clean water to bypass the dirty areas and flow into the natural environment.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Groundwater Quantity	Site clearing and infrastructure development	Site clearing or excavation below the water table depth will have a potential impact on the groundwater quantity and quality.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low	No	❖ The incline shafts must be sealed / grouted to minimise inflow of groundwater and negative impacts associated with cone of dewatering. ❖ Ensure that there are no geological structures that act as preferred groundwater flow paths in the decline areas.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Groundwater Quantity	Mine development	❖ Groundwater will seep into the box cut workings and may lead to minor drawdown cones. ❖ The numerical model indicated that the zone of influence will not extend further than 300 m from the box cut. ❖ Private borehole Spr01 is however situated in the anticipated zone of influence delineated for the construction phase of the incline shaft, at the Leslie 1A East incline shaft. This borehole is	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Pumped water to be contained in PCDs. Treatment of the pumped groundwater will be required for human consumption and construction activities. ❖ Use the water collected on site to minimise the use of clean borehole water or water from the municipality. ❖ Time-series groundwater monitoring is required to predict the dewatering cone and related impacts. ❖ Should it be found that the dewatering activities do impact on private boreholes then it is recommended that the mine should supply equal/better quality water to affected parties that rely on groundwater.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		the only source of water to this farm. ❖ Private borehole Wat7 is situated within the anticipated zone of influence at the Leslie 1C incline shaft. This borehole is the only source of water to this property.														
Groundwater Quality	Mine development	❖ Incline shafts and box cuts will expose the shallow, weathered aquifer and may allow contaminants to enter the groundwater environment; likely after rainfall. ❖ Deterioration in groundwater quality due to the increased suspended solids seeping in from cut plus pyrite starting to react due to exposure to oxygen and water. ❖ Quality impacts are suspected to be low	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low	Yes	❖ Local groundwater quality contains various naturally elevated element concentrations such as nitrate, sodium and sulphate that already exceed the maximum allowable safe drinking water standards. Regular groundwater monitoring must be implemented to assess current status versus baseline qualities. ❖ Site specific geochemical tests are recommended on the various geological horizons to identify the leach potential for each geological formation. This should be done before construction starts to assist with waste, coal and	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		during Construction .								discard placement on surface.						
Operation																
Groundwater Quantity	Mine dewatering	❖ Excavation of the incline and underground will create a cone of depression with a hydraulic gradient towards the mine. This will have an impact on groundwater levels. ❖ The cone of depression will affect many boreholes with levels dropping by 10m plus. ❖ Because water levels in the shallow weathered aquifer are not expected to be lowered because of mine dewatering, it is unlikely that any of the springs will be affected by mine dewatering.	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ A detailed assessment of impacted boreholes should be undertaken before the construction phase to determine borehole depths and yields. This info will assist with a detailed assessment on impacts and if a borehole will be destroyed by mining. ❖ Should it be found that the dewatering activities do impact on private boreholes then it is recommended that the mine should supply equal/better quality water to affected parties that rely on groundwater.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Groundwater Quality	Mine water contamination	❖ Rainwater infiltrating through the overburden stockpiles and/or backfilled	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ The initial acidification will be neutralized by the natural buffering capacity in the overlying rock. This can take place for	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		material into the groundwater environment could pollute the aquifers, by means of an increased salt load and metal precipitation. ❖ AMD from stock piles, waste rock and discard in rehabilitated areas. Water quality in the mine will slowly start deteriorating, which can be magnified with the oxidation of pyrite: high concentrations of sulphate suspected. ❖ Contaminant migration away from the mining area is expected to be limited as groundwater flow direction will be towards the mine.								years, until the neutralizing potential is depleted. Acidification is expected to be more of a problem post-closure. Mitigation that should be considered includes the management of the stockpile shape to control the ease with which water can run off from the facility. ❖ Avoid placement of the pollution control dams on areas with the potential for increased infiltration to groundwater, such as over fault of geology contact zones. ❖ The relevant technological options for the treatment and discharge of water during the operational phase should be further investigated to determine the most feasible end water use. ❖ Impacts associated with infiltration can be further mitigated by: o Vegetation of the stockpile and covering them with soil to minimise rainfall infiltration and						

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										mobilisation of dissolved metals. o Implementation of a lime cover on overburden stockpiles to neutralise acidity. ❖ The coal should be stored for less than 2 months and thus the time required for seepage to occur will be minimal. ❖ The coal should be compacted and the potential for the coal stockyard to generate acid will be greatly reduce. The compaction would be required not only to reduce the through flow oxygen, but also to prevent spontaneous combustion. ❖ Install seepage collectors underneath the stockyards and monitor the quality of the collected water. ❖ The floor of the coal stockpile should be well-prepared flat surface. This would be designed for the ease of operation and coal recovery, but also to prevent seepage to the groundwater by incorporating clay into the liner.						
Groundwater Quality	Mine water contamination	❖ The potential incorrect disposal of	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Implementation of an effective storm water	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
	/ infrastructure	hazardous wastes, workshop effluent, as well as spills and leaks at the maintenance workshops. ❖ The potential incorrect disposal of domestic waste at the offices and ablutions. ❖ Contamination from the Leslie 1A West area will spread towards the tributary of the Wilge River. A plume with sulphate concentrations exceeding 1 000 mg/L may reach this tributary over a distance of 200 m. ❖ Sulphate contamination from the discard facility and associated infrastructure at the Leslie 1C mining area may also migrate up to 400 m during the operational phase. Simulations suggest that the plume								management plan is required to contain all waste water and/or volatile organic compounds for treatment and recycling. ❖ All contaminant, storm water, waste and hazardous waste storage facilities and other contaminated water storage areas (pollution control dams) should be lined to pro-actively prevent infiltration of contaminated seepage water. ❖ Domestic waste disposal facilities should be located within the immediate vicinity of other wastes. ❖ Concentration of waste on small sites, using the cell concept should be practised. ❖ Effective covering of the waste to minimise oxygen ingress, thus creating anaerobic conditions within the waste and eliminating acidification. ❖ Ensure that coal discards are not placed within the domestic waste dump because of the acid-generating potential of the coal. ❖ Ensure that domestic wastes are fenced,						

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		will not reach the tributary of the Klipspruit during the operational phase, situated to the west of the site. The plume may reach the non-perennial stream to the east, but sulphate concentrations are not expected to increase significantly above 250 mg/L during this time.								equipped with groundwater monitoring facilities and licensed according to the relevant regulations.						
Decommissioning and Closure																
Groundwater Quantity	No abstraction	❖ Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. ❖ Post closure, groundwater levels will take more than 100 years to recover after mining ceases. ❖ Rising water levels in the mine will remove oxygen and effectively stop oxidation	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Mine is completely flooded, sulphide oxidation will essentially stop and the primary processes affecting water quality will be the dissolution of stored secondary mineral and available base minerals. Complete flooding is therefore advantageous from a geochemical and water quality viewpoint. ❖ Monitor the water table recovery and ensure that it is maintained below the regional water level so that the contamination plume is always directed towards	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		reactions that could lead to acid mine drainage conditions. ❖ With the available dataset and mine plan, it is concluded that the risk of decant from the underground workings is very low.								the mine and decant is avoided. Abstracted water (if required) must be treated on site and re-used.						
Groundwater Quality	No abstraction	❖ Groundwater level recovery in the underground workings is not expected to affect movement of contamination in the weathered aquifer post closure. The spread of contamination in the weathered aquifer will most probably occur under natural groundwater flow conditions. ❖ Leslie 1A West - plume from the shaft is expected to move in a north-westerly direction to the tributary	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Ensure that the water table within the mine is maintained below the regional water level so that the contamination plume is always directed towards the mine. ❖ Infiltration to groundwater should be controlled and can be achieved through installation of liners, sufficient surface drainage and surface capping to insulate against infiltration. ❖ Grout curtains or scavenger wells could intercept seepage moving towards a sensitive receptor. ❖ Sulphate concentrations in the mine would reduce to half of the initial concentrations in the long-term. This could be achieved if the	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		of the Kromdraaispruit. Sulphate concentrations may increase to 1 700 mg/L in groundwater reaching this stream. Leslie 1A East - plume from the discard dump will migrate in a westerly direction towards the same tributary of the Kromdraaispruit. This portion of the plume is not expected to reach the stream during the 100-year simulation period. The plume from the discard dump will also continue to spread in an easterly direction towards tributary of the Wilge River and sulphate concentrations may increase to 3 500 mg/L in groundwater reaching this stream over the 100-year								mine is flooded and oxygen is eliminated from the system and in turn eliminate acid mine drainage inside the mine or if rehabilitation of the dumps left on surface is done to the highest standards to reduce or eliminate the influx of water into the backfill and waste material. ❖ Surface runoff must be diverted around the dumps and backfilled decline back into the catchment post closure. ❖ Time-series groundwater monitoring is required to predict the rate of groundwater recovery more accurately. ❖ Intercept trenches of wells should be positioned downstream from the dump areas to collect any possible discharge water. This water should be pumped and stored in PCDs.						

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		simulation period. ❖ Leslie 1C - plume from the discard dump expected to move in southerly direction towards the Klipspruit and reach the stream in the 100-year simulation period. Sulphate concentrations exceeding 1 000 mg/L may be recorded at this position. The plume will migrate towards the tributary of the Klipspruit and sulphate concentrations are expected to increase to around 1 300 mg/L in this area.														
Post- Closure																
Groundwater Quantity	No abstraction	❖ Once the mine is closed and dewatering ceases, groundwater will start to recover to its pre-mining level. ❖ Post closure, groundwater levels will take more than 100 years to	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Mine is completely flooded, sulphide oxidation will essentially stop and the primary processes affecting water quality will be the dissolution of stored secondary mineral and available base minerals. Complete flooding is therefore advantageous from a geochemical and	*Major +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		recover after mining ceases. ❖ Rising water levels in the mine will remove oxygen and effectively stop oxidation reactions that could lead to acid mine drainage conditions. ❖ With the available dataset and mine plan, it is concluded that the risk of decant from the underground workings is very low.								water quality viewpoint. ❖ Monitor the water table recovery and ensure that it is maintained below the regional water level so that the contamination plume is always directed towards the mine and decant is avoided. Abstracted water (if required) must be treated on site and re-used.						
Groundwater	No abstraction	❖ Quality - Groundwater level recovery in the underground workings is not expected to affect movement of contaminatio n in the weathered aquifer post closure. The spread of contaminatio n in the weathered aquifer will most probably occur under natural groundwater	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Ensure that the water table within the mine is maintained below the regional water level so that the contamination plume is always directed towards the mine. ❖ Infiltration to groundwater should be controlled and can be achieved through installation of liners, sufficient surface drainage and surface capping to insulate against infiltration. ❖ Grout curtains or scavenger wells could intercept seepage moving	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		flow conditions. ❖ Leslie 1A West - plume from the shaft is expected to move in a north-westerly direction to the tributary of the Kromdraaispruit. Sulphate concentrations may increase to 1 700 mg/L in groundwater reaching this stream. Leslie 1A East - plume from the discard dump will migrate in a westerly direction towards the same tributary of the Kromdraaispruit. This portion of the plume is not expected to reach the stream during the 100-year simulation period. The plume from the discard dump will also continue to spread in an easterly direction towards								towards a sensitive receptor. ❖ Sulphate concentrations in the mine would reduce to half of the initial concentrations in the long-term. This could be achieved if the mine is flooded and oxygen is eliminated from the system and in turn eliminate acid mine drainage inside the mine or if rehabilitation of the dumps left on surface is done to the highest standards to reduce or eliminate the influx of water into the backfill and waste material. ❖ Surface runoff must be diverted around the dumps and backfilled decline back into the catchment post closure. ❖ Time-series groundwater monitoring is required to predict the rate of groundwater recovery more accurately. ❖ Intercept trenches of wells should be positioned downstream from the dump areas to collect any possible discharge water. This water should be pumped and stored in PCDs.						

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
		tributary of the Wilge River and sulphate concentrations may increase to 3 500 mg/L in groundwater reaching this stream over the 100-year simulation period. ❖ Leslie 1C - plume from the discard dump expected to move in southerly direction towards the Klipspruit and reach the stream in the 100-year simulation period. Sulphate concentrations exceeding 1 000 mg/L may be recorded at this position. The plume will migrate towards the tributary of the Klipspruit and sulphate concentrations are expected to increase to around 1 300 mg/L in this area.														

10.3.4 Biodiversity

10.3.4.1 Biodiversity

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Construction																
Biodiversity	Site clearance for infrastructure and associated access roads as well as disturbances such as noise and dust.	Loss of areas classified as CBA (MTPA, 2014) and wetlands of importance	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Avoid CBA areas and implement buffer zones	*Severe*	*Long Term > 5 years*	*National/International*	High	*Possible*	High
		Loss of area of plant endemism (Mucina & Rutherford, 2006)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Avoid areas of remaining indigenous vegetation, restrict infrastructure areas to brownfield areas only	*Moderate*	*Long Term > 5 years*	*National/International*	Moderate	*Possible*	Moderate
		Loss of Endangered & Vulnerable habitat (NBA, 2011)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones.	*Moderate -*	*Short Term*	*National/International*	Moderate	*Possible*	Moderate
Flora	Site clearance for infrastructure and associated access roads as well as disturbances such as noise and dust.	Loss of plant species of conservation importance	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Avoid areas in which plant species of conservation concern occur; ❖ If some areas cannot be avoided implement rescue of plant species of conservation concern.	*Moderate -*	*Short Term*	*National/International*	Moderate	*Possible*	Moderate
		Encroachment of alien invasive plant species	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ An alien invasive plant management plan needs to be compiled and implemented	*Moderate -*	*Short Term*	*Regional*	Moderate	*Possible*	Moderate

										during construction to prevent the growth of invasives on cleared areas						
Fauna	Site clearance for infrastructure and associated access roads as well as disturbances such as noise and dust.	Loss of habitat for species of conservation concern (NBA, 2011)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones.	*Severe*	*Long Term > 5 years*	*National/International*	High	*Possible*	High
		Loss of species of conservation concern. Displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Possible*	High	Yes	❖ Avoid high biodiversity sensitivity areas (natural vegetation, watercourses & wetlands) and comply to prescribed buffer zones; ❖ Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during construction.	*Severe*	*Long Term > 5 years*	*National/International*	High	*Possible*	High
Operation																
Flora	Operation of underground mining activities.	Encroachment of alien invasive plant species	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasives on cleared areas.	*Minor -*	*Short Term*	*Regional*	Low	*Possible*	Low

Fauna	Operation of underground mining activities.	Loss of species of conservation concern and their habitat. Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust, poaching and noise)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ Mitigation measures can be added to infrastructure such as powerlines to avoid bird impacts; ❖ Monitoring impacts of operational activities on fauna so that adaptive management practises can be implemented if required; ❖ Implement speed control measures on all roads to prevent road kill; ❖ Restrict access to high biodiversity areas (drainage lines, wetlands etc) in the vicinity of mining operations ❖ Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during operation.	*Minor -*	*Long Term > 5 years*	*Regional*	Moderate	*Possible*	Moderate
Decommissioning and Closure															

Flora	Decommissioning activities.	Encroachment of alien invasive plant species	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ Implementation of alien invasive plant management plan needs to be continued during decommissioning to prevent the growth of invasives on rehabilitated areas; ❖ Rehabilitation of site with indigenous vegetation that occurs in the vicnity of project area.	*Minor -*	*Long Term > 5 years*	*Regional*	Moderate	*Possible*	Moderate
Fauna	Decommissioning activities.	Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust, poaching and noise)	*Major -*	*Long Term > 5 years*	*National/International*	High	*Definite*	High	Yes	❖ All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed.	*Moderate -*	*Short Term < 18 months*	*National/International*	Moderate	*Possible*	Moderate

10.3.4.2 Aquatic Fauna

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Construction																
Aquatic Ecology	Site Clearing for Surface Infrastructure	Alteration of catchment hydrology and water quality deterioratio	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low

		n in the Vaal and Olifants Water Management Area								❖ Implement clean and dirty water separation.						
Aquatic Ecology	Construction of Surface Infrastructure	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Aquatic Ecology	Construction of underground access portals (shafts)	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Aquatic Ecology	The placement of waste (overburden) and topsoil stockpiles	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation. ❖ The implementation of lining material to reduce seepage.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Operation																
Aquatic Ecology	Operation of surface infrastructure (roads, conveyors, offices, coal wash plants and workshops)	Alteration of catchment hydrology and water quality deterioration in the	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low

		Vaal and Olifants Water Management Area								dirty water separation.							
Aquatic Ecology	Storage of Run of Mine (RoM) Coal	Water quality deterioration in the Vaal and Olifants Water Management Area	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Aquatic Ecology	Storage of coal mineral Discard	Water quality deterioration in the Vaal and Olifants Water Management Area	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Unlikely*	Medium
Aquatic Ecology	Storage of contaminated water in Pollution Control Dam's (PCD's)	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. Implement clean and dirty water separation. ❖ Lining of PCD's to reduce seepage.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Unlikely*	Medium
Aquatic Ecology	Active underground mining	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation. ❖ Implement subsidence risk assessment.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Unlikely*	Medium
Decommissioning and Closure																

Aquatic Ecology	Removal of infrastructure	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Unlikely*	Low
Aquatic Ecology	Rehabilitation of waste stockpiles	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water Management Area	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	Yes	❖ Effective stormwater management. ❖ Adhere to specific buffer requirements. ❖ Implement clean and dirty water separation.	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Unlikely*	Low
Post- Closure																
Aquatic Ecology	Acid Mine Drainage decant	Water quality deterioration in the Vaal and Olifants Water Management Area	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Investigate and implement water treatment options.	*Major -*	*Long Term > 5 years*	*Regional*	High	*Unlikely*	Medium
Aquatic Ecology	Seepage from permanent waste stockpiles	Water quality deterioration in the Vaal and Olifants Water Management Area	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Investigate and implement water treatment options.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Unlikely*	Medium
Aquatic Ecology	Subsidence of undermined areas	Alteration of catchment hydrology and water quality deterioration in the Vaal and Olifants Water	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Investigate subsidence further to implement mitigation actions.	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Unlikely*	Medium

		Management Area														

10.3.4.3 Wetlands

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Construction																
Wetlands	The removal of vegetation, ground compaction and infrastructure placement.	Destruction of wetland systems	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Minimise footprint area of infrastructure. ❖ Avoid wetland areas and adhere to recommended buffer areas.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Placement of infrastructure within the catchment area	Loss / reduced catchment water yield	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Minimise infrastructure footprint area. ❖ Incorporate soft / green engineering where feasible. ❖ Separate clean and dirty water. ❖ Implement best practice storm water management. ❖ Avoid wetland areas and adhere to recommended buffer areas.	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low
Wetlands	Vegetation removal and altered surface flow dynamics	Increased in suspended solid concentrations	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	-	❖ Implement phased vegetation clearing to minimise the extent of bare areas. ❖ Concurrent rehabilitation. ❖ Separate clean and dirty water. ❖ Implement best practice storm water management. ❖ Stay clear of the recommended buffer zones.	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Wetlands	Onsite mixing, fuelling and use of machines and vehicles. Erosion of the cleared footprint areas.	Contamination of surface water resources	*Major -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Possible*	Medium	Yes	❖ Separate clean and dirty water. ❖ Implement best practice storm water management. ❖ No cleaning of vehicles, machines and equipment in water resources. ❖ Servicing of machines, vehicles and equipment in designated areas. ❖ Storage of potential contaminants in bunded areas. ❖ All contractors must have spill kits available and be trained in the correct use thereof.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Disturbances caused by noise, traffic, machines and human movement	Loss of species diversity	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	-	❖ Minimise footprint area of infrastructure. ❖ Make use of existing access routes. ❖ Avoid wetland areas and adhere to buffer areas. ❖ Minimise noise disturbance. ❖ Implement dust suppression. Implement waste management.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Introduction of "pests" and weeds into the area.	Change in species abundances	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	-	❖ Minimise footprint area of infrastructure. ❖ Make use of existing access routes. ❖ Avoid wetland areas and adhere to buffer areas. ❖ Minimise noise disturbance. ❖ Implement dust suppression. ❖ Implement waste management.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Construction of underground mine	Loss of wetland systems	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium	Yes	❖ Sinkholes are likely to occur in such areas which might drain wetlands in some cases. ❖ Stay well clear of such areas (if present) and ensure that the layout	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
										of components that directly impact upon the surface stay clear of the recommended buffer zones. ❖ A rock engineering report is recommended for further mitigation measures.						
Wetlands	Construction of associated infrastructure	Loss of wetland systems	*Major -*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ Avoid wetland areas and adhere to recommended buffer areas.	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low
Wetlands	Construction of associated infrastructure	Loss of sub-surface flows	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ The loss of sub-surface flows is imminent. ❖ A hydropedology study is recommended to further improve mitigation and recommendations.	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High
Operation																
Wetlands	Operation of underground mine	Destruction. of wetland systems	*Moderate -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Unlikely*	Low	-	❖ The operation of underground mines is unlikely to have a direct impact on wetlands. ❖ A rock engineering report is recommended for further mitigation measures.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Operation of the opencast's supporting infrastructure	Loss / reduced catchment water yield	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Minimise the footprint area of supporting infrastructure. ❖ Any loss of water to the catchment must be quantified, and mitigation options to re-introduce water in a safe and environmentally friendly way must be assessed.	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Wetlands	Operation of the opencast's supporting infrastructure	Los of sub-surface flows	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ The loss of sub-surface flows is imminent. ❖ A hydropedology study is recommended to further improve mitigation and recommendations.	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High
Wetlands	Operation of the	Increased in suspended	*Moderate -*	*Medium Term >*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Separate clean and dirty water.	*Minor -*	*Medium Term > 18*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	BEFORE MITIGATION Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE	Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
	opencast's supporting infrastructure	solid concentrations		*18 months < 5 years*						❖ Implement best practice storm water management.		*months < 5 years*				
Wetlands	Operation of opencast and underground mine	Mine water discharge from dewatering of underground mining area	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Contain waste water in a PCD. ❖ Contaminated water must not be discharged into the watercourses. ❖ Clean and dirty water must be separated. ❖ This water could be looked at for treatment and then re-introduced to mitigate losses to the catchment water hydro-dynamics.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Possible*	Medium
Wetlands	Operation of ROM and overburden stockpiles	AMD and salinization	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ The introduction of oxygen and water should be limited as much as possible for these systems. ❖ Specific amelioration should additionally be applied for the overburden stockpile. ❖ Impermeable layers, seepage pumps and other mitigation measures should be part of the stockpile layout.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Possible*	Medium
Wetlands	Operations of the wash plant and the Eskom plant	Contamination of surface- and ground water	*Moderate -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Possible*	Medium	Yes	❖ Proper drainage systems should be part of this layout, clean and dirty water should be separated and continued monitoring should be involved to monitor possible contamination. ❖ The surface and groundwater reports must be considered for further mitigation measures.	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low
Decomissioning and Closure																

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Wetlands	Removal of infrastructure	Restored catchment water yield	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low	-	❖ All voids must be backfilled, and surface infrastructure must be removed from the site. Compacted areas must be ripped (perpendicularly) to a depth of 300mm. ❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Recommendations for a suitable seed mix is made. ❖ Any gullies or dongas must also be backfilled. ❖ The area must be shaped to a natural topography. Trees (or vegetation stands) removed must be replaced. ❖ No grazing must be permitted to allow for the recovery of the area. ❖ Attenuation ponds may be created in channels to retain water in the catchment.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Backfill of voids	Rehabilitated topography and surface flow dynamics (including subsidence)	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low	-	❖ All voids must be backfilled, and surface infrastructure must be removed from the site. ❖ Compacted areas must be ripped (perpendicularly) to a depth of 300mm. ❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Any gullies or dongas must also be backfilled. The area must be shaped to a natural topography.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Wetlands	Backfill of void, and shaping of catchment area	Increased in suspended solid concentrations	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low	-	❖ Decommission cut-off berms and drains last. ❖ Debris must be placed in preferential flow paths. ❖ Compacted areas must be ripped (perpendicularly) to a depth of 300mm. ❖ A seed mix must be applied to rehabilitated and bare areas. ❖ Any gullies or dongas must also be backfilled. ❖ The area must be shaped to a natural topography.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Backfill of voids	Restoration of shallow recharge	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low	-	❖ The mining of the hard plinthic layer is not likely to be restored (by means of a "plug"), and this recharge will be lost. Mitigation is therefore not possible.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Wetlands	Erosion of bare areas, soils and leaks from machines and equipment, waste disposal	Contamination of surface water resources	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium	-	❖ Ensure vehicles and machines are maintained and serviced off-site. ❖ Implement concurrent rehabilitation, applying a proven seed mix to rehabilitated and bare areas. ❖ Debris must be placed in preferential flow paths.	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low
Wetlands	AMD decant	AMD discharge from mine areas	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	-	❖ Determine the likelihood of AMD, and proactively implement measures to prevent or reduce this. ❖ Priority would be to ensure the treatment of this water to suitable standards for aquatic ecology. ❖ Rehabilitation of the area and shaping of the topography must minimise the ingress	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
										of water into the mining area. ❖ Additionally, measures must also be considered to implement constructed wetlands at likely decant areas, and the planting of tree reduce groundwater recharge.						
Wetlands	Ripping of compacted areas	Improving soil quality	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	-	❖ Monitor the footprint area to make note of compacted areas. ❖ These areas should be ripped, ameliorated and revegetated.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

10.3.5 Air Quality

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Air quality	❖ Site clearance ❖ Construction activities	$PM_{2.5}$ and PM10	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Minimise areas to be cleared ❖ Implement dust suppression on access and haul roads	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Operation																
Air quality	❖ Processing activities Leslie 1A ❖ Vehicles on access and hail roads	$PM_{2.5}$ and PM_{10}	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Either chemical or wet suppression on haul roads. ❖ Mitigation of both crushing and screening at the CHPP. ❖ Re-design of mine layout to reduce haul road distances. ❖ Use of conveyor belts for on-site transport of materials and implementation of rail transport for off-site transportation.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium

Air quality	❖ Processing activities Leslie 1C ❖ Vehicles on access and hail roads	$PM_{2.5}$ and PM_{10}	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Either chemical or wet suppression on haul roads. ❖ Mitigation of both crushing and screening at the CHPP / Elimination of the CHPP. ❖ Re-design of mine layout to reduce haul road distances. ❖ Use of conveyor belts for on-site transport of materials and implementation of rail transport for off-site transportation. ❖ Elimination of the CHPP. ❖ Locate the above-ground mining activities further south.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	Medium
Decommissioning and Closure																
Air quality	❖ Removal of infrastructure and rehabilitation	$PM_{2.5}$ and PM10	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Rehabilitate and vegetate co-disposal facility ❖ Rehabilitation and revegetation of site roads	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

10.3.6 Noise

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Noise - Leslie 1A	Numerous simultaneous construction activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Significance of the noise impact is Low and no additional mitigation measures are required	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Unlikely*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Noise - Leslie 1A	Numerous simultaneous construction activities at night	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Minimise night-time construction activities closer than approximately 700m from the closest potential noise-sensitive receptors if the activities is not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm). ❖ Minimise the use of simultaneous construction activities closer than 1,000m when operating at night. ❖ Ensure that equipment is fitted with the correct and appropriate noise-abatement measures. ❖ Eliminate the use of equipment that generates an impulsive noise when operating within 1,000m of potential receptors.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Noise - Leslie 1C	Numerous simultaneous construction activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Unless the closest receptors are relocated (NSDs 02, 03, 07 and 16), there is a possibility that noise levels will be high at some time during the	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										construction phase. ❖ Mitigation may reduce the noise level, duration of impact as well as the probability of a noise impact occurring, but, due to the proximity of the closest receptors the significance of a noise impact would remain medium.						
Noise - Leslie 1C	Numerous simultaneous construction activities at night	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Major -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Definite*	Medium	-	❖ Minimise night-time construction activities closer than approximately 700m from the closest potential noise-sensitive receptors if the activities are not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm). ❖ Minimise the use of simultaneous construction activities closer than 1 000m when operating at night. ❖ Ensure that equipment is fitted with the correct and appropriate noise-abatement measures.	*Minor -*	*Short Term < 18 months*	*Regional*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										❖ Eliminate the use of equipment that generates an impulsive noise when operating within 1 000m of potential receptors.						
Operation																
Noise - Leslie 1A	Numerous simultaneous operational activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low	-	❖ Significance of the noise impact is Low and no additional mitigation measures are required	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Noise - Leslie 1A	Numerous simultaneous operational activities at night	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	-	❖ Relocate the plant and associated infrastructure further than 700m from NSD20. ❖ Develop the waste dump or a topsoil dump between NSD20 and the mining portal and plant infrastructure to ensure that the line of sight is broken between this NSD and noise-generating mining infrastructure.	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Noise - Leslie 1C	Numerous simultaneous operational activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	-	❖ If viable, the haul road could be relocated further than 200m from NSD02 (moved further south, passing between waste rock dump and	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										the co-disposal dump). ❖ Develop a berm between NSD02 and the haul road.						
Noise - Leslie 1C	Numerous simultaneous operational activities at night	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	-	❖ If viable, the haul road could be relocated further than 200m from NSD02 (moved further south, passing between waste rock dump and just north of the co-disposal dump); ❖ Develop a berm between NSD02 and the haul road; ❖ Minimize night-time operational activities within 500m of NSD02 at the waste rock and the co-disposal dump; ❖ If viable, construct the dumps in closer than approximately 700m from the closest potential noise-sensitive receptors if the activities are not taking place behind a sound barrier (temporary or as formed by a residue or topsoil berm); ❖ Remove topsoil to reduce the level of the plant	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										infrastructure in terms of the surrounding surface level; ❖ Increase the height of the topsoil berm between NSD07 and mining infrastructure.						
Decommissioning and Closure																
Noise - Leslie 1A	Numerous simultaneous demolition activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low	-		*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Noise - Leslie 1C	Numerous simultaneous demolition activities during the day	Increased total noise levels in the area, changing existing ambient sound levels at receptors	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low	-		*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

10.3.7 Blasting and Vibration

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Neighbouring areas	Blasting	Ground vibration Impact on houses	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low	-	❖ Reduce charge mass per delay, changed or re-define blast design	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Unlikely*	Low
Neighbouring areas	Blasting	Ground vibration Impact on Boreholes	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Unlikely*	Low	-	❖	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Unlikely*	Low
Neighbouring areas	Blasting	Ground vibration Impact on graves / heritage	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	-	❖ Reduce charge mass per delay, changed or re-define blast design	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

Neighbouring areas	Blasting	Ground vibration Impact on Roads	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Reduce charge mass per delay ❖ Changed or re-define blast design ❖ Site location changes ❖ Road diversion	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Neighbouring areas	Blasting	Air blast Impact on houses	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	-	❖ Stemming control and audit, ❖ Use proper stemming materials, ❖ Re-design blasts, ❖ Re-locate households.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Neighbouring areas	Blasting	Air Blast Impact on Boreholes	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	-	-	-		*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	-	-
Neighbouring areas	Blasting	Air Blast Impact on graves / heritage	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	-	-	-		*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	-	-
Neighbouring areas	Blasting	Air Blast Impact on Roads	-	*Short Term < 18 months*	*Site or Local*	-	-	-	-		-	*Short Term < 18 months*	*Site or Local*	-	-	-
Neighbouring areas	Blasting	Fly rock Impact on houses	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Stemming control and audit, ❖ Use proper stemming materials, ❖ Re-design blasts, ❖ Re-locate households.	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Possible*	Medium
Neighbouring areas	Blasting	Fly rock Impact on Boreholes	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	-		*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Neighbouring areas	Blasting	Fly rock Impact on graves / heritage	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	-	❖ Stemming control and audit, ❖ Use proper stemming materials, ❖ Re-design blasts, ❖ Re-locate households.	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Neighbouring areas	Blasting	Fly rock Impact on Roads	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	-	❖ Stemming control and audit, ❖ Use proper stemming materials, ❖ Re-design blasts, ❖ Re-locate households.	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low
Operation																
None			-	-	-	-	-	-	-		-	-	-	-	-	-
Decommissioning and Closure																
None			-	-	-	-	-	-	-		-	-	-	-	-	-
Post- Closure																
None			-	-	-	-	-	-	-		-	-	-	-	-	-

10.3.8 Visual

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Vegetation	Site clearance	loss of vegetation / Loss of visual screening	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Clearly define areas to be cleared. Do not clear past designated areas. ❖ Retain natural vegetation outside of clearance zone	*Moderate +*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium
Air	Site clearance and construction of and access roads	Dust generated from site clearance	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Implement daily dust suppression and pave roads where possible to avoid transport related dust pollution	*Moderate -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium
Visual	Site Preparation	Soil stripping and topsoil stockpiling	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Vegetate and maintain stockpiles to the recommended minimum height.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Visual	Construction of surface infrastructure	Visual intrusion to the scenic view	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Use material with colours that will visually blend with the natural environment	*Moderate +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Visual	Construction sites	Visual intrusion to the scenic view	*Major -*	*Short Term < 18 months*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Screen construction sites with mesh fence covers (in natural green colour).	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Visual	Mobilisation of excavators for construction	Visual intrusion on the scenic view	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Screening of mobile equipment might not be possible either than to screen the whole construction site via fence cover	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Soil	Soil stripping and topsoil stockpiling	loss of topography of the area	*Major -*	*Medium Term > 18 months < 5 years*	*Regional*	Medium	*Definite*	Medium	Yes	❖ Remove minimum amount of existing topsoil as possible and only remove where necessary. ❖ All soil stripping should be done according to the soils management guidelines as prescribed by soil scientist. ❖ Place soils as close as possible to the access portal and avoid relocation.	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium
Operation																

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Vegetation	Underground access portal at Leslie 1 A and Leslie 1C	removal of vegetation	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Only remove vegetation within the designated boundary	*Moderate +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium
Visual	Soil Stockpiling	Change in the topography of the site	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Place topsoil and subsoil stockpiles on the edge of the site boundary to create visual screening into the access portal. ❖ Revegetate stockpiles to avoid erosion.	*Moderate +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium
Visual	Co-disposal Discard Dump	Visual intrusion on the scenic view	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Place Co-disposal Discard Dump behind topsoil stockpile	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Visual	ROM stockpile	Visual intrusion on the scenic view	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Keep ROM stockpile to the minimum height recommended	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Night Sky	Lighting	Light pollution at night	*Major -*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ Keep lighting to minimum. ❖ Direct light downwards to avoid illumination to the sky. ❖ Use motion light sensor to avoid lighting unused places.	*Moderate -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High
Topography	Underground access portal at Leslie 1 A and Leslie 1C	Loss of natural slope and contour line	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Encourage concurrent rehabilitation. ❖ Employ surveyor when shaping the subsoil and topsoil	*Minor +*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Visual	Topsoil and subsoil stockpile	Topsoil erosion and drainage pattern	*Major -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Revegetate soon after stockpiling to avoid erosion and a drainage patterns forming on the stockpile.	*Minor +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low
Visual	Coal transportation	Visual intrusion by dust	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Implement daily dust suppression procedures	*Minor +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low
Visual	Truck hauling on the roads and queuing on the loading bay	Visual Intrusion	*Major*	*Long Term > 5 years*	*Regional*	High	*Definite*	High	Yes	❖ Avoid long queueing of trucks in the loading bay	*Moderate -*	*Long Term > 5 years*				
Decommissioning and Closure																

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Topography	Removal of infrastructure	loss of natural slope and topography	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Dismantle and remove all infrastructure. Revegetation and rehabilitation plan in consultationwith landscape architect / botanist.	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Topography	Removal of berms	loss of natural slope and topography	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Remove all berms and revegetate all disturbed areas	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Topography	Underground access portal	loss of natural slope and topography	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Backfill and reshape with a surveyor. ❖ Reshape to create a gently-slope which is free-draining topography	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Topography	ROM stockpile, Co-disposal Discard Dump removal	loss of natural slope and topography	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Reshape and create a gentle slope which is free- draining to meet the final land use or land capability commitments and water management objectives	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Topography	Rehabilitation	Landform stability	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Institute a rehabilitation monitoring program with a rehabilitation specialist	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

10.3.9 Traffic

Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
Construction																
Road network	Construction materials being transported to site	Added traffic on the road network	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium	No	❖ Road network able to support additional trucks .	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium
Road network	Employees and laborourers transported to/ from site	Added traffic on the road network	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium	No	❖ Road network able to support additional commuter trips.	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium
Air quality	Vehicles travelling on gravel roads	Dust will increase with increased traffic flow	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	No	❖ Ensure that gravel roads are kept watered to prevent dust (other dust	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Possible*	Low

		along gravel roads								suppression measures may also be used).						
Access roads	Construction of access roads	New access roads	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium	No	❖ As per EMP	*Minor -*	*Short Term < 18 months*	*Site or Local*	Low	*Definite*	Medium
Operation																
Road network	Coal haulage to/ from site; and mine staff to/from site	Added traffic on the road network	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Road network able to support additional trucks.	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Air quality	Vehicles travelling on gravel roads	Dust will increase with increased traffic flow along gravel roads	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	No	❖ Ensure that gravel roads are kept watered to prevent dust (other dust suppression measures may also be used).	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Noise	Coal haulage to/ from site; and mine staff to/from site	Noise levels affecting sensitive areas including residential areas	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	❖ Speed limits to be kept low, and define routes away from residential areas.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Decommissioning and Closure																
Road network	Rubble and other materials being removed from site	Added traffic on the road network	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium	No	❖ Road network able to support additional trucks.	*Minor -*	*Medium Term > 18 months < 5 years*	*Regional*	Low	*Unlikely*	Low

10.3.10 Heritage

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Heritage	1A - Mining Activities	Destruction of graves at LES002, LES003 and LES007	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	No	❖ Demarcate sites with a 50-meter buffer and avoid them. If this is not possible a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Heritage	1B - Mining Activities	Endangerment of graves at LES015	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	❖ Demarcate sites with a 50-meter buffer and avoid them. If this is not possible a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Heritage	1C - Mining Activities	Destruction of graves at LES019, LES022 and LES025	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	No	❖ Demarcate sites with a 50-meter buffer and avoid them. If this is not possible a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Heritage	1A - Mining Activities	Destruction of historical structures LES004, LES011 and LES012	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Demarcate sites with a 50-meter buffer and avoid them if possible. If this is not possible, the sites may be destroyed following a destruction permit from SAHRA.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Heritage	1C - Mining Activities	Destruction of historical structures LES017, LES020 and LES023	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Demarcate sites with a 50-meter buffer and avoid them if possible. If this is not possible, the sites may be destroyed following a destruction permit from SAHRA.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low
Operation																
Heritage	Overall	Impact on palaeontology	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	No	❖ The EAP and ECO must be informed that a Very High Palaeontological Sensitivity is allocated to the whole study area. ❖ A Phase 1 PIA document and "Chance Find Protocol" must be completed during the first month of excavation. These recommendations must be incorporated in the EMPr of this project.	*Minor +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

10.3.11 Social

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Economic	Project commencement	Employment opportunities	*Moderate +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ Establish targets for the employment and training; ❖ Adopt recruitment strategies that ensure local people are given	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										employment preference; ❖ Effective implementation of training and skills development initiatives; ❖ The recruitment process has to be transparent and equitable.						
Economic	Project commencement	Multiplier impacts on the local economy	*Minor +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium	Yes	❖ Preference should be given to capable subcontractors who based within the local municipal area; ❖ Align skills development to build capacity of SMMEs	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Economic	Project commencement	Community development through LED projects	*Minor +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	Yes	❖ Ensure that there is stakeholder buy-in; ❖ Aligning LED projects with those of other development role-players	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Geographic/Socio-Cultural	Project commencement	Change in movement patterns	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	No	❖ Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access points during construction activities; ❖ Leslie Coal mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium
Geographic	Project commencement	Loss of and/or Damage to Agricultural Land and Infrastructure	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	No	❖ ensure that the project design and associated layout seeks to minimise the project	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										footprint, thus minimising the loss of agricultural land; will engage with each directly affected landowner with the intention to acquire only the required servitude area; ❖ Should Leslie Coal Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes – potentially as part of a lease agreement; ❖ Where damage is incurred, suitable compensation must be negotiated with the affected farmer; ❖ Prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase.						
Economic	Project commencement	Physical and economic displacement	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment; a Resettlement Action Plan and associated Livelihood Restoration Plan may be required. No affected farm	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										worker should be left without secure tenure or income; Implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement; ❖ Implement a Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances.						
Socio-cultural wellbeing	Project commencement	Disturbance of cultural, spiritual and religious sites	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	❖ Ensure that the community is included in decisions regarding cultural, spiritual and religious sites; ❖ Establish specific clan landowner protocols for activities that have spatial proximity to known sacred sites; ❖ Recommendations as indicated in the heritage impact assessment study should be implemented	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Institutional, Legal, Political and Equity	Project commencement	Increased pressure on municipal services	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ To limit, as far as reasonably possible, additional pressure on existing infrastructure and services; ❖ To work in partnership with government, industry, and relevant organisations to enhance the existing	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										infrastructure and services; ❖ To liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Project; ❖ To make available, maintain and effectively implement a grievance/complaints register that is easily accessible to all neighbours and affected stakeholders.						
Demographic Change/Socio-Cultural Wellbeing	Project commencement	Increased social pathologies linked to influx of workers and job seekers	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ To limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; ❖ to liaise openly and frequently with affected stakeholders to ensure they have information about the Project	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Socio-Cultural Wellbeing	Project commencement	Increased Nuisance Factors and Changed Sense of Place	*Moderate -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Minimise all nuisance factors such as noise, air quality, traffic, and visual-Implement all mitigation measures as specified in the relevant specialist studies; ❖ Make available, maintain and effectively implement a grievance/complaints register that is easily accessible to all neighbours and affected stakeholders; ❖ To liaise openly and frequently with	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										affected stakeholders to ensure they have information about activities that will generate nuisance factors.						
Operation																
Economic	Mining	Employment opportunities	*Moderate +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	❖ If possible a training and skills development programme for the local workers should be initiated prior to the operational phase; ❖ Effective implementation of training and skills development initiatives; ❖ Recruitment should be formalised and co-ordinated through the Department of Labour- avoid appointments at the gate of the mining operation;	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Economic	Mining	Multiplier impacts on the local economy	*Minor +*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Possible*	Low	Yes	❖ Preference should be given to capable subcontractors who based within the local municipal area; ❖ Align skills development to build capacity of SMMEs	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High
Economic	Mining	Community development through LED projects	*Minor -*	*Medium Term > 18 months < 5 years*	*Site or Local*	Low	*Definite*	Medium	Yes	❖ Maximise benefits from local employment, skills and economic development	*Major +*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High
Geographic/Socio-Cultural	Mining	Change in movement patterns	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	❖ Where possible ensure that access to fields and grazing areas are uninterrupted by providing alternative access routes and/or temporary access	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										points during construction activities; ❖ Leslie Coal mine should ensure that residents are kept informed on a day-to-day basis of construction progress and of when access will be blocked.						
Geographic	Mining	Loss of and/or Damage to Agricultural Land and Infrastructure	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Definite*	High	Yes	❖ Ensure that the project design and associated layout seeks to minimise the project footprint, thus minimising the loss of agricultural land; ❖ will engage with each directly affected landowner with the intention to acquire only the required servitude area; ❖ should Leslie Coal Mine acquire the full farm and the project footprint only affects a portion of the land, the surrounding usable land should be utilised for agricultural purposes – potentially as part of a lease agreement; ❖ Where damage is incurred, suitable compensation must be negotiated with the affected farmer; ❖ prepare a site Rehabilitation Plan that will be implemented as part of the decommissioning phase.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Economic	Mining	Physical and economic displacement	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Suitable mitigation measures should be defined that protect the farm workers and ensure that they are adequately provided for and supported should they be moved or lose their employment; ❖ a Resettlement Action Plan and associated Livelihood Restoration Plan may be required. ❖ No affected farm worker should be left without secure tenure or income; implement surface lease agreements with all community members who have grazing or ploughing land, this will minimise the impact of economic displacement; ❖ implement a Grievance Mechanism to ensure ongoing, proactive engagement and effective management of grievances.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Socio-cultural wellbeing	Mining	Disturbance of cultural, spiritual and religious sites	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Ensure that the community is included in decisions regarding cultural, spiritual and religious sites; establish specific clan landowner protocols for activities that have spatial proximity to known sacred sites; ❖ recommendations as indicated in the heritage impact	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										assessment study should be implemented						
Institutional, Legal, Political and Equity	Mining	Increased pressure on municipal services	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Limit, as far as reasonably possible, additional pressure on existing infrastructure and services; ❖ work in partnership with government, industry, and relevant organisations to enhance the existing infrastructure and services; ❖ liaise openly and frequently with affected stakeholders to ensure they have information about the proposed Project; and ❖ make available, maintain and effectively implement a grievance/complaints register that is easily accessible to all neighbours and affected stakeholders.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Demographic Change/Socio-Cultural Wellbeing	Mining	Increased social pathologies linked to influx of workers and job seekers	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	❖ Limit, as far as reasonably possible, social ills caused by influx of workers and job-seekers; liaise openly and frequently with affected stakeholders to ensure they have information about the Project. ❖ It should be noted that Leslie Coal Mine has no control over activities related to workers' behaviour, however	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
										it is recommended that HIV/AIDS campaigns are conducted within the affected area.						
Socio-Cultural Wellbeing	Mining	Increased Nuisance Factors and Changed Sense of Place	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Minimise all nuisance factors such as noise, air quality, traffic, and visual-Implement all mitigation measures as specified in the relevant specialist studies; ❖ make available, maintain and effectively implement a grievance/complaints register that is easily accessible to all neighbours and affected stakeholders; ❖ liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

10.3.12 Community Health

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Soil-, Water- and Waste-related Diseases	Influx of workers Mining activities	❖ Potential contamination with hydrocarbons and chemicals during construction	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Groundwater and surface water quality must be monitored; ❖ Restrict access to project-created water bodies; ❖ Conduct baseline water and sanitation studies;	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium

										❖ Ensure proper disposal of human waste generated from the project; ❖ Ensure proper waste management.						
Accidents/Injuries	Transport of goods and personnel Transport of staff Light vehicle traffic	❖ Change in morbidity and mortality data related to commercial motor vehicle (CMV) traffic on roadways ❖ Change in morbidity and mortality data related to non-commercial motor vehicle crashes.	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Engage the Local Municipality and interested and affected parties to assist with programmes targeted at improving traffic management and road safety in the study area; ❖ Develop a clear policy for the management of emergencies or accidents in the community as a direct result of the projects activities; ❖ Support with local safety and security as addressed in these specialist studies.	*Minor +*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Exposure to Potentially Hazardous Materials, Noise and Malodours	Diesel Particulate Matter Noise Blasting Exposure to noxious fumes Hazardous chemicals	❖ Pollutants and emissions released by construction activities may increase the prevalence of related respiratory illnesses and water related illnesses	*Moderate +*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Conveyor belts should be used where possible instead of haul trucks for the on-site transport of materials and rail transport should be considered where possible for off-site transport of ROM coal. ❖ All coal processing should be moved off site for Leslie 1C, and if possible, also for Leslie 1A. ❖ A comprehensive mitigation programme should be implemented on any remaining haul roads. ❖ A comprehensive, continuous air quality monitoring programme must be undertaken to ensure that mitigation measures are applied at all times to keep ambient air concentrations of PM_{10}	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low

										and $PM_{2.5}$ within the NAAQS over residential areas; ❖ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective; ❖ Environmental noise monitoring; ❖ Develop and implement a Storm Water Management Plan; ❖ Undertake groundwater and surface water monitoring.						
Operation																
Acute Respiratory Infections and Respiratory Effects from Housing	Influx of workers	❖ Change in the rates of respiratory diseases ❖ Increase in prevalence of respiratory illnesses if household is overcrowded ❖ Increasing prevalence of respiratory health outcomes.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Support community-based information campaigns related to TB symptoms and the need to seek care. ❖ Influx management and advice with regards to town planning to prevent overcrowding; ❖ Develop partnerships to support the community-based TB control programs in conjunction with the DoH and any NGOs.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Sexually Transmitted Infections, including HIV/AIDS	Influx of workers	❖ Change in the rates of STI ❖ Increasing the number of orphans and child headed households ❖ Increase the risk for transactional sex.	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Develop a HIV/AIDS policy that incorporates both the workplace and community considerations; ❖ Develop an integrated HIV management program that considers both the workplace and the community. ❖ Support (financial or otherwise) NGO groups active in the area on gender-based sexual violence;	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium

										❖ Support community-based condom distribution centres.						
Soil-, Water- and Waste-related Diseases	Influx of workers Mining activities	❖ Burden on water and sanitation infrastructure ❖ Potential contamination with hydrocarbons and chemicals during operations ❖ Unplanned developments may influence environmental health conditions and further contaminate surface water bodies ❖ Increase in income improves ability to afford basic environmental health services. This may result in a decline in cases of soil, water and sanitation-related diseases	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Groundwater and surface water quality must be monitored; ❖ Restrict access to project-created water bodies; ❖ Conduct baseline water and sanitation studies; ❖ Ensure proper disposal of human waste generated from the project; ❖ Ensure proper waste management.	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Food and Nutrition-Related Issues	Changes in Income and Expenditure Consumption Water Quality and Quantity Influx Change of Livelihoods and Practices	❖ Change in regional food cost ❖ Food inflation, increasing food deprivation, nutrition-related diseases ❖ Poor food hygiene and quality of food services	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Reduce project-related communicable diseases that may impact nutrition; ❖ Food inflation management as part of social program ❖ Support local procurement of food items in combination with incentives to increase local production.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

		may increase food-related illnesses ❖ More consumption of fast food related to increased income may increase non-communicable (lifestyle) diseases													
Accidents/Injuries	Transport of goods and personnel Transport of staff Light vehicle traffic	❖ Change in morbidity and mortality data related to commercial motor vehicle (CMV) traffic on roadways ❖ Change in morbidity and mortality data related to non-commercial motor vehicle crashes.	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Engage the Local Municipality and interested and affected parties to assist with programmes targeted at improving traffic management and road safety in the study area; ❖ Develop a clear policy for the management of emergencies or accidents in the community as a direct result of the projects activities; ❖ Support with local safety and security as addressed in these specialist studies.	*Minor +*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Exposure to Potentially Hazardous Materials, Noise and Malodours	Diesel Particulate Matter Noise Blasting Exposure to noxious fumes Hazardous chemicals	❖ Change in morbidity and mortality data from poor air quality events ❖ Pollutants and emissions released by construction and operational activities may increase the prevalence of related respiratory illnesses and water related illnesses	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Conveyor belts should be used where possible instead of haul trucks for the on-site transport of materials; ❖ All coal processing should be moved off site for Leslie 1C, and if possible, also for Leslie 1A if possible. ❖ A comprehensive mitigation programme should be implemented on any remaining haul roads. ❖ If off-site rail transport is used together with on-site conveyor belts at Leslie 1A, and the coal processing plant is kept, all possible mitigation measures	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low

		❖ Influx of people into the area may increase domestic activities, including the use of domestic fuel, pesticides resulting in increased air pollution and associated Increases in the prevalence of related respiratory illnesses								must be undertaken to limit the emissions of PM2.5 and PM10 from the coal processing plant. ❖ A comprehensive, continuous air quality monitoring programme must be undertaken to ensure that mitigation measures are applied at all times to keep ambient air concentrations of PM10 and PM2.5 within the NAAQS over residential areas; ❖ Mining related machines and vehicles to be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective; ❖ Environmental noise monitoring; ❖ Develop and implement a Storm Water Management Plan; ❖ Undertake groundwater and surface water monitoring.						
Social Determinants of Health	Influx of persons into surrounding communities	❖ Change in morbidity and mortality data related to psychosocial distress ❖ Change in median household income ❖ Change in unemployment ❖ Change in the percentage of households	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Social management plans and recommendations as part of the SIA; ❖ Reduce substance-abuse and improve social cohesion; ❖ Supporting education programs with a gender equity focus; ❖ Plan for mine closure; ❖ Identify and support vulnerable groups; ❖ Support graduate training programs for the youth in the community	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium

		living below poverty line ❖ Change in educational attainment ❖ Increase in xenophobia, violence, crime, prevalence of substance abuse and gender violence ❖ With the expected population growth and influx of job seekers, who may bring their families along, household size may increase resulting in overcrowding ❖ Construction workers and an influx of national and international people in search of economic opportunities are expected to put enormous pressure on the South African Police Services and immigration control ❖ Increase in psychosocial problems, as a result of retrenchment at decommissioning phase A positive impact on poverty														

		status for a small number of people employed at the Leslie 1 Project site ❖ Influx of people and increased income may result in illegal substances being available more freely															
Cultural Health Practices	Influx of persons into surrounding communities	❖ More people are practicing and using traditional medicine which may contribute to reducing the health burden if they are trained and knowledgeable ❖ Negative health outcomes	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Develop a disease-prevention plan that involves traditional healers.	*Minor +*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium
Health Systems Issues	Influx of persons into surrounding communities	❖ Change in ratio of people to health care providers ❖ Change in time needed for emergency response ❖ Influx of people resulting in overburdened health facilities with inadequate health service ❖ Overburdened community health facilities, inadequate	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Influx management and supporting health facilities to cope with the increased population if related to project; a ❖ Support community volunteer programs through expansion of the community-based peer health educator group.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

		health service resulting from more people in the area														
Non-Communicable Diseases	creased incomes increased availability of tobacco, alcohol and narcotic drugs	❖ High costs associated with absenteeism due to ill health; ❖ Loss of trained or skilled people from the workforce as a result of disease. ❖ Impact on the family unit with potential social and behavioural impacts.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	-	❖ Support health education programs as part of a community-based peer health educator program; ❖ Support the local healthcare personnel with training on disease-management programs and the recognition of NCD symptoms and management thereof; ❖ Support healthcare facilities with diagnostic medical hardware, where feasible.	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Closure and Decommissioning			-	-	-	-	-	-	-		-	-	-	-	-	-
Acute Respiratory Infections and Respiratory Effects from Housing	Influx of workers	❖ Loss of income due to retrenchment	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	❖ Support community-based information campaigns related to TB symptoms and the need to seek care. ❖ Influx management and advice with regards to town planning to prevent overcrowding; ❖ Develop partnerships to support the community-based TB control programs in conjunction with the DoH and any NGOs.	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium
Sexually Transmitted Infections, including HIV/AIDS	Influx of workers	❖ Loss of income during closure and decommissioning phase of the Project may cause people to get involved in prostitution	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Develop a HIV/AIDS policy that incorporates both the workplace and community considerations; ❖ Develop an integrated HIV management program that considers both the workplace and the community. ❖ Support (financial or otherwise) NGO	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium

										groups active in the area on gender-based sexual violence; and ❖ Support community-based condom distribution centres.						
Social Determinants of Health	Influx of persons into surrounding communities	❖ Increase in psychosocial problems, as a result of retrenchment at decommissioning phase A positive impact on poverty status for a small number of people employed at the Leslie 1 Project site	*Major -*	*Long Term > 5 years*	*Regional*	High	*Possible*	High	Yes	❖ Social management plans and recommendations as part of the SIA; ❖ Reduce substance-abuse and improve social cohesion; ❖ Supporting education programs with a gender equity focus; ❖ Plan for mine closure; ❖ Identify and support vulnerable groups; and ❖ Support graduate training programs for the youth in the community	*Minor -*	*Long Term > 5 years*	*Regional*	Medium	*Possible*	Medium

10.3.13 Climate Change

Affected Environment	Activity	Impact Description	Before Mitigation						Cumulative Impact	Mitigation measures / Recommendations	After Mitigation					
			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance			Magnitude	Duration	Spatial Scale	Consequence	Probability	Significance
Construction																
Climate	Construction of the Leslie 1 Project	Greenhouse Gas Emissions	*Minor -*	*Short Term < 18 months*	*National/International*	Medium	*Definite*	Medium	Yes	The major mitigation action related to the Leslie 1 Coal Mine is the selection of mining method. In this regard the proposed Leslie 1 Coal Mine has selected underground mining as mining method which, in comparison to open pit mining, is a much less emission intensive option.	*Minor -*	*Short Term < 18 months*	*National/International*	Medium	*Definite*	Medium
Operational																
Climate	Mining of coal	Greenhouse Gas Emissions	*Minor -*	*Permanent*	*National/International*	Medium	*Definite*	Medium	Yes	The major mitigation action related to the Leslie 1 Coal Mine is the selection of mining method. In this regard the proposed Leslie 1 Coal Mine has selected underground mining as mining method which, in comparison to open	*Minor -*	*Permanent*	*National/International*	Medium	*Definite*	Medium

										pit mining, is a much less emission intensive option.						
Climate	Mining of coal and combustion of coal	Greenhouse Gas Emissions	*Major -*	*Permanent*	*National/International*	High	*Definite*	High	Yes	The proposed coal mine would need to mitigate its greenhouse gas emissions to reduce its contribution to national emissions and climate change. Hybridising the power plant by substituting the source of thermal energy away from coal towards more carbon neutral sources.	*Minor -*	*Permanent*	*National/International*	Medium	*Definite*	High

10.4 Summary of Specialist Reports

A summary of the specialist reports has been provided in Chapter 8, Subchapter 9.2, Subchapter 9.3, and in the specialist reports in Appendix D. Table 10-134 provides a high-level summary of the specialist reports.

Table 10-134: Specialist report summary.

List of Studies Undertaken	Recommendations of Specialist Studies	Specialist recommendations included in the EMPr	Cross reference in the report (subchapters)
Soil, Land Use and Land Capability	All recommendations and mitigation/management measures contained in the specialist reports have been included in Subchapter 9.3 of this report.	All feasible recommendations and mitigation/management measures contained in the specialist reports have been included in the EMPr	❖ 8.4 ❖ 9.2.1 ❖ 9.3.1
Surface Water			❖ 8.5 ❖ 9.2.2 ❖ 9.3.2
Groundwater			❖ 8.6 ❖ 9.2.3 ❖ 9.3.3
Biodiversity			❖ 8.7 ❖ 9.2.4 ❖ 9.3.4
Air quality			❖ 8.8 ❖ 9.2.5 ❖ 9.3.5
Noise			❖ 8.9 ❖ 9.2.6 ❖ 9.3.6
Blasting and Vibration			❖ 8.10 ❖ 9.2.7 ❖ 9.3.7
Visual			❖ 8.11 ❖ 9.2.8 ❖ 9.3.8
Traffic			❖ 8.12 ❖ 9.2.9 ❖ 9.3.9
Heritage and Palaeontology			❖ 8.13 ❖ 9.2.10 ❖ 9.3.10
Social			❖ 8.14 ❖ 9.2.11 ❖ 9.3.11
Community Health			❖ 8.15 ❖ 9.2.12 ❖ 9.3.12
Climate Change			❖ 8.16 ❖ 9.2.13 ❖ 9.3.13

10.5 Unplanned Events, Risks and Management Measures

Risks have been identified in Subchapter 9.2 and addressed in Subchapter 9.3.

10.6 Environmental Impact Statement

A detailed description of the methodology utilised to determining the environmental impacts and their respective probability, magnitude and severity is provided in Subchapter 9.3 as well as in the specialist reports contained in Appendix D.

During the risk assessment process, it was found that the proposed project would result in a number of impacts with a "**High Negative**", as well as a "**High Positive**", significance rating post-mitigation. Only these impacts have been discussed Table 10-135.

Table 10-135: Key Findings with high Impacts

Specialist Studies	Environmental Aspect	Finding	Significance After Mitigation
Negative Impacts			
Soil, Land Capability and Agricultural Potential	Soil	Disturbance of in situ horizon organisation	High
	Land Capability	Loss of arable land capability	High
	Land Use	Change in land use from agriculture to mining	High
Visual	Visibility	Light pollution at night	High
Positive Impacts			
Social	Project commencement Mining Activities	Employment opportunities	High
		Multiplier impacts on the local economy	High
		Community development through LED projects	High

It must be noted that although there are high negative impacts post mitigations, these do not constitute fatal flaws.

11 Information for Consideration and Inclusion

11.1 Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions and limitations are applicable to this EIA report:

- All information provided to Kongiwe Environmental, AOL and I&AP's, was correct at the time it was provided;
- It is assumed that the 5 mining areas identified by AOL and its engineers represent technically feasible sites for the establishment of the underground mining operations;
- This report and its investigations are project-specific, and consequently the environmental team did not evaluate any other mining alternatives;
- The assumptions and/or limitations and/or gaps in knowledge have been extracted from the specialist reports and are included below;
- The impact of overlapping mineral rights of the Leslie 1 Project and Pan African Resources (PAR) Evander Gold project could not be assessed due to the fact that no information was provided by PAR, even though multiple requests for this information were made. It must be noted that the MPRDA allows for the overlap of mineral rights for different mineral resources over the same area, and thus the overlapping rights of the Leslie 1 Project and PAR's prospecting and mining activities is not a fatal flaw. This is further demonstrated by the successful mining of coal and gold simultaneously over the same areas in the Evander area over a period of the last 80 years. It is the view of the EAP that the DMR must instruct applicant and PAR to set up a working forum prior to the commencement of any mining activity where there are overlapping rights to ensure that there is understanding between the parties as to where surface infrastructure is to be placed, who is mining where and when, where intersecting boreholes are, and management of water and environmental liabilities between the parties.

11.1.1 Soil, Land Capability and Land Use

A study of this nature will inherently contain various assumptions and limitations. The following **assumptions** were made during the assessment and reporting phases:

- It is assumed that the Applicant, Engineers and representative EAP have concluded site investigations that are project-specific. Consequently, this study did not evaluate any other mining alternatives;
- It is assumed that the project layout, installation and operation procedures have been designed to minimise environmental impacts as far as possible;
- It is assumed that the seasonality of the assessment was adequate to assess the present soil forms, and did not affect the outcome of the agricultural potential of the land. Fieldwork was undertaken from 3rd April 2018 to 6th April 2018 and 11th April to 13th April, during the region's Autumn months;
- It is assumed that all the information provided by the Applicant, EAP and consulted farmers / landowners is accurate and current to the Leslie 1 Project;

- It is assumed that the laboratory analysis conducted on the soil samples was undertaken by a SANS accredited laboratory, and that the testing and analysis of the samples was completed by a competent professional with the relevant experience;
- It is assumed that soil nutrient deficiencies or toxicity will be rectified through liming and/or fertilisation, therefore fertility status was not considered as a limitation to the current agricultural potential of the land; and
- It is assumed that the databases (GIS and survey data) used for the compilation of this report represent the most accurate and up-to-date information available at the time.

The following **limitations and gaps in knowledge** exist with regard this study. Cognisance of the following limitations and gaps in knowledge have been taken into account when assessing and formulating the conclusions of the soil report:

- Since mining of the Leslie 1 Project is expected to be by means of underground methods, the detailed soil survey was focused on the surface infrastructure areas of Leslie 1A and 1C. Box-cuts/portals in Leslie 1B, 1D and 1E were also investigated.
- While predictive soil mapping techniques can be applied for soil assessment of larger areas (such as those of the underground mining areas), it is not appropriate for the Leslie 1 project area as the area is known for great heterogeneity in soil forms.
- Sampling by definition means that not all areas are assessed, and therefore some aspects of soil and land capability may have been overlooked in this assessment. However, it is the opinion of the professional specialist that this assessment was carried out with sufficient sampling and in sufficient detail to enable the applicant, the EAP and the regulating authorities to make an informed decision regarding the proposed activities;
- A 150m X 150m intense grid soil survey was conducted on those portions of the Project Area where surface infrastructure, as originally defined by the client, is to be located. Any changes in the project boundary subsequent to the provided information may negatively impact the robustness of this report;
- For the Box-cut areas/portal, haul roads design and placements were not provided and therefore could not be sampled;
- The soil profiles were observed using a 1 500mm hand-held soil auger. A description of the soil characteristics deeper than 1 500mm cannot be given;
- A few landowners and farmers shared information on crop yields during the site visit. This data has not been verified by assessment of precision harvester yields, etc. as these were not available;
- As it was not possible to conduct an intense grid survey on the entire project areas, it is unlikely that the soil map units have been delineated with 100% accuracy. Soil map units could include other soil type(s) as the boundaries between the mapped soils are not absolute, but rather a continuum of a gradual change from one form to another.

11.1.2 Surface Water

None

11.1.3 Groundwater

The numerical modelling is based on the following assumptions:

- Aquifer parameters were inferred from studies completed at the adjacent Springboklaagte mine. No site-specific data is available for the project area at present.
- The source characterisation used for the project was inferred from a study completed at Springboklaagte mine in the absence of site-specific information.
- Only advective transport of contaminants was simulated. Assumptions made regarding advection, are discussed below. While it is acknowledged that attenuation will take place in the soils, there is currently insufficient information available to quantify the extent to which this takes place. As such, simulations are based on the precautionary principle and take the worst-case scenario into consideration
- The extent of the numerical model is based on natural groundwater barriers, as discussed below. These include water divides, as well as rivers and streams.
- The extent and timing of mining was obtained from the Mine Works Programme.

Uncertainties with the numerical groundwater modelling are approached conservatively, based on the precautionary principle, to ensure that the predictions and impact assessment in this report addresses the maximum potential impact of the proposed development. The uncertainties in the model include:

- **Uncertainties regarding aquifer conditions within the Leslie 1 project area:** The impact assessment is based on aquifer conditions identified for the adjacent Springboklaagte mine. It cannot be confirmed with certainty that the same conditions will prevail at the Leslie 1 project.
- U**ncertainties regarding borehole depth, construction and geology intersected:** This information is not available for the hydrocensus boreholes. For this reason, it was assumed that all hydrocensus boreholes target the fractured rock aquifer.
- **Uncertainties regarding the borehole elevations: T**he elevations used for the hydrocensus boreholes during simulations were inferred from hand-held GPS measurements and inaccuracies may occur. It is however thought that the error in elevation will not exceed the calibration error of 5 m.
- **Mathematical modelling uncertainties:** It is not possible with the available information to quantify the heterogeneity present in the aquifers simulated. For this reason, there are inherent uncertainties in the model. The level of confidence in the model can be improved with the incorporation of additional monitoring data.

11.1.4 Biodiversity

11.1.4.1 Terrestrial

The following limitations should be noted for the study:

- As per the scope of work, the fieldwork component of the assessment comprised one assessment only, that was conducted during the wet season. This study has not assessed any temporal trends for the respective seasons;
- The scope of work for the project did not include blasting as a potential impact during the construction or operational phase. However, if such action is to be taken the authors of this report must be contacted to consult on further mitigation measures which will need to be taken to prevent undue disturbance to fauna in the area;
- The assessments were conducted on those portions of the Project area as originally defined by the client, any changes in the project boundary subsequent to this may negatively impact the robustness of this report;
- No detailed activity list for the Proposed Project was provided and therefore the risk assessment has been completed based on presumptions for standard underground mining operations;
- The impact assessment was completed for the proposed mining areas and supporting infrastructure for the Project area. The impact assessment has considered these layouts to be final, and have not considered the No Go alternative; and
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

11.1.4.2 Aquatic

The following limitations should be noted for the study:

- A single aquatic ecology survey was completed for this assessment. Thus, temporal trends were not investigated.
- No wetlands were considered in this study.
- Due to the rapid nature of the assessment and the survey methods applied, fish diversity and abundance was likely to be under estimated.
- Invertebrates were only considered to the Family level and thus a defined species list for aquatic invertebrates was not completed.
- Only sites in proximity to proposed activity (project area) were selected for this assessment.
- Access within the project area was limited to areas where access by local land owners had provided consent. Sites were selected with this considered. An additional survey has been recommended to cover gaps in this study.
- Sites where raw sewage was observed were not considered for assessment due to health risks to the aquatic ecology practitioner.
- The proposed activities listed in this study are based on the assessment of several existing underground coal mine activities. A number of assumptions have been made through the compilation of the activity list.

11.1.4.3 Wetland

The following aspects were considered as limitations:

- Most of the project area is characterised by sub-surface flows which in some cases seep out and subsequently contribute to the formation of wetland conditions within the first 50cm (from ground level). Given the size of the areas characterised by these sub-surface flows and the lack of wetland indicators throughout the project area, limitations exist in the accuracy of the delineation of seeps;
- Delineations have only been assigned to wetlands within the vicinity of the proposed infrastructure. These delineations end abruptly once the infrastructure area is outside of the wetland's reach;
- Limitations did exist regarding access of some of the areas. Therefore, some of the delineations have been completed at a desktop level only, with extrapolations from field surveys; and
- The GPS used for water resource delineations is accurate to within five metres. Therefore, the wetland delineation plotted digitally may be offset by at least five m to either side.

11.1.5 Air Quality

As the proposed Leslie 1 Project is still in the planning phase, many of the parameters required for the modelling were unavailable. Furthermore, no site-specific particle size fraction data, moisture content or clay content information was available. Therefore, use was made of averages from similar processes (US EPA, 1995) for many of the parameters, and in some cases, conservative estimates and 'worst-case' values were used in the model.

Although CHPPs were planned for both Leslie 1A and 1C, the location and size of these was not included in the proposed infrastructure diagrams in the DSR for the mine (Kongiwe , 2018). For the purposes of modelling, an area equivalent to the proposed mine infrastructure was used for these CHPPs, and it was assumed that they would be located in the area of the ROM stockpiles positions indicated i. It was assumed that primary crushing will take place in the mine to reduce the ROM to a size suitable for transport on the conveyor belt. Secondary and tertiary crushing and screening was included in the modelling of the CHPP.

It was assumed that the conveyor belt for transportation of ROM coal from the Leslie 1A western block to the CHPP on Leslie 1A eastern block will be in place from the first year of production i.e. coal will not be trucked from the western block to the eastern block at all.

It was assumed that the waste dumps indicated on the mine layout plan (Kongiwe, 2018) were to be used for storage of overburden, and that all discard from the CHPPs would be removed to the co-disposal discard dumps. The amount of discard was calculated as 386 Mt tons of coal produced less the 124.696 Mt product coal (Kongiwe, 2018) divided over the 32 years of expected production.

Whilst care has been taken to assess the potential air pollution impact from the proposed mining, more accurate input data may result in different conclusions.

The closest weather station to the proposed project is the Eskom monitoring station in Leandra. However, upper air soundings are not available from this weather station, and data is only available up to the end of 2014. For this reason, WRF modelled data was used for the modelling.

It should be noted that isopleth plots reflecting the 24-hour averaging periods contain only the highest predicted ground level concentrations for that averaging period, over the entire three-year period for which simulations were undertaken. It is therefore possible that, even though a high average daily concentration is predicted to occur at certain locations, this may only be true for one day during the entire period.

Tailpipe emissions were not included. Although the activities at the proposed Leslie 1 Project would emit gases, primarily by haul trucks and mining vehicles, the impact of these compounds were not included in this assessment. The sulphur content of South African diesel is too low (0.05% for Sasol Turbodiesel ™) and mining equipment is too widely dispersed over mine sites to cause sulphur dioxide (SO_2) levels to be exceeded even in mines that use large quantities of diesel.

The scope of the work only covers ambient concentration impacts beyond the mine's boundaries, occupational health issues were not addressed.

11.1.6 Noise

11.1.6.1 Measurements of Ambient Sound Levels

- This study collected measurements at three locations for more than 100 hours in 10-minute bins. It is assumed that the measurement locations represent other residential dwellings in the area (similar environment), yet, in practice this can be highly erroneous as there are numerous factors that can impact on ambient sound levels, including:
  - the distance to closest trees, number and type of trees as well as the height of trees;
  - available habitat and food for birds and other animals;
  - distance to residential dwelling, type of equipment used at dwelling (compressors, air-conditioners, pumps, etc.);
  - general maintenance condition of house (especially during windy conditions); and
  - number and type of animals kept in the vicinity of the measurement locations.
- This study found that traffic in the area was very low, yet it cannot be assumed that it is always low.
- While the windshields used limits the effect of fluctuating pressure across the microphone diaphragm, the effect of wind-induced noises in the trees in the vicinity of the microphone did impact on the ambient sound levels. The site visits unfortunately coincided with a relatively windy period

11.1.6.2 Calculating Noise Emissions – Adequacy of Predictive Methods

The noise emissions into the environment from the various sources as defined will be calculated for the operational phase in detail, using the sound propagation model described in ISO 9613-2. The following was considered:

- The octave band sound pressure emission levels of processes and equipment;
- The distance of the receiver from the noise sources;
- The impact of atmospheric absorption;

- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Topography and conceptual layouts,
- Acoustical characteristics of the ground. 50% soft ground conditions were modelled, as the area where the mining activity would be taking place is well vegetated and sufficiently uneven to allow the consideration of relatively soft ground conditions. This is because the use of hard ground conditions could represent a too precautionary situation.

The noise emission into the environment due to additional traffic were calculated using the sound propagation model described in SANS 10210. Corrections such as the following were considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used;
- Ground acoustical conditions

Sound or noise levels generally refers to a sound pressure level as measured using an instrument, whereas the noise rating level refers to a calculated sound exposure level to which various corrections and adjustments was added. These noise rating levels are further processed into a 3D map illustrating noise contours of constant rating levels or noise isopleths. In this project it illustrates the potential extent of the calculated noises of the complete project and not noise levels at a specific moment in time. It is used to define potential issues of concern and not to predict a noise level at a potential noise-sensitive receptor. For this the selected model is internationally recognised and considered adequate.

11.1.6.3 Adequacy of Underlying Assumptions

There are a number of assumptions that is important to note, including:

- Mitigation (specifically the relocation of the closest NSD) will be implemented during the construction phase, before the start of the operational phase;
- The mine will use available topsoil and overburden to develop berms around the mining operation. There will be a berm of at least 3 metre height around certain mining infrastructure limiting the line of sight to the mining operation.

11.1.6.4 Uncertainties of Information Provided

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to model noise levels accurately at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. Assumptions include:

- At the time this report was written, the potential locations of ventilation fans were not defined. This study will locate ventilation fans close to the access portals (at each portal);

- The octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of this processes/equipment. The determination of these levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;
- Sound power emission levels from processes and equipment change depending on the load the process and equipment is subject too. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load. Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worse-case scenario;
- As it is unknown which processes and equipment will be operational (and when operational and for how long), modelling considers a scenario where all processes and equipment are under full load for a set time period. Modelling assumptions complies with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely over-estimate noise levels;
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor;
- XYZ topographical information is derived from the ASTER Global DEM data, a product of METI and NASA. There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify;
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. 50% soft ground conditions will be modelled as the area where the operation is taking place is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

11.1.7 Blasting and Vibration

The following assumptions have been made:

- The project is a greenfields project with no drilling and blasting operations currently active.
- 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 no data is available from this operation for a confirmation of the predicted values as it is a greenfields site with no current blasting activities.
- The project is at a stage where specific portal designs are not yet available. Possible locations were indicated and these locations used. To establish possible influences a portal layout similar to the client’s Leslie 2 project was used. The information from this layout is best estimates.

- Blast Management & Consulting was not involved in the blast design.
- The work done is based on the author's knowledge and information provided by the project applicant.

11.1.8 Visual

Only a preliminary mine layout was available. Detailed dimensions, such as the vertical offset of proposed surface infrastructure above ground level, were however not available, and were assigned based on consultation with the Environmental Project Manager and experience from similar infrastructure in previous projects. All viewsheds were based off terrain level. As such these viewsheds do not incorporate distractive views in the form of vegetation or land use (infrastructure, buildings, etc.).

The validity of third party data, such as elevation, land use and vegetation cannot be guaranteed as no ground-truthing or data validation procedures were used. This level of assessment excludes surveys to establish viewer preference and thereby their sensitivity. For example, localized visual perceptions of the economically depressed communities may be influenced rather by the short term economic and job opportunities that will exist rather than the direct visual perception of the project; and the major limitation of this study is the unavoidable subjectivity relating to the assessment of the visual impact. Findings will also be restricted to information on hand, as well as the quality of spatial data.

11.1.9 Traffic

None.

11.1.10 Heritage and Palaeontology

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the current dense vegetation cover. As such, should any heritage features and/or objects not included in the present inventory be located or observed, a heritage specialist must be contacted immediately.

11.1.11 Social

- The study is based on data obtained from the community survey, 2016, which may not reflect accurate information;
- Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion;
- It should be noted that the social environment is a dynamic, constantly changing entity. It is therefore not always possible to predict all social impacts to a very high level of accuracy. Care has been taken to identify the most likely and significant impacts in the most appropriate way for the current local context;
- Social impacts can be experienced by affected communities on an actual or a perceptual level. It

is therefore not always possible to quantify social impacts properly;

- It should be noted that predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of impact assessment- the specialist has attempted to assess (where possible) the impact during the decommissioning phase.

11.1.12 Community Health

The following are the recognised limitations of the study:

- The specialist team was denied access into healthcare facilities (by the Department of Health) to conduct interviews with key informants at the time of field visit. At this point in time Niara is still awaiting written approval from the DoH –email correspondence between Niara cHIA Specialist and the relevant DoH personnel has been appended to the specialist Report (Appendix C)
- The study often refers to local level data which has some limitations that need to be understood and respected. Recording and reporting of the health data within the visited Healthcare facilities is completed manually and it is likely that the recording may lack required accuracy. However, this information is invaluable in understanding the health challenges in the area, although the limitation must be considered when evaluating information, as its ability to be used as a robust baseline and to monitor relevant health impacts is limited; and
- FGDs are normally based on respondents' self-declaration which may be prone to recall or response bias. Moreover, when it comes to questions on one's private life, study participants tend to be affected by a social desirability bias, where they may choose to give answers that are socially acceptable;
- As the proposed Leslie 1 Project is still in the planning phase, many of the parameters required for the Air Quality Modelling were unavailable. Average values from the literature were used for many of the parameters, and in some cases, conservative estimates and 'worst-case' values were used in the model. Whilst care has been taken to assess the potential air pollution impact from the proposed mining activities, more accurate input data may result in different conclusions.

This study must be viewed as a prospective / predictive study as the Project is still in the Environmental Application Phase.

The study does not address classic occupational health concerns (e.g., physical hazards or environmental hazards encountered by workers), which are referred to as 'inside the fence' and are addressed by federally mandated health and safety protocols enforced by the department of Labour and Occupational Health and Safety Act 85 of 1993.

11.1.13 Climate Change

None.

11.2 Aspects for inclusions as considerations of the Environmental Authorisation

Should the DMR grant EA for this project, it should be subject to the following conditions:

- The project may not commence prior to the EA being issued;
- The project should remain in full compliance with the requirements of the EMPr and with all regulatory requirements;
- The EMPr should be implemented by qualified environmental personnel who have the competence and credibility to interpret the requirements of the EMPr. Such persons must be issued with a written mandate by Leslie Coal Mine management to provide guidance and instructions to employees and contractors;
- Leslie Coal Mine should conduct annual internal auditing of environmental performance and annual reporting to the DMR;
- Leslie Coal Mine must undertake annual external auditing of the environmental performance and provide the DMR with a copy of the auditing report;
- Stakeholder engagement must be maintained during the construction, operational and closure/rehabilitation phases of the project, with the emphasis on the continuing provision of information; and
- The EMPr and EIA are dynamic documents. Since the Leslie 1 project is being implemented in phases over a number of years (35 years), it is recommended that the EMPr and the EIA be updated prior to the start of activities in the new mining areas, specifically for Leslie 1B, 1C and 1D, which will only be mined years after the start of the project.

Furthermore, should the EIA be granted, the following conditions should be included and / or taken into account:

- Compilation of a Mine Area and species-specific Biodiversity Monitoring and Action Plan to be implemented for the duration of the life of mine;
- Compilation of a Closure & Rehabilitation Plan to be implemented for the duration of the life of mine. This plan must make provision for continuous rehabilitation as well as the rehabilitation upon closure of the mine.
- Compilation of a plant Search and Rescue plan for Species of Conservation Concern.
- Permits for removal of protected plant species need to be obtained from the DAFF.
- Compilation of an Alien and Invasive Species Plan to be implemented for the duration of the life of mine;
- Compilation of an Erosion and Sediment Control Programme during the life of mine;
- A spill containment plan is required to be in place prior to construction.
- Compilation of a Water Management Plan aimed at reducing and/or eliminating adverse impacts on the receptors identified. These include existing private groundwater users, wetlands, rivers and streams
- Water Management Plan to include the compilation of a Water Quality Monitoring programme should be implemented before construction of the Pit to assess the impact on the surrounding water bodies
- A Chance Find procedure for heritage resources and artefacts needs to be in place.

- Compilation of a Community Development Programme to be implemented through the life of mine;
- Implement design elements to exclude the burial grounds with a 50-metre buffer. If this is not possible, a detailed grave relocation process must be implemented as required under the NHRA and National Health Act regulations.
- Confirm the depth of private boreholes, as well as the pump installation depth of boreholes currently in use. Record the pre-mining safe yield and groundwater demand associated with each hydrocensus borehole identified, even those outside the zone of impact during the Construction Phase. It is important to record this information prior to mining to ensure that baseline information is available for each private borehole that is in use;
- Undertake a baseline structural survey within the blasting zone of influence;
- Prior to undermining any area, and with specific reference to the existing overlap of Lebogang Township with the MRA, possible future extensions to Lebogang Township and the potential development at Grootlaagte portion 7, it is deemed that a land survey be undertaken to determine surface features and infrastructure and then a geotechnical assessment be performed. These assessments must inform the Life of Mine plan and the mine plan must be evolve and be revised to ensure that these structures are secure and safe from any form of surface subsidence or distortion. The applicant must demonstrate competence to the DMR in the ability to undermine these areas, as well as abide by all legislation relating to underground mining.

11.3 Proposed Management objectives and outcomes for inclusion in the EMPr

The EMPr is compiled with the aim of achieving a required end state that, as far as possible, ensures that environmental quality is maintained. The EMPr describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored. Moreover, the EMPr will address the environmental impacts during the construction, operational, decommissioning (where applicable post-closure) phases of the Project. Due regard must be given to environmental protection during the entire Leslie 1 Project, and a number of environmental recommendations are made in this regard. These recommendations are aimed at ensuring that the contractor maintains adequate control over the Project to:

- Minimise the extent of an impact during the life of the Leslie 1 Project;
- Maintain a state of Environmental Quality following completion of the Leslie 1 Project;
- Ensure appropriate restoration of areas affected by the Leslie 1 Project; and
- Prevent long term environmental degradation.

The impact management objectives and outcomes for the Leslie 1 Project are as follows:

- To minimise the negative environmental impacts as far as feasible;
- To maximise the positive and minimise the negative socio-economic impacts;
- To capture, contain, treat and recycle all contaminated water arising from the mining operations on site and to prevent the discharge of contaminated water to the environment;
- To minimise the safety and congestion impacts of traffic due to the mining operation by limiting coal trucking to daylight hours, strict enforcement of traffic regulations and road rules, avoiding

trucking during peak hours and addressing road maintenance needs in cooperation with the road authorities;
- To soften the visual impact of the project by applying the recommended mitigation measures; and
- To maintain cordial relationships with local residents, authorities and other stakeholders via sustained open communication.

11.4 Rehabilitation Requirements

As the mine is an underground mine, there will be no concurrent rehabilitation. Final rehabilitation will be carried out once the Leslie 1 Project goes into its closure phase. This final rehabilitation will be carried out within the context of the closure plan.

The principles for proper rehabilitation, which should be followed, are:

- Preparing a comprehensive rehabilitation plan prior to the commencement of all mining areas;
- Landform design (levelling, top-soiling) and seeding;
- Maintenance management and eradication of invader species; and minimising the area cleared for mining and associated facilities to that which are absolutely necessary for the safe operation of the mine.

The objective of the final rehabilitation, decommissioning and mine closure plan, which must be measurable and auditable, is to identify a post-mining land use that is feasible through:

- Providing the vision, objectives, targets and criteria for final rehabilitation, decommissioning and closure of the project;
- Outlining the design principles for closure;
- Explaining the risk assessment approach and outcomes and link closure activities to risk rehabilitation;
- Detailing the closure actions that clearly indicate the measures that will be taken to mitigate and/ or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- Committing to a schedule, budget, roles and responsibilities for final rehabilitation, decommissioning and closure of each relevant activity or item of infrastructure;
- Identifying knowledge gaps and how these will be addressed and filled;
- Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- Outlining monitoring, auditing and reporting requirements.

11.5 A reasoned opinion: Should the Leslie 1 Project be approved?

Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Leslie 1 Project can be mitigated to within acceptable limits and that the project should be authorised.

This opinion holds provided all the recommendations proposed in the specialist studies and the EIA and EMP as well as legislative requirements are implemented and adhered to.

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

The findings of the impact assessment have shown that the Leslie 1 Project would conclusively result in certain negative impacts to the environment, however, none of the specialist studies objected to the project. Moreover, the scientific specialist mitigations measures have been included into this EIA and EMP Report to reduce the significance of all the identified negative impacts. Most negative impacts can be reduced through the implementation of mitigation measures.

Leslie 1 is an underground project with minimal surface infrastructure, which thereby reduces the negative effects on agriculture, which is an important sector in the area. By avoiding areas of high agricultural potential, the two activities can co-exist.

The potential positive impacts include the creation of jobs, generation of wealth within the community and an additional coal resource towards the economy. The quality of coal makes it suitable for use in the domestic thermal market (Eskom). The Leslie 1 Project will thus facilitate the planned mining activities and will have rollover benefits in terms of local employment, local economic development and, increased government revenue and taxes.

11.6 Period for which Environmental Authorisation is required

The EA is required for a period of 30 years.

11.7 Other information requirements

These have been discussed throughout the EIA report. For each additional information requirement, the applicable Chapter and/or Subchapter will be referenced.

11.7.1 Oath Undertaking

The EAP hereby confirms:

- The correctness, to the best of his knowledge, of the information provided in the specialist reports and on information provided by Leslie Coal Mine (Pty) Ltd. The information was accepted as being as reliable as information generated during an EIA and a feasibility study, and provided in good faith, can be;
- The inclusion of comments and inputs from stakeholders and I&APs;
- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- The acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

12 Financial Provision

The Rehabilitation, Decommissioning and Mine Closure Report is included in Appendix D17.

12.1 Closure Cost Methodology

The closure cost calculation has been performed in accordance with NEMA GN R1147 of 2015 Financial Provision Regulations. The methodology employed to calculate the closure costs is detailed in Section 15.1.3 of the Rehabilitation, Decommissioning and Mine Closure Report. Section 15.1.3.1 presents the potential unplanned closure costs (worst case scenario) for year 1 of the Project. Rehabilitation spend (excluding concurrent rehabilitation) will be greatest during the latter part of the mine lifecycle (decommissioning phase) as this is when infrastructure will be demolished, the laydown area rehabilitated and the entire mining footprint prepared for the submission of a closure certificate.

Note that only cost associated with the closure and rehabilitation of Leslie 1A Mining Area will be considered in this report as the Leslie 1C Mining Area will only commence mining activities following Year 11. Furthermore, costs associated with the areas identified for possible MRF Expansion, PCD and dirty water trench have not been included in this report. Should mining continue to Leslie 1C Mining Area, this will be included in future closure and rehabilitation costs.

Due to the current uncertainty surrounding the change in the Financial Provision Regulations, this report has utilised the current existing regulations and has only determined a provision for Year 1 of the potential operations. If the Mining Right granted by the DMR, the financial provision will require updating annually, and as such any future disturbances post Year 1 will be determined and closure provisions made accordingly.

It must be noted that the amounts presented in this section are nominal and undiscounted, the calculation does not include the time-value of money.

12.2 Concurrent Annual Environmental Cost

Concurrent annual environmental costs will be included into the operating budget of the mine. The operation has not been initiated and a Zero (R 0.00) rand concurrent annual environmental cost is reported.

12.3 Unplanned Closure Cost Year 1

The closure costs of the aspects linked with the project have been determined using the DMR Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provisions Provided by a Mine (2005). The closure costs are based solely on the premature closure of **Leslie 1A Mine Area**, as this would be the only area that would have been impacted upon within one year of operation.

The approach to calculating the closure quantum as specified in the DMR Guideline is summarised as follows and is reported in Table 2-2 of the guideline:

- Step 1: Determine the Mineral Mined which will be Coal.
- Step 2A: Determine Primary Risk Class which is determined as High Risk.
- Step 3: Determine Environmental Sensitivity has been determined by reference to Table B.4 of the DMR Guideline as "High"
- Step 4.1: Determine level of information – Limited information is available at this stage of the project and as such Option 3 a rule based approach will be followed.
- Step 4.2: Determine the closure components and associated rates; Table 12-1 details the rates which have been escalated with the Consumer Price Index since the inception of the guidelines. These increase in rates are detailed in Appendix B.

Table 12-1: Rates associated with closure components 2018

Main Description	Included in Project	Unit	Rate 2018
1. Dismantling of processing plant and related structures (including overland conveyors and powerlines)	Yes	m^3	R14.39
2(A). Demolition of steel buildings and structures	Yes	m^2	R200.51
2(B). Demolition of reinforced concrete buildings and structures	Yes	m^2	R295.49
3. Rehabilitation of access roads	Yes	m^2	R35.89
4(A). Demolition and rehabilitation of electrified railway lines	No	m	R348.26
4(B). Demolition and rehabilitation of non-electrified railway lines	No	m	R189.96
5. Demolition of housing and facilities	No	m^2	R401.02
6. Open pit rehabilitation including final voids and ramps	No	Ha	R204,099.12
7. Sealing of shafts, adits and inclines	Yes	m^3	R107.65
8(A). Rehabilitation of overburden and spoils	Yes	Ha	R140,146.65
8(B). Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	Yes	Ha	R174,550.12
8(C). Rehabilitation of processing waste deposits and evaporation ponds (acidic, metal-rich waste)	No	Ha	R506,976.31
9. Rehabilitation of subsided areas	No	Ha	R117,351.71
10. General surface rehabilitation, including grassing of all denuded areas	Yes	Ha	R111,019.79
11. River diversions	No	Ha	R111,019.79
12. Fencing	No	Ha	R126.64
13. Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required)	No	Ha	R42,212.85
14. 2 to 3 years of maintenance and aftercare	Yes	Ha	R14,774.49

- Step 4.3: Determine the unit rates for closure components. The rates used in the assessment are based on the original 2005 rates included in the guideline, with these rates inflated by the Consumer Price Index (CPI) as published by Inflation World Wide until 2018.
- Step 4.4: Determination of weighting factors:

- Weighting Factor 1: The nature of the terrain where the operation is located is **Flat**.
- Weighting Factor 2: The proximity of the operation to an urban centre. In this instance the Project is considered **Peri urban**.

❖ Step 4.5: Identify areas of disturbance. Table 12-2 details the areas of disturbance measured for proposed infrastructures, as disturbed in Year 1 of operation. Note that the areas have been calculated based on the mine plan; however, opinions of the EAP have been taken to adequately calculate mining structures and infrastructure associated with similar operating mines. Therefore, areas covered hereunder may not correspond with the areas as detailed in the mine plan for Leslie 1A Mining Area. Additionally, as this cost is based on Year 1, only one incline shaft will have been sunk and a portion of the MRF would have been constructed.

Table 12-2: Areas of Disturbance

Infrastructure	Year 1 of Operation
Incline Shaft Rehabilitation	
Incline Shaft 1	3.5 ha
Sub Total	**3.5 ha**
Rehabilitation of Overburden and Spoils	
Topsoil Stockpile	1.4 ha
Product Stockpile	1.78 ha
ROM Pad	2.24 ha
ROM Buffer for Incline Shaft 1	2.76 ha
ROM Buffer for Incline Shaft 2	1.61 ha
MRF Co-disposal (Estimated that 20% of the 28.3 ha would be used in Year 1)	5.66 ha
Sub Total	**15.45 ha**
Demolition of Steel Buildings and Structures	
Coal Washing Plant	0.1 ha
Pump Station at PCD	0.01 ha
Sub Total	**0.11 ha**
Dismantling of Overland Conveyors and Powerlines	
Overland Conveyors (4,104.12 m x 1.5 m)	0.62 ha
Sub Total	**0.62 ha**
Demolition of Reinforced Concrete Buildings and Structures	
Mine Infrastructure/ Offices	0.08 ha
Heavy and Light Vehicle Workshop	0.1 ha
Temporary Workshops at Incline Shaft 1	0.01 ha
Temporary Change House and Offices ad Incline Shaft 1	0.01 ha
Sub Total	**0.2 ha**
Demolition of Dams	
Pollution Control Dam	1.36 ha
Sub Total	**1.36 ha**
Rehabilitation Access Roads	
Access Road for Heavy Vehicles (1,141.58 m x 15 m)	1.7 ha
Access Road for Light Vehicles (977.53 m x 8 m)	0.78 ha
Sub Total	**2.48 ha**
Total Area ha	**23.72 ha**

- Step 4.6: Identify closure costs from Specialists. At this stage of the project no specific closure costs have surfaced based on specialist studies completed to date. However the identification of closure costs from further specialist studies will be incorporated into future drafts of the rehabilitation, decommissioning and mine closure plan.
- Step 4.7: Proposed closure costs for the Project.

Table 12-3: Year 1 Unplanned Closure Cost

Risk Class	**High Risk A**						
Environmental Sensitivity	**High**						
Nature of Terrain (Weighting Factor 1)	**Flat**						
Proximity to Urban Area (Weighting Factor 2)	**Peri Urban**						
Main Description	**Units**	**Quantity**	**DMR Master Rate 2018**	**Multiplication Factor**	**Weighing Factor 1**	**Amounts**	**Comments**
1. Dismantling of processing plant and related structures (including overland conveyors and powerlines)	m^3	6,200	R 14.39	1	1.05	R 89,218.00	Coveyors
2(A). Demolition of steel buildings and structures	m^2	1,100	R 200.51	1	1.05	R 220,561.00	Wash Plant and Pump Station
2(B). Demolition of reinforced concrete buildings and structures	m^2	2,000	R 295.49	1	1.05	R 590,980.00	Mine Infrastructure and Workshops, incl temporary offices
3. Rehabilitation of access roads	m^2	24,944	R 35.89	1	1.05	R 895,240.16	Haul and access roads
7. Sealing of shafts, adits and inclines	m^3	35,000	R 107.65	1	1.05	R 3,767,750.00	Sealing of Incline Shafts
8(A). Rehabilitation of overburden and spoils	ha	15.45	R 140,146.65	1	1.05	R 2,165,265.74	Spoils and Topsoil
8(B). Rehabilitation of processing waste deposits and evaporation ponds (basic, salt-producing waste)	ha	1.36	R 174,550.12	1	1.05	R 237,388.16	PCD
10. General surface rehabilitation, including grassing of all denuded areas	ha	23.72	R 111,019.79	1	1.05	R 2,633,389.42	General rehabilitation
	Sub Total 1					R 10,599,792.48	
Preliminary and Generals	12,5% of Sub Total 1					R 1,324,974.06	
Administration and Supervision	6% of Sub Total 1					R 635,987.55	
Contingency	10% of Sub Total 1					R 1,059,979.25	
	Sub Total 2					R 13 620 733.34	
VAT @ 15%						R 2 043 110.00	
Grand Total - Sub Total 3						**R15 663 843.34**	

Table 12-4: Post Closure Costs

Risk Class	**High Risk A**						
Environmental Sensitivity	**High**						
Nature of Terrain (Weighting Factor 1)	**Flat**						
Proximity to Urban Area (Weighting Factor 2)	**Peri Urban**						
Main Description	**Units**	**Quantity**	**DMR Master Rate 2017**	**Multiplication Factor**	**Weighing Factor 1**	**Amounts**	**Comments**
Year 1 of operations post closure costs for 2 to 3 years of maintenance and aftercare	ha	23.72	R 14,774.49	1	1.05	R 350,450.90	Year 1
Sub Total 1						R 350,450.90	
P&Gs	12,5% of Sub Total 1					R 43,806.36	
Administration and Supervision	6% of Sub Total 1					R 21,027.05	
Contingency	10% of Sub Total 1					R 35,045.09	
Sub Total 2						R 450,329.41	
VAT @ 14%						67549.4115	
Grand Total - Sub Total 3						R517 878.82	

12.4 Total Unplanned Closure Cost

The total closure provision required for the project is detailed in the table below:

Table 12-5: Total Closure Provision

Mining Right	Closure Cost after YR1 of Operation	Post Closure Costs
Leslie 1 Mine	R15 663 843.34	R517 878.82
Total Unplanned Closure Provision		**R16 181 722.16**

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