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Blast and Vibration Assessment Report Proposed Universal Coal Kangala Extension Project	
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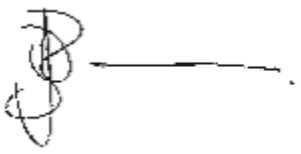
Signed:	
Name:	JD Zeeman

i. Document Prepared and Authorised by:

JD Zeeman
Blast Management & Consulting (2015/061002/07)
61 Sovereign Drive
Route 21 Corporate Park
Irene
South Africa

PO Box 61538
Pierre van Ryneveld
Centurion
0045

Cell: +27 82 854 2725 Tel: +27 (0)12 345 1445 Fax: +27 (0)12 345 1443

ii. Study Team Qualifications And Background

The study team comprises J D Zeeman (as the member of Blast Management & Consulting) and Blast Management & Consulting employees. Blast Management & Consulting's main areas of concern are pre-blast consultation and monitoring, insitu monitoring, post-blast monitoring and consulting as well as specialised projects. Blast Management & Consulting has been active in the mining industry since 1997 and work has been done at various levels for mining companies in South Africa, Botswana, Namibia, Mozambique, Democratic Republic of Congo, Sierra Leone and Côte d'Ivoire.

J D Zeeman holds the following qualifications:

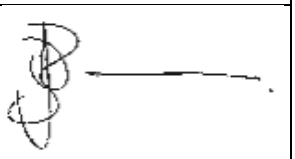
1985 - 1987	Diploma: Explosives Technology, Technikon Pretoria
1990 - 1992	BA Degree, University of Pretoria
1994	National Higher Diploma: Explosives Technology, Technikon Pretoria
1997	Project Management Certificate, Damelin College
2000	Advanced Certificate in Blasting, Technikon SA

Member: International Society of Explosive Engineers

iii. Independence Declaration

Blast Management & Consulting is an independent company. The work done for the report was performed in an objective manner and according to national and international standards, which means that the results and findings may not all be positive for the project applicant. Blast Management & Consulting has the required expertise to conduct such an investigation and draft the specialist report relevant to the study. Blast Management & Consulting did not engage in any behaviour that could be result in a conflict of interest in undertaking this study.

iv. Document Control:

Name & Company	Responsibility	Action	Date	Signature
C Zeeman Blast Management & Consulting	Document Preparation	Report Prepared	30/07/2018	
JD Zeeman Blast Management & Consulting	Consultant	Report Finalise	30/07/2018	

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1 Executive Summary

Universal Coal Development 1 (UCD1) wishes to develop a new opencast coal mining operation covering an extent of 251 hectares (ha), adjacent to the existing Universal Coal's Kangala Colliery on various portions of the Farm Strydpan 243 IR - herein referred to as the Kangala Extension Project. The proposed Kangala Extension Project is anticipated to use a standard truck and shovel mining method based on strip mining design and layout. The existing Coal Handling and Processing Plant (CHPP) at the Kangala Colliery will be utilised for the proposed Kangala Extension Project. It is expected that no new surface infrastructure such as offices, dams, stores facility, workshops, or change house will be required for the project.

The project footprint is in Victor Khanye Local Municipality, located within the Nkangala District Municipality, Mpumalanga Province. The project area covers portions 14, 16, 20, 23, 24, and RE of the Farm Strydpan 243 IR and is situated approximately 7.5km south-east of the town Delmas.

The project area was reviewed on scoping level phase. Various installations were identified within the 3500 m from the proposed opencast operation. Possible impacts at these points of interest associated with the planned operation was identified and considered. Three areas within the range from 0 to 3500 m from pit boundary were identified and indicated that could have different levels of possible influence. The possible influences and level of influence will be investigated and if required mitigation measures will be recommended during the impact assessment phase.

2 Introduction

Blast Management & Consulting was contracted as part of the Environmental Impact Assessment (EIA) team to perform an initial review of possible impacts with regards to blasting operations in the proposed Kangala Extension Project. Blast Management & Consulting as a company concentrates on the monitoring, prediction, analysis, audit and consulting on all aspects of blasting operations. Specifically are aspects such as ground vibration, air blast, fly rock, fumes and other influences evaluated.

3 Scope of Work

In presenting a scoping report the following scope of work is suggested and reported.

- Introduction
- Legislative Requirements
- Existing Status of project
- Source and receiving Environment
- Anticipated impacts

- Plan of environmental impact study

4 Legislative requirements

The following acts and guidelines contain references that will applicable to the study. There are currently no direct legislation with regards to ground vibration and air blast levels in South Africa. Aspects on control of blast impacts, vibration and air blast are not directly addressed in these acts but are supporting documents to the process of evaluating the possible influences. The short fall of direct legislation is supported by international standards and other guidelines with experience.
The following acts and supporting detail is considered:

- Explosives Act No. 26 Of 1956 And Its Amendments Gnr.1604 Of 8 September 1972
- Environment Conservation Act No. 73 Of 1989
- Mineral And Petroleum Resources Development Act No. 28 Of 2002 And Amendments Gnr.527 Of 23 April 2004
- Mine Health And Safety Act No. 29 Of 1996 And Amendments Gnr.93 Of 15 January 1997
- Ground vibration and air blast is also evaluated according to the USBM (United States Bureau of Mines) guidelines for safe blasting
- Ground vibration and air blast is also evaluated according to guidelines as used by Blast Management & Consulting based on experienced and knowledge.

5 Existing Status

The Kangala Extension Project is located approximately 7.5km south-east of the town Delmas within the Nkangala District Municipality, Mpumalanga Province, South Africa at coordinates (Lat/Lon WGS84) 26°12'15.50"S 28°38'52.65"E. Figure 1 shows the Locality Map for the project area and Figure 2 show the basic layout for the mine area and infrastructure.

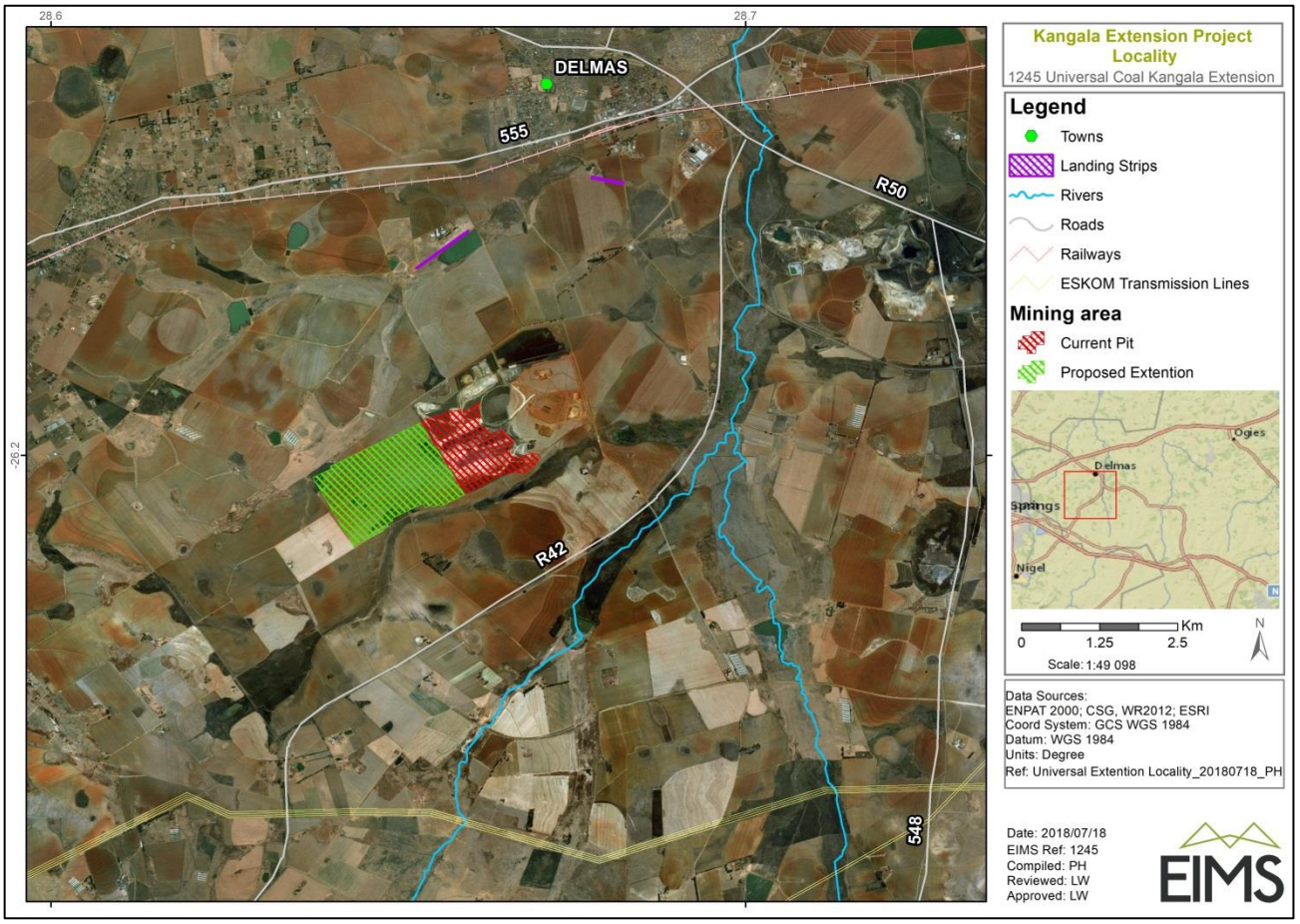

Figure 1: Locality Map

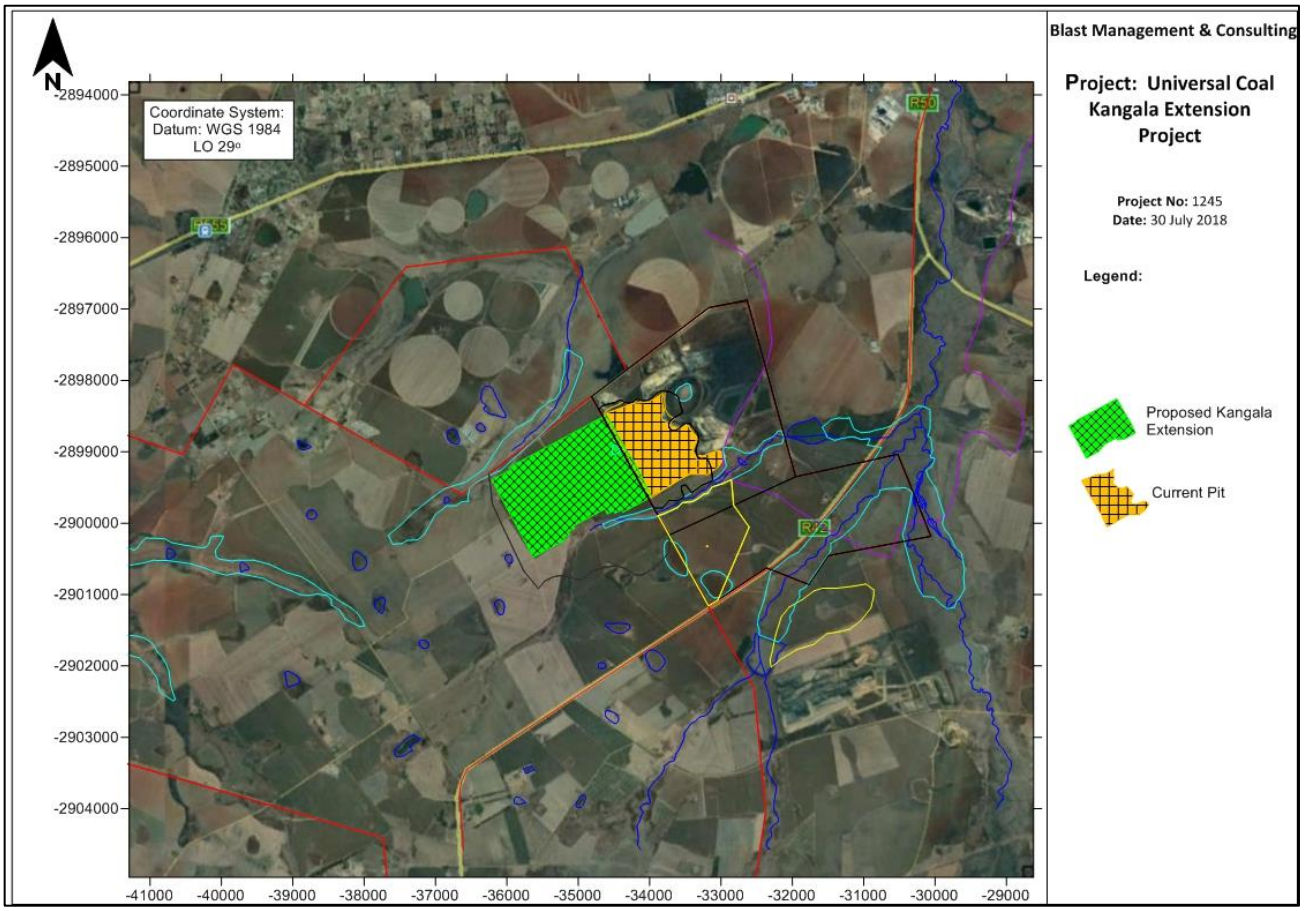

Figure 2: Mine Area with Infrastructure

6 Assumptions and Limitations

The following assumptions have been made:

- The anticipated areas of influence estimated in this report are based on the authors experienced from general blasting operations in the opencast coal environment.
- Accepted international and local standards with regulations are applied to guide the determination of expected influence areas.
- The assumption is made that the predicted influence areas are a good estimate. These will have to be confirmed with prediction models based on blast information data.
- Blast Management & Consulting was not involved in the mine or planned blast designs to be used.
- The work done is based on the author's knowledge and information provided by the project applicant.

7 Source and Receiving Environment

The proposed Kangala Extension Project is anticipated to use a standard truck and shovel mining method based on strip mining design and layout. The existing Coal Handling and Processing Plant (CHPP) at the Kangala Colliery will be utilised for the proposed Kangala Extension Project. It is expected that no new surface infrastructure such as offices, dams, stores facility, workshops, or change house will be required for the project.

The proposed project includes inter alia the following application processes with associated activities:

- New Environmental Authorisation (Scoping and Environmental Impact Report (S&EIR)) for:
    - Development of new opencast pit
- Section 102 Amendment
    - Revised Mine Works Programme (MWP) to include new opencast pit; and
    - Revised consolidated Environmental Management Plan Report (EMPr) to include new opencast pit.

The receiving environment is considered the area expected to be influenced directly adjacent to the Kangala Extension Project area and specifically the area adjacent to the Pit area. The area of influence is not expected to exceed a distance range of 3500m radius around the Pit Area. Figure 3 shows the location of the Kangala Extension Project Area and the anticipated receiving environment around the Pit, indicated as the Study area.

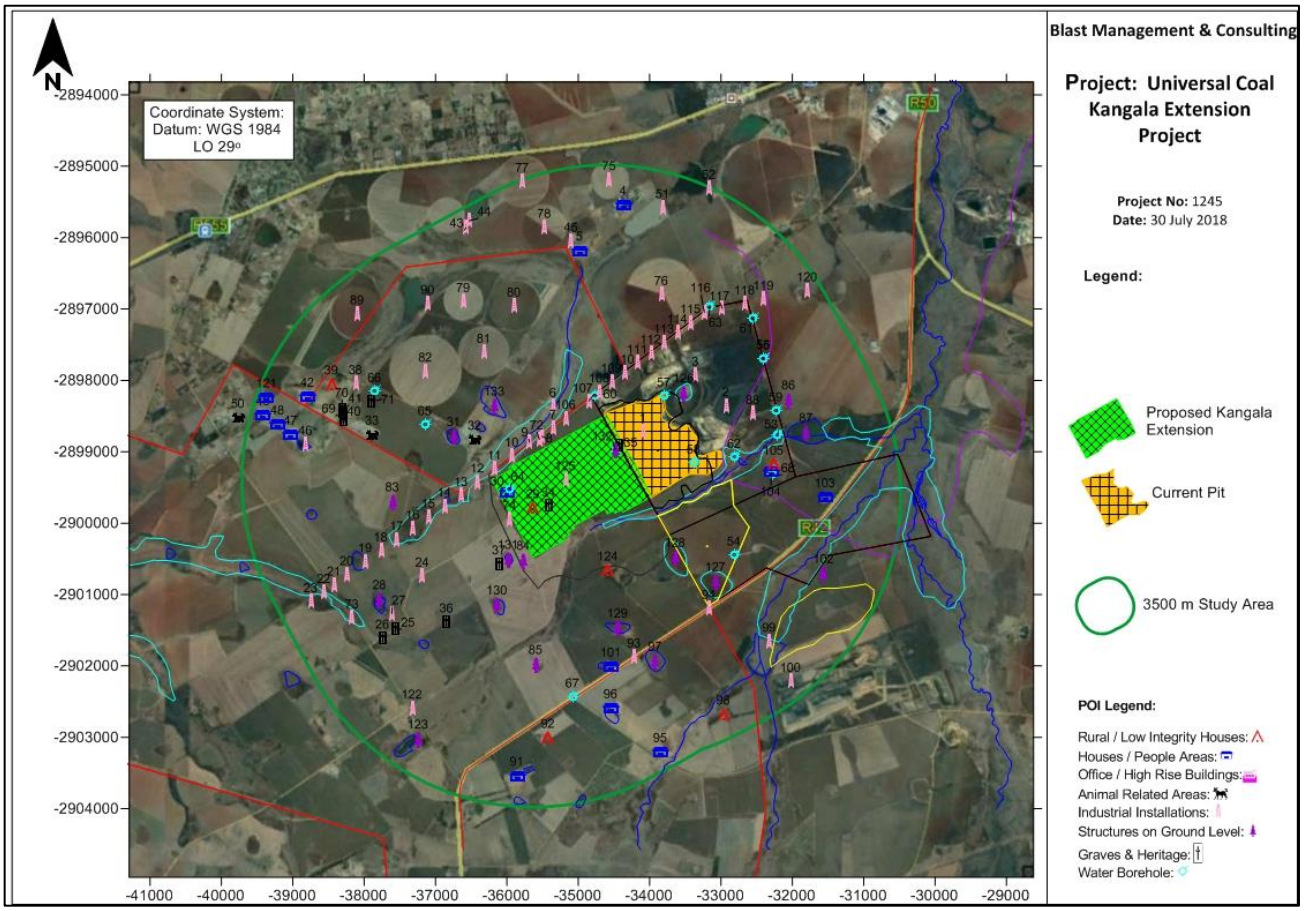

Figure 3: Study Area

8 Anticipated Impacts

Blasting operations primary objective is producing rock for crushing to be used in construction. The blasting operation has the potential to yield secondary effects such as ground vibration, air blast, fly rock and fumes. These aspects may have a negative impact on the surrounding areas depending on the levels generated. The potential impacts considered can be described as follows:

Ground vibration: Levels greater than recommended limits may be damaging to structures. Different structures will also have different permitted levels. Ground vibration may cause damage if levels exceed the structures safe limit. People may also experience ground vibration as perceptible at very low levels and normally react negatively to the experience of ground vibration.

Air blast: In most cases the effect of air blast is underestimated. High levels of air blast could cause damage and normally windows are first to be damaged. Levels lower than required to induce damage may rattle windows and large roof surfaces. These effects are generally mistaken as ground vibration effect and leads to complaints. Rattling of doors and roofs causes concern and lead to upsetting people.

Fly Rock: Fly rock can be mitigated but possibility never eliminated. However it can be managed properly with relative ease. Control on fly rock will also control the effects of air blast. Fly rock is

greater concern when pit is located in close proximity of houses or structures or installations. Wild fly rock could cause damage to structures and installations but also be lethal to people and animals.

Considering the possible impacts given above the study will define the level of anticipated impact. The level of impact will also give guideline to the level of mitigation or management of the impacts. Management of the impacts could include the following aspects as indicated in Table 1 below. Detail of management and mitigation will be discussed in the report where applicable:

Table 1: Anticipated impact and possible management

Anticipated Impact	Mitigation / Management
Ground Vibration	Blast Design.
	Reduce charge mass per delay,
	Change drilling configuration,
	Alternative blasting,
	Change initiation systems,
Air Blast	Blast Design,
	Stemming controls,
	stemming lengths,
	Stemming materials,
	Meteorological concerns.
Fly rock	Blast Design,
	Stemming controls,
	stemming lengths,
	Stemming materials,
	Geological concerns.

The objective is to outline the expected environmental effects that blasting operations could have on the surrounding environment. The study will investigate the related levels and possible influences of expected ground vibration, air blast, fly rock and noxious fumes on the area of 1500m[1] surrounding the blast areas.

The receiving environment is classed into three areas:

- 0 to 500 m which is considered the most critical. In most blasting operations this area is considered the unsafe zone and is normally cleared of all people and animals when blasting is done in a mining environment.
- Lesser sensitive or medium sensitivity is the 500 m to 1500 m [2] reference area. 1500m is considered range by Blast Management & Consulting as range where influence may be less but still requires active monitoring.
- The lowest critical or low sensitivity area is the 1500 m to approximately 3500 m. In this area the effects have more possibility of upsetting people than causing damage to structures.

[1] Determined by Blast Management & Consulting from Experience

[2] Estimated from experience by Blast Management & Consulting

Indicated in Figure 4 are different ranges indicated with various points of interest identified to date. These points are locations of possible receptors. At this stage this is not the final list of receptors or types of receptors as site visit will confirm receptors and more detail review is required of the area. This is a basic indication of possible receptors.

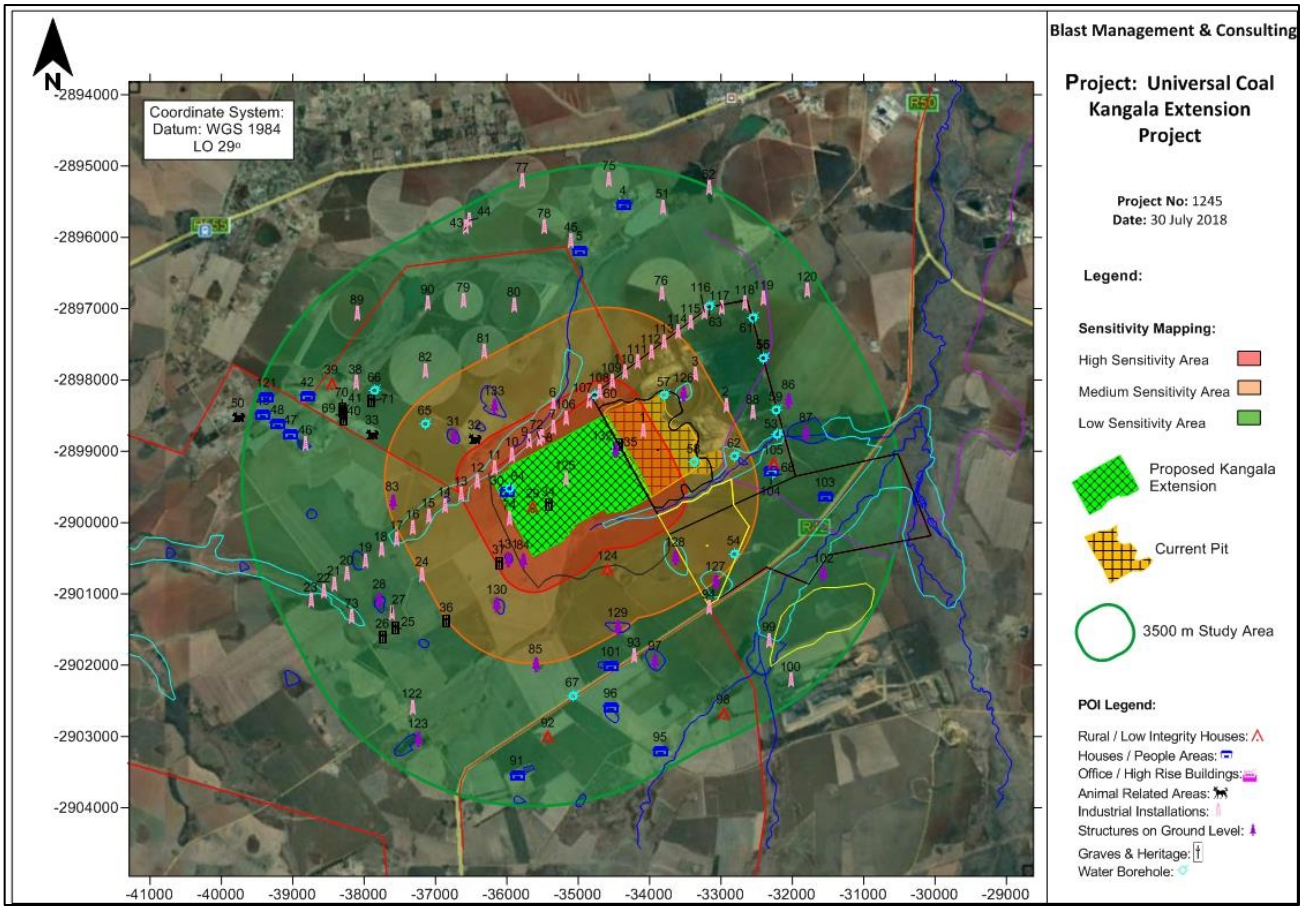

Figure 4: Study Area with POI and ranges from Pit Area

The specific levels of influence to be considered contributing to damage of structures / installations in the area cannot be determined at this stage. The geology and expected drilling and blasting operations to be done with the possible influence with regards to the human perceptions of ground vibration and air blast will be considered. Humans are sensitive to even very low level effects of ground vibration and air blast. In order to take this into consideration an area of 1500m is identified as area that could observe influence. This is in view that people will experience ground vibration levels as low as 0.75mm/s[3].

[3] Chiapetta F, A Van Vreden, 2000, Vibration/Air blast Controls, Damage Criteria, Record Keeping and Dealing with Complaints. 9th Annual BME Conference on Explosives, Drilling and Blasting Technology, CSIR Conference Centre, Pretoria, 2000.

The objective is to outline the expected environmental effects that blasting operations could have on the surrounding environment. The study will investigate the related levels and possible influences of expected ground vibration, air blast, fly rock on the surrounding area.

9 Plan of study

In order to complete impact assessment the following is required to be done:

- Conduct a site visit for determining location of structures and structure profile: Determine typical structures and installations that are found in within the influence radius form the operation.
- Obtain all relevant data and information on proposed blasting methods and methodology.
- The process then consists of modelling the expected impact based on planned drilling and blasting information for the operation. Various accepted mathematical equations[4] are applied to determine the attenuation of ground vibration, air blast and fly rock. These values are then calculated over distance from site and shown as amplitude level contours. Overlay of these contours with the location of the various receptors then give indication of the possible impact and expected result of potential impact. Evaluation of each receptor according to the predicted levels will indicate level of possible influence and required mitigation if necessary. The possible environmental or social impacts are then addressed in the detailed EIA phase investigation.
- Prepare a report that provides the discussion and outcomes of all evaluations.
- Present the outcomes to interested and affected parties if required.

[4] Persson, P. A., R. Holmberg and J. Lee, 1994, Rock Blasting and Explosives Engineering, Boca Raton, Florida: CRC Press.

10 Scoping Phase Impact Assessment

The scoping phase impact is based on review of the planned project area with the surrounding infrastructure. Evaluation is done based on the three areas of sensitivity and the type of infrastructure observed in the areas of 0 to 500 m, 0 to 1500 m and beyond 1500 m.

Table 2: Scoping Phase Impact Assessment

IMPACT DESCRIPTION		PRE - MITIGATION							POST - MITIGATION								IMPACT PRIORITISATION				
Impact	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence	Public response	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
Ground vibration Impact on houses	Operation	-1	3	4	4	4	4	-15	-1	3	4	3	3	4	-13	High	2	2	2	1.50	-19.50
Ground vibration Impact on roads	Operation	-1	3	4	4	4	2	-7.5	-1	3	4	3	2	2	-6	High	2	2	2	1.50	-9.00
Ground vibration Impact on boreholes	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	2	5	-15	High	2	2	2	1.50	-22.50
Ground vibration Impact on heritage sites	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	4	5	-17.5	High	2	2	2	1.50	-26.25
Ground vibration Impact on Powerlines	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	3	5	-16.25	High	2	2	2	1.50	-24.38
Ground vibration Impact on broilers	Operation	-1	3	4	4	5	5	-20	-1	3	4	3	3	5	-16.25	High	2	2	2	1.50	-24.38
Air Blast Impact on houses	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	3	5	-16.25	High	2	2	2	1.50	-24.38
Air Blast Impact on roads	Operation	-1	3	4	4	4	1	-3.75	-1	3	4	3	2	1	-3	High	2	2	2	1.50	-4.50
Air Blast Impact on boreholes	Operation	-1	3	4	4	4	2	-7.5	-1	3	4	3	2	2	-6	High	2	2	2	1.50	-9.00

IMPACT DESCRIPTION		PRE - MITIGATION							POST - MITIGATION								IMPACT PRIORITISATION				
Impact	Phase	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Pre-mitigation ER	Nature	Extent	Duration	Magnitude	Reversibility	Probability	Post-mitigation ER	Confidence	Public response	Cumulative Impact	Irreplaceable loss	Priority Factor	Final score
Air Blast Impact on heritage sites	Operation	-1	3	4	4	4	3	-11.25	-1	3	4	3	4	3	-10.5	High	2	2	2	1.50	-15.75
Air Blast Impact on Powerlines	Operation	-1	3	4	4	4	2	-7.5	-1	3	4	3	3	2	-6.5	High	2	2	2	1.50	-9.75
Air Blast Impact on broilers	Operation	-1	3	4	4	5	5	-20	-1	3	4	3	3	5	-16.25	High	2	2	2	1.50	-24.38
Fly Rock Impact on houses	Operation	-1	3	4	4	4	2	-7.5	-1	3	4	3	3	2	-6.5	High	2	2	2	1.50	-9.75
Fly Rock Impact on roads	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	2	5	-15	High	2	2	2	1.50	-22.50
Fly Rock Impact on boreholes	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	2	5	-15	High	2	2	2	1.50	-22.50
Fly Rock Impact on heritage sites	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	4	5	-17.5	High	2	2	2	1.50	-26.25
Fly Rock Impact on Powerlines	Operation	-1	3	4	4	4	5	-18.75	-1	3	4	3	3	5	-16.25	High	2	2	2	1.50	-24.38
Fly Rock Impact on broilers	Operation	-1	3	4	4	5	3	-12	-1	3	4	3	3	3	-9.75	High	2	2	2	1.50	-14.63

11 Conclusion and Recommendations

The Kangala Extension Project was reviewed on scoping level phase. Points of interest were identified for possible influence. Various installations were identified within the 3500 m from the proposed new operation. Three areas ranging from 0 to 3500 m was identified with different levels of possible influence indicated. The possible influences and level of influence will be investigated and if required mitigation measures will be recommended during the impact assessment phase.