SMEC South Africa
Member of the Surbana Jurong Group

SMEC INTERNAL REF . JT0062

Final Report

Traffic Impact Assessment: Kalgold Mine

Reference No. JT0062
Prepared for EIMS
26 November 2021

Document Control

Document	Traffic Impact Assessment: Kalgold Mine
File Location	P1J1
Project Name	Kalgold Mine Specialist Report: TIA
Project Number	JT0062
Revision Number	00

Revision History

Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
00	5 November 2021	Mandy Jablonski; Muzi Nkosi	Naye Miya	Naye Miya
01	26 November 2021	Mandy Jablonski; Muzi Nkosi	Naye Miya	Naye Miya

Issue Register

Distribution List	Date Issued	Number of Copies
EIMS	26 November 2021	1

SMEC Company Details

Approved by	Naye Miya		
Address	267 Kent Avenue, Ferndale, Randburg, 2194		
Telephone		**Facsimile**	
Email	Naye.miya@smec.com	**Website**	

Important Notice

This report is confidential and is provided for the purposes of Specialist Traffic Impact Assessments to support Environmental Impact Assessment and to provide information to relevant authorities on the proposed Mine changes relevant to traffic. This report is provided pursuant to a Consultancy Agreement between SMEC South Africa Pty Limited ("SMEC") and EIMS, under which SMEC undertook to perform a specific and limited task for Harmony Gold Mining Company. This report is strictly limited to the matters stated in it and subject to the various assumptions, qualifications and limitations in it and does not apply by implication to other matters. SMEC makes no representation that the scope, assumptions, qualifications and exclusions set out in this report will be suitable or sufficient for other purposes nor that the content of the report covers all matters which you may regard as material for your purposes.

This report must be read as a whole. The executive summary is not a substitute for this. Any subsequent report must be read in conjunction with this report.

The report supersedes all previous draft or interim reports, whether written or presented orally, before the date of this report. This report has not and will not be updated for events or transactions occurring after the date of the report or any other matters which might have a material effect on its contents, or which come to light after the date of the report. SMEC is not obliged to inform you of any such event, transaction or matter nor to update the report for anything that occurs, or of which SMEC becomes aware, after the date of this report.

Unless expressly agreed otherwise in writing, SMEC does not accept a duty of care or any other legal responsibility whatsoever in relation to this report, or any related enquiries, advice or other work, nor does SMEC make any representation in connection with this report, to any person other than EIMS. Any other person who receives a draft or a copy of this report (or any part of it) or discusses it (or any part of it) or any related matter with SMEC, does so on the basis that he or she acknowledges and accepts that he or she may not rely on this report nor on any related information or advice given by SMEC for any purpose whatsoever.

Table of Contents

1 Executive Summary 6

2 Introduction 7

2.1 Background 7

2.2 Objectives 7

3 Document Structure 8

4 Specialist Details 10

5 Terms of Reference 10

6 Project Description 11

6.1 Background 11

6.2 Programme 11

6.3 Development access 12

7 Legislative and Policy Framework 13

7.1 Land Transport regulations 13

7.2 Environmental Regulations 13

8 Methodology and Approach 14

8.1 Scenario development 14

8.2 Evaluation criteria 15

9 Data Collection and Analysis 17

9.1 Accounting for Covid-19 17

9.2 Traffic Survey 19

9.3 Base Year Volumes 20

9.4 Trip Generation 20

9.4.1 Operational Trip Generation 21

9.4.2 Construction Trips 21

9.5 Trip Distribution 23

10 Receiving Environment 24

10.1 Surrounding Road Network 24

10.2 Existing Intersection Capacity Analysis and Conditions 24

10.2.1 Intersection 1: N18 Existing Site Access- No New Access (Worst Case) 25

11 Impact Assessment 26

11.1 Assessing and Quantifying Impacts 26

11.1.1 Intersection Capacity Analysis 26

11.1.2 Effect of E80's on surfaced roads 26
11.1.3 Planning Phase Impacts 27
11.1.4 Construction Phase Impacts 27
11.1.5 Operational Phase Impacts 30
11.1.6 Decommissioning Phase Impacts 31
11.1.7 Rehabilitation and Closure Phase Impacts 32
11.2 Impact Assessment Methodology 34
12 Specialist Management Plan 35
13 Conclusion 36
14 Assumptions, Uncertainties and Gaps In Knowledge 37

Appendices

Appendix 1: Specialist Declaration

Appendix 2: Specialist CV

Appendix 3: Stick Diagrams

Appendix 4: Detailed Capacity Results

1 Executive Summary

SMEC South Africa (Pty) Ltd was appointed by Environmental Impact Management Services (EIMS) on behalf of Harmony Gold Mining Company to provide a specialist report for transport, hereafter referred to as a Traffic Impact Assessment (TIA). The report aims to quantify the traffic impact of the planned expansion of the Kalgold Mine and recommend measures to mitigation against the impact. Kalgold is an open-pit gold mine situated on the Kraaipan Greenstone belt, 55km southwest of Mahikeng, North West Province and is applying for environmental authorisation to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month.

The following impacts were assessed for the planning; construction; operational; decommissioning and rehabilitation and closure phases of the project, where relevant:

- Site Access;
- Site Access Intersection Capacity Analysis using SIDRA Intersection;
- Deterioration of road network condition (Effect of E80's on surfaced roads);
- Increase in dust along site access road; and
- Temporary Closure of the N18.

The existing site access layout is acceptable from a capacity perspective for the full life-span of the mine. A 500m acceleration lane on the exit side of the north east approach needs to be provided at the access along the N18. This is based on the requirement of TMH16 which states that where heavy vehicles exiting the site via this access exceed 10 heavy vehicles in a 12-hour daytime period or 5 heavy vehicles in a 12-hour night-time period, an acceleration lane should be provided. The traffic count conducted at the site access showed over 10 heavy vehicles exiting the site during a 12-hour daytime period.

A new site access has been proposed. It should have the same layout as the existing access and needs to be checked to ensure sufficient sight distances. If a new access is implemented, the existing access will need to be closed to meet the minimum access spacing requirements on rural Class 1 roads (8km) otherwise special permission from SANRAL will be required.

No intersection capacity upgrades are recommended for the surrounding road network to accommodate the future traffic growth.

The following mitigation measures by the mine are recommended:

- Internal Gravel Access Roads should be maintained to support heavy vehicle movement.
- Heavy vehicle trips for planning, construction, decommissioning and rehabilitation and closure phases should be limited to off-peak hours as far as possible and distributed throughout a period as far as possible (avoid multiple vehicles arriving or departing at once)
- Limit heavy vehicle speed to 40km/h along internal site roads
- Water down gravel roads on a regular basis to reduce dust
- Provide bypass routes for the temporary road closure during construction

It is recommended that the applicant's request be approved from a traffic and transportation perspective.

2 Introduction

2.1 Background

SMEC South Africa (Pty) Ltd was appointed on behalf of Harmony Gold Mining Company (hereafter referred to as Harmony), by Environmental Impact Management Services (EIMS) to provide a specialist report for transport, hereafter referred to as a Traffic Impact Assessment (TIA) for the proposed Harmony Kalgold operation (Kalgold) expansion project. Kalgold is an open-pit gold mine situated on the Kraaipan Greenstone belt, 55km southwest of Mahikeng, North West Province and is applying to expand its mining rights. The purpose of this TIA is to investigate and assess the impact of traffic generated by the proposed expansion on the surrounding road network in the immediate vicinity of the development site. The site location is shown in Figure 2-1.

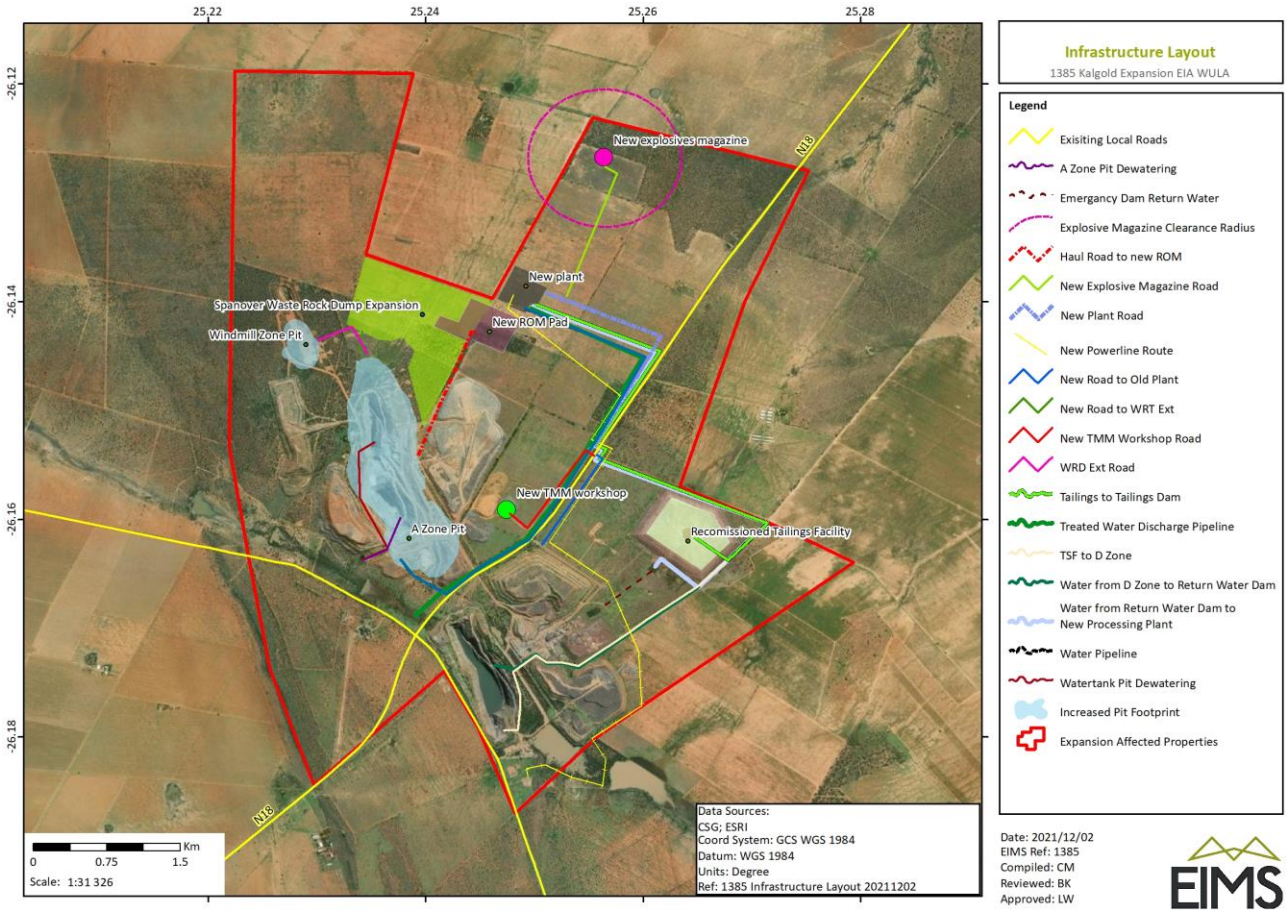

Figure 2-1: Locality Plan

2.2 Objectives

The objectives of this study are to:

- Evaluate the potential traffic impacts on the road network in the immediate vicinity of the development;
- Evaluate the impact of additional heavy vehicles on the public road network in the immediate vicinity of the development; and
- Evaluate other transport-related implications on the surrounding environment.

3 Document Structure

This report has been compiled in accordance with the EIA Regulations, 2014 (Government Notice (GN) R982). A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 3-1 below.

Table 3-1: Report Structure

Environmental Regulation	Description	Section in Report
NEMA EIA Regulations 2014 (as amended)		
Appendix 6 (1)(a):	Details of – the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 0 Section 4 Appendix B
Appendix 6 (1)(b):	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix A
Appendix 6 (1)(c):	an indication of the scope of, and the purpose for which, the report was prepared;	Section 2
Appendix 6 (1)(cA):	an indication of the quality and age of base data used for the specialist report;	Section 9
Appendix 6 (1)(cB):	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 10 and 11
Appendix 6 (1)(d):	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
Appendix 6 (1)(e):	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 8
Appendix 6(1)(f):	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	N/A
Appendix 6(1)(g):	an identification of any areas to be avoided, including buffers;	N/A

Environmental Regulation	Description	Section in Report
Appendix 6(1)(h):	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	N/A
Appendix 6(1)(i):	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 14
Appendix 6(1)(j):	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 11
Appendix 6(1)(k):	any mitigation measures for inclusion in the EMPr;	Section 11
Appendix 6(1)(l):	any conditions for inclusion in the environmental authorisation;	Section 11
Appendix 6(1)(m):	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 12
Appendix 6(1)(n):	a reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 13
Appendix 6(1)(o):	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
Appendix 6(1)(p):	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
Appendix 6(1)(q):	any other information requested by the competent authority.	N/A

4 Specialist Details

Naye Miya is a professionally registered Technologist with twelve (12) years of experience in both Traffic Engineering and Modelling. He obtained his B-Tech degree in Transportation Engineering Technology from the University of Johannesburg in 2013. He has a vast array of experience, which spans the entire spectrum of traffic and transport engineering. His complete CV is included in Appendix B.

Naye is the current Section Manager of the Planning and Traffic Engineering unit at SMEC South Africa. His role includes technical modelling and reporting on transport-related projects such as traffic signal designs, transport masterplans, data collection projects and various traffic impact assessment studies. Naye has also been involved in various projects in countries like Rwanda, Kenya, Nigeria and Angola.

5 Terms of Reference

Terms of Reference were defined in the project proposal in which the following needs for this report were identified:

- Evaluate the impacts of the proposed expansion to the mine on existing road network and traffic volumes. The study must determine the specific traffic needs during the different phases of implementation;
- Evaluate the roadway capacity of the road network;
- Evaluate the site access;
- Confirm freight and transport requirements during construction, operation and maintenance;
- A high-level transport plan for the transportation of equipment to site, if relevant;
- Determine (Abnormal) Permit requirements, if any;
- Determine no. of E80's distributed to the road network
- Determine any Traffic Engineering Service Contributions according to relevant guidelines (e.g. TMH 15 South African Engineering Service Contribution Manual for Municipal Road Infrastructure); and
- Reporting.

6 Project Description

6.1 Background

The Kalgold Mine expansion proposed is shown in Figure 6-1 and includes a new plant, new ROM Pad, recommissioned Tailings facility, increased pit footprints and extension to the spanover waste rock dump. A new internal plant road has also been proposed. The mine is currently operational, and many of the staff required for the changes are already accessing the site, and much of the construction machinery is already on-site. Having noted the baseline of the mine, the mine is anticipated to generate and attract traffic from the labourers and materials to the site in the different lifecycles of the mines, i.e., construction, expanded operations and decommissioning.

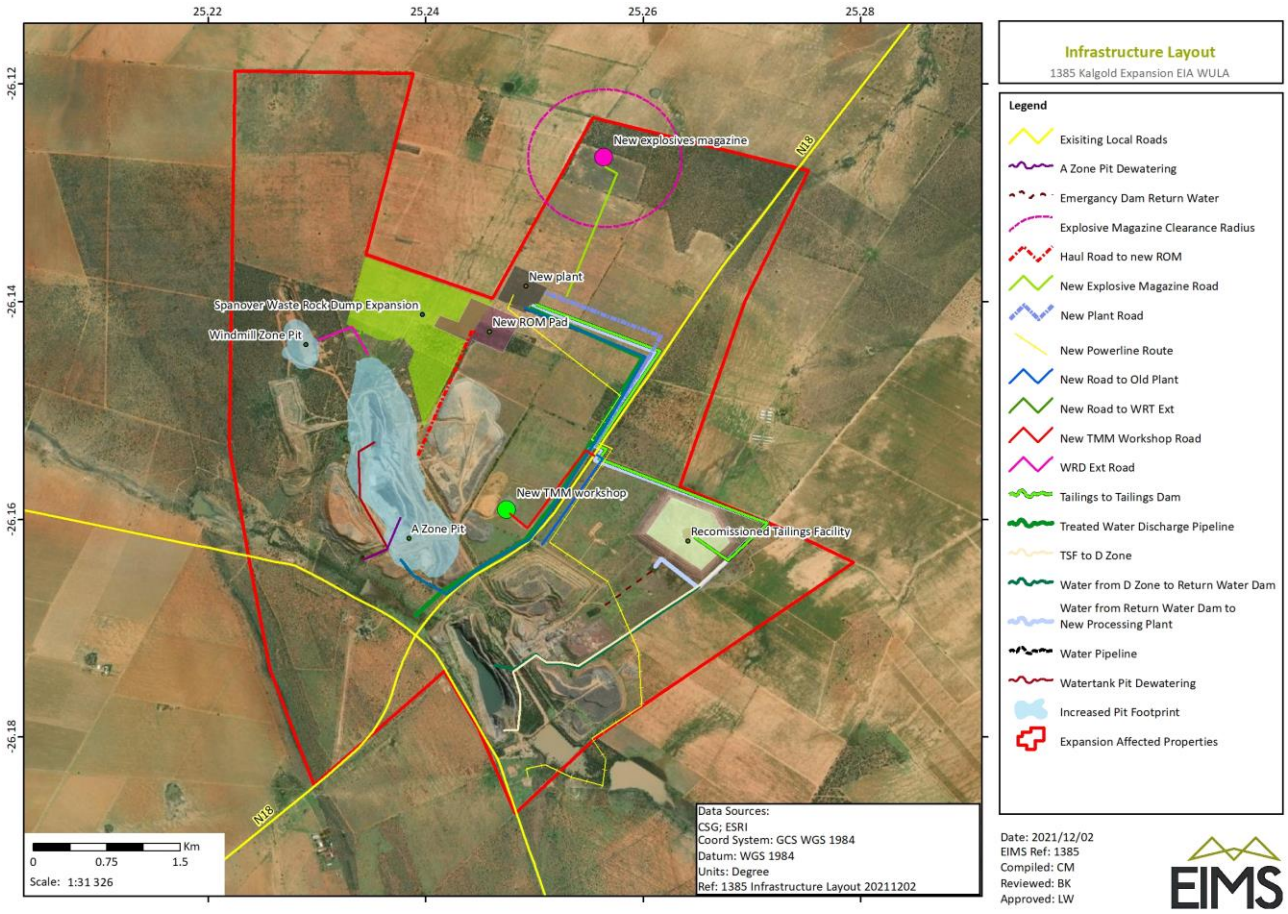

Figure 6-1: Kalgold Proposed Expansion Layout

6.2 Programme

The plant will be constructed over a six to seven month period. The proposed life of the mine is 12 years, with a potential extension depending on gold prices and additional resources found through exploration. The expected life for the project is highlighted in the following points:

- Construction period (worst-case): 2022-2024
- Operational period: 2024-2036
- Decommissioning period: 2036

6.3 Development access

The current access to the mine is shown in Figure 6-2 below. The southern most point marked “Existing Access” is the main access to the site from the north and south of the N18. TMH16 requires that acceleration lanes be provided on rural Class 1 roads to allow trucks turning onto the road to accelerate before entering the traffic stream in cases where the number of heavy vehicles turning onto the Class 1 road exceeds 10 vehicles during the day (12-hour period) or 5 vehicles during the night (12-hour period). Under existing conditions (based on the traffic count conducted at the site access), a total of 11 trucks from the south approach access the N18 which is more than the threshold number of trucks during any 12-hour period. The existing access has only 50m acceleration lanes rather than the 500m lanes recommended, it is therefore proposed that a 500m acceleration lane be provided on the north east approach along the N18 in order to be align to the requirement of TMH16 (See Figure 6-2) unless special allowance was made by the road authority (SANRAL) and design engineers.

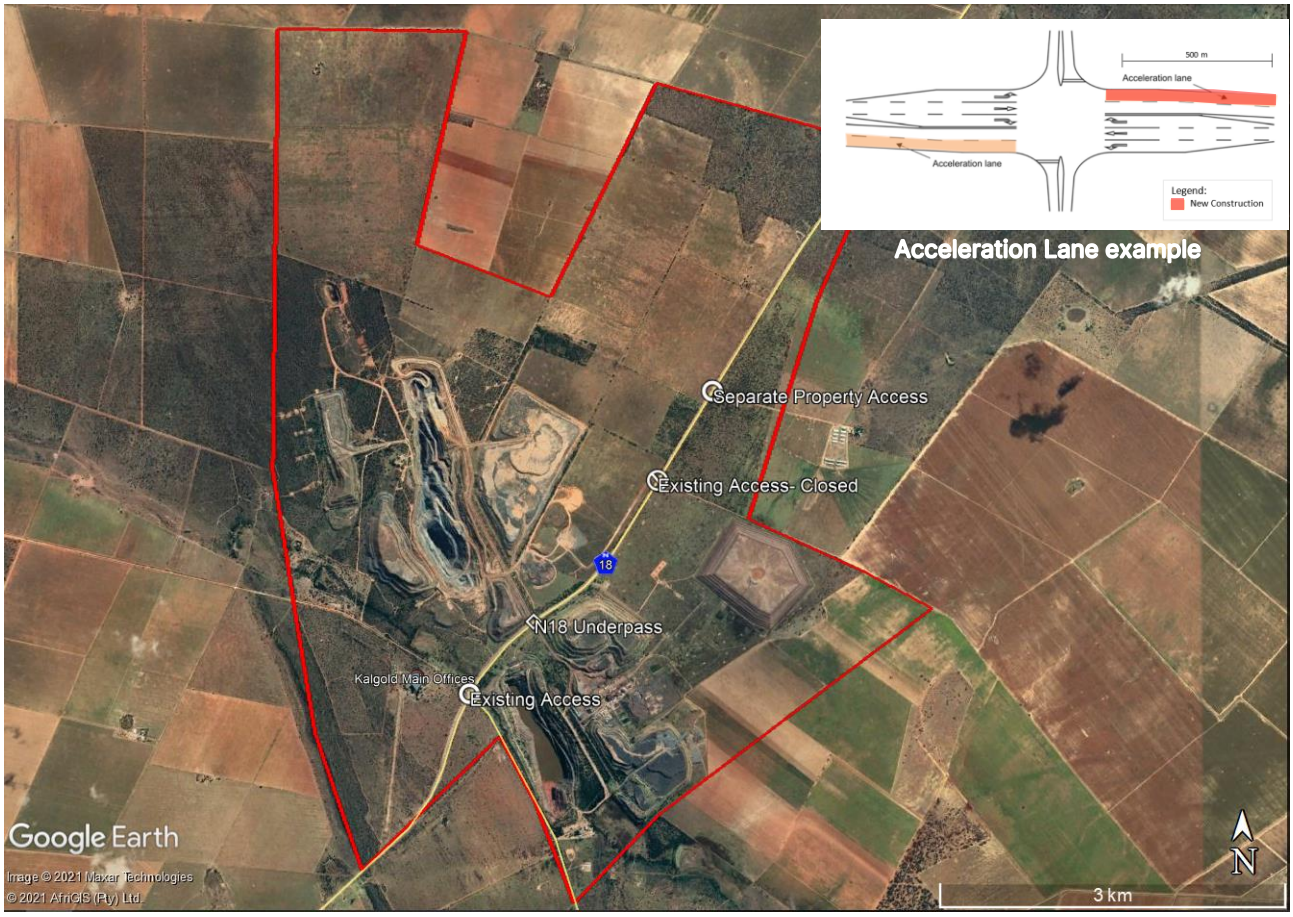

Figure 6-2: Kalgold Site Access Points

There is an access gate to the south of the N18 labelled “Existing Access- Closed,” however, this gate is currently closed and does not provide access to the site. A new access to the site has been proposed and is being investigated. The TRH26 South African Road Classification and Access Management Manual stipulates that the minimum spacing for accesses to Class 1 roads in rural areas is 8km. The full length of the site along the N18 is just under 8km and as such, only one access to the site should be provided under normal conditions. As such, a new site access point would likely require the closure of the existing access. In case an exception is made due to special circumstances and both accesses are opened, it is recommended that the two accesses be located as far apart as possible.

7 Legislative and Policy Framework

7.1 Land Transport regulations

The National Land Transport Act NLTA (Act No 5 of 2009) requires the integration of land transport planning with the land development process and the preparation of integrated transport plans which constitutes the transport component of the integrated development plans of municipalities. These integrated transport plans include the regulation and provision of transport infrastructure for all modes of transport. According to the National Land Transport Act, property developments within a transport area are subject to traffic impact and transport assessments. In light of the above, the following documents were used to guide the processes in the compilation of this report:

- The Technical Methods for Highways (TMH) 16: Volume 1 and Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual and Volume 2;
- The Technical Methods for Highways (TMH) 17: South African Trip Data Manual;
- The Technical Recommendations for Highways (TRH) 26: South African Road Classification and Access Management Manual; and
- The Technical Recommendations for Highways (TRH) 16: Traffic Loading for Pavement and Rehabilitation Design.

7.2 Environmental Regulations

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 2014, as amended in 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.

In pursuit of this, SMEC utilised guidelines as outlined in the Government Gazette No. 43110 which was promulgated on 20 March 2020 in terms of section 24(5)(a) and (h) of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and reporting requirements set out in Appendix 6 of the EIA Regulations, 2014 (as amended).

8 Methodology and Approach

Additional traffic on the road network could result in changes to the operations of that road network. It is for this reason that the traffic impact has to be quantified for all major phases of a development. This traffic impact assessment was conducted according to the Technical Methods for Highways (TMH) 16: Volume 1 and Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual. According to the guidelines, a fully-fledged traffic impact assessment was required to be carried out in order to quantify and determine the extent of the traffic impact to be generated by the proposed development. The methodology entailed the process shown in Figure 8-1.

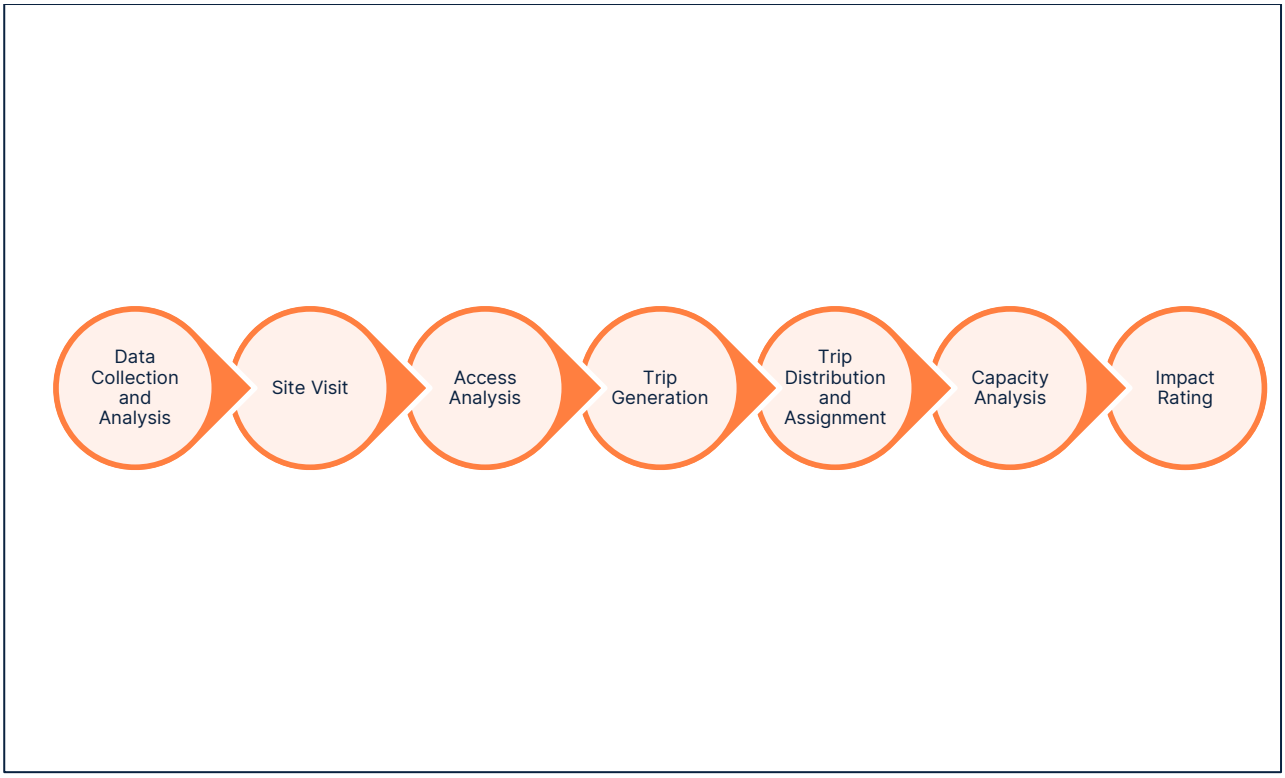

Figure 8-1: Methodology Process

8.1 Scenario development

The following scenarios were analysed to determine the traffic impacts on the different lifecycle phases of the mine on the surrounding road network configuration:

- Scenario 1: 2024 Base Traffic AM and PM Peak Hours (Refer to Section 10.2);
- Scenario 2: 2024 Base Traffic + Construction Traffic AM and PM Peak Hours (Refer to Section 11.1.4.3);
- Scenario 3: 2036 Background Traffic + Operational Volumes AM and PM Peak Hours (Refer to Section 11.1.5.3); and
- Scenario 4: 2036 Background Traffic + Decommissioning Traffic AM and PM Peak Hours (Refer to Section 11.1.6.3).

Scenarios 4 was assumed to generate a similar or less traffic than the Operational Scenario (Scenario 3), and as a result only scenario 3 was analysed as an indication for this case.

8.2 Evaluation criteria

The traffic impact will be measured in this report by determining a level of service for each intersection within the study area. The performance of intersections on the road networks is defined by the level of service (LOS) for each approach to the intersection. These levels of service have been defined in the Highway Capacity Manual (HCM, 2010) as shown in Table 8-1. During the peak hours, the road infrastructure capacity provided should ensure that the intersection approach level of service should ideally not exceed LOS D.

Table 8-1: Level of Service for Intersections (HCM)

Level of Service	Average Approach Delay (d) for Signalised Intersections (seconds)	Average Approach Delay (d) for Priority Intersections (seconds)
A	d ≤ 10	d ≤ 10
B	10 < d ≤ 20	10 < d ≤ 15
C	20 < d ≤ 35	15 < d ≤ 25
D	35 < d ≤ 55	25 < d ≤ 35
E	55 < d ≤ 80	35 < d ≤ 50
F	80 < d	50 < d

The following definitions from the Highway Capacity Manual 2000 are applicable to this report:

Level of Service (LOS)

LOS is a measure of intersection performance determined based on the average delay at intersections. In most rural and urban areas an overall LOS of A to D is acceptable. LOS E or F are considered to be undesirable. In short, LOS is defined in terms of delay. Delay is a measure of intersection or roadway performance which is measured based on the driver discomfort, frustration, fuel consumption and lost travel time. Delay at intersections depends on various factors such as the type of signal control, the volume of traffic and volume/capacity ratio of each approach at an intersection (C A O'Flaherty, 1997). The intersection performance has been rated based on the average delay, i.e. the LOS of the intersections under investigation will be measured based on the intersection average delay.

Capacity

Capacity refers to the maximum hourly rate at which vehicles can reasonably be expected to traverse a lane or roadway during a given period under prevailing roadway, traffic and control conditions.

Volume

Volume refers to the hourly rate (vehicles/hour), the actual flow rate for an approach or lane.

Volume to Capacity ratio (V/C)

Volume/capacity ratio (v/c) is a measure of intersection or roadway performance. It is the ratio of a number of vehicles on the road to the available capacity of the roadway. The road link capacity in the study area was rated

based on the volume/capacity ratio. According to the National Department of Transport Manual for Traffic Impact Study (2012), the intersection capacity should be evaluated as follows:

- v/c<1: the intersection operates under capacity,
- v/c=1: the intersection operates at capacity, and
- v/c>1: the intersection operates over capacity.

9 Data Collection and Analysis

9.1 Accounting for Covid-19

The contagious nature of COVID-19 resulted in different governments implementing lockdowns with strict restrictions on movement in efforts to slow down the spread. The lockdowns had severe impacts across all sectors of the economy resulting in drastic changes in traffic patterns. The restrictions on movement resulted in less traffic on the road network. The implemented lockdown restrictions opened the South African economy to the possibilities of remote working which reduces the need to travel. It is certain at this point that COVID-19 will remain reality for the long foreseeable future, but certainties around traffic patterns returning the old normal are not so clear.

In light of impact of the associated lockdown restrictions, SMEC used historical traffic counts available in the study area as an indication of traffic reductions due to covid-19 lockdowns by comparing the 2019 and 2020 ADT and ADTT. Count 06 as shown in Figure 9-1 on the N18 was used to provide an indication of the traffic volumes along the N18. While the count is quite far from the site, most of the area between the count and the site comprises of agricultural land-use and volumes along the N18 near the site are not expected to be significantly different to Count 06.

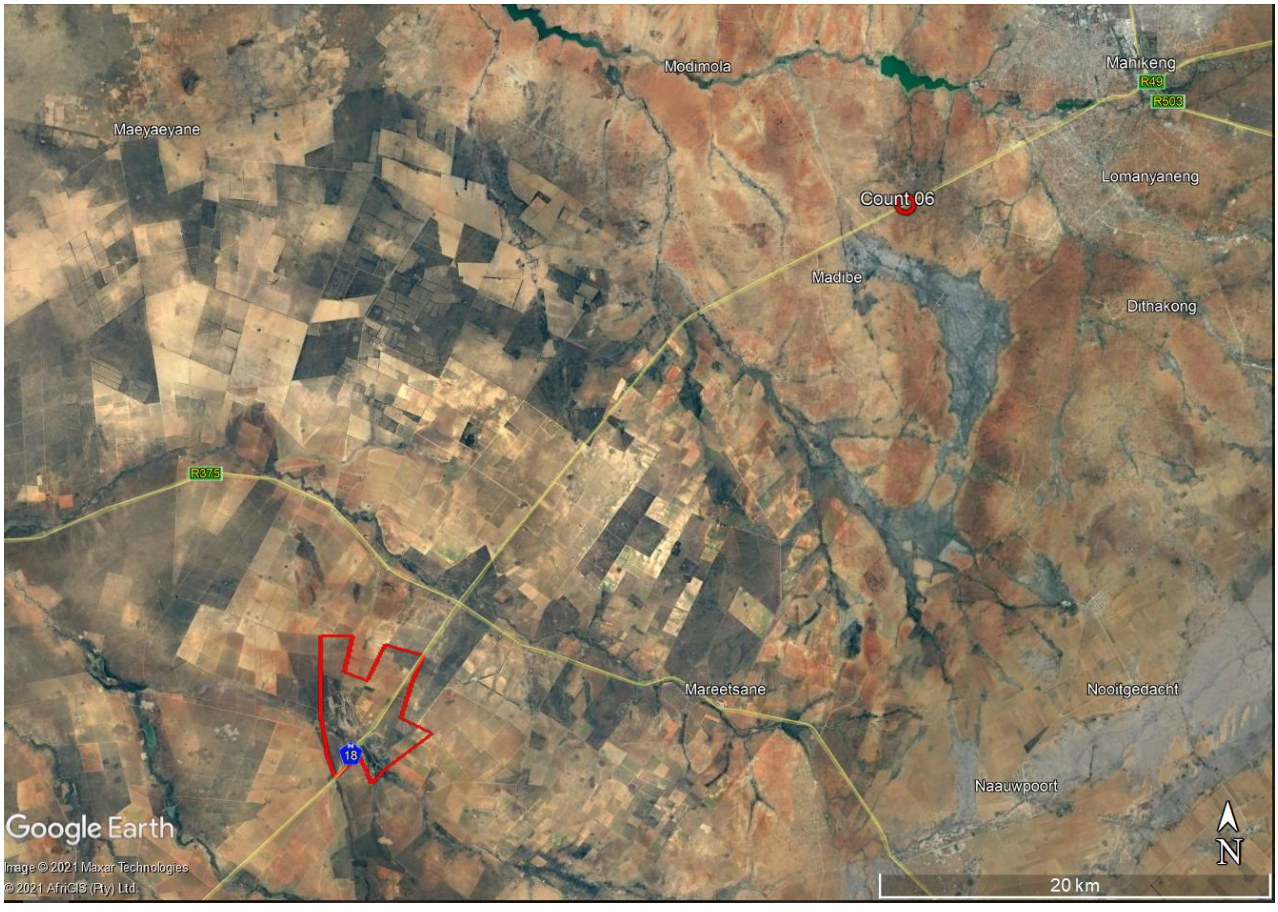

Figure 9-1: SANRAL Traffic Count Location

Count 06, as shown in the previous Figure 9-1 is a permanent SANRAL counting station (Site number 1375; Site identifier 21138; Site Name: Mafikeng South; N018 Section: 06). The 2019 traffic volumes were extracted as a basis for further analysis. 295 days of 2019 were counted in order to retrieve the traffic data. Key data from the site is shown in Table 9-1.

Table 9-1: Summary of Count 06 counting station

Highlight	Northbound (to Mahikeng)	Southbound (to Setlagole)
Average Daily Traffic (ADT)	1 738	1 737
Average Daily Truck Traffic	118	119
Percentage Trucks	6.8%	6.9%
Estimated Average E80 per Truck	2.1	2.0
Typical Flow for 2019 Weekday (Thursday used) AM Peak (Highest from 07:00-09:00)	110 vehicles per hour	150 vehicles per hour
Typical Flow for 2019 Weekday (Thursday used) PM Peak (Highest from 14:00-17:00)	150 vehicles per hour	140 vehicles per hour

Table 9-2 shows the difference (2019 vs 2020) in traffic patterns at the SANRAL station count 6.

Table 9-2: Comparison table at Count 06

Highlight	**2019**	**2020**
ADT	3475	3428
ADTT	237	205
Percentage trucks	6.8%	6.0%
Average E80 per truck	2.05	1.9

Worth noting are the following:

- ADT- 1,37% reduction
- ADTT- 15,61% reduction

9.2 Traffic Survey

A 12-hour manual classified traffic count was conducted on the 10th of October 2021 at the Kagold Mine Access. The traffic counts were conducted between 06:00 and 18:00. Figure 9-2 summarises the relevant peak hour extracted from the traffic counts. The AM peak was found to be 06:30-07:30 and the PM Peak 16:30-17:30.

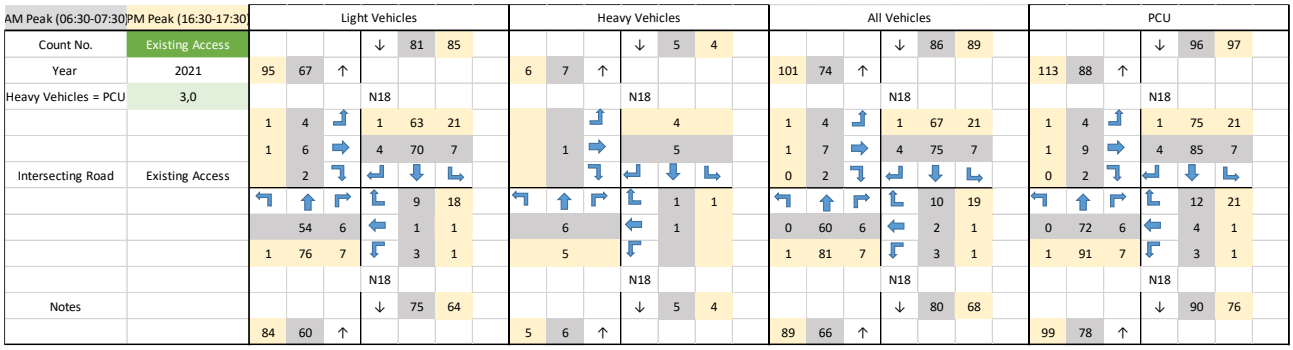

Figure 9-2: 2021 AM and PM Peak traffic counts

A full list of intersections to be evaluated in this report are included in Table 9-3. Only the site accesses are considered as the nearest intersections are outside the scope required by The Technical Methods for Highways (TMH) 16: Volume 1 and Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual and Volume 2.

Table 9-3: List of Intersections

Intersection Number	Description
1	N18 Existing Site Access- Assuming No New Access (Worst Case)
2	N18 Proposed Site Access- Existing Site Access Closed (Worst Case) Note: The traffic volumes for this scenario will be similar to those in Intersection 1 and it is assumed the design of the new access will, at a minimum, have 60m acceleration lanes (for capacity purposes- 500m acceleration lanes are required as the heavy vehicle threshold is met according to TMH 16).

9.3 Base Year Volumes

The traffic counts conducted on 10 October 2021 were conducted under Covid-19 Lockdown level 2. The data from the SANRAL count 6 station indicated a 1.5% reduction in traffic between 2019 and 2020 years. In order to account for this decrease due to Covid-19, the peak hour traffic volumes extracted from the manual traffic counts were adjusted by applying the following conservative factors informed by Section 9.1:

- Increase no. of light vehicles by 5%
- Increase no. of heavy vehicles by 20%

The resultant peak hour henceforth referred to as base year traffic volumes which includes background traffic and operational traffic (as the survey was conducted while the mine was operational) are shown in Figure 9-3.

AM Peak (06:30-07:30)	PM Peak (16:30-17:30)	Light Vehicles						Heavy Vehicles						All Vehicles						PCU					
Count No.	Existing Access				↓	85	89				↓	6	5				↓	91	94				↓	103	104
Year	2021	100	70	↑				7	8	↑				107	79	↑				121	96	↑			
Heavy Vehicles = PCU	3,0				N18						N18						N18						N18		
		1	4		1	66	22	0	0		0	5	0	1	4		1	71	22	1	4		1	81	22
		1	6		4	74	7	0	1		0	6	0	1	8		4	80	7	1	10		4	92	7
Intersecting Road	Existing Access	0	2					0	0					0	2					0	2				
						9	19					1	1					11	20					13	23
		0	57	6		1	1	0	7	0		1	0	0	64	6		2	1	0	78	6		5	1
		1	80	7		3	1	0	6	0		0	0	1	86	7		3	1	1	98	7		3	1
					N18						N18						N18						N18		
Notes					↓	79	67				↓	6	5				↓	85	72				↓	97	82
		88	63	↑				6	7	↑				94	70	↑				106	85	↑			

Figure 9-3: 2021 Base Year (Adjusted Background and Operational traffic adjusted to account for Covid-19)

9.4 Trip Generation

Trip generation rates are measured in units of trip ends, with either an origin or a destination at the development. It is the sum of traffic to or from a development. The Trip Generation Rates for Mining Operations are not provided for in the September 2013 TMH 17: South African Trip Data Manual. As such, the trip generation of the proposed mining activity was estimated based on data collected at the already operational site, first principles and the interpretation of data provided by the client.

The standard practices for studies such as this compels the author to quantify trip generation for the following stages:

- Planning Stage;
- Construction Stage;
- Operational Stage; and
- Decommissioning Stage.

The planning phase of the project entails compilation of various reports from various specialists located across the country and not necessarily based on site. There is negligible to no traffic generated during this stage and therefore will not be investigated in this report.

The decommissioning phase is assumed to have the same number of trips generated as the operational phase and will only have short-term effects. The two critical components of this study in terms of traffic and transportation are therefore the construction and operational periods of this project.

9.4.1 Operational Trip Generation

The site is currently operational over 24 hours a day with a total labour complement of 684 persons. The peak hour trips generated by the already operational site were recorded as follows:

- AM Peak Trips In: 17
- AM Peak Trips Out: 18
- PM Peak Trips In: 30
- PM Peak Trips Out: 20

The majority of site labour gain access to the site using one of the 7 staff minibus taxis. Based on the information provided by the client, the labour component is expected to remain unchanged with the expected increase in production expected to be induced by other means including machinery.

For the purposes of this exercise, a conservative 30% increase was applied to the current operational traffic accessing and exiting the site during the peak hour to allow for the day to day variations in operational traffic. Therefore the estimated new trip generation for the Kagold Mine is as follows (All vehicles):

- AM Peak Trips In: 22
- AM Peak Trips Out: 23
- PM Peak Trips In: 39
- PM Peak Trips Out: 26

While gold is transported directly off the site by air and waste and tailings are stored on the mine premises, reagents are delivered to the site in super link trucks with 20-ton capacities. All reagents are delivered during the 12-hour daytime period. Table 9-4 shows the estimated tons per month of different reagents and the associated assumptions in terms of number of trucks per month, day and peak hour. The increase in heavies is already accounted for in the above 30% increase.

Table 9-4: Reagents and Peak Hour Truck Trips Generated

Reagent	tons per month	trucks per month (add 5% for wastage then divide by 20 due to truck size- Round up to nearest unit)	trucks per day conservative estimate- assume all trucks in month arrive over 20 day period)	trucks per peak hour (conservative estimate- assume 30% of daily total arrive in each peak hour)
Steel balls - SAG Milling	299	16	1	
Gold: Lime	253	14	1	
Gold: Flocculant - Mill Thickening	5	1	1	
Gold: Cyanide	650	35	2	
Gold: Carbon	15	1	1	
Gold Elution: HCL	141	8	1	
Gold Elution: Caustic Soda	29	2	1	
Gold Elution: Cyanide	18	1	1	
TOTAL	1410	78	9	3

9.4.2 Construction Trips

The contractor has already done construction on the site previously and some of the equipment and materials is already on site. Additional materials and equipment will be required, however the majority of heavy vehicles with equipment and materials are expected to arrive outside of peak periods. As such, a nominal number of 10 heavy vehicles In and Out of the site are used as a high-level estimate based on construction quantities of the construction trips generated during the peak hour for capacity calculation purposes.

In addition to the heavy vehicles, labour for construction is also required to access the site. The labour component is expected to be relatively minimal and therefore 34 additional light vehicles (made up of private vehicles and minibus taxis) are expected to enter and exit the site during the AM Peak and PM Peak Period. Table 9-5 shows an overview of the construction labour trip breakdown.

Table 9-5: Construction Labour Trip Breakdown

Labourer data	Quantity	Units
Provided number of labourers	300	persons
Private Vehicle Users	30	persons
Minibus Taxi Users	270	persons
Staff using access in peak hour	210	persons
Private Cars Peak Hour	21	light vehicles
Minibus Taxis Peak Hour (Capacity = 15 persons)	13	light vehicles
AM Peak: Vehicles In	24	light vehicles
AM Peak: Vehicles Out	10	light vehicles
PM Peak: Vehicles In	10	light vehicles
PM Peak: Vehicles Out	24	light vehicles

In summary, the construction trip generation traffic is as follows:

- Light vehicles – 24 In, 10 Out – AM Peak Hour
- Heavy Vehicles - 10 In, 10 Out – AM Peak Hour
- Light vehicles – 10 In, 24 Out – PM Peak Hour
- Heavy Vehicles - 10 In, 10 Out – PM Peak Hour

9.5 Trip Distribution

The trips estimated in the trip generation stage were distributed onto the road network in the immediate vicinity of the development site. The sources of labour would most likely be the townships to the south and Mahikeng located directly north east. The townships to the south are much closer than Mahikeng, although Mahikeng is more urban, therefore it was assumed that 60% of labour would come from the north while 40% would come from the south. For heavy vehicles it was assumed that 100% of vehicles would access from the northern portion of the site.

The trip distribution of the labour construction and operational traffic is depicted in Figure 9-4.

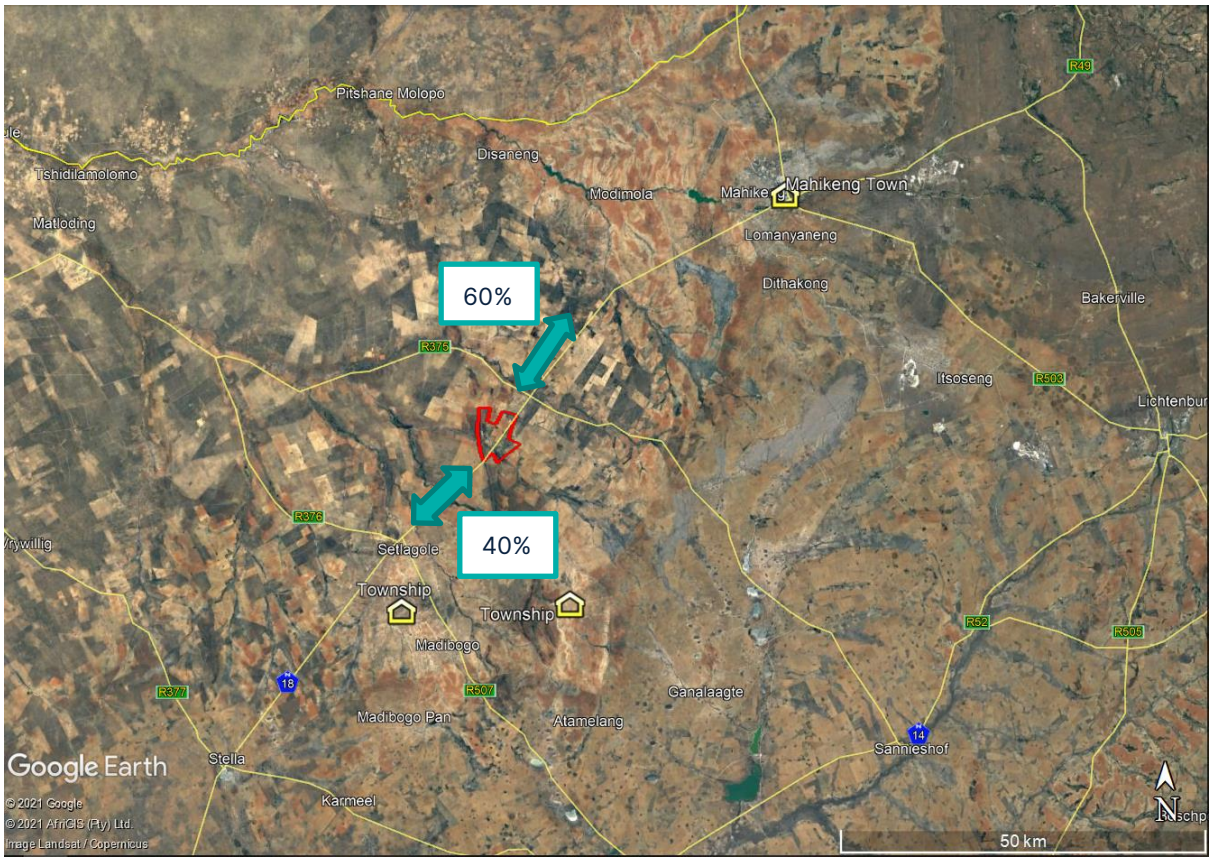

Figure 9-4: Labour and Construction Trip Distribution

10 Receiving Environment

The site is currently operational, and an existing access is used. This chapter deals with the road network in and around the study area.

10.1 Surrounding Road Network

The site gains direct access to the National Class 1 Road of the N18. This portion of the N18 is a single carriageway with one lane per direction and carries low to medium volumes of traffic throughout the day. The road has a posted speed limit of 120km/h. The road is in fair condition, however narrow shoulders or in some cases no paved shoulder could result in safety concerns for abnormal vehicles using the road.

Figure 10-1: N18 Google Streetview Imagery (2010)

10.2 Existing Intersection Capacity Analysis and Conditions

The estimated 2021 peak hour traffic volumes are depicted Figure 10-2.

AM Peak (06:30-07:30)PM Peak (16:30-17:30)		Light Vehicles						Heavy Vehicles						All Vehicles						PCU					
Count No.	Existing Access				↓	85	89				↓	6	5				↓	91	94				↓	103	104
Year	2021	100	70	↑				7	8	↑				107	79	↑				121	96	↑			
Heavy Vehicles = PCU	3,0				N18						N18						N18						N18		
		1	4		1	66	22	0	0		0	5	0	1	4		1	71	22	1	4		1	81	22
		1	6		4	74	7	0	1		0	6	0	1	8		4	80	7	1	10		4	92	7
Intersecting Road	Existing Access	0	2					0	0					0	2					0	2				
						9	19					1	1					11	20					13	23
		0	57	6		1	1	0	7	0		1	0	0	64	6		2	1	0	78	6		5	1
		1	80	7		3	1	0	6	0		0	0	1	86	7		3	1	1	98	7		3	1
					N18						N18						N18						N18		
Notes					↓	79	67				↓	6	5				↓	85	72				↓	97	82
		88	63	↑				6	7	↑				94	70	↑				106	85	↑			

Figure 10-2: 2021 Background traffic

10.2.1 Intersection 1: N18 Existing Site Access- No New Access (Worst Case)

The intersection is a two-way priority-controlled intersection. The north and south approaches are free-flowing. Figure 10-3 shows the intersection layout. 30-60m acceleration and deceleration lanes are provided along the N18 at the access.

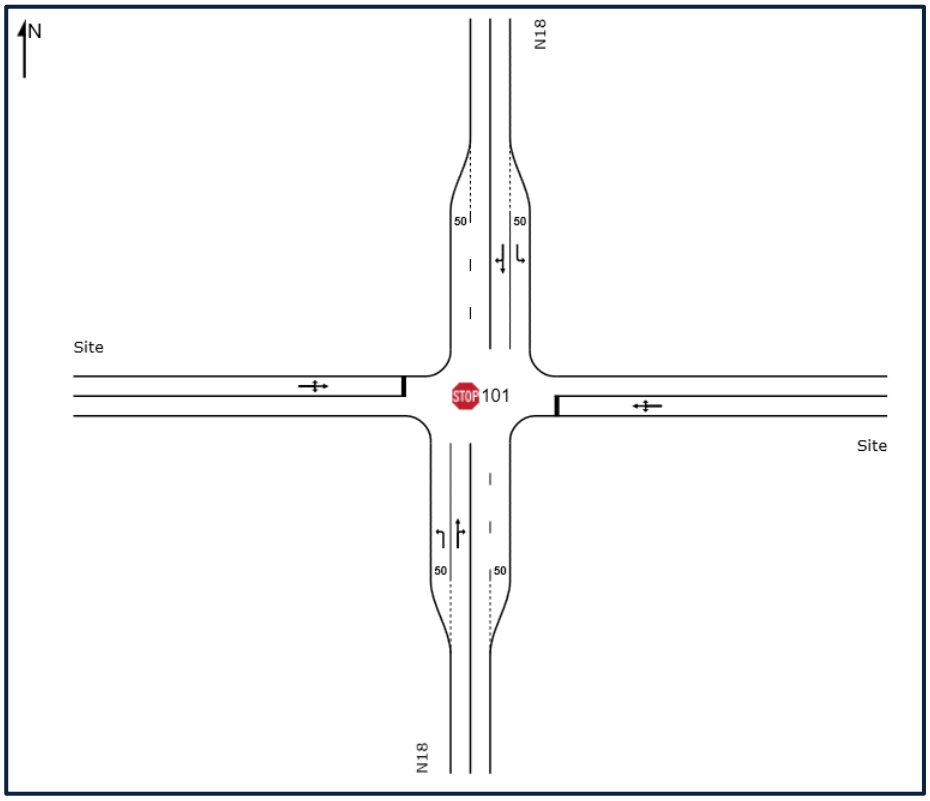

Figure 10-3: Intersection 1 Existing Layout

11 Impact Assessment

11.1 Assessing and Quantifying Impacts

The Assessment and Quantification of impacts provides a discipline specific assessment of the potential transport related effects of the mine and was used to inform the Impact Rating Summary included in Section 11.2.

11.1.1 Intersection Capacity Analysis

The potential traffic impact caused by additional traffic on the road network is identified and quantified in this section. Generally, the following phases are investigated for EIA purposes:

1. Planning Phase;
2. Construction Phase;
3. Operational Phase;
4. Decommissioning Phase; and
5. Rehabilitation and Closure Phase.

The potential impact is expected to be minimal or insignificant during the planning, and the rehabilitation phase. This is due to low volumes of traffic expected to be generated by the two phases. In light of this, only the Construction, Operational and Decommissioning phases were investigated in detail.

11.1.2 Effect of E80's on surfaced roads

E80 is an 80kN equivalent axle load used to determine the required strength of a road pavement. The average E80's for different heavy vehicle configurations is shown in the following table as extracted from COTO TRH16.

Table 11-1: Average E80 per heavy vehicle (Source: COTO TRH16)

Vehicle Type	Average E80's	Range in average E80's
2-axle truck	0.7	0.3-1.1
3-axle truck	1.7	0.8-2.6
4-axle truck	1.8	0.8-3.0
5-axle truck	2.2	1.0-3.0

Approximately 13 trucks enter the facility on a daily (12-hour) basis under normal conditions (based on new traffic count at existing access). It's assumed that an average of 20 trucks access the facility during 24 hours of normal operations. These trucks are assumed to be empty outbound (assume 0.8 E80's/ heavy vehicle) and fully loaded inbound (assume 2.6 E80's/ heavy vehicle) the following table estimates the inbound and outbound development generated E80's over the 12 year operational period with no adjustments for holidays or weekends.

Table 11-2: Total E80s

Direction	12 Year Total E80's
Inbound E80's	70 080
Outbound E80's	227 760

SAPEM Chapter 10: Road Class A shows that a road such as the N18 should be designed to accommodate 3-100 million E80's over a 20 year period (per lane). As such, the impact of the mine's E80's is of low significance and has already predominantly been allowed for as the mine is already operational.

11.1.3 Planning Phase Impacts

This phase does not have significant traffic related impacts. No further impact analysis is required for this phase.

11.1.4 Construction Phase Impacts

The significance of construction phase impacts before and after mitigation measures are summarised in Section 11.2.

11.1.4.1 Deterioration of road network condition

Heavy vehicle construction trips are expected to cause additional wear and tear on the surrounding road network. As most construction will take place on site with existing equipment, the expected effects of this short-term construction on the surrounding road network is minor as the surrounding national road network has been designed to carry heavy vehicles over long periods. The gravel access road to the site is expected to sustain damage during the construction and should be repaired and maintained as required.

Mitigation measures

The following mitigation measures are proposed:

- Repair and maintenance of site gravel access road within site during construction period

Cumulative Impacts

Cumulative impacts of traffic loading will cause increasing deterioration of this road which may require additional repair and maintenance.

11.1.4.2 Increase in dust along gravel site access road

Dust is generated along gravel roads due to heavy vehicles operating at high speeds. There are no nearby residential communities and heavy vehicle volumes are fairly low therefore effects are not expected to be significant.

Mitigation measures

The following mitigation measures are proposed:

- Limit heavy vehicle speed to 40km/h along site access road
- Water down access road on a regular basis (as required) to reduce dust

11.1.4.3 Impact of additional traffic volumes on intersection capacity

The following table highlights the SIDRA intersection capacity results for 2024 Background Traffic + Construction Traffic. As shown in the table, no further capacity upgrades are required to support construction trips. With the existing access and the proposed access performing at overall LOS A.

Table 11-3: SIDRA Intersection Analysis Results: Construction Period - existing access Layout

	2024 Base + Construction							
	Weekday AM				Weekday PM			
	Delay (sec)	V/C (%)	LOS	95% queue (veh)	Delay (sec)	V/C (%)	LOS	95% queue (veh)
South	1,9	0,053	LOS A	0,1	1,2	0,065	LOS A	0,1
East	11,2	0,037	LOS B	0,1	10,9	0,54	LOS B	0,2
North	3	0,083	LOS A	0,2	3,4	0,07	LOS A	0,2
West	10,5	0,041	LOS B	0,2	10,2	0,039	LOS B	0,1
	LOS A				LOS A			

Table 11-4: SIDRA Intersection Analysis Results: Construction Period - proposed access layout

	2024 Base + Construction							
	Weekday AM				Weekday PM			
	Delay (sec)	V/C (%)	LOS	95% queue (veh)	Delay (sec)	V/C (%)	LOS	95% queue (veh)
South	1,9	0,053	LOS A	0,1	1,2	0,064	LOS A	0,1
East	11,2	0,037	LOS B	0,1	10,9	0,054	LOS B	0,2
North	3	0,038	LOS A	0,2	3,4	0,077	LOS A	0,2
West	10,5	0,041	LOS B	0,2	10,2	0,039	LOS B	0,1
	LOS A				LOS A			

11.1.4.4 Mitigation measures

The following mitigation measures are proposed:

- Limit construction heavy vehicle trips to off-peak hours when possible
- Ensure SARTSM Vol 2 Guidelines are followed in case number of heavy vehicles exceeds 10 per 12-hour daytime period or 5 per 12-hour nighttime period, or ensure special approval from the road authority

11.1.4.5 Road Closure of N18 for construction

The expansion of the mine will also entail 60km of piping, of which a portion crosses the N18. This portion will be closed for a short periods during construction which will stop traffic travelling along the N18.

Mitigation measures

Given that the mine is located on both sides of the N18, temporary road closure with deviation lanes will be required to maintain connectivity during pipe laying which be across the N18. Figure 11-1 shows the traffic deviation layout plan for the Kalgold mine. This will allow traffic on the N18 to divert during the temporary closure of the road. Traffic volumes are sufficiently low (less than 100vph) to be accommodated on the proposed diversion roads.

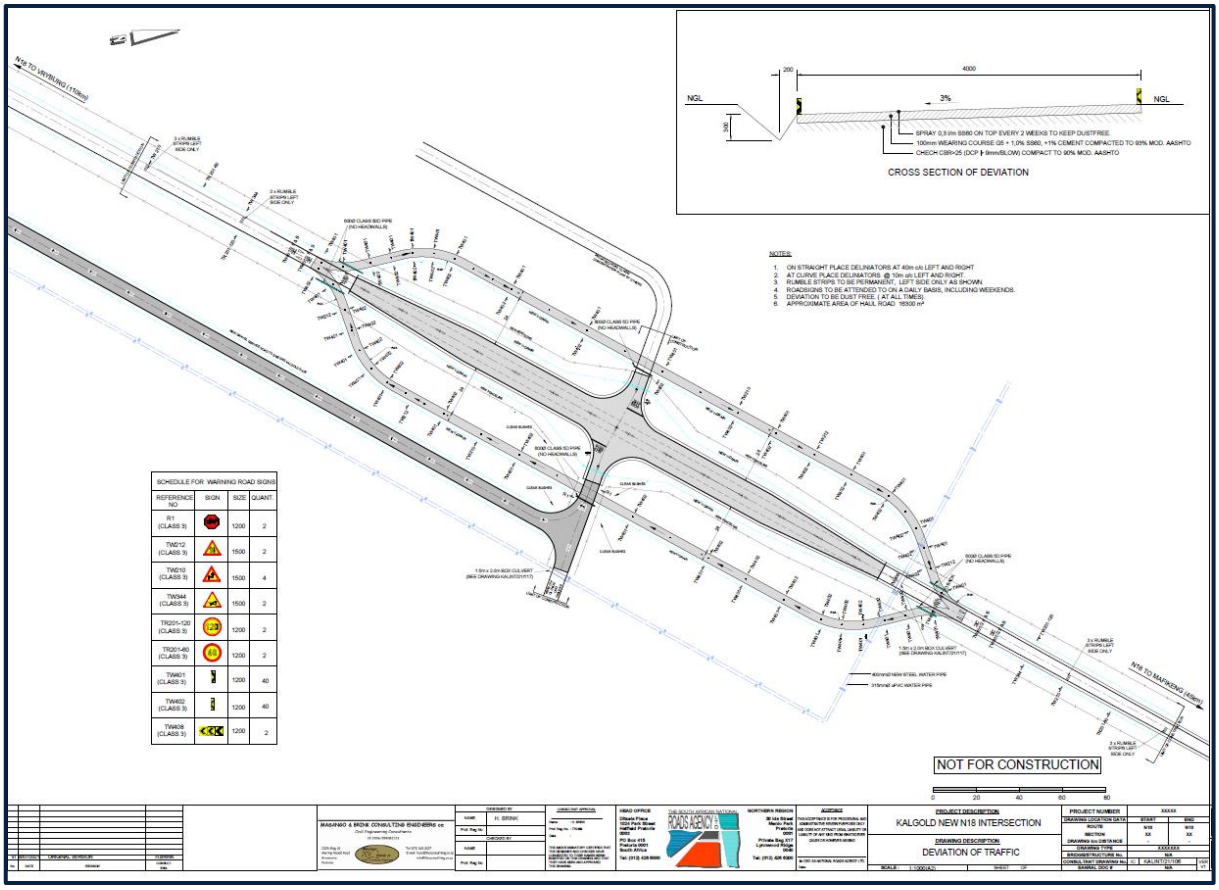

Figure 11-1: Kalgold mine traffic deviation layout plan

11.1.5 Operational Phase Impacts

The significance of operational phase impacts before and after mitigation measures are summarised in Section 11.2.

11.1.5.1 Deterioration of road network condition

Heavy vehicle trips are expected to cause additional wear and tear on the surrounding road network which will mean road maintenance of the surrounding road network will be required earlier than previously expected. Details on the number of additional E80's on the surrounding road network are indicated in Section 0. All roads affected by these heavy vehicles have been designed to carry heavy vehicles over long periods.

Mitigation measures

The following mitigation measures are proposed:

- Repair and maintenance of site gravel access road with during operational period

11.1.5.2 Increase in dust along gravel site access road

Dust is generated along gravel roads due to heavy vehicles operating at high speeds. Dust may negatively affect nearby farms.

Mitigation measures

The following mitigation measures are proposed:

- Limit heavy vehicle speed to 40km/h along site access road
- Water down access road on a regular basis (as required) to reduce dust

11.1.5.3 Impact of additional traffic volumes on intersection capacity

The operational trips were imposed on the intersections with the 2036 background demand. The following table shows the results summary for this scenario. As shown in the results, no additional upgrades are required to meet the operational demand.

Table 11-5: SIDRA Intersection Results: 2036 Operational - existing access layout

Weekday AM				Weekday PM			
Delay (sec)	V/C (%)	LOS	95% queue (veh)	Delay (sec)	V/C (%)	LOS	95% queue (veh)
1,2	0,074	LOS A	0,1	1	0,093	LOS A	0,1
11,4	0,052	LOS B	0,2	11,4	0,77	LOS B	0,3
1,3	0,083	LOS A	0,1	2,4	0,069	LOS A	0
10,5	0,039	LOS B	0,1	11,4	0,01	LOS B	0
LOS A				LOS A			

Table 11-6: SIDRA Intersection Results: 2036 Operational - Proposed access layout

	Weekday AM				Weekday PM			
	Delay (sec)	V/C (%)	LOS	95% queue (veh)	Delay (sec)	V/C (%)	LOS	95% queue (veh)
South	1,2	0,074	LOS A	0,1	1	0,093	LOS A	0,1
East	11,4	0,052	LOS B	0,2	11,4	0,077	LOS B	0,3
North	1,3	0,083	LOS A	0,1	2,4	0,069	LOS A	0
West	10,5	0,039	LOS B	0,1	11,4	0,01	LOS B	0
	LOS A				LOS A			

Mitigation measures

No mitigation measures are required to accommodate the mine trips on the surrounding road network. Upgrades to meet the background traffic demand for the area are the responsibility of the relevant road authorities and these will accommodate new demand generated by the mine.

11.1.6 Decommissioning Phase Impacts

The significance of decommissioning phase impacts before and after mitigation measures are summarised in Section 11.2.

11.1.6.1 Deterioration of road network condition

Heavy vehicle construction trips are expected to cause additional wear and tear on the surrounding road network. The expected effects of this short-term decommissioning on the surrounding road network is minor as the surrounding national road network has been designed to carry heavy vehicles over long periods. The gravel access road to the site is expected to sustain damage during the decommissioning and should be repaired and maintained as required.

Mitigation measures

The following mitigation measures are proposed:

- Repair and maintenance of site gravel access road within site during construction period

Cumulative Impacts

Cumulative impacts of traffic loading will cause increasing deterioration of this road which may require additional repair and maintenance.

11.1.6.2 Increase in dust along gravel site access road

Dust is generated along gravel roads due to heavy vehicles operating at high speeds. There are no nearby residential communities and heavy vehicle volumes are fairly low therefore effects are not expected to be significant.

Mitigation measures

The following mitigation measures are proposed:

- Limit heavy vehicle speed to 40km/h along site access road
- Water down access road on a regular basis (as required) to reduce dust

11.1.6.3 Impact of additional traffic volumes on intersection capacity

As already mentioned, the decommissioning trips are anticipated to be similar to the construction trips. As such, the impact evaluated for the construction scenario will also be applicable for this scenario. In the construction scenario, it was found that there is minimum impact on the supporting road network

Mitigation measures

No mitigation measures are required to accommodate the mine trips on the surrounding road network from a capacity perspective.

11.1.7 Rehabilitation and Closure Phase Impacts

11.1.7.1 Deterioration of road network condition

Heavy vehicle rehabilitation and closure trips are expected to cause additional wear and tear on the surrounding road network. The expected effects of this short-term phase on the surrounding road network is minor as the surrounding national and provincial road network has been designed to carry heavy vehicles over long periods. The gravel access road to the site is expected to sustain damage during this period.

Mitigation measures

The following mitigation measures are proposed:

- Repair and maintenance of site gravel access road with during rehabilitation and closure period

Cumulative Impacts

Cumulative impacts of traffic loading will cause increasing deterioration of this road which may require additional repair and maintenance.

11.1.7.2 Increase in dust along gravel site access road

Dust is generated along gravel roads due to heavy vehicles operating at high speeds. Dust may negatively affect nearby residential communities.

Mitigation measures

The following mitigation measures are proposed:

- Limit heavy vehicle speed to 40km/h along site access road
- Water down access road on a regular basis (as required) to reduce dust

11.1.7.3 Impact of additional traffic volumes on intersection capacity

Additional traffic volumes for this phase are short-term and are expected to be lower than in the operational phase. No further analysis of intersection capacity is required to meet this demand, however heavy vehicle trips should be limited to off-peak hours during this period to ensure larger vehicles do not negatively affect the surrounding intersections during peak periods.

Mitigation measures

The following mitigation measures are proposed:

- Limit construction heavy vehicle trips to off-peak hours

.

11.2 Impact Assessment Methodology

The impact significance rating methodology, as provided by EIMS, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. This determines the environmental risk. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S). The impact assessment will be applied to all identified alternatives. Where possible, mitigation measures were recommended for impacts identified. Table 11-7 shows a summary of the effects pre and post mitigation.

Table 11-7: Impact Rating Summary

IMPACT DESCRIPTION							Priority Factor Criteria			
Identifier	Impact	Alternative	Phase	Pre-mitigation ER	Post-mitigation ER	Confidence	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
1.1.1	Deterioration of road network condition	Alternative 1	Construction	-6,75	-6,75	High	1	1	1,00	-6,75
1.1.2	Increase in dust along access road	Alternative 1	Construction	-4,5	-3,5	High	1	1	1,00	-3,50
1.1.3	Increase in peak hour traffic volumes	Alternative 1	Construction	-6	-6	High	1	1	1,00	-6,00
1.1.4	Deterioration of road network condition	Alternative 1	Operation	-6,75	-6,75	High	1	1	1,00	-6,75
1.1.5	Increase in dust along access road	Alternative 1	Operation	-4,5	-3,5	High	1	1	1,00	-3,50
1.1.6	Increase in peak hour traffic volumes	Alternative 1	Operation	-6	-6	High	1	1	1,00	-6,00
1.1.7	Deterioration of road network condition	Alternative 1	Decommissioning	-6,75	-6,75	High	1	1	1,00	-6,75
1.1.8	Increase in dust along access road	Alternative 1	Decommissioning	-4,5	-3,5	High	1	1	1,00	-3,50
1.1.9	Increase in peak hour traffic volumes	Alternative 1	Decommissioning	-6	-6	High	1	1	1,00	-6,00

12 Specialist Management Plan

Table 12-1: Example of mitigation measures including requirements for timeframes, roles and responsibilities etc.

	Mitigation Measures						
	1. Site access, Security and Traffic Management						
A	Gravel Access Road should be maintained to support heavy vehicle movement.	Construction Operation Decommissioning Rehab and closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Safe access road to site	Visual Assessment
B	Heavy vehicle trips for planning, construction, decommissioning and rehabilitation and closure phases should be limited to off-peak hours	Construction Decommissioning Rehab and closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	Limit heavy vehicle trips to surrounding road network during peak hours; Construct 500m acceleration lanes to accommodate heavy vehicles at access	Heavy vehicle arrival times
C	Limit heavy vehicle speed to 40km/h along site access road Water down access road on a regular basis to reduce dust	Construction Operation Decommissioning Rehab and closure	Ongoing	Applicant Contractor	Contractors EO (Daily) Mine EO (Weekly) ECO (Monthly)	No dust to affect nearby farms	Record-watering; Road accident statistics
D	N18 bypass links during road closure of N18 for construction period	Construction	Temporary	Applicant Contractor	Traffic Safety Officer	Allow safe alternative for vehicles when the N18 is closed	On-site safety checks; Road accident statistics

13 Conclusion

SMEC South Africa (Pty) Ltd was appointed on behalf of Harmony by Environmental Impact Management Services (EIMS) to provide a specialist report for transport, hereafter referred to as a Traffic Impact Assessment (TIA). Kalgold is an open-pit gold mine situated on the Kraaipan Greenstone belt, 55km southwest of Mahikeng, North West Province and is applying for environmental authorisation to expand its current production from the current production rate of 130 000 tons per month to 300 000 tons per month

The following impacts were assessed for the planning; construction; operational; decommissioning and rehabilitation and closure phases of the project, where relevant:

- Site Access
- Site Access Intersection Capacity Analysis using SIDRA Intersection
- Deterioration of road network condition (Effect of E80's on surfaced roads)
- Increase in dust along site access road
- Temporary Closure of the N18

The existing site access layout is acceptable from a capacity perspective for the full lifespan of the mine. The heavy vehicles exiting the site via this access exceed 10 heavy vehicles in a 12-hour daytime period, therefore 500m acceleration lanes will need to be provided at the access along the N18.

A new site access has been proposed. It should have the same layout as the existing access and needs to be checked to ensure sufficient sight distances. If a new access is implemented, the existing access will need to be closed to meet the minimum access spacing requirements on rural Class 1 roads (8km) otherwise special permission from SANRAL will be required.

No intersection capacity upgrades are recommended for the surrounding road network to accommodate the future traffic growth.

The following mitigation measures are recommended:

- Internal Gravel Access Roads should be maintained to support heavy vehicle movement.
- Heavy vehicle trips for planning, construction, decommissioning and rehabilitation and closure phases should be limited to off-peak hours as far as possible and distributed throughout a period as far as possible (avoid multiple vehicles arriving or departing at once).
- Limit heavy vehicle speed to 40km/h along internal site roads.
- Water down gravel roads on a regular basis to reduce dust.
- Provide bypass routes for the temporary road closure during construction.

It is recommended that the applicant's request be approved from a traffic and transportation perspective.

14 Assumptions, Uncertainties and Gaps In Knowledge

Details on assumptions have been included in detail where relevant in the report. As this study was conducted during the covid-19 pandemic, historic data was used as a basis for analysis. Future changes to trip patterns and the development rate of the surrounding area are likely to result in changes to typical traffic volumes in the area. Historic counts grown at 3% per annum provide a conservative estimate of the demand on the surrounding road network and required road authority upgrades are likely to be less extensive than estimated in this report. Conservative assumptions were made in terms of construction labour requirements, no. of labourers accessing the site at the same time and in the distribution of trips to the surrounding road network.

Appendix 1 Specialist Declaration

Appendix 2 Specialist CV

Appendix 3 Stick Diagrams

Appendix 4 Detailed Capacity Resultsa

Redefining exceptional

Through our specialist expertise, we're challenging boundaries to deliver advanced infrastructure solutions.

www.smec.com