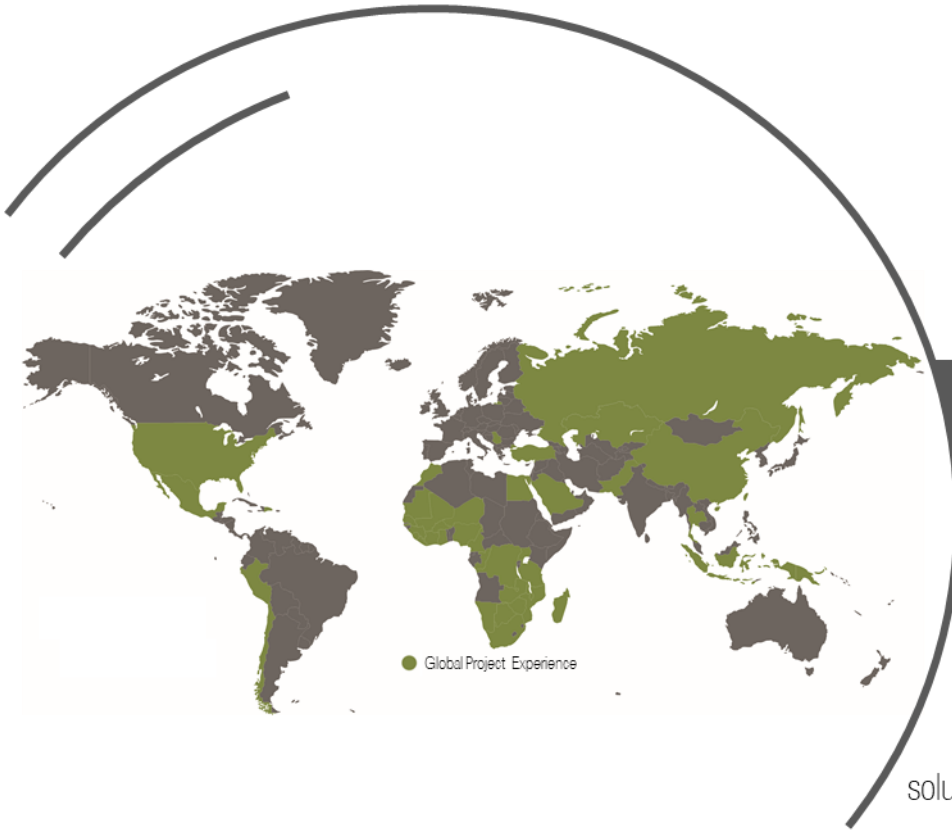

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Pan African Resources PLC (PAR) Environmental Application Process

Environmental Noise Impact Assessment

Prepared for:
Pan African Resources PLC (PAR)

Project Number:
PAR7273

July 2022

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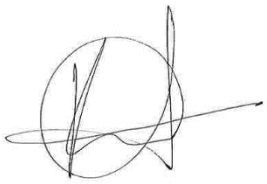
Report Type:	Environmental Noise Impact Assessment
Project Name:	Pan African Resources PLC (PAR) Environmental Application Process
Project Code:	PAR7273

Name	Responsibility	Signature	Date
Keenan Terry (Cand.Sci.Nat)	Report Compiler		July 2022
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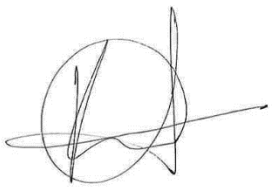
I, Keenan Terry, declare that: –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
    - I declare that there are no circumstances that may compromise my objectivity in performing such work;
    - I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and

- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

07/12/2021

Date

Findings, recommendations and conclusions provided in this report are based on the best available scientific methods and the author's professional knowledge and information at the time of compilation. Digby Wells employees involved in the compilation of this report, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

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Any recommendations, statements or conclusions drawn from or based on this report must clearly cite or make reference to this report. Whenever such recommendations, statements or conclusions form part of a main report relating to the current investigation, this report must be included in its entirety.

EXECUTIVE SUMMARY

Digby Wells Environmental (hereafter Digby Wells) has been appointed to undertake an Environmental Application Process and associated specialist studies for the Mogale Cluster - Mining Right (GP) 30/5/1/2/2 (206) Mining Right (MR) and, more specifically for the proposed construction of a large-scale gold tailings retreatment operation. Pan African Resources PLC (PAR) has entered into a Sale and Purchase Agreement for the acquisition of the shares in and claims against Mogale Gold (Pty) Ltd (Mogale Gold). The agreement was entered into between PAR and the liquidators of Mintails Mining SA (Pty) Ltd (in liquidation) (MMSA). MMSA is the holding company of Mogale Gold. The intended transaction is subject to a due diligence investigation which is in the process of being concluded.

This Environmental Nosie Impact Assessment (ENIA) report forms part of the suite of specialist studies required as part of the Environmental Application Process.

The baseline characterisation of the Project Area encompasses a selection of Noise Sensitive Receivers (NSRs) on Google Earth® Imagery, followed by a site survey in October 2021 at two (2) locations to establish the existing ambient soundscape of the area. The approach used in determining the ambient noise level was based on the methodology described in the NEMA, 1998 (Act No. 107 of 1998) as amended (GN R320 of 20 March 2020) and the SANS 10103:2008 standard. A Cirrus Optimus Green, precision integrating Sound Level Meter (SLM) was used to conduct the measurements. The measurements were taken for a 48-hr period at each location, taking into account the daytime as well as night-time noise characteristics

The results from the field measurements show the LAeq recorded for both daytime and night-time. Based on the results, the LAeq daytime ambient noise levels at measurement monitoring location N1 was 44 dBA which was below the SANS 10103:2008 guidelines maximum limit rating of 50dBA for a daytime suburban environment. The LAeq for daytime ambient noise level at monitoring location N2 was 62 dBA which was above the SANS 10103:2008 guidelines maximum limit rating of 50dBA for a daytime suburban environment. For night-time, The LAeq night-time ambient noise level at both monitoring locations (N1 – 42 dBA and N2 – 55 dBA) were above the above the SANS 10103:2008 guidelines maximum limit rating of 40 dBA for night-time suburban environment. The main noise sources impacting these measurement locations were similar to the daytime sources.

The main noise sources that impacted the monitoring locations were:

- Anthropogenic; Communication (people talking / shouting) and Vehicle activity (light and heavy vehicles); and
- Natural; birds (birdsong/chirping), poultry (chickens).

The following conclusions can be drawn for the ambient noise levels in the Project area and its immediate surroundings:

- The resulting overall ambient noise levels as determined by the noise monitoring survey show the area does not comply with the SANS 10103:2008 guidelines limits for day and night-time;
- The noise contributions of vehicular activity along the R28 and M13 represent a perennial contributor to the background. The background noise to a large extent will mask out the day and night-time emissions caused by the future mining operations at nearby sensitive receivers.

Noise dispersion modelling scenarios were conceptualized for the construction and operational phases, with the model predictions indicating negligible impacts on the ambient soundscape at the NSRs for construction and operational phases.

In summary:

- Sensitive receivers that fall within 0.5 km of the Project area for the daytime construction and operational phases are predicted to experience noise impacts above the SANS 10103:2008 regulatory limits.
- Sensitive receivers that fall within 1.0 km of the Project area for the night-time operational phase are predicted to experience noise impacts above the SANS 10103:2008 regulatory limits.
- Predicted future emissions from the daytime construction and operational phase, as well as the night-time operational phase, of the Project will not result in an increase in the ambient noise level at the NSRs located greater than 0.5 km and 1.0 km (Day and Night) radius of project reclamation activities.
- Hence, the development of the project will not lead community/group responses (as per the SANS 10103:2008 guidelines) to noise emissions, as the cumulative impact is categorized as “Little” (0-10 dBA), resulting in “Sporadic complaints” if any from the NSR.

The findings from the impact assessment ranking methodology for the operational phase have indicated minor impacts on the nearby sensitive receivers from Project related activities. However, the implementation of mitigation measures during the different phases of the Project is recommended and is predicted to result in negligible impacts post-mitigation. The aforementioned will result in emission reduction and a further decrease in anticipated noise impacts onsite and at the receivers.

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Appendix A: Impact Assessment Ranking

LIST OF ACRONYMS, ABBREVIATIONS AND DEFINITIONS

A-weighting	The A-weighting filter covers the full audio range - 20 Hz to 20 kHz and the shape is similar to the response of the human ear at the lower levels
AEL	Air Emission Licence
Ambient Noise	Ambient noise is the noise from all sources combined − mining noise, traffic noise, birdsong, running water, etc.
CONCAWE	Conservation of Clean Air and Water in Europe
dB(A)	Decibels, 'A' Weighted is the most commonly used standard frequency weighting designed to reflect the response of the human ear to noise.
EA	Environmental Authorisation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
ENIA	Environmental Noise Impact Assessment
ha	Hectare
km	Kilometre
LA_{90}	The noise level exceeded for 90% of the measurement, calculated by statistical analysis.
LA_{eq}	A-frequency weighted, equivalent sound level value for a specific period measured using Impulse – time weighting.
LAmax	The maximum Sound Level with 'A' Frequency weighting and Fast Time weighting during the measurement period.
LAmin	The maximum Sound Level with 'A' Frequency weighting and Fast Time weighting during the measurement period.
LReq,T	The equivalent continuous A-weighted sound pressure level, in decibels (dBA), determined over a specific time period.

m	Metre
MCLM	Mogale City Local Municipality
MR	Mining Right
Mt	Million tons
NCRs	Noise Control Regulations
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
Noise Level	Means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes, after such meter had been put into operation, and, if the alleged disturbing noise has a discernible pitch, to which 5dBA has been added.
NSRs	Nearby Sensitive Receivers
PAR	Pan African Resources
SANS	South African National Standard
SLMs	Sound Level Meters
SPL	Sound Pressure Level
SPLs	Sound Power Levels
TSFs	Tailing Storage Facilities
WUL	Water Use Licence

CONTENT OF THIS REPORT IN ACCORDANCE WITH THE REGULATION GNR982 OF 2014, APPENDIX 6 (AS AMENDED)

Legal Requirement		**Section in Report**
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of-	iii to iv, 5
	(i) the specialist who prepared the report; and	iii to iv, 5
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	iii to iv, 5
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page iii to iv
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	3

Legal Requirement		Section in Report
cA	And indication of the quality and age of the base data used for the specialist report;	7.1
cB	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	8
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	7.1.1.2
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	7
(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;	2.2
(g)	an identification of any areas to be avoided, including buffers;	N/A
(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;	2.1
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	4
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	8
(k)	any mitigation measures for inclusion in the EMPr;	11
(l)	any conditions/aspects for inclusion in the environmental authorisation;	N/A
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	12
(n)	a reasoned opinion (Environmental Impact Statement) -	13
	whether the proposed activity, activities or portions thereof should be authorised; and	13
	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;	11
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A

Legal Requirement		Section in Report
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q)	any other information requested by the competent authority.	N/A

1. Introduction

Digby Wells Environmental (hereafter Digby Wells) has been appointed to undertake an Environmental Application Process and associated specialist studies for the Mogale Cluster - Mining Right (GP) 30/5/1/2/2 (206) Mining Right (MR) and, more specifically for the proposed construction of a large-scale gold tailings retreatment operation. Pan African Resources PLC (PAR) has entered into a Sale and Purchase Agreement for the acquisition of the shares in and claims against Mogale Gold (Pty) Ltd (Mogale Gold). The agreement was entered into between PAR and the liquidators of Mintails Mining SA (Pty) Ltd (in liquidation) (MMSA). MMSA is the holding company of Mogale Gold. The intended transaction is subject to a due diligence investigation which is in the process of being concluded.

Mogale Gold owns the right to extract and process gold from tailings recourses by reprocessing old gold mine slimes dams and sandy mine dumps left by the extensive historic mining activities that have taken place in the area since 1888. PAR is only interested in the surface operations associated with Mining Right (MR) 206 (i.e., Tailings Storage Facilities (TSFs) for reclamation, processing and deposition), and therefore the focus of this application process.

The project consists of 120 Mt of tailings to be reprocessed and firstly deposited into the West Wits Pit (current authorisation in place for in-pit deposition) and then undertake deposition of the footprint of 1L23-1L25 footprint (New Tailings Facility) once capacity has been reached within the West Wits Pit. Eventually there will be two TSFs: one at the current WWP and the other at the current 1L23-1L25 TSF.

Alternatives are being considered for potential deposition of tailings material into the other pits associated with Mintails, such as Monarch and Emerald Pits.

It must be noted that once the West Wits Pits reaches capacity the surface deposition will extend in a northern direction from the pit onto surface, expanding the deposition footprint associated with West Wits Pit.

There are six dumps being considered to be reprocessed, the largest of which amounts to 57.9 Mt, while the smallest contains 0.57 Mt. The primary location of processed tailings storage has been earmarked for deposition in the West Wits Pit. There are three smaller dumps which could also be included and reprocessed as part of the project namely 1L4, 1L5 and 1L6.

2. Project Description

PAR plans to undertake activities relating to reclamation associated with gold-bearing TSFs through hydraulic reclamation. Digby Wells was appointed as the Independent Environmental Consultant to undertake the Environmental Impact Assessment (EIA) Application process which comprises an Air Emission Licence (AEL) and Water Use Licence (WUL) for the proposed gold-bearing TSFs.

The site comprises existing infrastructure such as sand dumps, Lancaster Dam and an open pit that will be used for the deposition of tailings materials. A process plant, overland pumping and piping inclusive of associated water management infrastructure will form part of the proposed infrastructure that will require an authorisation. Once the open pit is filled, a new TSF will potentially be constructed on the footprint area of one of the reclaimed TSF sites (1L23-1L25) (Figure 2-1). The footprint of the area is 2,923.3 ha which consists of MR 206 (referred to as the Project Area in this report) and its associated infrastructure which includes: GI, G2 plant; North Sand; South Sand; 1L23; 1L28; 1L13; 1L8; 1L10; West Wits Pit and Lancaster Dam.

Ancillary infrastructure such as pipelines, powerlines and pumps will be required for the proposed reclamation activities and will be included in support of the Environmental Application Process, which will be undertaken.

2.1. Project Locality

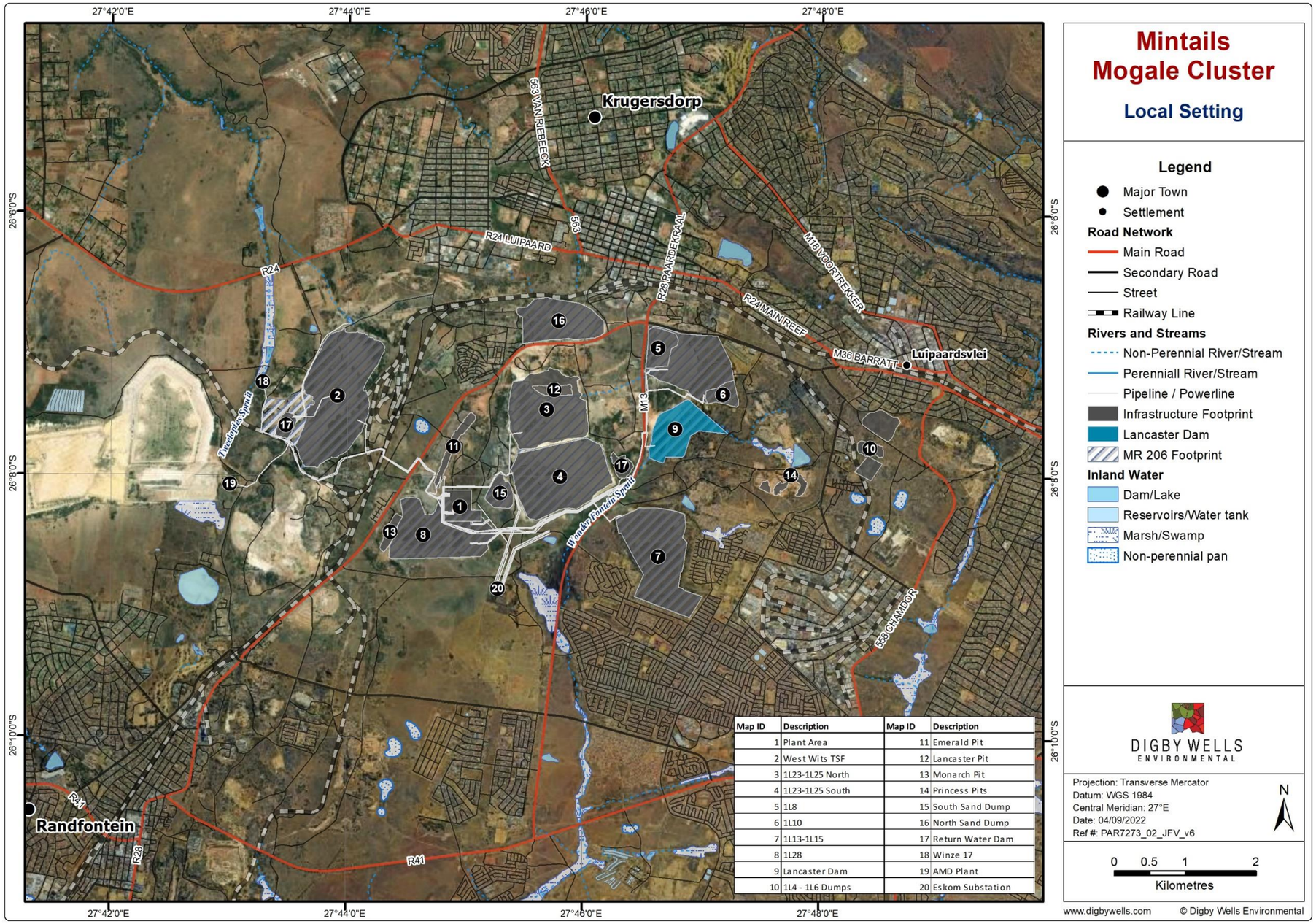
The project is within the Mogale City Local Municipality (MCLM), which is located within the West Rand District Municipality. The MCLM is the regional services authority, and the area falls under the jurisdiction of the Krugersdorp Magisterial District.

The project is about 4 km south of Krugersdorp and 4 km northeast of Randfontein, approximately 10 km off the N14 National Road in the Gauteng Province, in an area that has been transformed by past gold mining activities.

The project locality of the site is illustrated in Figure 2-1, the Project Locality Map.

Table 2-1: Summary of the PAR Project Location Details

Province	Gauteng
District Municipality	West Rand District Municipality
Local Municipality	Mogale Local Municipality
Nearest Town	Krugersdorp (4 km), Randfontein (4 km)
GPS Co-ordinates (Relative centre point of the study area)	26°07'45.54"S
	27°45'40.85"E



Map ID	Description	Map ID	Description
1	Plant Area	11	Emerald Pit
2	West Wits TSF	12	Lancaster Pit
3	1L23-1L25 North	13	Monarch Pit
4	1L23-1L25 South	14	Princess Pits
5	1L8	15	South Sand Dump
6	1L10	16	North Sand Dump
7	1L13-1L15	17	Return Water Dam
8	1L28	18	Winze 17
9	Lancaster Dam	19	AMD Plant
10	1L4 - 1L6 Dumps	20	Eskom Substation

Figure 2-1 : Project Locality

2.2. Proposed Infrastructure and Activities

Table 2-2 below details the project phases and associated activities to be considered in this ENIA.

Table 2-2: Project Phases and Associated Activities

Project Phase	Associated Activities
Construction Phase	Site clearing for the construction of the new processing plant facility and ancillary infrastructure such as pipelines, pump stations, electrical supply etc.
	Construction of the new processing plant and ancillary infrastructure such as pipelines, pump stations, electrical supply etc.
	Employment and procurement for construction related activities.
Operational Phase	Hydraulic reclamation of the associated historic tailings facilities and sand dumps.
	Operation of pump stations during the operational phase.
	Maintenance of pipeline routes during the operational activities.
	Infilling of processed tailings material into the West Pits Pit and other potential pits.
	Surface tailings deposition within the West Wits Pit.
	Tailings deposition onto the historic footprint of 1L23-1L25.
	Production of Gold.
	Progressive rehabilitation of the new tailings facility footprints (West Pits TSF and 1L23-1L25 TSF).
	Employment and procurement for operational related activities.
Decommissioning Phase	Removal, decommissioning and rehabilitation of surface infrastructure such as pipelines, powerlines, pumps etc. footprints.
	Removal, decommissioning and rehabilitation of the processing plant footprint.
	Rehabilitation of the old TSF footprints.
	Rehabilitation of the old Mintails Processing Plant footprint.
	Final rehabilitation of this facility.
	General rehabilitation of the surrounding area, including wetland rehabilitation.

3. Scope of Work (SoW)

The ENIA aims to establish the current/existing soundscape of the receiving environment (Project area and immediate surroundings) and a noise dispersion modelling assessment to predict the future implications of mining on the ambient noise levels and exposure scenarios. The aforementioned applies to the Nearby Sensitive Receivers (NSRs) as a result of the construction and operational phases of the proposed Project.

Based on the above, the noise scope of work encompasses the following:

- Environmental noise baseline monitoring surveys;
- Assessment of the future noise impacts and comparison against regulatory standards for compliance; and
- Recommendations of management measures, including mitigation and monitoring requirements.

4. Assumptions, Limitations and/or Exclusions

Assumptions, limitations and exclusions pertaining to this Project are discussed in Table 4-1 and are included as part of this assessment.

Table 4-1: Assumptions, Limitations and Exclusions

Assumption, Limitation, or Exclusion	Consequence
The construction phase is assumed to be carried out during daytime hours only (06:00-18:00).	Only a daytime scenario was modelled.
It was assumed that reclamation activities will be carried out for both day and night-time.	A day and night-time scenario were modelled.
The modelling approach assumed that the reclamation mining method (hydraulic mining and sand mining) applied at a particular historic tailing and sand dumps would be applied across all the other tailings and dumps. i.e., all sand dumps will be reclaimed using the same methodology and machinery/equipment.	None, the approach represents a realistic day to day scenario.
Due to security issues, the baseline measurements had to be taken at only two (2) receivers.	None, the selected monitoring locations are a representative sample of the receiving environment.

5. Details of the Specialist(s)

Keenan Terry (Author) is the Noise Lead and Environmental GIS Specialist at Digby Wells & Associates (Pty) Ltd. He obtained a BSc. degree in Environmental Science as well as a BSc (Hons) degree in Environmental Science from the University of Kwa-Zulu Natal. He is a member of the South African Council for Natural Scientific Professions (SACNASP), the

International Association for Impact Assessment South Africa (IAIAsa), and the South African Geomatics Council (SAGC).

6. Relevant Legislation, Standards and Guidelines

The legislation, regulation, and guidelines considered in this noise report are tabulated and discussed briefly in Table 6-1. The applicable standards in terms of compliance are discussed in Section 5.1 below.

Table 6-1: Applicable Legislation, Regulations, Guidelines, and By-Laws

Legislation, Regulation, Guideline, or By-Law	Applicability
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) as Amended The NEMA is the statutory framework to enforce Section 24 of the Constitution of the Republic of South Africa …(Section 24: ***the right to a healthy environment and the right to have the environment protected).*** The NEMA is intended to promote cooperative governance and ensure that the rights of people are upheld, but also recognise the necessity of economic development.	Principles from NEMA relevant to noise pollution, Section 24(4) b(i) … "the investigation and assessment of the potential impacts of activities that require authorisation or permission.". Procedures for the Assessment and minimum Criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of The National Environmental Management Act, 1998, when applying for environmental authorisation.
National Noise Control Regulations, R.154 of 1992 (the Noise Regulations) promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The National Noise-Control Regulations (GN R154 in Government Gazette No. 13717 dated 10 January 1992) (NCRs) form part of the Environmental Conservation Act and these Regulations apply to external noise. The NCRs differentiates between Disturbing Noise levels (which is objective and scientifically measurable which are generally compared to existing ambient noise level) and Noise Nuisance (which is a subjective measure and is defined as noise that "*disturbs or impairs or may disturb or impair the convenience or peace of any person*"). Local Authorities use Controlled Areas to identify areas with high noise levels. Restrictions have been set out for development that occurs in these Controlled Areas. These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the	The purpose of these Regulations is to prescribe general measures for the control of noise. As such, a Noise Impact Assessment in accordance with the NCRs must be undertaken for submission to determine the potential disturbing and nuisance noise levels associated with a particular development.

Legislation, Regulation, Guideline, or By-Law	Applicability
Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication.	
Noise Control Regulations for the Gauteng Province, No.75 of 1999 promulgated in terms of Section 25 of the Environmental Conservation Act, 1989 (Act 73 of 1989) The control of noise in the Gauteng Province is legislated in the form of Noise Control Regulations specific to the Gauteng province and is promulgated in terms of section 25 of the Environment Conservation Act No. 73 of 1989. In 1996, Schedule 5 of the Constitution devolved responsibility to the provinces to administer these regulations themselves. Gauteng (GN 5479/PG 75/19990820) is one of three provinces that have done so. Subsequently, the NCRs have been repealed in these provinces. Also, various municipalities have their By-Laws regarding noise control.	The purpose of these Regulations is to prescribe general measures for the control of noise in the Gauteng province.
South African National Standard (SANS) 10103:2008 Edition 6: The measurement and rating of environmental noise with respect to annoyance and to speech communication The standard covers methods and gives guidelines to assess working and living environments with respect to acoustic comfort, excellence, and with respect to possible annoyance by noise (i.e., whether complaints can be expected). It also gives a method to predict speech communication efficiency	The purpose of this standard is to provide a guideline for the measurement and rating of environmental noise.
South African National Standard (SANS) 10328:2008 Edition 2: Methods for environmental noise impact assessments The standard covers procedures for environmental noise impact investigations and assessments.	The purpose of this standard is to provide a guideline for environmental noise impact investigations and assessments. Therefore, this ENIA has been prepared in compliance with this standard

6.1. Applicable South African Standards

NEMA (Act No. 107 of 1998) as amended provides a legislative framework for environmental management in South Africa. Pollution, as described in NEMA from a noise perspective, means any change in the environment caused by noise emitted from any activity, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or will have such an effect in the future. Principles from NEMA relevant to noise pollution include: Section 28(1) "*Every person who causes, has caused or*

may cause significant pollution, must take reasonable measures to prevent such pollution", Section 24(4) b(i) … "*the investigation and assessment of the potential impacts of activities that require authorisation or permission*." and Section 24(7) "*Procedures for the investigation, assessment, and communication of the potential impact of activities*". Principles from NEMA (GN R320 of 20 March 2020) provide the criteria for the specialist assessment and minimum report content requirements for the impacts of noise on the environment for activities requiring environmental authorisation.

The National NCRs is the primary law on noise in the Republic of South Africa (GN R154 of 10 January 1992) and is promulgated in terms of Section 25 of the Environment Conservation Act (ECA) No. 73 of 1989. The Regulations put in place various measures for the prevention of noise pollution and national norms as well as standards for the regulation/control of noise in South Africa. Schedule 5 of the Constitution, devolved responsibility to the provinces to administer these regulations themselves, subsequently, the NCRs were repealed in the Gauteng province. The control of noise in the Gauteng Province is now legislated in the form of Noise Control Regulations specific to the Gauteng (GN 5479/PG 75/19990820) province and is promulgated in terms of Section 25 of the Environment Conservation Act No. 73 of 1989. Based on the Gauteng NCRs, it is prohibited to make, produce, or cause a disturbing noise, or allow it to be made, produced, or caused by any person, animal, machine, device, or apparatus or any combination thereof. The Gauteng NCRs describes a "disturbing noise" as a noise level that rises above the designated zone level or if no zone level has been designated, the typical rating levels for ambient noise in districts. The ambient noise in different districts (residential and non-residential) are presented in Table 6-2.

The South African Bureau of Standards (SABS) is the National Standards Body in the Republic of South Africa that is responsible for the development, maintenance, and promotion of South African National Standards (SANS) as mandated by the Standards Act No.8 of 2008. The SANS 10103:2008 and SANS 10328:2008 have been identified in NEMA,1998 (Act No. 107 of 1998) (GN R320 of 20 March 2020) as the national standard for the assessment of noise impacts for residential and non-residential areas as defined in these standards. The acceptable rating levels according to SANS 10103:2008 for ambient noise in different districts (residential and non-residential) are presented in Table 6-2.

Table 6-2: Acceptable Rating Levels for Noise in Districts (SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,DNA}$	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,DNA}$	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
NON-RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50
NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.						
NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7						
NOTE 3 In districts where outdoor $L_{R,dn}$ exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor $L_{Req,T}$ values in line with those given in table 1.						
NOTE 4 For industrial districts, the $L_{R,dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, LReq,d = LReq,n =70 dBA can be considered as typical and normal.						
NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.						
NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as nature reserves, private game farms, national parks, wilderness areas and bird sanctuaries, should not exceed a maximum Weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.						
A - The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.						

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,DNA}$	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
B - The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.						
C – $L_{Req,T}$ is the equivalent continuous A-weighted sound pressure level (LAeq,T) during a specified time interval, plus specified adjustments for tonal character, impulsiveness of the sound and the time of day.						
D – dBA 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.						

The SANS10103:2008 also provides guidelines for addressing the issues concerning environmental noise and for estimating communities' responses to increases in the general ambient noise levels as a result of an intruding noise. The probable community/group response to levels over the acceptable rating levels are presented in Table 6-3, where LReq,T is the equivalent continuous A-weighted sound pressure level, in decibels (dBA), determined over a specific period. 'A-weighted' is a standard weighting of the audible frequencies designed to reflect the response of the human ear to noise.

Table 6-3: Categories of Community/Group Response (SANS 10103, 2008)

Excess ($\Delta L_{Req,T}$)[a]dBA	Estimated community/group response	
	Category	Description
0 – 10	Little	Sporadic complaints
5 – 15	Medium	Widespread complaints
10 - 20	Strong	Threats of action
>15	Very strong	Vigorous action
NOTE Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.		
a ΔLReq,T should be calculated from the appropriate of the following:		
1) ΔLReq,T = LReq,T of ambient noise under investigation MINUS LReq,T of the residual noise (determined in the absence of the specific noise under investigation);		
2) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;		
3) ΔLReq,T = LReq,T of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or		
4) ΔLReq,T = Expected increase in LReq,T of ambient noise in an area because of a proposed development under investigation.		

7. Methodology

The approach used in investigating the baseline conditions of the proposed Project area and its immediate surroundings is covered in the section below.

7.1. Environmental Noise Baseline Assessment

The baseline characterisation encompassed a description of the existing soundscape using measurement data at pre-selected NSRs in the vicinity of the Project area. The locations served as suitable reference points for the measurement of ambient noise levels.

7.1.1. Existing Soundscape

The existing soundscape refers to the acoustic environment as perceived or experienced and/or understood by a person or people (Axelsson et al, 2019). The existing soundscape was determined based on the results of a noise monitoring survey that was conducted in October 2021, at two (2) pre-selected NSRs.

7.1.1.1. Sensitive Receivers

Noise sensitive receivers include, but are not limited to; industrial, educational, and residential facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to noise pollution. Google Earth® Imagery was used to identify the nearby sensitive receivers in the vicinity of the Project area. The locations of the potential sensitive receivers are displayed in Figure 7-1.

7.1.1.2. Measurement of Ambient Noise Levels

The noise monitoring survey was undertaken from 13th October – 18th October 2021 to determine ambient noise levels at sensitive receivers designated as receivers N1 and N2. The noise monitoring locations were chosen to be as relevant as possible to the Project design. It is anticipated that these monitoring locations would remain the same for the construction and operational phase monitoring. Table 7-1 and Figure 7-1 indicate the noise monitoring locations where the noise measurements was be conducted.

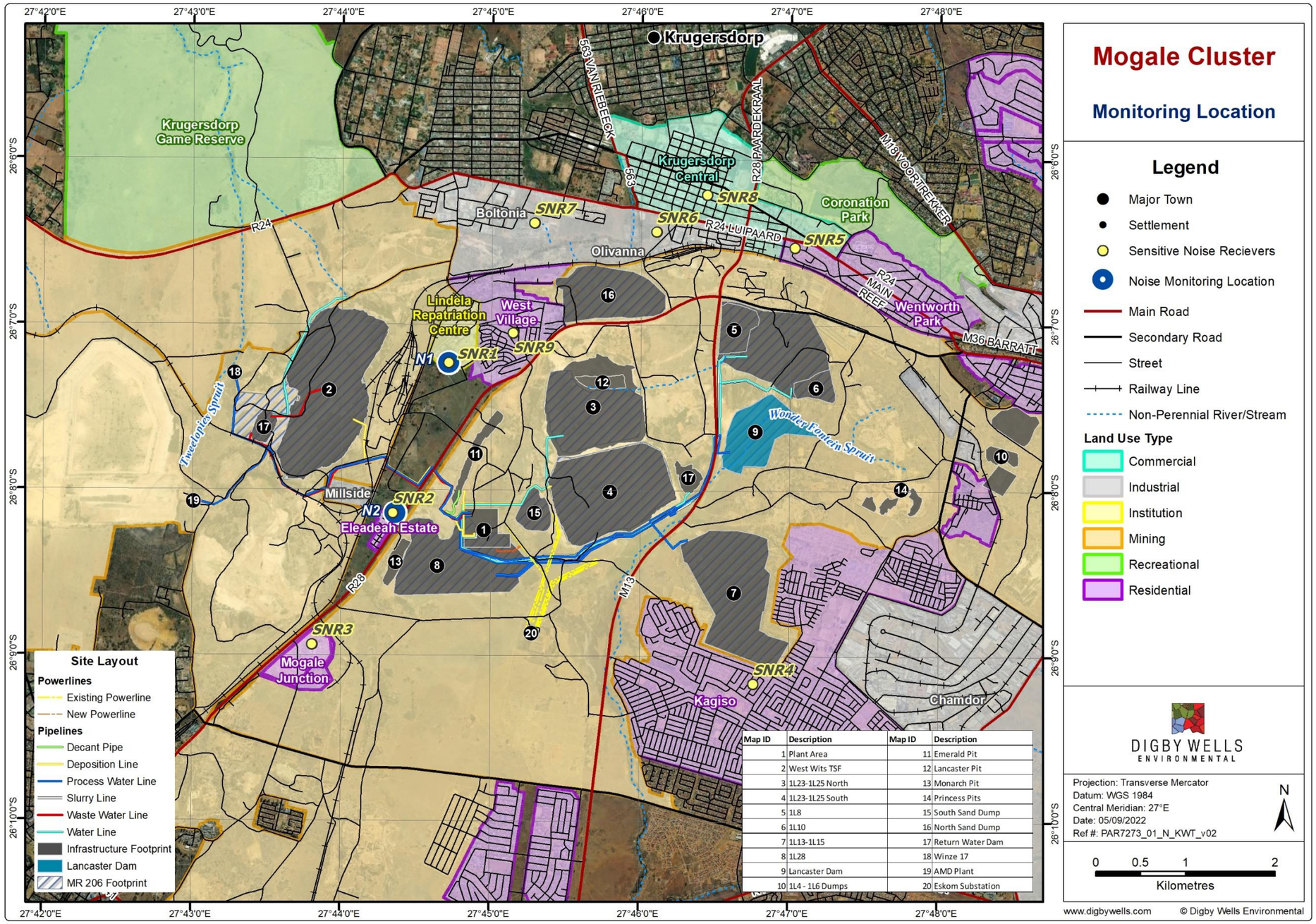
The approach used for the noise monitoring survey was based on NEMA (Act No. 107 of 1998) as amended (GN R320 of 20 March 2020) and the SANS 10103:2008 standard. Noise is often classified into roughly three (3) categories; Continuous, Intermittent, and Impulsive noise. According to Bruel and Kjaer, 2001 these noise types are defined as follows:

- Continuous noise refers to noise that occurs without interruption such as noise produced by machinery i.e., pumps or processing equipment when in operation;
- Intermittent noise refers to noise that operates in cycles or events such as noise produced by a passing vehicle or aircraft; and
- Impulsive noise refers to noise from impacts or explosions, e.g., from a pile driver, punch press or gunshot.

Table 7-1: Noise Measurement Location

Site ID	Location	Category of receiver	GPS coordinates
N1	Lindela Repatriation Centre	Suburban districts	26° 7.232'S & 27° 44.713'E
N2	Eleadah Estate	Suburban districts	26° 8'7.57"S & 27°44'24.01"E

During the site visit, long-term continuous measurement of forty-eight (48) hours was recorded at each monitoring location, with ambient noise levels collected every second for the duration of the measurement. The measurement took into account both daytime as well as night-time noise characteristics. According to the SANS 10103:2008 standard where 'Day – 6 am to 22 pm' and 'Night – 22 pm to 6 am'.



Map ID	Description	Map ID	Description
1	Plant Area	11	Emerald Pit
2	West Wits TSF	12	Lancaster Pit
3	1L23-1L25 North	13	Monarch Pit
4	1L23-1L25 South	14	Princess Pits
5	1L8	15	South Sand Dump
6	1L10	16	North Sand Dump
7	1L13-1L15	17	Return Water Dam
8	1L28	18	Winze 17
9	Lancaster Dam	19	AMD Plant
10	1L4 - 1L6 Dumps	20	Eskom Substation

Figure 7-1: Noise Measurement and Sensitive Receivers Locations

A Cirrus, Optimus Green, 'Class 1, precision grade' Sound Level Meter (SLM), compliant with International Standards IEC 61672-1 was used for the measurements. The instrument was field calibrated with a Cirrus, sound level calibrator and 1/3 octave band logging were employed. Measurements were taken at a measurement height of 1.5 m above ground level and no closer than 3m to any reflecting surface (e.g., wall) in accordance with the SANS 10103:2008 standard (see Figure 7-2 and Figure 7-3).

Figure 7-2: Noise Monitoring at Location N1

Figure 7-3: Noise Monitoring at Location N2

The parameter measured at each measurement location included but was not limited to, the equivalent continuous sound pressure level (LAeq). It is a common practice to measure noise levels using the A-weighting setting built into all SLMs. The LAeq noise level data describes the average noise level for the measurement period taking into account all noise sources that were audible at the specific measurement location. The ambient noise measurements, including the A-weighted sound level parameters for minimum (LAmin), maximum (LAmax), 90th percentile (LA90) for the four measurement locations were also recorded and archived.

The meteorological conditions were also captured for the duration of the measuring period and are displayed in Table 7-2.

Table 7-2: Meteorological Conditions (World Weather Online, 13 - 18 October 2021)

	Air Pressure (mb)	Relative Humidity (%)	Temperature (°C)	Wind Speed (km/h)	Rain (mm)
Average	1013	12	24	10	0
Maximum	1018	19	34	18	0
Minimum	1008	7	17	4	0

7.2. Future Noise Sources and Sound Power Levels

This section describes various sources of noise associated with the construction and operational phases of the proposed project that can result in noise emissions audible to the NSRs in the area. Namely, noise from Industry and Traffic.

7.2.1. Industry Noise (Mining Infrastructure – Equipment and Machinery)

The mechanized industry creates serious noise problems for sensitive receivers. This noise is due to the machinery of all kinds and often increases with the power of the machine. Sound generation mechanisms of machinery are reasonably well understood, and the noise may contain predominantly low or high frequencies, tonal components, be impulsive or have unpleasant and disruptive temporal sound patterns.

7.2.1.1. Construction Noise

The noise from the construction phase will be highly variable as different activities (site clearing for the construction of the new processing plant facility and ancillary infrastructures such as pipelines, pump stations, electrical supply etc., and the construction of the new processing plant) will be taking place at different times, for different periods (operating cycles), in different combinations/sequences and on different parts of the construction site. Noise from the installation and construction of fixed installations such as the processing plant and relevant pipelines (slurry and water etc.) often result in noise emissions. Mobile equipment/machinery such as truck-mounted mobile cranes, Tractor-Loader-Backhoes (TLBs) etc, also result in noise emissions that may affect NSRs. Noise emissions from the proposed noise generating infrastructure associated with the construction phase will be assessed in this noise study.

7.2.1.2. Operational Noise

The noise from the operational phase will also be highly variable as different activities (hydraulic reclamation of the associated historic tailings and sand dumps as well as the processing plant) will be taking place at different times, for different periods (operating cycles), in different combinations/sequences and on different parts of the Project area. The hydraulic mining reclamation process involves the use of high-pressure water cannons (commonly referred to as water monitors) to break up the material and turn it into a slurry as it mixes with the runoff water. The slurry will be screened to remove vegetation and other material with the underflow directed to the slurry pipeline which will deliver the slurry to the processing plant. A slurry pump/pump station will be used to generate the pressure required to pump the slurry in the slurry pipeline to the plant and from the plant to the pit. For the sand dumps, sand material will be loaded onto a dump truck using a Front-End Loader (FEL). The dump truck will transport the sand to the processing plant where it will be screened to remove vegetation and other material. The plant will prepare the slurry and treat it for gold extraction and beneficiation. Noises from the water cannons, vibrating screens, slurry pump stations and the loading and off-loading of dump trucks will result in noise emissions that may affect NSRs. These emissions will be assessed in this noise study.

7.2.2. Electricity Generation (Transformers and Transmission Lines)

Noise generated from electricity generation (transformers and transmission lines) does not create serious noise problems for NSRs. Electrical service providers go to great lengths to minimise the noises associated with electricity generation and transmission. Transformer noise is generated when the sheet steel used in the core of the transformer deforms when being magnetized, this is known as magnetostriction (De Jager, 2018). Due to the transformer core being composed of many sheets of steel, the deformation in each sheet occurs erratically in comparison to its neighbour which results in the “low-frequency hum sound” frequently associated with transformers. This noise is relatively easy to mitigate with the use of acoustic shielding and the placement of the transformer in relation to the sensitive receivers therefore will not be considered further in this study.

Corona noise is the most common noise associated with transmission lines and is heard as a crackling or hissing sound. Corona is the breakdown of air into charged particles caused by the electrical field at the surface of conductors. This type of noise varies with both weather and voltage of the line (70kV or higher) and most often occurs in conditions of heavy rain and high humidity (typically > 80%). An electric field surrounds power lines and causes the implosion of ionized water droplets in the air, which produces the sound. Since Corona noise is only a feature during fog or rain, transmission line noise will not be considered further in this study.

7.2.3. Transportation Noise (Haul/Access Road)

Transportation noise, including road traffic, rail traffic and air traffic noise creates serious noise problems for sensitive receivers. As a general rule, larger and heavier vehicles emit more noise than smaller and lighter vehicles. The noise of road vehicles is mainly generated from the engine and frictional contact between the vehicle and the ground and air. In general, road-contact noise exceeds engine noise at speeds higher than 60 km/h. The sound pressure level (SPL) from traffic can be predicted from the traffic flow rate, the speed of the vehicles, the proportion of heavy to light vehicles, and the nature of the road surface. The hauling of sand from the sand dumps to the processing plant will result in noise emissions that may affect the NSRs. These emissions will be assessed in this noise study.

Based on the aforementioned, an inventory of the noise generating equipment/machinery (point, line and area noise sources) including their octave band sound power levels (SPLs) was developed for the proposed Project based on industry experience and information gathered from similar operations as well as PAR. The SPLs for noise generating equipment/machinery per project phase are presented in Table 7-3. The SPLs are given in the A-weighted scale, which is used to filter the sound levels according to the human ear's varying response to different frequencies.

Table 7-3: Sound Power Levels from Main Noise Generating Equipment / Machinery

Project Phase	Noise Source	Sound Power Level dBA
Construction Phase	General Noise	96.5
	Articulated Dump Truck	107
	Truck-Mounted Mobile Crane	109
	Tractor-Loader-Backhoes (TLB)	108.8
Operational Phase	Front End Loader	105
	Articulated Dump Truck	107
	Water Canyon	113.8
	Vibrating Screen	109.1
	Slurry pump	109
	Processing Plant	112.64

The total number of the noise generating equipment/machinery (point, line and area noise sources) including their octave band SPLs were imported into the SoundPlan Essential modelling software for noise dispersion modelling.

7.3. Noise Dispersion Modelling

The future noise impacts of the proposed development were estimated using the **CON**servation of **C**lean **A**ir and **W**ater in **E**urope (CONCAWE) calculation method for noise

dispersion modelling. Noise dispersion modelling simulates outdoor sound propagation and predicts the noise levels at the sensitive receivers. The SoundPlan Essential modelling software was used for carrying out the computational calculations of the noise dispersion model in accordance with the CONCAWE calculation method. The model is described in the sections below.

7.3.1. Model Description

The CONAWE method is a prescribed standard (SANS 10357:2004 'The calculation of sound propagation by the CONCAWE method') in South Africa for calculating the propagation of sound over distances of up to two kilometres, under a variety of meteorological and topographical conditions. In addition, the method accounts for:

- The attenuation of noise due to the geometrical spreading of the noise;
- The effect of the ground surface;
- Height of the source and receiver;
- Atmospheric attenuation/absorption; and
- The screening effect of the topography and other barriers (vegetation, walls, berms etc.).

The CONCAWE method calculates the octave band sound pressure levels at a receiver from the following information:

- The octave band power levels of the source;
- The pressure, temperature and the relative humidity of the air;
- The wind speed and the wind direction; and
- The nature of the ground surface between the source and the receiver.

The aforementioned information, including topography (elevation) data, is imported into the SoundPlan Essentials modelling software. The software generates corrections such as the correction for working hours of industrial noise sources etc. within the software using industry-accepted equations before calculating the predicted octave band sound pressure levels at a receiver. Traffic noise is also calculated within the software taking into account corrections for speed, the number of vehicles (light and heavy) gradient and the surface of the proposed road.

7.3.2. Predicted Future Noise Impact

The approach applied for determining the predicted future noise impacts associated with the proposed project were drawn from the guidelines provided by SANS 10103:2008 and the Gauteng NCRs. The future noise impacts were assessed by comparing the predicted propagating noise levels derived from the output of the noise dispersion model with the current ambient noise levels established during the baseline assessment survey.

8. Findings and Discussion

A summary of the ENIA findings as they relate to the baseline environment and the future impacts associated with the construction and operational phases of the proposed Project is provided below.

8.1. Baseline Environment

The receiving environment (project area and its immediate surroundings) is located within an urban environment and is characterised by high population density. The Project area and is close to two major towns (Krugersdorp and Randfontein) and is surrounded by several local communities (see Figure 7-1).

The identified land use of the receiving environment is predominantly residential (including institutions), commercial, industrial, recreational, and mining (Mogale complex). A regional (R28) and the main road (M13) runs through the Project area and is near the proposed plant area.

The activities associated with the baseline environment such as mining activity, traffic, industrial activity, and anthropogenic activities have the potential to influence the existing soundscape of the receiving environment. Results from the noise monitoring survey indicated that the activities mentioned above in addition to natural sources of noise in the area (birds etc.) had a significant (contributed to the exceedance of the regulatory limits for day and night) noise impact.

8.1.1. Sensitive Receivers

The identified NSRs were the communities surrounding the Project area (Figure 7-1), these include:

- Lindela Repatriation Centre (SNR1) is located west of North Sand and north-west of IL23-IL25 dumps. The centre is located 1.7 km from North Sand and 1.2 km from IL23-IL25 dumps.
- Eleadah Estate (SNR2) is located west of the IL28 dump. The estate is located approximately 200 m from the IL28 dump.
- Mogale Junction Estate (SNR3) is located to the south-west of the Project area (MR 206 – IL28 Dump). The estate is located approximately 0 – 1 km from the IL28 Dump.
- Kagiso (SNR4) suburban settlement is located to the south of the Project area (MR 206 – IL13-IL15 Dump). The settlement is developed and is directly adjacent to the IL13-IL15 Dump (0 - 250 m to dump boundary).
- Wentworth Park (SNR5) suburban settlement located to the north-northeast of the Project area (MR 206 – IL8 – IL10 Dump). The settlement is developed and is directly adjacent to the IL8 – IL10 Dump (50 – 800 m to dump boundary).

- Olivanna (SNR6) suburban settlement and industrial area are located to the north-northwest of the Project area (MR 206 – North Sand Dump). The settlement is developed and is directly adjacent to the North Sand Dump (0 – 1 km to dump boundary).
- Boltonia (SNR7) suburban settlement and industrial area are located to the north-northwest of the Project area (MR 206 – North Sand Dump). The settlement is developed and is directly adjacent to the North Sand Dump (0 – 1 km to dump boundary).
- Krugersdorp (SNR8) commercial area located to the north of the of Project area (MR 206 – IL8 – IL10 Dump). The commercial area is located approximately 900 m from the IL8 – IL10 Dump.
- West Village (SNR9) suburban settlement is located to the west of the Project area (MR 206 – North Sand Dump). The settlement is developed and is directly adjacent to the North Sand Dump (0 – 1 km to dump boundary).

The receivers were characterised as sensitive due to the proximity of the receivers to the Project area. The locations of the potential sensitive receivers are displayed in Figure 7-1.

8.1.2. Ambient Noise Levels

The results of the noise monitoring survey are presented in Table 8-1 and are discussed in the sections below. The ambient noise levels recorded on-site, the rating limits according to the SANS 10103:2008 guidelines, are presented side by side. The SPL (sound pressure level) is given in the A-weighted scale, which is used to filter the sound levels according to the human ear's varying response to different frequencies.

The time history graph per noise measurement location is displayed in Figure 8-1 and Figure 8-2. The graph shows the noise profile data as recorded in-field by the Cirrus SLM instrument and is presented in the A-weighted scale.

The noise sources that were audible during the noise monitoring survey, contributing to the existing soundscape are depicted in Table 8-2. The main noise sources that impacted the monitoring locations were:

- Anthropogenic; Communication (people talking / shouting) and Vehicle activity (light and heavy vehicles); and
- Natural; birds (birdsong/chirping), poultry (chickens).

Table 8-1: Baseline Noise Measurements

Sample ID	SANS 10103:2008 rating limit					
	Type of district	**Period**	**Acceptable Rating Level dBA**	**$L_{Aeq,T}$ dBA (Field Measurement)**	**Maximum / Minimum dBA**	**Date**
N1	Suburban	Daytime	50	44	73 / 33	13/10/2021 – 15/10/2021
		Night-time	40	42	79 / 32	
N2	Suburban	Daytime	50	62	92 / 39	16/10/2021 – 18/10/2021
		Night-time	40	55	82 / 36	
	Indicates current $L_{Aeq,T}$ levels above either the daytime rating limit or the night-time rating limit					

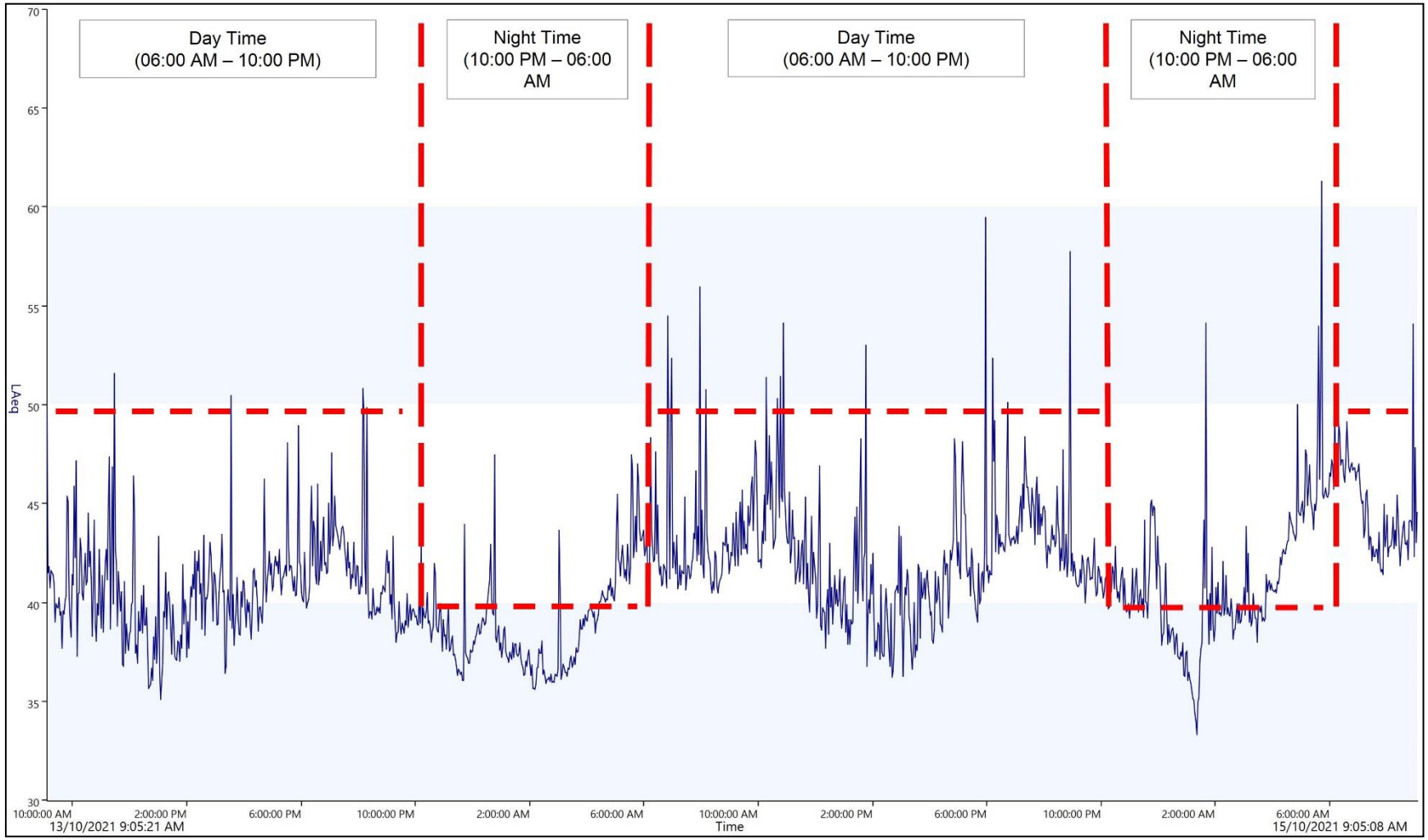


Figure 8-1: N1 Time Series Graph

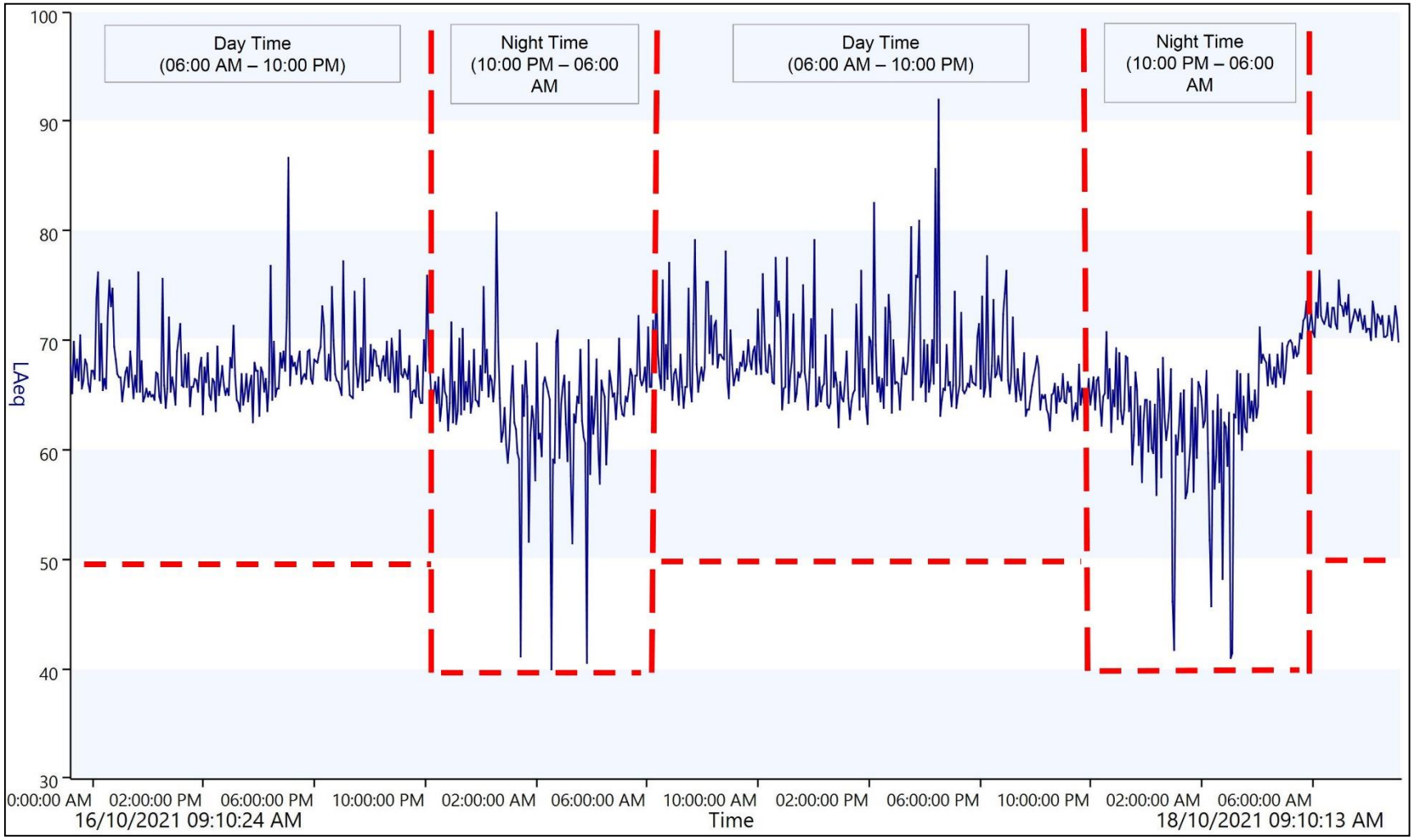


Figure 8-2: N2 Time Series Graph

Table 8-2: Noise Sources Identified

Location ID	Day	Noise Type	Night	Noise Type
N1	Birds (birdsong/chirping)	Intermittent	Birds (birdsong/chirping)	Intermittent
	Poultry (chickens)	Intermittent	Poultry (chickens)	Intermittent
	Vehicle activity (Light and heavy vehicles)	Intermittent	Vehicle activity (Light)	Intermittent
	Communication (People talking / shouting)	Intermittent		
N2	Birds (birdsong/chirping)	Intermittent	Birds (birdsong/chirping)	Intermittent
	Vehicle activity (Light and heavy vehicles) along the R28	Intermittent	Vehicle activity (Light and heavy vehicles) along the R28	Intermittent
	Communication (People talking / shouting)	Intermittent	Communication (People talking / shouting)	Intermittent
	Reverse alarm	Intermittent		
	Generator	Continuous		

8.1.2.1. Day-Time Results

The LAeq average for daytime ambient noise level measured throughout the measuring period for both monitoring locations was 53 dBA which is above the SANS 10103:2008 guidelines maximum limit rating of 50dBA allowable for outdoor daytime ambient noise in suburban districts. The LAeq for daytime ambient noise level at monitoring location N1 was 44 dBA which was below the SANS 10103:2008 guidelines maximum limit rating of 50dBA. The LAeq for daytime ambient noise level at monitoring location N2 was 62 dBA which was above the SANS 10103:2008 guidelines maximum limit rating of 50dBA.

The identified noise sources contributing to the daytime ambient noise levels at the various measurement locations are presented in Table 8-2.

The results from the measurements suggest that the overall ambient noise levels of the receiving environment do not comply with the acceptable standards for daytime noise in suburban districts.

8.1.2.2. Night-Time Results

The LAeq average for night-time ambient noise level measured throughout the measuring period for both monitoring locations was 48 dBA which is above the SANS 10103:2008 guidelines maximum limit rating of 40 dBA allowable for outdoor night-time ambient noise in suburban districts. The LAeq night-time ambient noise level at both monitoring locations (N1

– 42 dBA and N2 – 55 dBA) were above the SANS 10103:2008 guidelines maximum limit rating of 40 dBA.

The identified noise sources contributing to the night-time ambient noise levels at the various measurement locations are presented in Table 8-2.

The results from the measurements suggest that the overall ambient noise levels of the receiving environment do not comply with the acceptable standards for night-time noise in suburban districts.

8.2. Noise Model Simulations

The Project-related noise contour lines generated are reported and discussed for the construction phase (daytime only) and operational phase (daytime and night-time). Findings are presented in the sections below.

8.2.1. Construction Phase Model Results

The noise contour lines for the construction phase are depicted in Figure 8-3. The model results for the daytime construction phase indicates that the areas where the SANS 10103:2008 guidelines maximum daytime limit of 50dBA is predicted to be exceeded are mostly confined within 0.5 km of the noise generating activities associated with the construction of the plant and the relevant pump and pipeline routes (without mitigation measures). The noise impact that the construction phase (pre-mitigation) will have on the NSRs is varied due to the activities being undertaken. As construction activities progress along the pipeline routes, the impact on the NSRs will change based on the proximity of the NSRs to the noise generating source(s). The model results show that NSRs beyond a distance of 0.5 km will experience negligible impact (do not experience noise levels that exceed the daytime regulatory limits as per SANS 10103:2008) pre-mitigation. While NSRs within the 0.5km radius are likely to be exposed to noise levels that range between 50 dBA and 90.1 dBA (see Figure 8-3) depending on the NSRs proximity to the noise generating source(s) in operation during construction. As a result, these NSRs are likely to exceed the daytime regulatory limits (as per SANS 10103:2008) and result in a noise disturbance from a Gauteng NCR perspective.

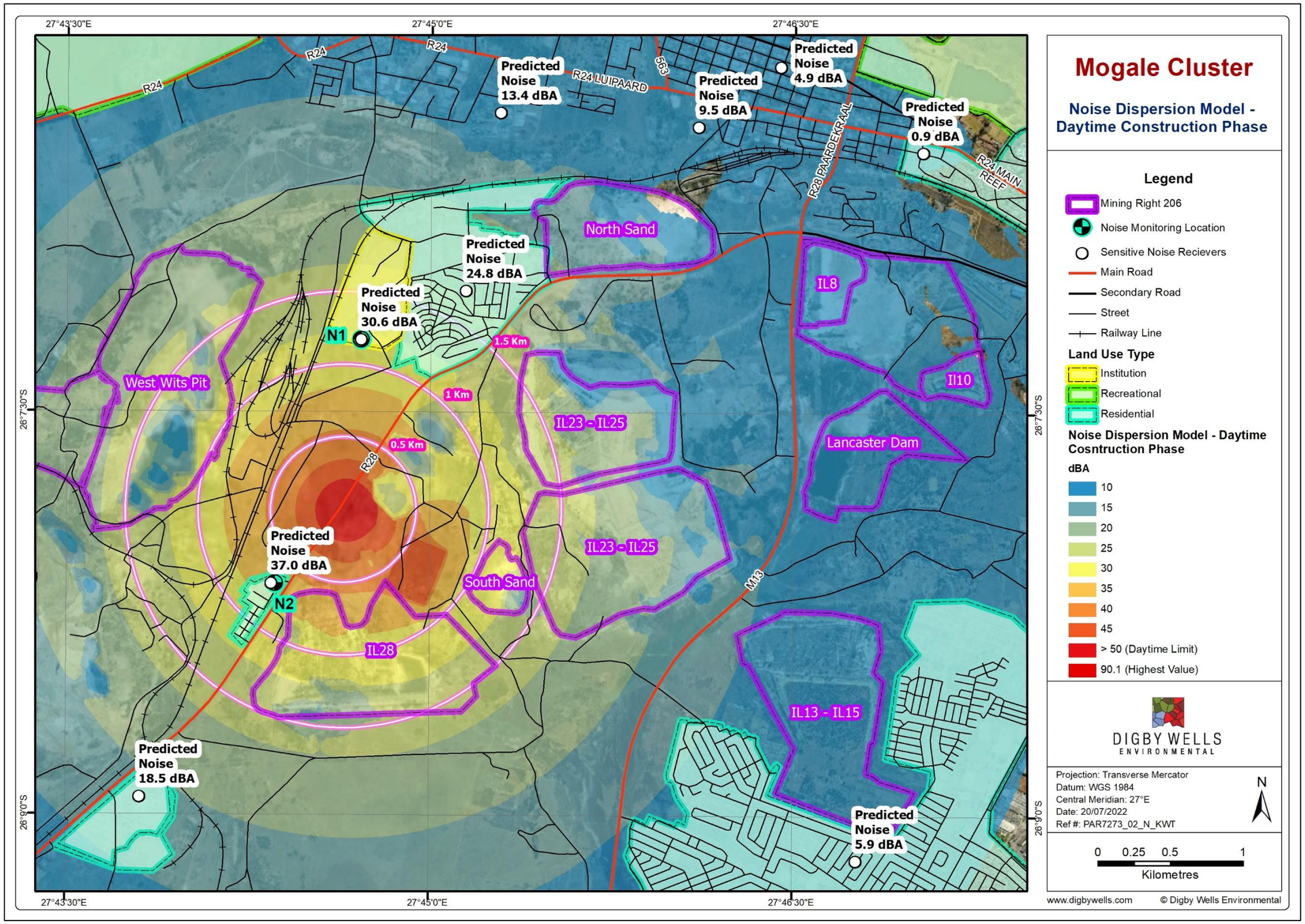


Figure 8-3: Predicted Noise at Selected Receivers for the Construction Phase (Daytime)

8.2.2. Operational Phase Model Results

The noise contour lines are displayed in Figure 8-4 to Figure 8-9 showing the predicted noise levels for day and night-time during the operational phase. Three (3) models were run for the operation phase. These include:

- Historic tailings reclamation – accounts for noise emissions associated with the hydraulic mining of the dumps;
- Sand dump reclamation – accounts for noise emissions associated with the excavation and hauling of the north and south sand dumps; and
- Processing plant – accounts for noise emissions associated with the operation of the processing plant.

The results of the models are displayed and discussed below.

8.2.2.1. Tailings Reclamation

The model results for the daytime and night-time operational phase – reclamation of the historic tailings without mitigation measures are presented in Figure 8-4 and Figure 8-5. Model results for the daytime (see Figure 8-4) indicates that sound propagation (without mitigation measures) is highest (exceeds the SANS 10103:2008 guidelines maximum daytime limit of 50dBA) within a 0.5 km radius of the noise generating source(s) used for the reclamation of the tailings. Therefore, receivers at a distance greater than the 0.5 km radius from the noise source, will experience levels below the limit.

Due to the mining methodology, the noise levels at the nearby NSRs will vary, due to the varying distances as hydraulic reclamation progresses across the tailings, as well as from one tailings to the other. The results from the model indicate that a distance of 0.5 km and beyond, the NSRs will experience negligible impacts (not exceeding SANS daytime regulatory limits of 50 dBA) pre-mitigation regardless of the progression of the reclamation activities.

For NSRs within the 0.5 km radius, the exposure levels can vary between 50 dBA and 97.4 dBA depending on the proximity to the noise generating source. These levels are in exceedance of the SANS daytime limit of 50 dBA and will result in a noise disturbance from a Gauteng NCR perspective.

The model results for the night-time operational phase (see Figure 8-5) indicates that emissions within a 1 km radius of the noise generating source(s) during reclamation will exceed the SANS night-time limit of 40 dBA. The NSRs at 1 km and beyond will experience limited noise disturbance based on model predictions The model results indicate that NSRs at a distance of 1.0 km and beyond, will experience negligible impacts (noise levels that are below the SANS guideline of 40 dBA) pre-mitigation regardless of the progression of the reclamation activities. For NSRs within the 0.5 km radius, exposures will range between 50 dBA and 96.5 dBA (see Figure 8-5) depending on the proximity to noise generating sources. As a result, exceedances are likely to occur, and this may result in a noise disturbance from a Gauteng NCR perspective.

8.2.2.2. Sand Dump Reclamation

The model results for the daytime and night-time operational phase surface reclamation of the sand dumps (north sand dump) without mitigation measures are presented in Figure 8-6 and Figure 8-7.

Model results for the daytime (see Figure 8-6) indicates that the areas were the noise emissions (without mitigation measures) will exceed the SANS guideline of 50 dBA are confined within a 0.5 km radius. The NSRs at 0.5 km and beyond will experience noise levels that are below the daytime guideline. The ambient noise levels at the NSRs will vary as reclamation progresses across each sand dump. For NSRs within the 0.5 km radius, the exposure levels will vary between 50 dBA and 87.7 dBA (see Figure 8-6) depending on their proximity to noise generating source. As a result, exceedance of the SANS guideline will occur, resulting in a noise disturbance from Gauteng NCR perspective.

The night-time results without mitigation measures, is depicted in Figure 8-7. The noise emissions show exceedances of the night-time SANS guideline of 40 dBA at a 0.7 km radius of the noise generating source. Any NSR within this zone will experience exposure level that will vary between 50 dBA and 89.8 dBA (see Figure 8-7) depending on their proximity to noise generating source. As a result, exceedance of the SANS guideline will occur, resulting in a noise disturbance from Gauteng NCR perspective.

For NSRs at 0.7 km and beyond, the noise exposure will be minimal (i.e., lower than the SANS guideline for night-time) pre-mitigation regardless of the progression of the reclamation activities.

8.2.2.3. Processing Plant

The model results for the daytime and night-time operational operation of the processing plant without mitigation measures are presented in Figure 8-8 and Figure 8-9. Model results for the daytime indicates that sound propagation resulting in exceedance of the daytime SANS guideline of 50 dBA will impact areas that are within a 0.5 km radius from the plant (especially in the north and southern axis). The model results indicate that emission from the daytime operation of the processing plant will not result in exposure levels above the SANS daytime limit of 50 dBA at the NSRs. The predicted noise exposure levels at the NSRs will not result in a noise disturbance from a Gauteng NCR perspective.

The predicted night-time emissions from the operation of the processing plant without mitigation measures show areas where exceedance of the SANS night-time guideline of 40 dBA are likely to occur (see Figure 8-9). These areas are confined to a 1.0 km radius from the plant (especially in the north and southern axis).

The model results indicate that emission from the daytime operation of the processing plant will not result in exposure levels above the SANS daytime limit of 50 dBA at the NSRs. The predicted noise exposure levels at the NSRs will not result in a noise disturbance from a Gauteng NCR perspective.

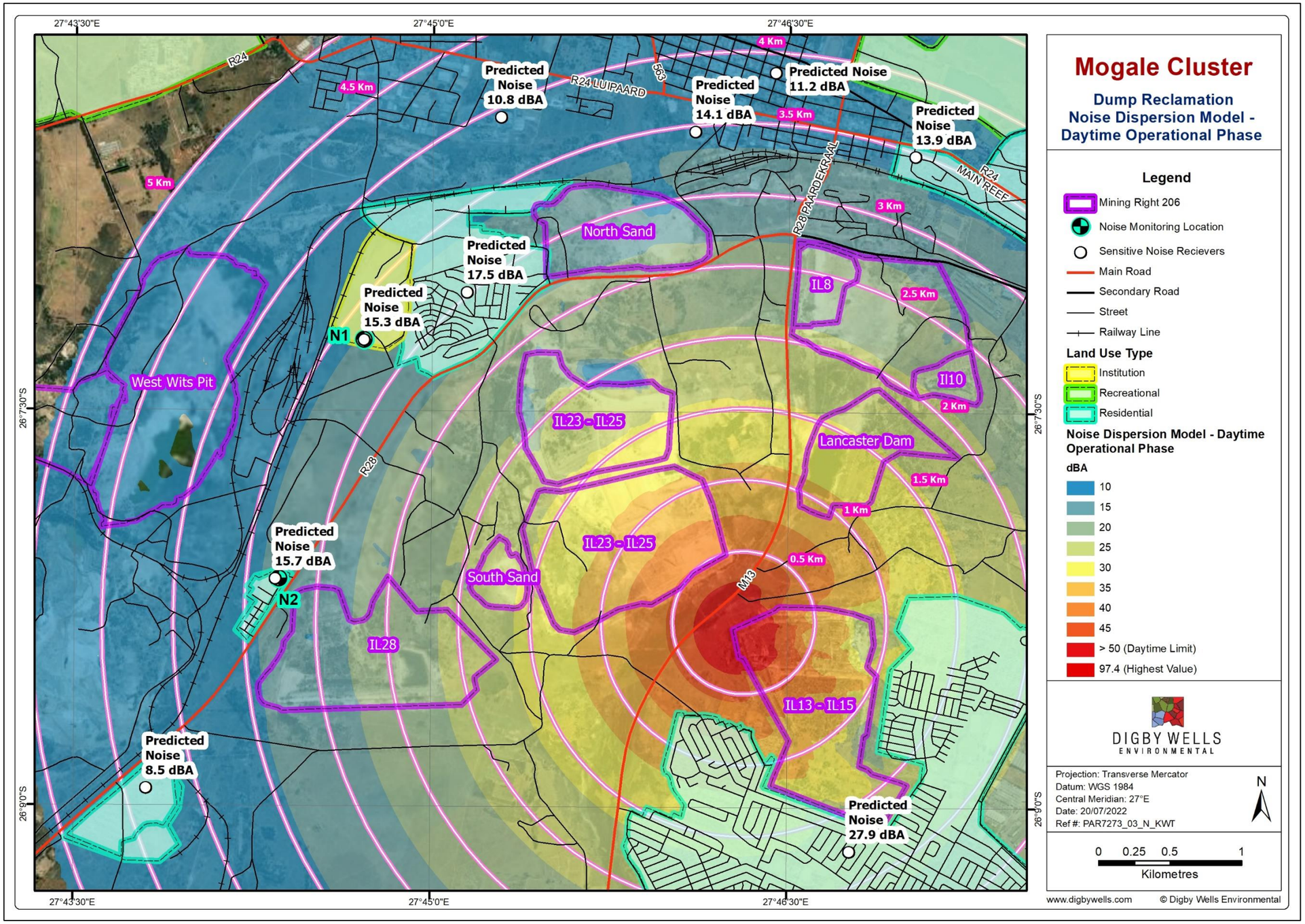


Figure 8-4: Predicted Noise at Selected Receivers for the Operational Phase (Daytime) at IL28 Dump

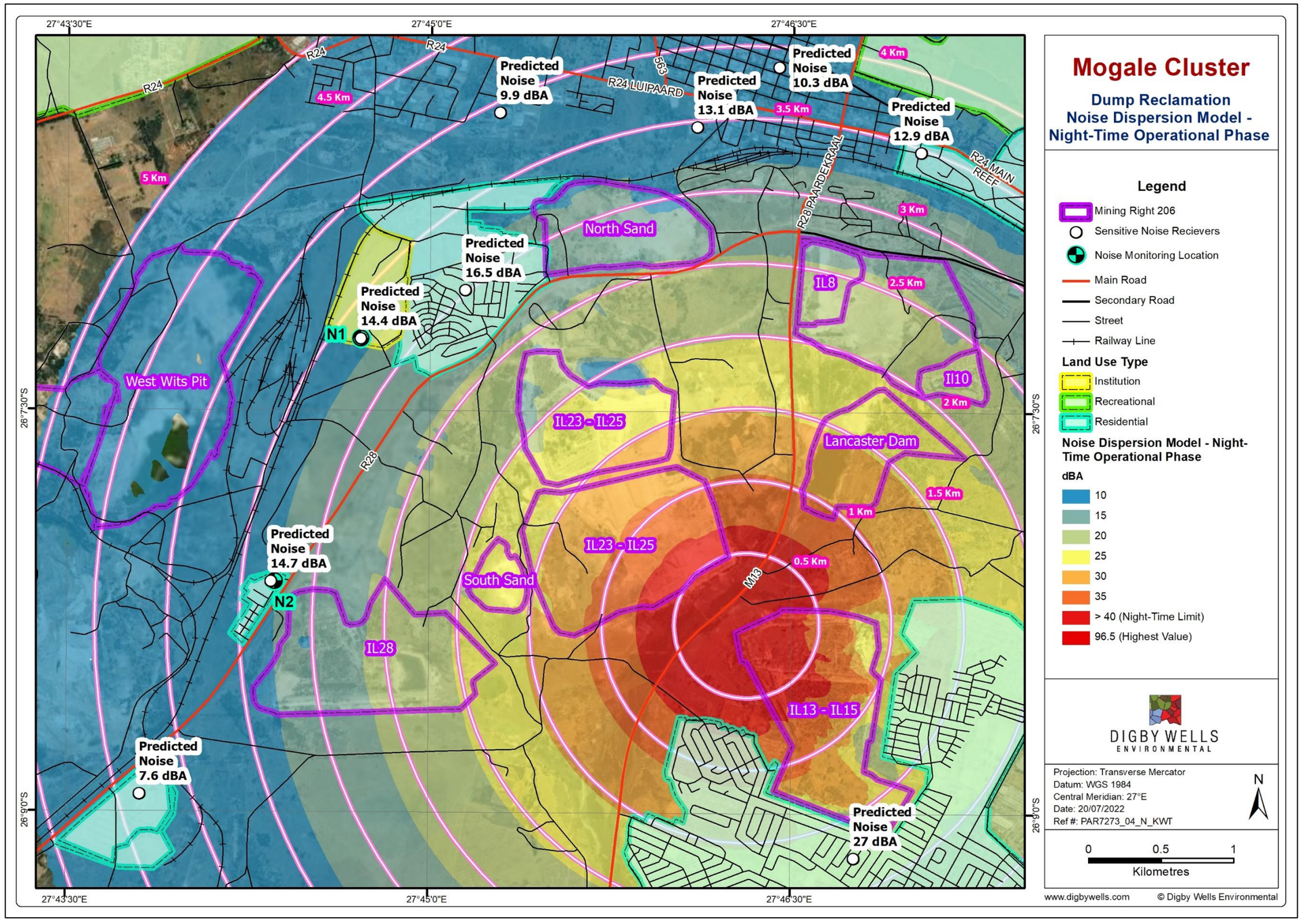


Figure 8-5: Predicted Noise at Selected Receivers for the Operational Phase (Night-time) at IL28 Dump

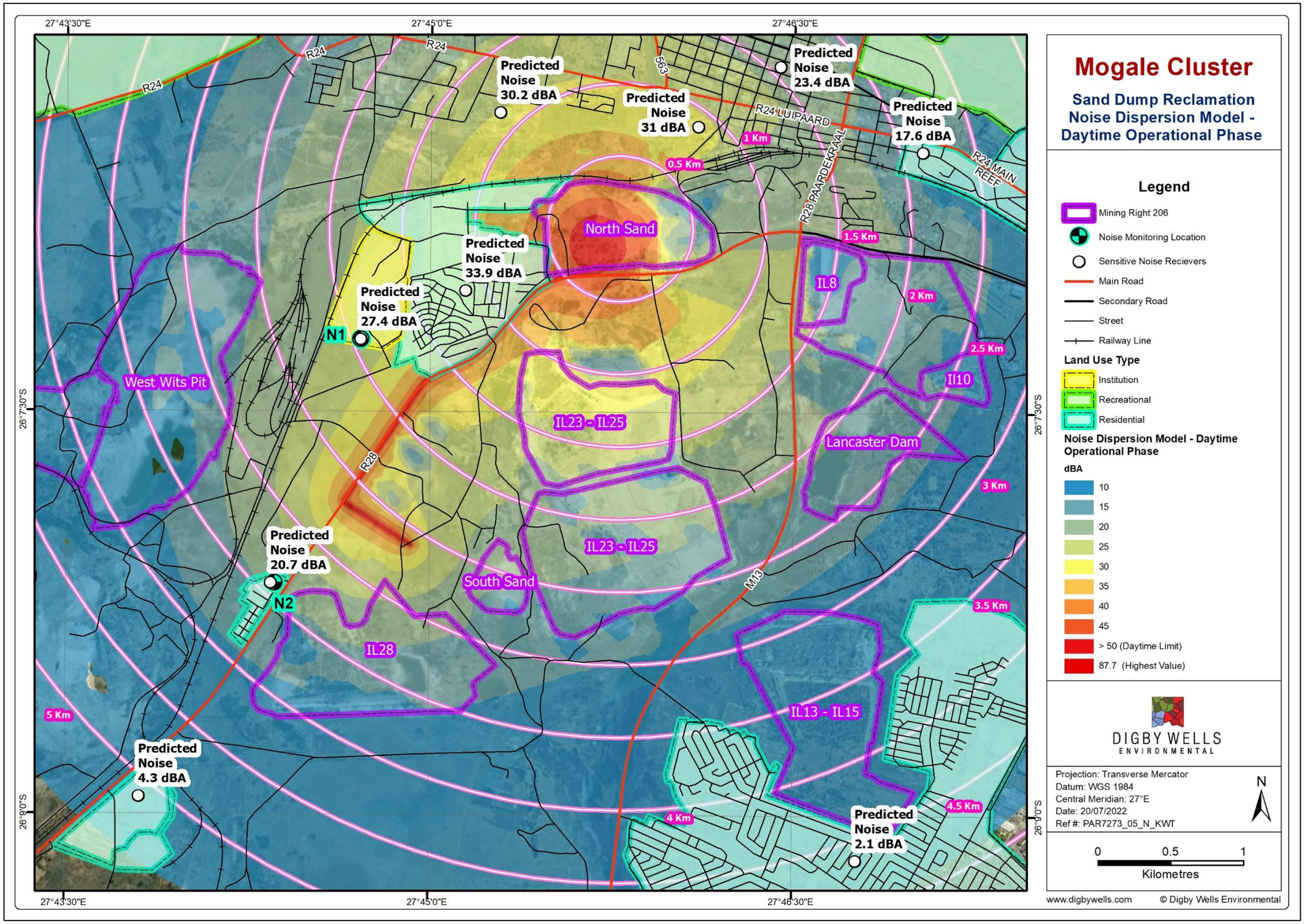


Figure 8-6: Predicted Noise at Selected Receivers for the Operational Phase (Daytime) at North Sand Dump

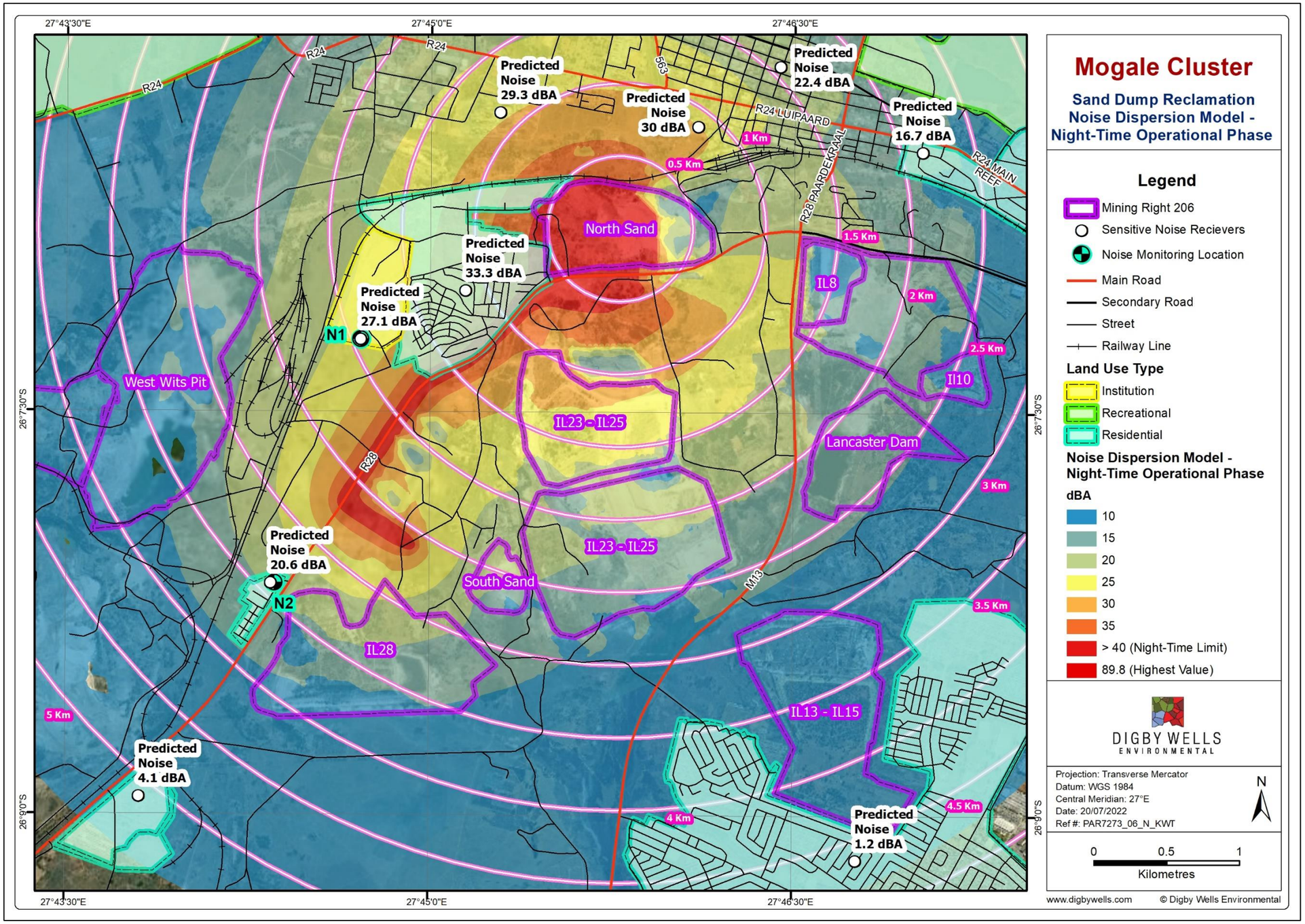


Figure 8-7: Predicted Noise at Selected Receivers for the Operational Phase (Night-time) at North Sand Dump

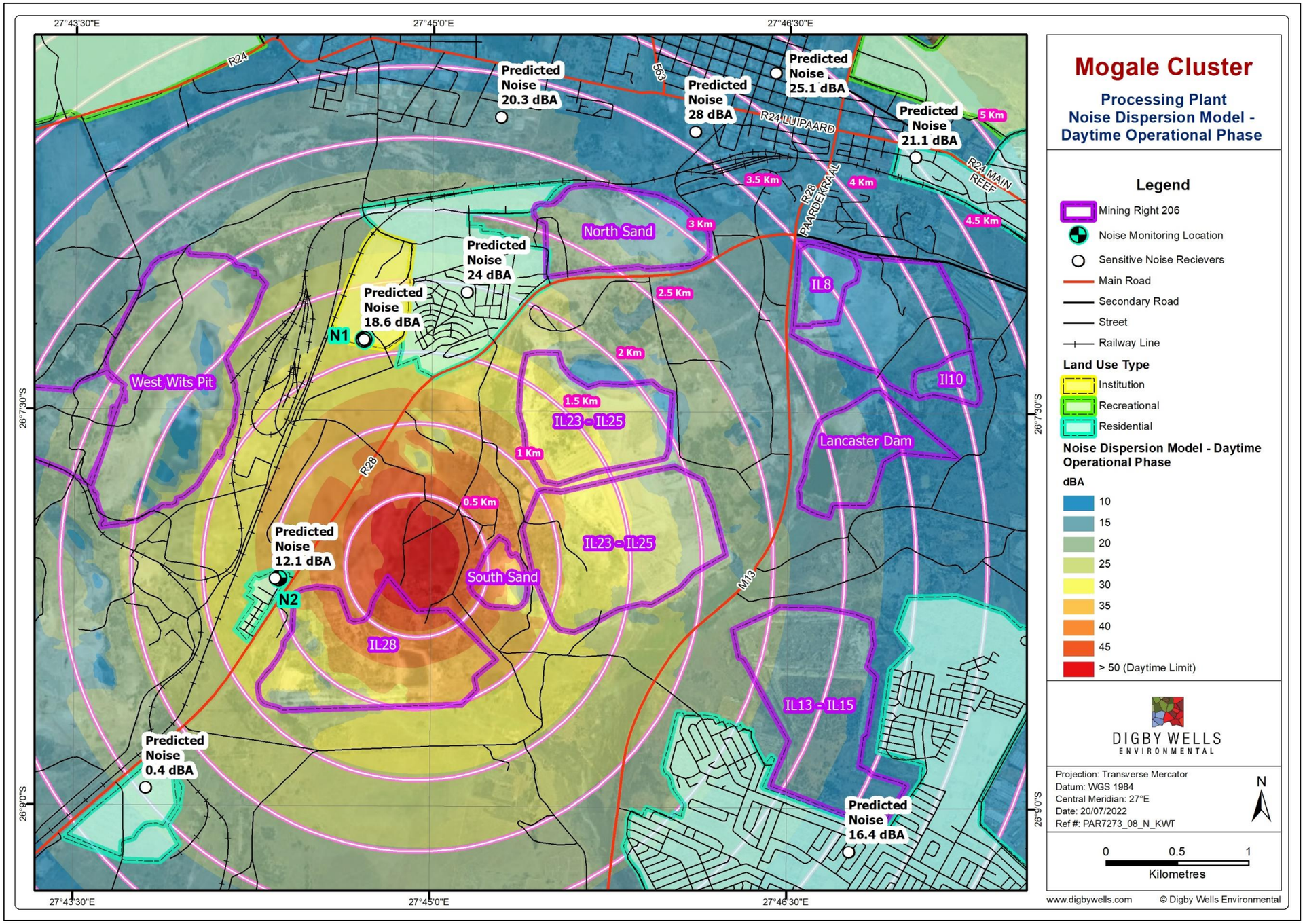


Figure 8-8: Predicted Noise at Selected Receivers for the Operational Phase (Daytime) at the Processing Plant

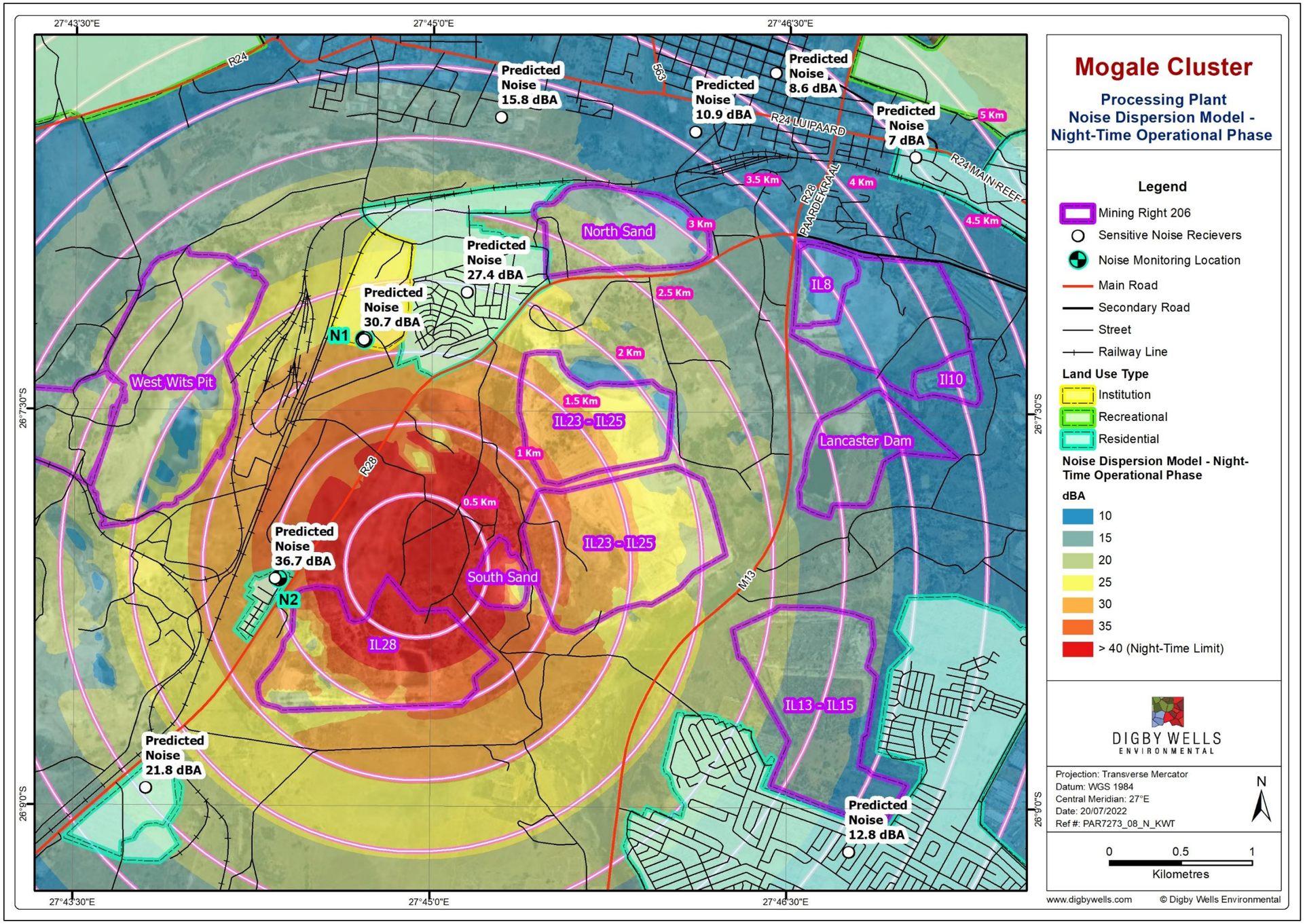


Figure 8-9: Predicted Noise at Selected Receivers for the Operational Phase (Night-time) at the Processing Plant

8.3. Predicted Future Noise Impacts Results

The cumulative future noise impacts at the NSRs for the construction and operational phase of the project are reported and discussed in the sections below.

8.3.1. Construction

Table 8-3 presents the cumulative daytime future ambient noise level that a NSR will experience as a result of the construction phase activities associated with the proposed project. The cumulative results indicate that no receiver will experience an increase in ambient noise levels. Therefore, the community/group response (as per SANS 10103:2008 guidelines) to noise emissions from the daytime construction phase can be categorized as “Little” (0-10 dBA), resulting in “Sporadic complaints” if any from the NSRs.

Table 8-3: Cumulative Future Impact for the Construction Phase (Daytime Only)

Receivers	Daytime ambient noise levels measured at the receivers (dBA)	Predicted (dispersion model) noise from construction activities (dBA)	Cumulative level (dBA)	Increase in ambient noise level dBA
Day Time (Limit 50dBA)				
N1	44	30.6	44	0
N2	62	37.0	62	0
SR3	53*	18.5	53	0
SR4	53*	5.9	53	0
SR5	53*	0.9	53	0
SR6	53*	9.5	53	0
SR7	53*	13.4	53	0
SR8	53*	4.9	53	0
SR9	53*	24.8	53	0
	Indicates predicted $L_{Aeq,T}$ levels above the daytime rating limit rating limit of 50dBA.			

8.3.2. Operational

Table 8-4 presents the cumulative noise level (both day and night) that a NSR will experience if all the noise generating equipment/machinery for the operational phase activities (hydraulic mining, sand dump mining and the operation of the processing plant) were operational at the same time. The results from Table 8-4 indicate that no receiver will experience noise levels that exceeds the day and night-time regulatory limits from a SANS 10103:2008 guidelines perspective. Therefore, the predicted noise levels during the operational phase will not result in a noise disturbance in terms of the Gauteng NCRs at NSRs.

* Overall daytime ambient noise level measured at the noise sensitive receivers.

Table 8-5 presents the cumulative future noise level (both day and night) that a NSR will experience as a result of the future reclamation activities associated with the proposed project. The results from Table 8-5 indicate that the cumulative future noise level for day and night-time operational phase at NSRs (excluding SNR1 - daytime) exceeds the day and night-time regulatory limits from a SANS 10103:2008 guidelines perspective. However, this is mainly due to the existing background noise level which exceeds (excluding SNR1 -daytime) regulatory limits for day and night and are non-compliant in terms of the SANS 10103:2008 guidelines. In addition, the model results presented in Table 8-5 also indicate that no receiver for day and night-time operational phase will experience an increase in ambient noise levels. Therefore, the community/group response (as per the SANS 10103:2008 guidelines) to noise emissions from the daytime operational phase can be categorized as “Little” (0-10 dBA), resulting in “Sporadic complaints” if any from the NSR.

Table 8-4: Cumulative Noise Levels at the Noise Sensitive Receivers for the Operational Phase (Day and Night-time)

Receivers	Predicted (Slime dispersion model) noise (dBA)	Predicted (Sand Dump dispersion model) noise (dBA	Predicted (Processing Plant dispersion model) noise (dBA	Cumulative noise level (dBA)
Operational Phase Daytime (Without Mitigation)				
N1	15.3	27.4	30.7	32
N2	15.7	20.7	36.3	36
SR3	8.5	4.3	21.2	22
SR4	27.9	2.1	12.2	28
SR5	13.9	17.6	6.6	19
SR6	14.1	31	10	31
SR7	10.8	30.2	15.9	30
SR8	11.2	23.4	8.4	24
SR9	17.5	33.9	27.2	35
Operational Phase Night-Time (Without Mitigation)				
N1	14.4	27.1	30.7	32
N2	14.7	20.6	36.7	37
SR3	7.6	4.1	21.8	22
SR4	27	1.2	12.8	27
SR5	12.9	16.7	7	19
SR6	13.1	30	10.9	30
SR7	9.9	29.3	15.8	30
SR8	10.3	22.4	8.6	23
SR9	16.5	33.3	27.4	34
	Indicates predicted $L_{Aeq,T}$ levels above either the daytime rating limit of 50dbA or the night-time rating limit of 40dBA.			

Table 8-5: Cumulative Future Impact for the Operational Phase (Day and Night-time)

Receivers	Ambient noise levels measured at the receivers (dBA)	Predicted (Dump dispersion model) noise (dBA)	Predicted (Sand Dump dispersion model) noise (dBA	Predicted (Processing Plant dispersion model) noise (dBA	Cumulative noise level (dBA)	Increase in ambient noise level (dBA)
Operational Phase Daytime (Without Mitigation)						
N1	44	15.3	27.4	30.7	44	0
N2	62	15.7	20.7	36.3	62	0
SR3	53*	8.5	4.3	21.2	53	0
SR4	53*	27.9	2.1	12.2	53	0
SR5	53*	13.9	17.6	6.6	53	0
SR6	53*	14.1	31	10	53	0
SR7	53*	10.8	30.2	15.9	53	0
SR8	53*	11.2	23.4	8.4	53	0
SR9	53*	17.5	33.9	27.2	53	0
Operational Phase Night-Time (Without Mitigation)						
N1	42	14.4	27.1	30.7	42	0
N2	55	14.7	20.6	36.7	55	0
SR3	48*	7.6	4.1	21.8	48	0
SR4	48*	27	1.2	12.8	48	0
SR5	48*	12.9	16.7	7	48	0
SR6	48*	13.1	30	10.9	48	0
SR7	48*	9.9	29.3	15.8	48	0
SR8	48*	10.3	22.4	8.6	48	0
SR9	48*	16.5	33.3	27.4	48	0
	Indicates predicted $L_{Aeq,T}$ levels above either the daytime rating limit of 50dbA or the night-time rating limit of 40dBA.					

* Overall day and night-time ambient noise level measured at the noise sensitive receivers excluding rain events.

9. Environmental Noise Impact Assessment

The impact assessment ranking methodology in Appendix A was applied in rating the implications of the different phases of the Project on the ambient noise levels of the receiving environment. The impact assessment approach has been formalised to comply with Regulation 31(2)(l) of the NEMA.

9.1. Construction Phase

Activities during the Construction Phase that may have potential impacts on the ambient noise levels in the area are indicated in Table 9-1.

Table 9-1: Interactions and Impacts of Activity

Interaction	Impact
Site clearing for the construction of the new processing plant facility and ancillary infrastructure such as pipelines, pump stations, electrical supply etc.	Noise emissions from equipment/machinery during the construction phase may increase the noise levels at NSRs and may result in a noise disturbance.
Construction of the new processing plant and ancillary infrastructure such as pipelines, pump stations, electrical supply etc.	

9.1.1. Impact Description

The activities associated with the daytime construction phase will lead to the emission of noise that will not exceed the SANS 10103:2008 daytime guideline limit of 50 dBA nor result in the increase in ambient noise levels at the NSRs. Existing noise levels at these sites are not compliant, but the non-compliance is not mining related.

Hence, the development of the project will not lead community/group response (as per the SANS 10103:2008 guidelines) to noise emissions, as the cumulative impact is categorized as “Little” (0-10 dBA), resulting in “Sporadic complaints” if any from the NSR. The construction phase activities will occur during daylight hours only therefore the anticipated noise emissions associated with these activities will be limited to daytime only. In addition, the construction phase will be short-term.

9.1.1.1. Management Objectives

The noise management objective is to minimise noise emissions and to ensure that the noise exposure levels at the nearby sensitive receivers do not exceed the SANS 10103:2008 guidelines. Also, to ensure that mitigation measures are implemented so noise levels are below limit values and in compliance with the guidelines.

9.1.1.2. Management Actions

The following management measures are recommended as good practice guidelines:

- Construction activities should be restricted to daylight hours;
- Construction activities should be carried out in phases;
- Construction machinery and vehicles should be switched off when not in use;
- Construction vehicles should be with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;
- Machinery and construction vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
- Regulate vehicle speeds on the main, access and haul roads.

9.1.1.3. Impact Ratings

The noise impact during the construction phase of the Project has been assessed and the rating is provided in Table 9-2.

Table 9-2: Significance Ratings for Construction Phase

Activity and Interaction: Construction phase activities as per Table 9-1			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Noise will emanate from the machinery and/or equipment, and vehicles operating during the construction activities.			
Prior to mitigation/ management			
Duration	Short Term (2)	Noise will be generated for the duration of each activity in the construction phase	Negligible (negative) – 18
Extent	Limited (2)	It is expected that the noise impact will be limited to the project site and its immediate surroundings.	
Intensity	Minor (2)	The predicted noise levels based on the noise dispersion model indicate that the impacts will not result in a noise disturbance. Therefore, noise impacts will be minor at the nearby receivers.	
Probability	Unlikely (3)	The predicted noise levels based on the noise dispersion model indicate that the impacts will not result in a noise disturbance. Therefore, noise impacts will be unlikely at the nearby receivers.	
Nature	Negative		
Mitigation/ Management actions			

Activity and Interaction: Construction phase activities as per Table 9-1			
Dimension	**Rating**	**Motivation**	**Significance**
• Construction activities should be restricted to daylight hours; • Construction activities should be carried out in phases; • Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should be with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Machinery and construction vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.			
Post- mitigation			
Duration	Short Term (2)	Noise will be generated for the duration of each activity in the construction phase	Negligible (negative) – 15
Extent	Very Limited (1)	It is expected that the noise impact will be limited to the isolated parts of the Project area post-mitigation.	
Intensity	Minor (2)	Predicted noise impacts at the noise sensitive receivers will remain negligible post-mitigation.	
Probability	Unlikely (3)	Noise impacts are unlikely to occur post-mitigation.	
Nature	Negative		

9.2. Operational Phase

Activities during the Operational Phase that may have potential impacts on the ambient noise levels in the area are indicated in Table 9-3.

Table 9-3: Interactions and Impacts of Activity

Interaction	Impact
Hydraulic reclamation of the associated historic tailings facilities and sand dumps	Noise emissions from equipment/machinery during the operation phase may increase the noise levels at NSRs and may result in a noise disturbance.
Operation of pump stations during the operational phase	
Production of Gold	
Progressive rehabilitation of the new tailings facility footprints (West Pits TSF and 1L23-1L25 TSF	

9.2.1. Impact Description

The activities associated with the daytime operational phase will not lead to the emission of noise that will exceed the SANS 10103:2008 day time guidelines limit of 50 dBA at NSRs. Existing noise levels at these sites are not compliant, but the non-compliance is not mining related.

Hence, the development of the project will not lead community/group response (as per the SANS 10103:2008 guidelines) to noise emissions, as the cumulative impact is categorized as "Little" (0-10 dBA), resulting in "Sporadic complaints" if any from the NSR.

The same scenario applies to night-time cumulative noise levels, as the cumulative impact is categorized as "Little" (0-10 dBA). The operation phase activities will occur during both day and night-time and will be long-term in nature.

9.2.1.1. Management Objectives

The noise management objective is to minimise noise emissions and to ensure that the noise exposure levels at the nearby sensitive receivers do not exceed the SANS 10103:2008 guidelines. Also, to ensure that mitigation measures are implemented so noise levels are below limit values and in compliance with the guidelines.

9.2.1.2. Management Actions

The following management measures are recommended as good practice guidelines.

- Machinery and vehicles should be switched off when not in use;
- Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;
- Acoustic enclosures for noise generating equipment such as the slurry pump station;
- Slurry pump station should be located as far as possible (ideally 0.5 - 1 km) from NSRs;
- Noise monitoring on a regular basis to identify problematic areas/areas of concern;
- Machinery and vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and
- Regulate vehicle speeds on the main, access and haul roads.

9.2.1.3. Impact Ratings

The noise impact during the Operational Phase of the Project has been assessed and is provided in Table 9-4.

Table 9-4: Significance Ratings for Operational Phase

Activity and Interaction: Operational phase activities as per Table 9-3			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Noise will emanate as a result of reclamation activities and the operation of the plant.			
Prior to mitigation/ management			
Duration	Project Life (5)	Noise emissions will be generated throughout the project life	Negligible (negative) – 27
Extent	Limited (2)	It is expected that the noise impact will be limited to the project site and its immediate surroundings.	
Intensity	Minor (2)	The predicted noise levels based on the noise dispersion model indicate that the impacts will not result in a noise disturbance. Therefore, noise impacts will be negligible at the nearby receivers.	
Probability	Likely (3)	The predicted noise levels based on the noise dispersion model indicate that the impacts will not result in a noise disturbance. Therefore, noise impacts will be unlikely at the nearby receivers.	
Nature	Negative		
Mitigation/ Management actions			
• Machinery and vehicles should be switched off when not in use; • Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Acoustic enclosures for noise generating equipment such as the slurry pump station; • Slurry pump station and vibrating screener should be located as far as possible (ideally 0.5 - 1 km) from NSRs; • Noise monitoring on a regular basis to identify problematic areas/areas of concern; • Machinery and vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.			
Post- mitigation			
Duration	Project Life (5)	Noise emissions will be generated throughout the project life	Negligible (negative) – 24
Extent	Very Limited (1)	It is expected that the noise impact will be limited to the isolated parts of the Project area post-mitigation.	

Activity and Interaction: Operational phase activities as per Table 9-3			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Minor (2)	Predicted noise impacts at the noise sensitive receivers will remain negligible post-mitigation.	
Probability	Unlikely (3)	Noise impacts are unlikely to occur post-mitigation.	
Nature	Negative		

9.3. Decommissioning Phase

Activities during the Decommissioning Phase that may have potential impacts on the ambient noise levels in the area are indicated in Table 9-5.

Table 9-5: Interactions and Impacts of Activity

Interaction	Impact
Removal, decommissioning and rehabilitation of surface infrastructure such as pipelines, powerlines, pumps etc. footprints.	Noise emissions from equipment/machinery during the decommissioning phase may increase the noise levels at NSRs and may result in a noise disturbance.
Removal, decommissioning and rehabilitation of the processing plant footprint.	
Rehabilitation of the old TSF footprints.	
Rehabilitation of the old Mintails Processing Plant footprint.	
Final rehabilitation of this facility.	
General rehabilitation of the surrounding area, including wetland rehabilitation.	

9.3.1. Impact Description

The rehabilitation, demolition and removal of the infrastructure will involve the use of machinery and/or equipment, and vehicles similar to those used in the construction phase. This will lead to the emission of noise to the ambient environment, including the at NSRs. The decommissioning phase activities will occur during daylight hours only therefore the predicted noise emissions will be limited to daytime only. In addition, the decommissioning phase will be short-term in nature, therefore, the predicted noise impacts will also be short-term. The significance of the noise impact will be negligible due to the simultaneous reduction in the cumulative noise onsite and at NSRs.

9.3.1.1. Management Objectives

The noise management objective is to minimise noise emissions and to ensure that the noise exposure levels at the nearby sensitive receivers do not exceed the SANS 10103:2008 guidelines. Also, to ensure that mitigation measures are implemented so noise levels are below limit values and in compliance with the guidelines.

9.3.1.2. Management Actions

The following management measures are recommendations as good practice guidelines:

- Restrict decommissioning activities to daylight hours;
- Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound;
- Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers;
- Regulate speed limits on access roads; and
- Switch off equipment when not in use.

9.3.1.3. Impact Ratings

The noise impact during the Decommissioning Phase of the Project has been assessed and is provided in Table 9-6.

Table 9-6: Significance Ratings for Decommissioning Phase

Activity and Interaction: Decommissioning phase activities as per Table 9-5			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Noise will emanate from the machinery and/or equipment, and vehicles operating during the decommissioning phase activities.			
Prior to mitigation/ management			
Duration	Short term (2)	Noise will be generated for the duration of each activity in the decommissioning phase.	Negligible (negative) – 18
Extent	Limited (2)	It is expected that the noise impact will be limited to the project site and its immediate surroundings.	
Intensity	Minor (2)	Minor implications on the surrounding area are anticipated	
Probability	Unlikely (3)	Noise impacts at nearby receivers from decommissioning activities are unlikely to occur due to the simultaneous	

Activity and Interaction: Decommissioning phase activities as per Table 9-5			
Dimension	**Rating**	**Motivation**	**Significance**
		reduction in noise generating Project related sources.	
Nature	Negative		
Mitigation/ Management actions			
• Restrict decommissioning activities to daylight hours; • Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.			
Post- mitigation			
Duration	Short Term (2)	Noise will be generated for the duration of each activity in the decommissioning phase.	Negligible (negative) – 12
Extent	Site Specific (1)	Noise generated post-mitigation will be limited to specific isolated parts of the site.	
Intensity	Minimal (1)	Minimal implications on the surrounding area are anticipated post-mitigation	
Probability	Unlikely (3)	Noise impacts at nearby receivers from decommissioning activities are unlikely to occur due to the simultaneous reduction in noise generating Project related sources.	
Nature	Negative		

10. Cumulative Impacts

The findings of this noise survey show that the predicted future noise emissions from the operational phase activities (hydraulic mining, sand dump mining and processing plant) for day and night-time will result in negligible (do not exceed regulatory limits for day and night) noise impacts. This is corroborated by the calculated cumulative noise impacts (refer to Section: 8.3) which indicates that the proposed project activities for both construction and operational phases will not increase the ambient noise levels at the NSRs. Irrespective of the above mentioned, it is recommended that quarterly noise monitoring be conducted to ensure the cumulative impacts are monitored and stay the same throughout the project life.

11. Environmental Management Plan

Table 11-1 provides a summary of the proposed Project activities, environmental aspects and impacts on the receiving environment. Information on the mitigation measures, mitigation type and timing of implementation of the Environmental Management Plan (EMP) are specified.

Table 11-1: Environmental Management Plan

Activities	Potential Impacts	Aspects Affected	Phase	Mitigation Measure	Mitigation Type	Time period for implementation
• Site clearing for the construction of the new processing plant facility and ancillary infrastructure such as pipelines, pump stations, electrical supply etc. • Construction of the new processing plant and ancillary infrastructure such as pipelines, pump stations, electrical supply etc.	Noise emission	Noise	Construction	• Construction activities should be restricted to daylight hours; • Construction activities should be carried out in phases; • Construction machinery and vehicles should be switched off when not in use; • Construction vehicles should be with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Machinery and construction vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.	Noise control measures; and Noise monitoring.	Upon commencement of the construction phase.
• Hydraulic reclamation of the associated historic slime and sand dumps • Operation of pump stations during the operational phase. • Progressive rehabilitation of the new tailings facility footprints (West Pits TSF and 1L23-1L25 TSF • Operation of the processing plant.	Noise emissions	Noise	Operational	• Machinery and vehicles should be switched off when not in use; • Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Acoustic enclosures for noise generating equipment such as the slurry pump station; • Slurry pump station and vibrating screener should be located as far as possible (ideally 0.5 - 1 km) from NSRs; • Noise monitoring on a regular basis to identify problematic areas/areas of concern; • Machinery and vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and • Regulate vehicle speeds on the main, access and haul roads.	Noise control measures; and Noise monitoring.	Upon commencement of the operational phase.

Activities	Potential Impacts	Aspects Affected	Phase	Mitigation Measure	Mitigation Type	Time period for implementation
• Removal, decommissioning and rehabilitation of surface infrastructure such as pipelines, powerlines, pumps etc. footprints. • Removal, decommissioning and rehabilitation of the processing plant footprint. • Rehabilitation of the old TSF footprints. • Rehabilitation of the old Mintails Processing Plant footprint. • Final rehabilitation of this facility. • General rehabilitation of the surrounding area, including wetland rehabilitation.	Noise emission	Noise	Decommissioning	• Restrict decommissioning activities to daylight hours; • Vehicles should be equipped with a Brigade white noise reversing alarm, rather than the conventional beeping type reverse alarms. The white noise reversing alarm produces a buzzer sound instead of the conventional beeping sound; • Regularly service machines and vehicles to ensure noise suppression mechanisms are effective e.g., installed exhaust mufflers; • Regulate speed limits on access roads; and • Switch off equipment when not in use.	Noise control measures; and Noise monitoring.	Upon commencement of the decommissioning phase.

12. Monitoring Programme

The noise emissions/impacts from the operational phase of the Project on the sensitive nearby receivers based on the findings from the assessment ranking methodology are negligible. However, it is recommended that a monitoring plan be implemented to monitor background noise levels, while mining is ongoing (increases and/or decreases in noise levels) throughout the project's life. The components to be included in the proposed monitoring plan are discussed below:

- Noise monitoring is to be conducted for the operational phases of the Project's life; and
- Quarterly noise measurements must be conducted at the prescribed locations (SNR1, SNR2 and SNR4 where monitoring is currently being undertaken.

Table 12-1: Noise Monitoring Programme

Monitoring Element	Comment	Frequency	Responsibility
Noise Monitoring	Noise monitoring in line with the requirements of SANS 10103:2008 on-site, and at selected receivers	Quarterly Noise Monitoring	Mine Environmental Officer

13. Conclusion and Recommendations

The existing ambient noise levels was assessed and have been established at selected NSRs in the Project area and its immediate surroundings. The results from the noise monitoring survey indicate that the ambient soundscape (LAeq) for both day and night-time for all monitoring locations were in exceedance of the SANS 10103:2008 guidelines for day time (except at N1). For night-time, the measured levels were all in exceedance of the limit values for receptors within a suburban environment. The main noise sources that impacted the monitoring locations were:

- Anthropogenic; Communication (people talking / shouting) and Vehicle activity (light and heavy vehicles); and
- Natural; birds (birdsong/chirping), poultry (chickens).

The following conclusions can be drawn for the ambient noise levels in the Project area and its immediate surroundings:

- The resulting overall ambient noise levels as determined by the noise monitoring survey show the area does not comply with the SANS 10103:2008 guidelines limits for day and night-time;

- The noise contributions of vehicular activity along the R28 and M13 represent a perennial contributor to the background. The background noise to a large extent will mask out the day and night-time emissions caused by the future mining operations at nearby sensitive receivers.

Noise dispersion modelling scenarios were conceptualized for the construction and operational phases, with the model predictions indicating negligible impacts on the ambient soundscape at the NSRs for construction and operational phases. In summary:

- Sensitive receivers that fall within 0.5 km of the Project area for the daytime construction and operational phases are predicted to experience noise impacts above the SANS 10103:2008 regulatory limits.
- Sensitive receivers that fall within 1.0 km of the Project area for the night-time operational phase are predicted to experience noise impacts above the SANS 10103:2008 regulatory limits.
- Predicted future emissions from the daytime construction and operational phase as well as the night-time operational phase of the Project will not result in an increase in the ambient noise level at the NSRs located greater than 0.5 km and 1.0 km (Day and Night) radius of project reclamation activities.
- Hence, the development of the project will not lead community/group responses (as per the SANS 10103:2008 guidelines) to noise emissions, as the cumulative impact is categorized as “Little” (0-10 dBA), resulting in “Sporadic complaints” if any from the NSR.

The findings from the impact assessment ranking methodology for the operational phase have indicated minor impacts on the nearby sensitive receivers from Project related activities. However, the implementation of mitigation measures during the different phases of the Project is recommended and is predicted to result in negligible impacts post-mitigation. The aforementioned will result in emission reduction and a further decrease in anticipated noise impacts onsite and at the receivers.

Based on the findings detailed in this report and the appropriate implementation of noise mitigation, management and monitoring measures, it is therefore recommended that the proposed Project be authorized from a noise impact perspective.

14. References

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Appendix A: Impact Assessment Ranking

The potential impacts from the proposed Project have been assessed based on the severity predicted on-site and at sensitive receptor(s). This culminates in a significance rating which identifies the most important impacts that require mitigation and/or management.

Based on international guidelines and South African legislation, the following criteria were considered when examining potentially significant impacts:

- Nature of impacts (direct / indirect, positive / negative);
- Duration (short / medium / long-term, permanent (irreversible) / temporary (reversible), frequent / seldom);
- Extent (geographical area, size of affected population / habitat / species);
- Intensity (minimal, severe, replaceable / irreplaceable);
- Probability (high / medium / low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact / risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 14-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts. Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in the Environmental Management Plan Report (EMPr).

The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 14-2, which is extracted from Table 14-1. The description of the significance ratings is discussed in Table 14-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 14-1: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and / or social order.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and / or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and / or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
4	On-going serious natural and / or social issues. Significant changes to structures / items of natural or social significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.
3	On-going natural and / or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and / or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 14-2: Probability/Consequence Matrix

Probability	Significance																																						
7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21

Consequence

Table 14-3: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Substantial (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Major (positive)
36 to 72	An positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Major (negative)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Substantial (negative)