

RVM 1, 2 & 3 Hydro Electric Power (Pty) Ltd

SCREENING NOISE REPORT

FOR BASIC ASSESSMENT

**Establishment of the RVM Hydro Electric Power
Plant on the Orange River near the town of
Kakamas, Northern Cape Province**



Study done for:

aurecon



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EXECUTIVE SUMMARY

M2 Environmental Connections was commissioned to compile a Screening Noise Report as part of a Basic Assessment process conducted for the proposed RVM Hydro Electric Power Project. The project is proposed by RVM 1,2 & 3 Hydro Electric Power (Pty) Ltd on the Orange River near the town of Kakamas, Northern Cape Province.

The project entails the development of a 10 and 9.9 Megawatt (MW) hydropower stations on the Orange River and the infrastructure can include:

- A low weir in the Orange River;
- An off-take structure at the weir in the river to facilitate the abstraction of water;
- Water conveyance infrastructure comprising a combination of either a canal, a pipeline and/or culverts to convey the water to each station's penstock;
- Each of the two stations comprising of;
 1. steel penstock to transfer the water from the shared water conveyance infrastructure;
 2. the power chamber;
 3. a high voltage distribution line to transfer power from each station to a nearby substation; and
 4. Access roads (following existing alignments where possible).

Daytime noise levels associated with construction activities is expected to be limited to an area within 500 meters from the activity. The nature of the noise is generally more impulsive and in a sensitive natural environment animals will try to relocate further from the noise source.

Noise associated with the operational phase is considered to be very low. This is because the hydro-power generation equipment is expected to be situated inside a building constructed from concrete/brick and mortar. These construction materials have a significant influence on the attenuation of noises from the equipment to the outside, with attenuation ranging between 20 and 30 dB resulting in a significant reduction in the noise levels and the extent of the potential noise impact. The nature of the noise is generally broadband, but if tones are present it may increase the risk of annoyance levels. Considering the worse-case scenario, due to the fact that the equipment will be situated inside a building the potential of a noise impact will be limited to the immediate surroundings.



This assessment however could not identify receptors living within 2,000 meters from the proposed development (excluding the powerline). Being a baseline assessment, it cannot comment on the potential risk of a noise impact on the natural environment.

This report concluded the following:

Construction Phase: The information available is adequate to conclude that there will be a low potential for a noise impact during the construction phase due to the large distance between receptors and construction areas (project footprint and construction road traffic noise). There is a low potential of a noise impact during the construction of the over-head power lines, especially when this work takes place within 500 meters from potential noise-sensitive developments. It is the opinion of the author that the potential of a noise impact would be of a low significance, but, should any potential and relevant stakeholder have a concern regarding noise during the public participation process, a Scoping level Noise Assessment are recommended.

To minimize this noise risk the following mitigation are proposed:

- Make use of the smallest available equipment for the task;
- Notify potentially sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 meters) of the NSD is to start.

Following information to be presented in writing:

- Description of Activity to take place;
- Estimated duration of activity;
- Working hours;
- Contact details of responsible party.
- Ensure that all equipment is maintained and fitted with the required noise abatement equipment;
- When any noise complaints are received, noise monitoring should be conducted at the complainant, followed by feedback regarding noise levels measured;
- The construction crew must abide by the local by-laws regarding noise, and if no local by-laws exist comply with "Draft model air quality management by-laws for adoption and adaptation by municipalities, GN 964 of 2009" (section 2.6);
- Where possible construction work should be undertaken during normal working hours (06H00 – 18H00), from Monday to Saturday; If agreements can be reached (in writing) with the all the surrounding (within a 1,000 distance) potentially sensitive receptors, these working hours can be extended.



Operation Phase: During the more important longer-term operational phase, the criteria as set out in the SANS10328:2008 guidelines indicate a low potential for a noise impact and that no further Scoping or other acoustical studies would be required.



Title:

Establishment of the RVM Hydro Electric Power Plant on the Orange River near the town of Kakamas, Northern Cape Province.

Client:

Aurecon South Africa (Pty) Ltd
for
RVM 1, 2 & 3 Hydro Electric Power (Pty) Ltd

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GLOSSARY OF ABBREVIATIONS

DEADP	Department of Environmental Affairs and Development Planning
DENC	Department of Environment and Nature Conservation
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Practitioner
ECA	Environment Conservation Act (Act 78 of 1989)
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
ENIA	Environmental Noise Impact Assessment
EMP	Environmental Management Plan
EMS	Environmental Management System
FEL	Front End Loader
IAPs	Interested and Affected Parties
i.e.	that is
IEM	Integrated Environmental Management
km	kilometres
LHD	Load haul dumper
m	Meters (measurement of distance)
m ²	Square meter
m ³	Cubic meter
mamsl	Meters above mean sea level
MENCO	M ² Environmental Connections cc
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NCR	Noise Control Regulations (under Section 25 of the ECA)
NGO	Non-government Organisation
PPE	Personal Protective Equipment
PPP	Public Participation Process
SABS	South African Bureau of Standards
SANS	South African National Standards
SHEQ	Safety Health Environment and Quality
WHO	World Health Organisation



GLOSSARY OF TERMS

<i>1/3-Octave Band</i>	A filter with a bandwidth of one-third of an octave representing four semitones, or notes on the musical scale. This relationship is applied to both the width of the band, and the centre frequency of the band. See also definition of octave band.
<i>A – Weighting</i>	An internationally standardised frequency weighting that approximates the frequency response of the human ear and gives an objective reading that therefore agrees with the subjective human response to that sound.
<i>Air Absorption</i>	The phenomena of attenuation of sound waves with distance propagated in air, due to dissipative interaction within the gas molecules.
<i>Alternatives</i>	A possible course of action, in place of another, that would meet the same purpose and need (of proposal). Alternatives can refer to any of the following, but are not limited hereto: alternative sites for development, alternative site layouts, alternative designs, alternative processes and materials. In Integrated Environmental Management the so-called “no go” alternative refers to the option of not allowing the development and may also require investigation in certain circumstances.
<i>Ambient Noise</i>	The all-encompassing sound at a point being composed of sounds from many sources both near and far. It includes the noise from the noise source under investigation.
<i>Ambient Sound</i>	The all-encompassing sound at a point being composite of sounds from near and far.
<i>Ambient Sound Level</i>	Means the reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such a meter was put into operation. In this report the term Background Ambient Sound Level will be used.
<i>Amplitude Modulated Sound</i>	A sound that noticeably fluctuates in loudness over time.
<i>Assessment</i>	The process of collecting, organising, analysing, interpreting and communicating data that is relevant to some decision.
<i>Audible Frequency Range</i>	Generally assumed to be the range from about 20 Hz to 20,000 Hz, the range of frequencies that our ears perceive as sound.
<i>Background Ambient Sound Level</i>	The level of the ambient sound indicated on a sound level meter in the absence of the sound under investigation (e.g. sound from a particular noise source or sound generated for test purposes). Ambient sound level as per Noise Control Regulations.
<i>C-Weighting</i>	This is an international standard filter, which can be applied to a pressure signal or to a SPL or PWL spectrum, and which is essentially a pass-band filter in the frequency range of approximately 63 to 4000 Hz. This filter provides a more constant, flatter, frequency response, providing significantly less adjustment than the A-scale filter for frequencies less than 1000 Hz.
<i>dB(A)</i>	Sound Pressure Level in decibel that has been A-weighted, or filtered, to match the response of the human ear.
<i>Decibel (db)</i>	A logarithmic scale for sound corresponding to a multiple of 10 of the threshold of hearing. Decibels for sound levels in air are referenced to an atmospheric pressure of 20 µ Pa.
<i>Diffraction</i>	Modification of the progressive wave distribution due to the presence of obstacles in the field. Reflection and refraction are special cases of diffraction.
<i>Direction of Propagation</i>	The direction of flow of energy associated with a wave.
<i>Disturbing noise</i>	Means a noise level that exceeds the zone sound level or, if no zone sound level has been designated, a noise level that exceeds the ambient sound level at the same measuring point by 7 dBA or more.
<i>Environment</i>	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group; these circumstances include biophysical, social, economic, historical, cultural and political aspects.
<i>Environmental impact</i>	A change resulting from the effect of an activity on the environment, whether desirable or undesirable. Impacts may be the direct consequence of an organisation’s activities or may be indirectly caused by them.
<i>Environmental Impact Assessment</i>	An Environmental Impact Assessment (EIA) refers to the process of identifying, predicting and assessing the potential positive and negative social, economic and biophysical impacts of any proposed project, plan, programme or policy that requires authorisation of permission by law and that may significantly affect the environment. The EIA includes an evaluation of alternatives, as well as recommendations for appropriate mitigation measures for minimising or avoiding negative impacts, measures for enhancing the positive aspects of the proposal, and environmental management and



	monitoring measures.
<i>Environmental issue</i>	A concern felt by one or more parties about some existing, potential or perceived environmental impact.
<i>Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$)</i>	The value of the average A-weighted sound pressure level measured continuously within a reference time interval T , which have the same mean-square sound pressure as a sound under consideration for which the level varies with time.
<i>Equivalent continuous A-weighted rating level ($L_{Req,T}$)</i>	The Equivalent continuous A-weighted sound exposure level ($L_{Aeq,T}$) to which various adjustments has been added. More commonly used as ($L_{Req,d}$) over a time interval 06:00 – 22:00 (T=16 hours) and ($L_{Req,n}$) over a time interval of 22:00 – 06:00 (T=8 hours).
<i>Footprint area</i>	Area to be used for the construction of the proposed development, which does not include the total study area.
<i>Frequency</i>	The rate of oscillation of a sound, measured in units of Hertz (Hz) or kiloHertz (kHz). One hundred Hz is a rate of one hundred times per second. The frequency of a sound is the property perceived as pitch: a low-frequency sound (such as a bass note) oscillates at a relatively slow rate, and a high-frequency sound (such as a treble note) oscillates at a relatively high rate.
<i>Green field</i>	A parcel of land not previously developed beyond that of agriculture or forestry use; virgin land. The opposite of Green field is Brown field, which is a site previously developed and used by an enterprise, especially for a manufacturing or processing operation. The term Brown field suggests that an investigation should be made to determine if environmental damage exists.
<i>G-Weighting</i>	An International Standard filter used to represent the infrasonic components of a sound spectrum.
<i>Harmonics</i>	Any of a series of musical tones for which the frequencies are integral multiples of the frequency of a fundamental tone.
<i>Infrasound</i>	Sound with a frequency content below the threshold of hearing, generally held to be about 20 Hz. Infrasonic sound with sufficiently large amplitude can be perceived, and is both heard and felt as vibration. Natural sources of infrasound are waves, thunder and wind.
<i>Integrated Development Plan</i>	A participatory planning process aimed at developing a strategic development plan to guide and inform all planning, budgeting, management and decision-making in a Local Authority, in terms of the requirements of Chapter 5 of the Municipal Systems Act, 2000 (Act 32 of 2000).
<i>Integrated Environmental Management</i>	IEM provides an integrated approach for environmental assessment, management, and decision-making and to promote sustainable development and the equitable use of resources. Principles underlying IEM provide for a democratic, participatory, holistic, sustainable, equitable and accountable approach.
<i>Interested and affected parties</i>	Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.
<i>Listed activities</i>	Development actions that is likely to result in significant environmental impacts as identified by the delegated authority (formerly the Minister of Environmental Affairs and Tourism) in terms of Section 21 of the Environment Conservation Act.
<i>Loudness</i>	The attribute of an auditory sensation that describes the listener's ranking of sound in terms of its audibility.
<i>Magnitude of impact</i>	Magnitude of impact means the combination of the intensity, duration and extent of an impact occurring.
<i>Masking</i>	The raising of a listener's threshold of hearing for a given sound due to the presence of another sound.
<i>Mitigation</i>	To cause to become less harsh or hostile.
<i>Negative impact</i>	A change that reduces the quality of the environment (for example, by reducing species diversity and the reproductive capacity of the ecosystem, by damaging health, or by causing nuisance).
<i>Noise</i>	a. Sound that a listener does not wish to hear (unwanted sounds). b. Sound from sources other than the one emitting the sound it is desired to receive, measure or record. c. A class of sound of an erratic, intermittent or statistically random nature.
<i>Noise Level</i>	The term used in lieu of sound level when the sound concerned is being measured or ranked for its undesirability in the contextual circumstances.
<i>Noise-sensitive development</i>	developments that could be influenced by noise such as: a) districts (see table 2 of SANS 10103:2008)



1. rural districts,
 2. suburban districts with little road traffic,
 3. urban districts,
 4. urban districts with some workshops, with business premises, and with main roads,
 5. central business districts, and
 6. industrial districts;
- b) educational, residential, office and health care buildings and their surroundings;
 c) churches and their surroundings;
 d) auditoriums and concert halls and their surroundings;
 e) recreational areas; and
 f) nature reserves.

In this report Noise-sensitive developments is also referred to as a Potential Sensitive Receptor

<i>Octave Band</i>	A filter with a bandwidth of one octave, or twelve semi-tones on the musical scale representing a doubling of frequency.
<i>Positive impact</i>	A change that improves the quality of life of affected people or the quality of the environment.
<i>Property</i>	Any piece of land indicated on a diagram or general plan approved by the Surveyor-General intended for registration as a separate unit in terms of the Deeds Registries Act and includes an erf, a site and a farm portion as well as the buildings erected thereon
<i>Public Participation Process</i>	A process of involving the public in order to identify needs, address concerns, choose options, plan and monitor in terms of a proposed project, programme or development
<i>Reverberant Sound Reverberation</i>	The sound in an enclosure excluding that is received directly from the source. The persistence, after emission of a sound has stopped, of a sound field within an enclosure.
<i>Significant Impact</i>	An impact can be deemed significant if consultation with the relevant authorities and other interested and affected parties, on the context and intensity of its effects, provides reasonable grounds for mitigating measures to be included in the environmental management report. The onus will be on the applicant to include the relevant authorities and other interested and affected parties in the consultation process. Present and potential future, cumulative and synergistic effects should all be taken into account.
<i>Sound Level</i>	The level of the frequency weighted and time weighted sound pressure as determined by a sound level meter.
<i>Sound Power Sound Pressure Level (SPL)</i>	Of a source, the total sound energy radiated per unit time. Of a sound, 20 times the logarithm to the base 10 of the ratio of the RMS sound pressure level to the reference sound pressure level. International values for the reference sound pressure level are 20 micropascals in air and 100 millipascals in water. SPL is reported as L_p in dB (not weighted) or in various other weightings.
<i>Soundscape</i>	Sound or a combination of sounds that forms or arises from an immersive environment. The study of soundscape is the subject of acoustic ecology. The idea of soundscape refers to both the natural acoustic environment, consisting of natural sounds, including animal vocalizations and, for instance, the sounds of weather and other natural elements; and environmental sounds created by humans, through musical composition, sound design, and other ordinary human activities including conversation, work, and sounds of mechanical origin resulting from use of industrial technology. The disruption of these acoustic environments results in noise pollution.
<i>Study area</i>	Refers to the entire study area encompassing all the alternative routes as indicated on the study area map.
<i>Sustainable Development</i>	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts: the concept of "needs", in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and the future needs (Brundtland Commission, 1987).
<i>Zone of Potential Influence</i>	The area defined as the radius about an object, or objects beyond which the noise impact will be insignificant.
<i>Zone Sound Level</i>	Means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is similar to the Rating Level as defined in SANS10103.



1 INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

M2 Environmental Connections was commissioned to compile a Screening Noise Report as part of a Basic Assessment process conducted for the proposed RVM Hydro Electric Power Project. The project is propose on Portion 0 (remainder) of the Farm no. 497 and Portion 1 of the Farm no. 498, near the town of Kakamas, Northern Cape Province.

1.2 BRIEF PROJECT DESCRIPTION

RVM 1,2 & 3 Hydro Electric Power (Pty) Ltd has identified a site 40 km from the town of Kakamas (refer **Figure 1-1**) to construct a 1 x 10 and 1 x 9.9 Megawatt (MW) hydropower stations on the Orange River. Four various optional localities have been identified by the developer and all four areas are illustrated in **Figure 1-1**.

It is assumed that the power plant will operate during all hours of the day and night.

Proposed infrastructure will include:

- A low weir in the Orange River;
- An off-take structure at the weir in the river to facilitate the abstraction of water;
- Water conveyance infrastructure comprising a combination of either a canal, a pipeline and/or culverts to convey the water to each station's penstock;
- Each of the two stations compromising of;
 5. steel penstock to transfer the water from the shared water conveyance infrastructure;
 6. the power chamber;
 7. a high voltage distribution line to transfer power from each station to a nearby substation; and
 8. Access roads (following existing alignments where possible).



1.3 PROJECT LOCATION

The study area comprises of the Portion 0 (remainder) of the Farm no. 497 and Portion 1 of the Farm no. 498 as well as potential Noise-sensitive developments (also know as receptors or NSD) within 2,000 meters from the power chambers.

1.4 TERMS OF REFERENCE

SANS 10328:2008 (Edition 3) specifies the methodology to assess the noise impacts on the environment due to a proposed activity that might impact on the environment. The standard also stipulates the minimum requirements to be investigated for screening purposes. These minimum requirements are:

- a) Identification and description of the noise sources and noise-sensitive developments associated with the development that has to be investigated;
- b) Identification and description of the noise sources and noise-sensitive developments in the target area that could affect the development (or that could be affected by the development) that has to be investigated;
- c) Identification, with the assistance of all interested or affected parties, and description of all the noise sources and noise-sensitive developments associated with the development, or located within the target area, that are to be excluded from the investigation. The reason(s) for the exclusion shall be stated; and
- d) A reference to this standard regarding the method of investigation.

The purpose of the investigation is to determine, by administrative means, whether the proposed development could have any significant acoustical implications. It is based on an overview of all the information available as well as the review of a questionnaire. If the outcome of all the questions are negative, the planned development or activity is not likely to present a noise disturbance. In this case, a scoping investigation and an environmental noise impact investigation could be dispensed and this Screening report may be submitted to the relevant authorities as part of the Environmental Authorization process.

If one or more of the answers to the questions for this study is affirmative, the acoustical impact could probably be significant and a scoping investigation and, if necessary, an environmental noise impact investigation shall be considered.



1.5 STUDY AREA

The topography is low mountains and hills with the surface comprising of rocky areas and vegetation typical of the Nama Karoo biome. Various wine estates seemed to make use of land closer to Kakamas, however these areas fall outside the study area.

The immediate area around the proposed facility would most probably be considered as rural in terms of the day/night ambient soundscape. A site regional map is presented in **Figure 1-1**.

1.6 AVAILABLE INFORMATION

No information could be sourced regarding the surrounding existing soundscape of the area.

1.7 NOISE-SENSITIVE DEVELOPMENTS

An assessment of the area was done using available topographical maps Google Earth® and Planet GIS Professional to identify Noise-sensitive developments (NSD) in the area.

Several potential NSDs were identified via available maps and illustrated in **Figure 1-2** as **green** dots. **Figure 1-2** also illustrates the receptors in relation to the proposed layout of the facility, specifically the noise source of significance identified as the powerhouse units (**red** dots). Light **blue** lines in this figure illustrate the water conveyance infrastructure of either canals or pipelines. None of the identified NSDs stays within 2,000 meters from the proposed developments.

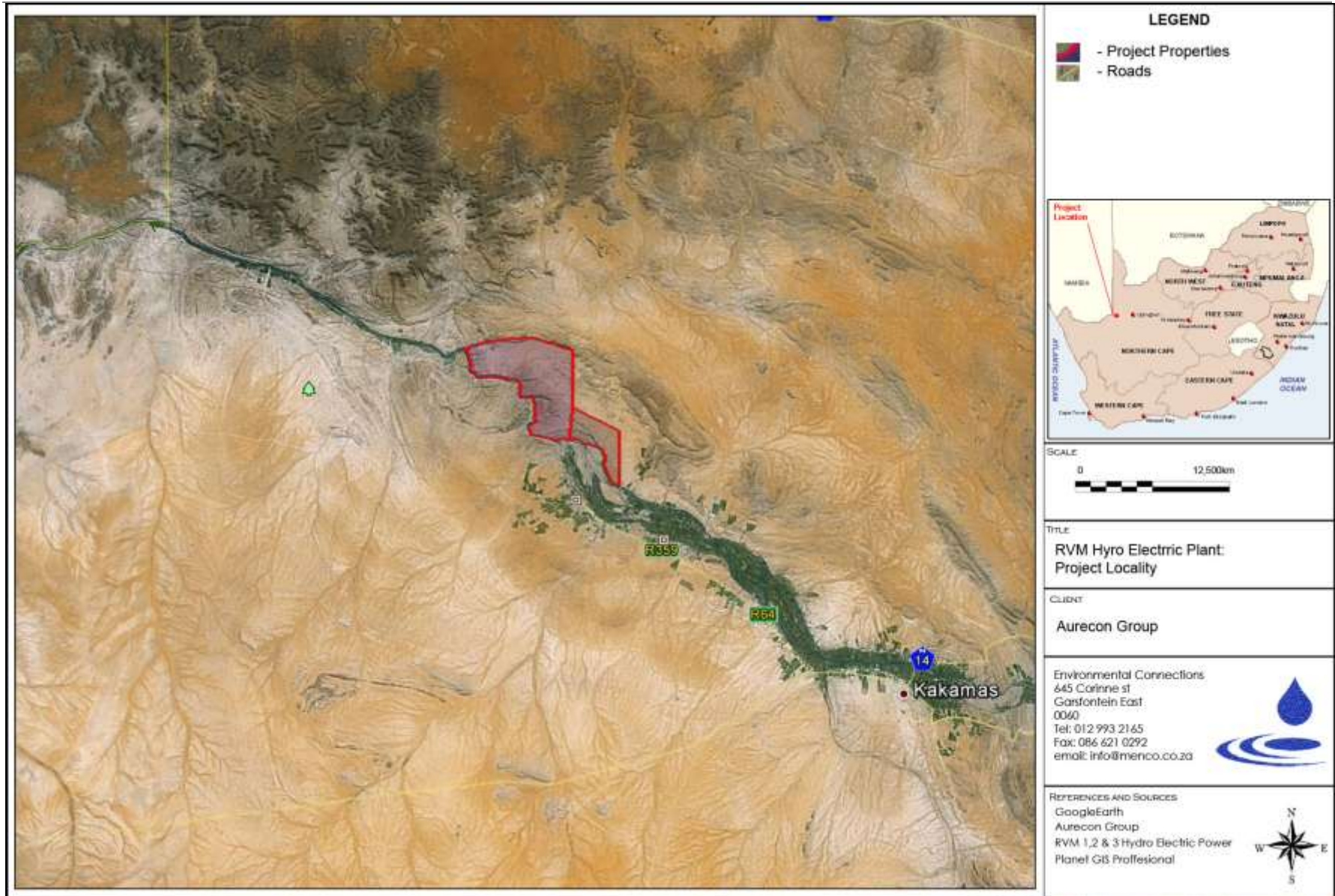


Figure 1-1: Regional locality map indicating location of the proposed development

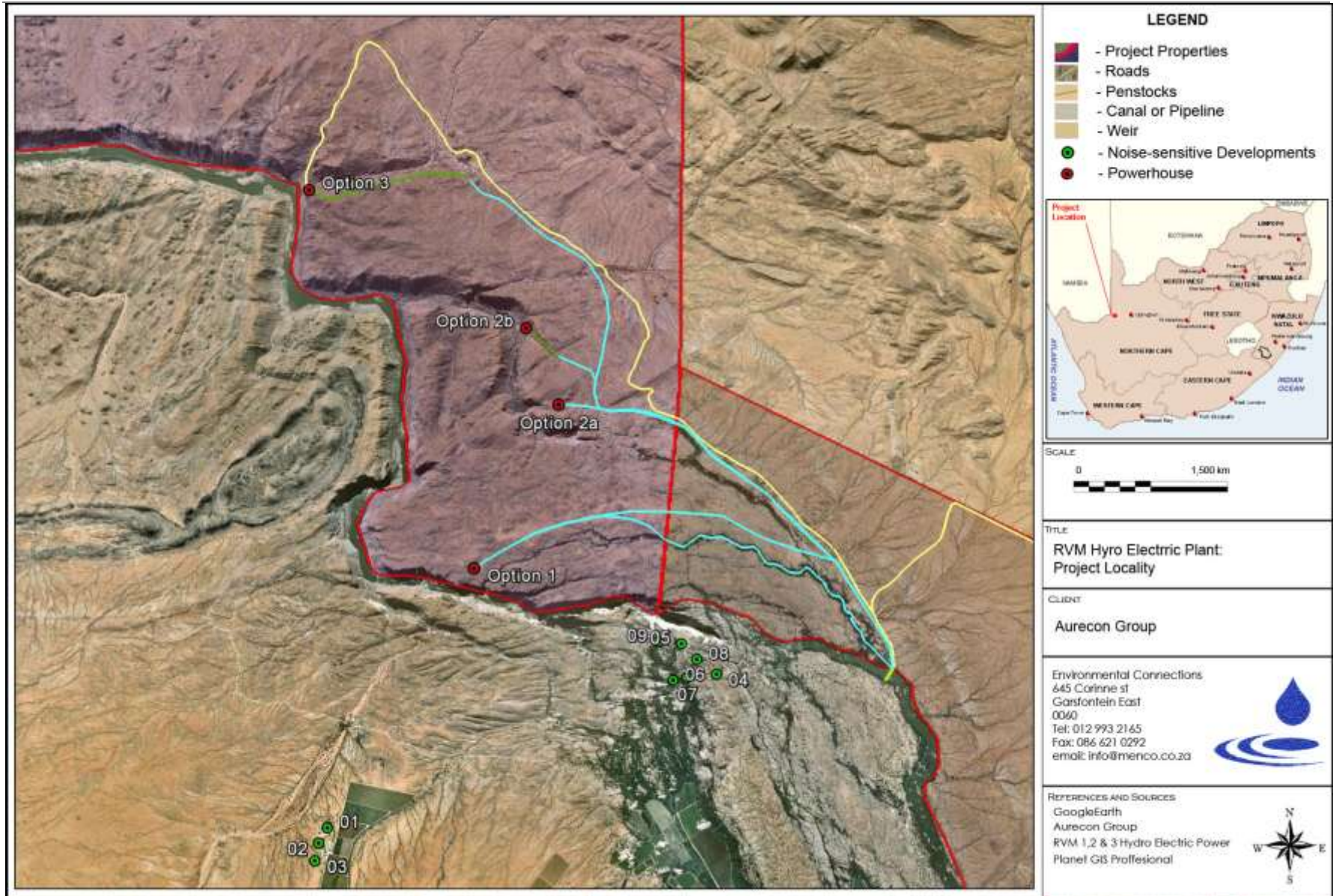


Figure 1-2: Locations of proposed development infrastructure in relation to receptors



2 POLICIES AND THE LEGAL CONTEXT

2.1 THE REPUBLIC OF SOUTH AFRICA CONSTITUTION ACT (“THE CONSTITUTION”)

The environmental right contained in section 24 of the Constitution provides that everyone is entitled to an environment that is not harmful to his or her well-being. In the context of noise, this requires a determination of what level of noise is harmful to well-being. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic, however, which has led to the development of noise standards (see Section 2.7).

“Noise pollution” is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function.

2.2 THE ENVIRONMENT CONSERVATION ACT

The Environment Conservation Act (“ECA”) allows the Minister of Environmental Affairs and Tourism (“now the Minister of Water and Environmental Affairs”) to make regulations regarding noise, among other concerns. The Minister has made noise control regulations under the ECA (see also section 2.5).

2.3 THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT

The National Environmental Management Act (“NEMA”) defines “pollution” to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating the proposed development to prevent noise pollution occurring. NEMA sets out measures which may be regarded as reasonable. They include measures:

1. to investigate, assess and evaluate the impact on the environment;
2. to inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment;
3. to cease, modify or control any act, activity or process causing the pollution or degradation;
4. to contain or prevent the movement of;
5. to eliminate any source of the pollution or degradation; or
6. to remedy the effects of the pollution or degradation.



2.4 NATIONAL ENVIRONMENTAL MANAGEMENT: AIR QUALITY ACT ("AQA")

Section 34 of the National Environmental Management: Air Quality Act (Act 39 of 2004) makes provision for:

- (1) the Minister to prescribe essential national noise standards -
 - (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or
 - (b) for determining -
 - (i) a definition of noise; and
 - (ii) the maximum levels of noise.
- (2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force but no such standards have yet been promulgated.

An atmospheric emission license issued in terms of section 22 may contain conditions in respect of noise.

2.5 NOISE CONTROL REGULATIONS

In terms of section 25 of the ECA, the national noise-control regulations (GN R154 in *Government Gazette* No. 13717 dated 10 January 1992) were promulgated. The NCRs were revised under Government Notice Number R. 55 of 14 January 1994 to make it obligatory for all authorities to apply the regulations.

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the NCR was devolved to provincial and local authorities. No current noise control regulations exist for the Northern Cape.

2.6 DRAFT MODEL AIR QUALITY MANAGEMENT BY-LAW FOR ADOPTION AND ADAPTATION BY MUNICIPALITIES

Draft model air quality management by-laws for adoption and adaptation by municipalities was published by the Department of Environmental Affairs in the *Government Gazette* of 15 July 2009 as General Notice (for comments) 964 of 2009. Section 18 specifically focuses on Noise Pollution Management, with sub-section 1 stating:



"No person shall 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 draft regulations differs from the current provincial Noise Control Regulations as it defines a disturbing noise as a noise that is measurable or calculable of which the rating level exceeds the equivalent continuous rating level as defined in SANS 10103.

2.7 NOISE STANDARDS

Four South African Bureau of Standards (SABS) scientific standards are considered relevant to noises from the proposed development. They are:

- SANS 10103:2008. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
- SANS 10210:2004. 'Calculating and predicting road traffic noise'.
- SANS 10328:2008. 'Methods for environmental noise impact assessments'.
- SANS 10357:2004. 'The calculation of sound propagation by the Concave method'.

The relevant standards use the equivalent continuous rating level as a basis for determining what is acceptable. The levels may take single event noise into account but single event noise by itself does not determine whether noise levels are acceptable for land use purposes. The recommendations that the standards make are likely to inform decisions by authorities but non-compliance with the standards will not necessarily render an activity unlawful *per se*.

2.8 INTERNATIONAL GUIDELINES

While there exist a number of international guidelines and standards that could encompass a document in itself, the one mentioned below was selected as it is used by different countries in the subject of environmental noise management.

2.8.1 Guidelines for Community Noise (WHO, 1999)

The World Health Organization's (WHO) document on the *Guidelines for Community Noise* is the outcome of the WHO- expert task force meeting held in London, United Kingdom, in April 1999. It is based on the document entitled "Community Noise" that was prepared for the World Health Organization and published in 1995 by the Stockholm University and Karolinska Institute.



The scope of WHO's effort to derive guidelines for community noise is to consolidate actual scientific knowledge on the health impacts of community noise and to provide guidance to environmental health authorities and professionals trying to protect people from the harmful effects of noise in non-industrial environments.

Guidance on the health effects of noise exposure of the population has already been given in an early publication of the series of Environmental Health Criteria. The health risk to humans from exposure to environmental noise was evaluated and guidelines values derived. The issue of noise control and health protection was briefly addressed.

The document uses the L_{Aeq} and $L_{A,max}$ noise descriptors to define noise levels. This document was important in the development of the SANS 10103 standard.

2.8.2 Night Noise Guidelines for Europe (WHO, 2009)

Refining previous Community Noise Guidelines issued in 1999, and incorporating more recent research, the World Health Organization has released a comprehensive report on the health effects of night time noise, along with new (non-mandatory) guidelines for use in Europe. Rather than a maximum of 30dB inside at night (which equals 45-50dB max inside), the WHO now recommends a maximum year-round outside night-time noise average of 40db to avoid sleep disturbance and its related health effects. The report notes that only below 30dB (outside annual average) are "*no significant biological effects observed,*" and that between 30 and 40dB, several effects are observed, with the chronically ill and children being more susceptible; however, "*even in the worst cases the effects seem modest.*" Elsewhere, the report states more definitively, "*There is no sufficient evidence that the biological effects observed at the level below 40 dB (night, outside) are harmful to health.*" At levels over 40dB, "*Adverse health effects are observed*" and "*many people have to adapt their lives to cope with the noise at night. Vulnerable groups are more severely affected.*"

The 184-page report offers a comprehensive overview of research into the various effects of noise on sleep quality and health (including the health effects of non-waking sleep arousal), and is recommended reading for anyone working with noise issues. The use of an outdoor noise standard is in part designed to acknowledge that people do like to leave windows open when sleeping, though the year-long average may be difficult to obtain (it would require longer-term sound monitoring than is usually budgeted for by either industry or neighbourhood groups).



While recommending the use of the average level, the report notes that some instantaneous effects occur in relation to specific maximum noise levels, but that the health effects of these “cannot be easily established.”

2.8.3 Equator Principles

The **Equator Principles** (EPs) are a voluntary set of standards for determining, assessing and managing social and environmental risk in project financing. Equator Principles Financial Institutions (EPFIs) commit to not providing loans to projects where the borrower will not or is unable to comply with their respective social and environmental policies and procedures that implement the EPs.

The Equator Principles were developed by private sector banks and were launched in June 2003. The banks chose to model the Equator Principles on the environmental standards of the World Bank and the social policies of the International Finance Corporation (IFC). 67 financial institutions (October 2009) have adopted the Equator Principles, which have become the de facto standard for banks and investors on how to assess major development projects around the world. The environmental standards of the World Bank have been integrated into the social policies of the IFC since April 2007 as the International Finance Corporation Environmental, Health and Safety (EHS) Guidelines.

2.8.4 IFC: General EHS Guidelines – Environmental Noise Management

These guidelines are applicable to noise created beyond the property boundaries of a development that conforms to the Equator Principle.

It states that noise prevention and mitigation measures should be applied where predicted or measured noise impacts from a project facility or operations exceed the applicable noise level guideline at the most sensitive point of reception. The preferred method for controlling noise from stationary sources is to implement noise control measures at source.

It goes as far as to proposed methods for the prevention and control of noise emissions, including:

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;



- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m² in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas ;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see **Table 2-1**) as well as highlighting the certain monitoring requirements pre- and post-development.

Table 2-1: IFC Table .7.1-Noise Level Guidelines

Receptor type	One hour L _{Aeq} (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 - 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

The document uses the L_{Aeq,1 hr} noise descriptors to define noise levels. It does not determine the detection period, but refers to the IEC standards, which requires the fast detector setting on the Sound Level Meter during measurements for Europe.



3 POTENTIAL NOISE SOURCES

Increased noise levels are directly linked with the various activities associated with the construction and operational phase of the activity. The specific activities relating to construction and operation of the facility will only be discussed in a generalised manner in the following sections.

It must be noted that commonly the most significant stage relating to noise is the operational phase, and not the construction phase. This is because the duration of activities during the construction phase are generally short.

3.1 POTENTIAL NOISE SOURCES: CONSTRUCTION PHASE

This document cannot accurately define construction activities that may take place for the proposed hydro power plant. Therefore conceptual construction activities could include the following:

- Construction or upgrading of access roads (following existing alignments where possible);
- Establishment of concrete foundations, strip footings, concrete pillars as well as other concrete related infrastructure;
- Installation of power chambers and associated mechanical or electrical infrastructure;
- Construction of the overland transmission lines (both 33 and 132 kV); and
- The construction of buildings and or housing units.

The equipment required to complete the above tasks may make use of the following equipment:

- Various temporarily, but fixed locations including workshops, crane lifts and material delivery areas;
- Various mobile equipment such as TLBs excavators, grader's, vibrator rollers, haul and water trucks; and
- Smaller on-site operated equipment such as concrete mixers, generators, grinders, drills and jack hammers;

In addition, instead of transporting the required material to the site using concrete trucks, portable concrete batching plants may be required to supply concrete onsite. Batching plant equipment may be relocated between the sites as the works progress to different areas of the site. The need for such batching plants, the number, and whether



they will be moved is yet unknown, however it is highly unlikely that a batching plant will be used for such a small construction operation.

Blasting may also be required as part of the civil works to clear obstacles or to prepare foundations. However, blasting will not be considered further for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use minimum explosives and will occur in a controlled manner. With regards to blasting in borrow pits, explosives are used with a low detonation speed, reducing vibration, sound pressure levels and air blasts. The breaking of obstacles with explosives is also a specialized field, and when correct techniques are used, it causes less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast.
- Blasts are an infrequent occurrence, with a loud but a relative instantaneous character. Potentially affected parties normally receive sufficient notice (siren), and the knowledge that the duration of the siren noise as well as the blast will be over relative fast, resulting in a higher acceptance of the noise.

The last significant source of noise during the construction phase is additional traffic to and from the site, as well as traffic on the site. Construction traffic is expected to be generated throughout the entire construction period.

Generally day-time noise levels associated with construction activities is limited to an area within 500 meters from the activity. The nature of the noise is generally more impulsive and in a sensitive natural environment animals will try to relocate further from the noise source.

Due to the temporary nature of construction related noises, as well as the fact that this will be taking place during the day when other sounds generally masks external noises, construction noises associated with this development should have a noise impact of low significance. It can increase annoyance levels and some preliminary noise-mitigation measures are proposed (see Recommendations – **section 5**).

3.2 POTENTIAL NOISE SOURCES: OPERATIONAL PHASE

The largest magnitude of noise as emitted by a hydro station is assumed to be the operations of the power chambers and steel penstock areas. The following



infrastructure/areas have been identified as possible noise sources of significance due to the proposed development:

- Water conveyance infrastructure – It has been indicated that the flow of water to the hydro power plant will make use of a canals or pipelines. The natural flow of water (gravity) will be used to deliver water to the power chambers, therefore no (potentially) noisy mechanical or electrical facility is assumed to be used as a driving force for water flow.
- Steel penstock – The quantity of water to the power chambers is controlled by means of a sluice (penstock).
- Power chamber – Location of the turbine chamber, converting water flow (energy) into electrical energy by various and sometimes complex means;
- Corona discharge from the high voltage distribution line - The distribution line to the identified substation is overhead and closely passes a number of potential noise-sensitive developments. While an electrical service provider (such as Eskom) goes to great lengths to design power transmission equipment to minimise the formation of corona discharges, it is bound to occur during certain atmospheric conditions. This however is an infrequent occurrence, and generally inaudible within approximately 50 meters. The noise impact from this noise source is considered to be of low significance; and
- Noises from vehicle traffic on access roads.

It is important to note that hydro-power generation equipment is always situated inside a building generally constructed from concrete/brick and mortar. These construction materials have a significant influence on the attenuation of noises from the equipment to the outside, with attenuation ranging between 20 and 30 dB likely. This will significantly reduce the extent of the potential noise impact. The nature of the noise is generally broadband, but if tones are present it may increase the risk of annoyance levels. Considering the worse-case scenario, due to the fact that the equipment will be situated inside a building the potential of a noise impact will be limited to the immediate surroundings.





4 METHODOLOGY: SCREENING QUESTIONNAIRE

As the exact noise emission of the propose facility is unknown, the potential noise impact would be evaluated as defined by SANS 10328:2008. This evaluation would be relevant for both the construction and operational phases.

Table 4.1: Questions for Noise Screening (SANS 10328:2008)

Question	Answer	Comment
Does the planned linear source (arterial road, planned arterial road reserve, or a main line railway line) at any position along the route pass within 1 000 m from an area which is developed or zoned for residential purposes?	No	<i>Access roads will make use of existing road alignments. Increases in traffic considered insignificant.</i>
Does the planned linear source (suburban road, planned suburban road reserve where only two lanes of traffic will be present at an average speed limit not exceeding 60 km/h, or a suburban electric traction railway line) at any position along the route pass within 500 m from an area which is developed or zoned for residential purposes?	No	<i>Not relevant</i>
Does the planned development of a residential area or a piece of land zoned for residential purposes fall within 1 000 m from a planned linear source (arterial road, planned arterial road reserve, or a main line railway line)?	No	<i>Not relevant</i>
Does the planned development of a residential area or a piece of land zoned for residential purposes fall within 500 m from a planned linear source (suburban road, planned suburban road reserve where only two lanes of traffic will be present at an average speed limit not exceeding 60 km/h, or a suburban electric traction railway line)?	No	<i>Not relevant</i>
Does a planned industrial development or a building housing plant fall within a distance of 1 000 m from an already developed residential area or land zoned for residential purposes?	No	<i>Closest power chamber unit and penstock are further than 2, 000 m from any receptor.</i>
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 1 000 m from an already developed industrial area or a building housing plant?	No	<i>Not relevant</i>
Does planned light industrial development or a building(s) housing workshops fall within a distance of 500 m from an already developed residential area or land zoned for residential purposes?	No	<i>Closest power chamber unit and penstock are further than 2, 000 m from a receptor.</i>
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 500 m from an already developed light industrial development or a building(s) housing workshops?	No	<i>Not relevant</i>
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 2 000 m from an existing wind generator farm?	No	<i>Not relevant</i>
Does a piece of land to be developed as a wind generator farm fall within 2 000 m from a piece of land to be developed for residential purposes or land to be zoned for residential purposes?	No	<i>Not relevant</i>
Does a piece of land to be developed for residential purposes or land to be zoned for residential purposes fall within 2 000 m from a low frequency source (e.g. low speed ventilation fans or low speed diesel engines)?	No	<i>Not relevant</i>



Does an activity containing a low frequency source (e.g. low speed ventilation fans or low speed diesel engines) to be developed fall within 2 000 m from a piece of land to be developed for residential purposes or land use to be zoned for residential purposes?	No	Closest power chamber unit is further than 2, 000 m from a receptor
Will the planned repaving of a suburban street be provided with normal, non-sound absorptive bitumen or cement concrete paving?	No	Not relevant
Where an aircraft landing strip, heliport, hoverport or airport is planned, or is to be altered, will this planned activity be such that the calculated appropriate limit noise contour for the full planned use of the activity fall inside the boundaries of any residential area or any piece of land zoned for residential purposes?	No	Not relevant
Where a residential area is planned or a piece of land is to be zoned for residential purposes, will the evaluated appropriate limit noise contour for the full planned use of an aircraft landing strip, heliport, hoverport or airport fall inside the boundaries of the residential area or the piece of land zoned for residential purposes?	No	Not relevant



5 CONCLUSIONS AND RECOMMENDATIONS

This report is a Screening Noise Assessment for the proposed RVM Hydro Electric Power Project on the Portion 0 (remainder) of the Farm no. 497 and Portion 1 of the Farm no. 498 near the town of Kakamas, Northern Cape Province. The conclusion from the desktop investigations indicated the following:

Construction Phase: The information available is adequate to conclude that there will be a low potential for a noise impact during the construction phase due to the large distance between receptors and construction areas (project footprint and construction road traffic noise). There is a low potential of a noise impact during the construction of the over-head power lines, especially when this work takes place within 500 meters from potential noise-sensitive developments. It is the opinion of the author that the potential of a noise impact would be of a low significance, but, should any potential and relevant stakeholder have a concern regarding noise during the public participation process, a Scoping level Noise Assessment are recommended.

To minimize this noise risk the following mitigation are proposed:

- Make use of the smallest available equipment for the task;
- Notify potentially sensitive receptors about work to take place at least 2 days before the activity in the vicinity (within 500 meters) of the NSD is to start. Following information to be presented in writing:
 - Description of Activity to take place;
 - Estimated duration of activity;
 - Working hours;
 - Contact details of responsible party.
- Ensure that all equipment is maintained and fitted with the required noise abatement equipment;
- When any noise complaints are received, noise monitoring should be conducted at the complainant, followed by feedback regarding noise levels measured;
- The construction crew must abide by the local by-laws regarding noise, and if no local by-laws exist comply with "Draft model air quality management by-laws for adoption and adaptation by municipalities, GN 964 of 2009" (section 2.6);
- Where possible construction work should be undertaken during normal working hours (06H00 – 18H00), from Monday to Saturday; If agreements can be reached (in writing) with the all the surrounding (within a 1,000 distance) potentially sensitive receptors, these working hours can be extended.



Operation Phase: During the more important longer-term operational phase, the criteria as set out in the SANS10328:2008 guidelines indicate a low potential for a noise impact and that no further Scoping or other acoustical studies (with regards to operational noises) would be required (refer to **Table 4.1**).



6 THE AUTHOR

The author of this report, M. de Jager (B. Ing (Chem), UP) graduated in 1998 from the University of Pretoria. He has been interested in acoustics as from school days, doing projects mainly related to loudspeaker enclosure design. Interest in the matter brought him into the field of Environmental Noise Measurement, Prediction and Control. As from 2007 he has been involved with the following projects:

- Full Noise Impact Studies for a number of Wind Energy Facilities, including: Cookhouse I and II, Amakhala Emoyeni, Dassiesfontein/Klipheuwel, Rhebokfontein, AB, Dorper, Suurplaat, Gouda, Riverbank, Oyster Bay, Walker Bay, De Aar, Loeriesfontein, Noupoot, Prieska, Deep River, West Coast, Happy Valley, Canyon Springs, Tsitsikamma WEF, West Coast One, Karoo and Project Blue.
- Full Noise Impact Studies for a number of mining projects, including: Skychrome (Pty) Ltd (A Ferro-chrome mine), Mooinooi Chrome Mine (WCM), Buffelsfontein East and West (WCM), Elandsdrift (Sylvania), Jagdlust Chrome Mine (ECM), Der Brochen, Apollo Brick (Pty) Ltd (Clay mine and brick manufacturer), Arthur Taylor Expansion project (X-Strata Coal SA), Klipfontein Colliery (Coal mine), Imbabala Coal, AurexGold, Sephaku Limestone Mine, Sekoko Railway Siding, Verkeerdepan Expansion, Schoongezicht Coal, WPB Colliery, Landau Expansion project (Coal mine).
- A number of smaller Noise Impact Assessments, Noise Monitoring Projects, Scoping Reports as well as Screening Investigations.

The author is independent consultants to the project and the Client. They:

- Does not and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations;
- have no, and will not engage in conflicting interests in the undertaking of the activity;
- have no, and will not engage in conflicting interests in the undertaking of the activity;
- undertake to disclose all material information collected, calculated and/or findings, whether favourable to the developer or not;
- will ensure that all information containing all relevant facts be included in this report.



7 REFERENCES

In this report reference was made to the following documentation:

1. SANS 10103:2004. 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'.
2. SANS 10328:2003. 'Methods for environmental noise impact assessments'.