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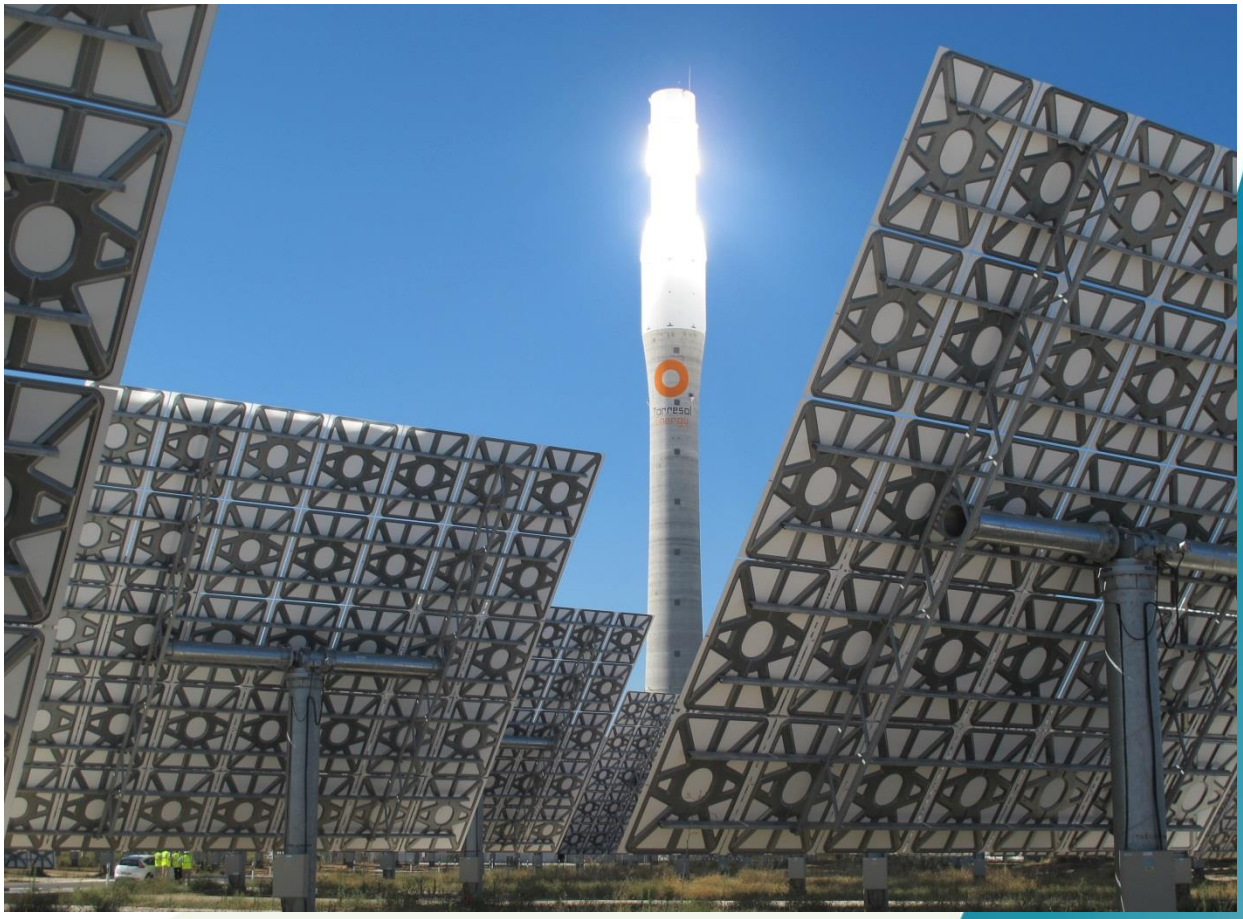

Sand Draai Concentrated Solar Power Park, Environmental Noise Scoping Assessment

Kheis Local Municipality, Northern Cape

Royal HaskoningDHV
Enhancing Society Together

Document title: Sand Draai Concentrated Solar Park, Environmental Noise Scoping Report

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Project name: SolAfrica Sand Draai CSP ENIA
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Client: SolAfrica Photovoltaic Energy (Pty) Ltd
Client contact: Nasi Rwigema

Reference: N/A

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Date/initials check: 10 October 2014
Approved by:
Date/initials approval:

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Executive Summary

SolAfrica is planning the construction of 125MW photovoltaic cells, 150MW from parabolic trough and 150MW from the Central Receiver tower, in the Northern Cape, outside the small town of Groblershoop. An environmental impact assessment (EIA) is underway and as a part og the process Royal HaskoningDHV conducted the environmental noise scoping assessment.

GENERAL DESCRIPTION OF STUDY AREA

The proposed CSP plant is located on the farm called Sand Draai. The plant will be constructed in the northern section of the farm. The gradient of the proposed CSP plant is flat, however some complex terrain ("Skurweberg" hills) is encountered in the study area, ~3km east from the most eastern corner of the farm. The region's key landmark is the Orange River, that feeds the region with continuous water. The area's climate is semi arid with long hours of sunshine during the summer. The region experiences low rainfall, compared to the national average and together with this the humidity is low throughout the year.

The region is classified as rural, with small agricultural holdings close to the river (irrigation farming) and vast open areas, used for small animal grazing). The regions population density is very low with higher population density closer to the main towns and orange river. There are limited roads in the region and a railway line passess through the study area (Saldana to Sishen railway passing within ~1km of the Sand Draai Farm).

The noise climate found in the region is very low and the localised to the existing noise source of the region.

- National Road N10, N8/R64, Gariep & Opwag gravel roads and Loop16 Access road along the railway line;
- Saldana – Sishen Railway line; and
- Bokpoort PV Plant (currently under construction).

POTENTIAL ENVIRONMENTAL IMPACTS

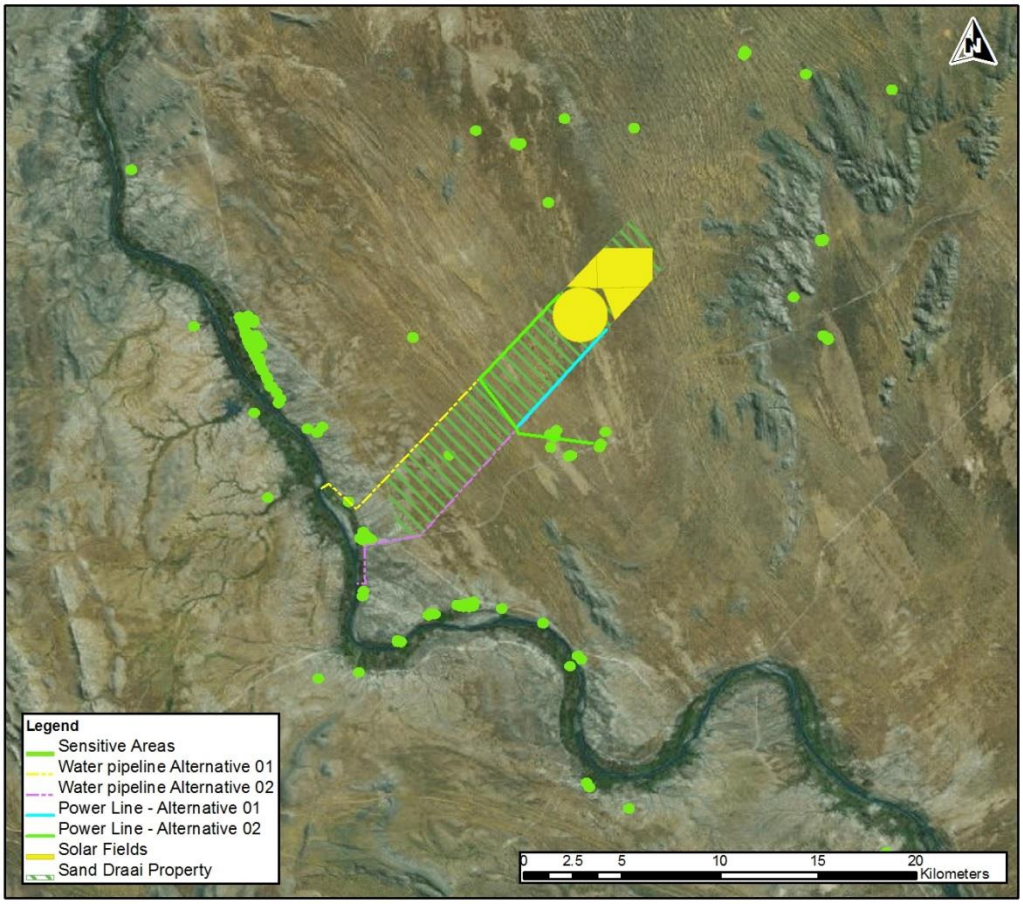
NOISE SOURCES

The existing noise sources and the potential expected future noise source that might have an impact on the surrounding environment are presented below:

- Railway line – Saldana/Sishen line – Expected 4 trains per day;
- Existing road traffic (mainly from the National Road N10, National Road N8 (Road R64), and Loop16) – it is expected that the CSP will increase the traffic volumes on the roads of the region.
- Noise from general farming operations (localised to the farmsteads – together with fan noise); and
- Proposed CSP Plant noises (boiler, cleaning schedule, etc.).

NOISE SENSITIVE AREA

The noise sensitive sites/areas in the study area that are potentially affected by the development of the CSP plant on this site is indicated in the figure below. The majority is farm steads and recreational areas of the region. It should be noted that within 1.5km of the proposed solar park area, there are no human inhabitants or any sensitive areas.



EXISTING NOISE CLIMATE

The determination of the existing noise climate is based on the measurements and observations made in the area, and where relevant also from the calculation of the noise from the traffic on the main roads.

The proposed area on the farm Sand Draai is remote from main roads and other farms steeds along the banks of the Orange River. The proposed area is very quiet and is typical a rural/agricultural noise environment. The noise climates in areas close to National Road N10 and National Road N8/Road R64 are degraded due to traffic. There is a noise nuisance factor in areas close to the Saldanha-Sishen railway line when trains pass.

PREDICTED NOISE CLIMATE

1. CSP Plant Generated Noise

With the construction of the CSP Plant the noise climates close to these facilities will alter in intensity, occurrence and frequency. The construction noise generated is temporary in nature and can be mitigated or stopped. During the operation of the CSP plant the main noise sources will be from the cooling fans, the salt pumps and the steam generating unit. The noise from the cooling fans is expected to be the loudest.

Assuming the plant will only be operational during the day, noise sensitive sites (in a rural setting) further than 2500 metres away from the Plant will not be impacted by the noise from the CSP plant. It is however expected that the start of a start-up boiler will occur during the morning (before sunrise) and might have an impact on noise sensitive sites within 4000 metres of the CSP plant.

2. CSP Plant Generated traffic

The total volume of traffic generated by the CSP Plant will be very small in comparison to the total volume of traffic on the adjacent main roads. It is expected that the increase in traffic will not increase the noise levels generated the the roads of the region.

PLAN OF STUDY – (WAY FORWARD)

The Noise Impact Investigation will be conducted in accordance with procedures contained in the South African National Standard (SANS) 10328 “Methods for environmental noise impact assessments”.

The full impact assessment must take into account the data provided in this report. The following input data can be used in the modelling of the different scenarios.

- Scenario 01: Baseline
- Scenario 02: Construction Phase – Earth Clearing
- Scenario 03: Construction phase – Assembly Area
- Scenario 04: Operational Phase – CSP plant
- Scenario 05: Operational Phase – Project associated activities
- Scenario 06: Pumping Station

Additional scenarios must be presented to test and evaluate the efficiency of proposed mitigation measures.

The meteorological data to use in the CadnaA software is, for annual assessments, an average temperature of 20°C and 50% humidity. As the facility is not operational during the night period, the focus of the assessment should lay with daytime investigations. However, the proposed operational start and end times of activities must be stated. If an activity could pose a noise impact during the night, then it should be investigated. The wind profile data in Table 11 can also be used to determine the impact under the typical wind conditions of the area.

As with any modelling programs, it is advised to incorporate the terrain profile of the study area in the modelling software.

All calculated model results must be compared to the project specific guidelines as provide in section 3.3. The cumulative impact should also be calculated (taking into account the baseline noise level + new additional noise from this project).

Declaration of Interest

I, Lodewyk Jansen declare that –

General Declaration:

- I act as the independent specialist in this application;
- I will preform work relating to the application in a manner, even if it 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 experience in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and 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 71 and is punishable in terms of Section 24F of the National Environmental Management Act.

Signature of specialist

Royal HaskoningDHV (Pty) Ltd

Name of company (if applicable)

2 October 2014

Date

Glossary of terms

NOISE:	Unwanted sound that is annoying or interferes with listening. Not all noise needs to be excessively loud to represent an annoyance or interference.
SOUND:	Sound is an oscillation in pressure, stress particle displacement, particle velocity in a medium – in room temperature. (In air speed of sound is 1125'/second or one mile in 5 seconds.) Sound produces an auditory sensation caused by the oscillation.
ACOUSTICS:	The science of Sound. Its production, transmission and effects.
ABSORPTION:	The properties of a material composition to convert sound energy into heat thereby reducing the amount of energy that can be reflected.
ATTENUATION:	The reduction of sound energy as a function of distance travelled. (See also Inverse Square Law).
BACKGROUND NOISE:	The sum total of all noise generated from all direct and reflected sound sources in a space that can represent an interface to good listening and speech intelligibility. (Hearing impaired persons are especially victimized by background noise).
BARRIER:	Anything physical or an environment that interferes with communication or listening. A poor acoustical environment can be a barrier to good listening and especially so for persons with a hearing impairment.
BEL:	A measurement of sound intensity named in honour of Alexander Graham Bell. First used to relate intensity to a level corresponding to hearing sensation.
FREE FIELD:	Sound waves from a source outdoors where there are no obstructions.
FREQUENCY:	The number of oscillations or cycles per unit of time. Acoustical frequency is usually expressed in units of Hertz (Hz) where one Hz is equal to one cycle per second.
FREQUENCY ANALYSIS:	An analysis of sound to determine the character of the sound by determining the amount of sounds at various frequencies that make up the overall sound spectrum. i.e.: Higher Frequency Sound or Pitch vs. Low Frequency.
IMPACT SOUND:	The sound produced by the collision of two solid objects. Typical sources are footsteps, dropped objects, etc., on an interior surface (wall, floor, or ceiling) of a building.
INVERSE SQUARE LAW:	Sound levels fall off with distance travelled. Sound level drops off 6 dB from source point for every doubling of distance
NOISE REDUCTION COEFFICIENT (NRC):	The NRC of an acoustical material is the arithmetic average to the nearest multiple of 0.05 of its absorption coefficients at 4 one third octave bands with centre frequencies of 250, 500, 1000, 2000 Hertz.
NUISANCE:	A legal definition of a noise that offends or upsets the receiver because it is occurring at the wrong time in the wrong place or is of a character that annoys due to excessive tonal components or impulses.
OCTAVE BANDS:	Sounds that contain energy over a wide range of frequencies are divided into sections called bands. A common standard division is in 10 octave bands identified by their centre frequencies 31.5, 63, 125, 250, 500, 1000, 2000, 4000 Hz.
RESONANCE:	The emphasis of sound at a particular frequency.
RESONANT FREQUENCY:	A frequency at which resonance exists.
SEPTUM:	A thin layer of material between 2 layers of absorptive material. i.e.: foil, lead, steel, etc. that prevents sound wave from piercing through absorptive material.
SOUND ABSORPTION:	The property possessed by materials, objects and air to convert sound energy into heat. Sound waves reflected by a surface causes a loss of energy. That energy not reflected is called its absorption coefficient.
SOUND ABSORPTION COEFFICIENT:	The fraction of energy striking a material or object that is not reflected. For instance if a material reflects 70% of the sound energy incident upon its surface, then its Sound Absorption Coefficient would be 0.30.
SOUND BARRIER:	A material that when placed around a source of noise inhibits the transmission of that noise beyond the barrier. Also, anything physical or an environment that interferes with communication or listening. For example, a poor acoustical environment can be a barrier to good listening and especially so for persons with a hearing impairment.

SOUND LEVEL METER:	A device that converts sound pressure variations in air into corresponding electronic signals. The signals are filtered to exclude signals outside frequencies desired.
SPL: SOUND PRESSURE LEVEL:	Quantity used to describe the loudness of a sound. The sound pressure level is expressed in decibels and is measured with a sound level meter. For example, a conversation between two people inside an average-size room will produce an average “A” weighted sound pressure level of 50 to 55 lb.
TIME WEIGHTED AVERAGE (TWA):	The yardstick used by the Occupational Safety and Health Administration (OSHA) to measure noise levels in the workplace. It is equal to a constant sound level lasting eight hours that would cause the same hearing damage as the variable noises that a worker is actually exposed to. (This hearing loss, of course, occurs over long-term exposures.) Same as LOSHA.
WAVELENGTH:	Sound that passes through air it produces a wavelike motion of compression and Parefaction. Wavelength is the distance between two identical positions in the cycle or wave. Similar to ripples or waves produced by dropping two stones in water. Length of sound wave varies with frequency. Low frequency equals longer wavelengths.

1 Introduction

Royal HaskoningDHV was commissioned to undertake the environmental noise specialist studies to determine the potential noise impact on the surrounding environment from the planned Concentrated Solar Park (CSP) on the farm of Sand Draai, located in the Kheis Local municipality, Northern Cape.

This report will assess the potential noise impact from all noise sources associated with the CSP project of Sand Draai. The assessment will highlight the existing conditions and character of the region, the methodology to follow and all will list all assumptions made.

The scoping phase is the environmental assessment stage of a project where issues are determined that should be addressed at subsequent stages (these can include impacts and preliminary alternatives). A scoping assessment of good quality reduces the risk of including inappropriate components or excluding components, which should be addressed in an environmental assessment.

Thus in the scoping report, some mitigation and remediation actions will be suggested, if it is found that mitigation measures should be incorporated in the design of the facility to reduce the noise impact of the planned facility on the environment. A legislative summary regarding noise in South Africa is discuss in this report, which summarises the relevant guideline maximum noise levels at different land use zones. The environmental impact significant rating methodology is described in the report.

1.1 Study Area Locality

The area of study is shown in Figure 1, below. The area is located north from the nearest town called Groblershoop, south from Gariep and on the eastern banks of the Orange River. The CSP project is located on the Sand Draai Farm property (the green dot indicates the proposed locality of where the CSP plant will be constructed, on the property of the Sand Draai farm).

Near the farm (~7km south), is an Eskom Sub-station where by the transmission lines from the CSP project will connect with to feed into the national grid. The Sand Draai CSP transmission lines will cross over the Bokpoort farm that is currently constructing a Photovoltaic (PV) plant, adjacent to the Eskom Substation.

The project will also pump water from the Orange River (~10km, west), the exact location of the pump station and type of pumps used is unknown at this stage. The Bokpoort PV plant is extracting water from the river at their pump station located north of the railway bridge.

The dominating land use in the region is classified as rural, with small scale agricultural activities. The population density of the region is sparse and there is no major (tarred) road passing the within 500m of the planned site.

1.2 Project Description

The planned Sand Draai CSP Plant will have an electricity generating capacity of 125MW photovoltaic cells, 150MW from parabolic trough technology and 150MW from the Central Receiver tower. The whole project will likely comprise:

- All associated heliostat fields (PV, Parabolic Trough and CSP);
- Thermal storage area;
- Power block (Central receiver, heat exchangers, turbine, generator and cooling block);
- Electrical sub station;
- Ablution faculties;
- Workshops; and
- Access and internal roads.

The project will also include an offsite water pump station located at the Orange River.
The project will, during the operational phase, be able to generate electricity on average for 10hours during the day (08:00 to 18:00).

The CSP technology can only operate at optimal capacity if the thermal conveyance medium is at a high temperature. The CSP will make use of a start-up boiler to heat up the medium before sunrise, to ensure the efficiency of the CSP.

Throughout the project lifecycle the heliostats will be cleaned from dust, it is assumed that a water cleaning truck will move along the heliostats to clean each item.

1.3 Scoping Report's Objectives

The scope of work for this assessment is defined in the SANS 10328:2008 "Methods for environmental noise impact assessments" document. A summary of the key aspects of the scoping phase is listed below:

- To determine and describe the existing noise climate of the region where the development will take place;
- To identify all existing noise sources in the study region that potentially could have an impact on the noise levels;
- To identify all sensitive receptors and developments in the region;
- To list all the possible noise causing equipment and processes that could be introduced by the new development in the region. Also estimate the Sound Power Level of the different equipment and/or processes;
- To indicate and describe the different scenarios and processes that should be investigated in the full impact assessment stage;
- To present all assumptions made during this assessment;
- To list the sensitive receptors that are excluded from the investigation – stating the reasons for their exclusion; and
- To layout the way forward for the full impact assessment.

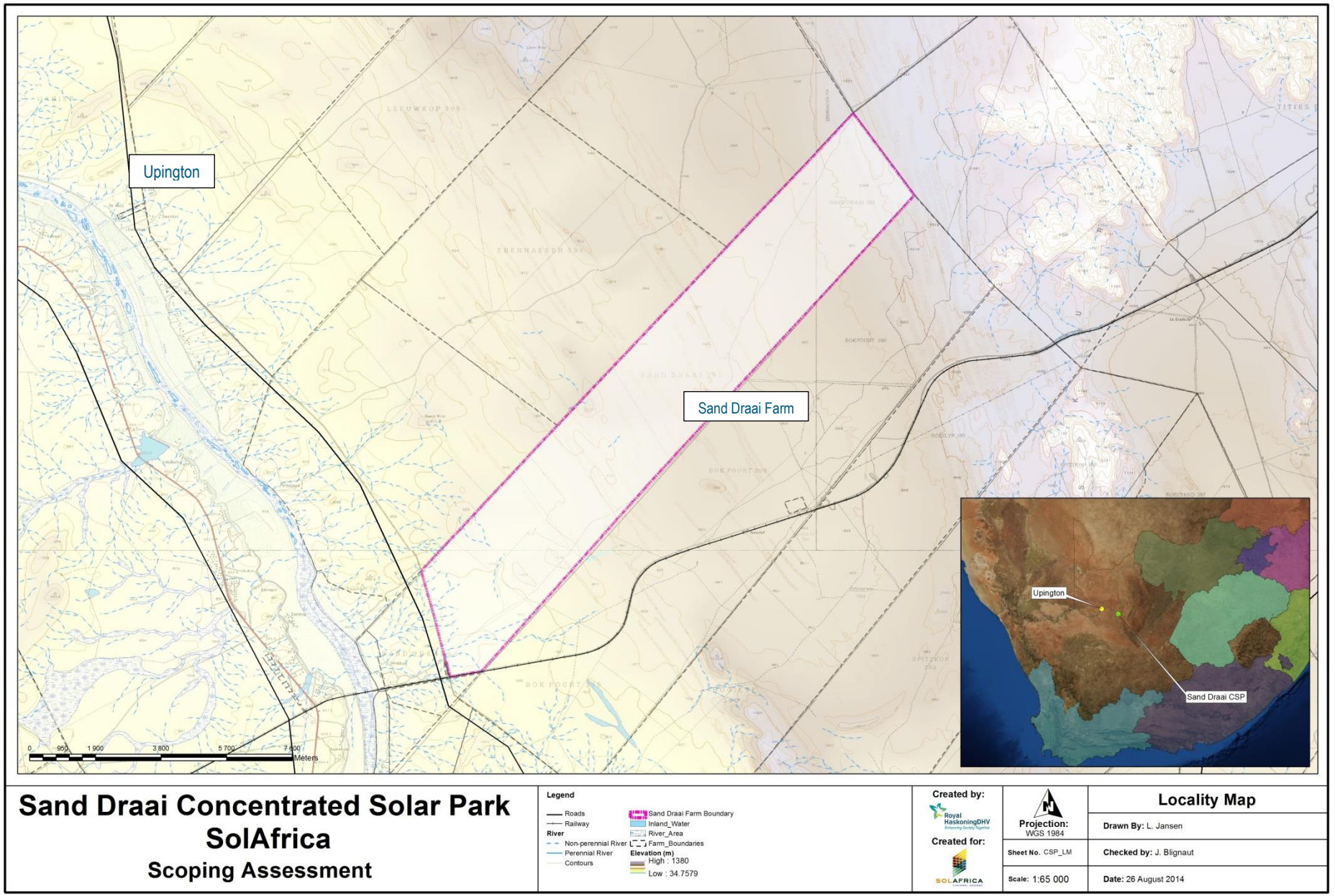


Figure 1: Locality map of the study area and CSP plant

2 Project Methodology

The general procedure to follow impact assessments regarding noise on the environment are outlined in SANS 10328:2008 “Methods for Environmental Noise Impact Assessment”. As per agreement with the client, this report focuses on the Scoping aspect of the investigation (Section 7). The type of development does qualify for a full impact assessment and the full impact assessment of the proposed development will be conducted after the scoping phase of the Environmental Impact Assessment is completed.

The investigation will address the key points as listed in section 7.5, following additional procedures and protocol listed in SANS 10103 and the noise control regulations.

2.1 Determination of the existing noise climate

The following methodology is set out to establish the existing noise climate of the region:

- The relevant technical details of the planned CSP Plant (as known at this stage) was reviewed in order to establish a comprehensive understanding of all aspects of the project that will influence the future noise climate;
- With the knowledge of the planned project, study area limits are calculated and based on the study area limits the sensitive receptors and major noise sources, were identified;
- The legislation is reviewed and the applicable noise standards were established. The National Noise Control Regulations and the SANS 10103:2008 standards were applied together with the SANS 10328 guidelines.
- The existing *noise climate* of the study area was determined by means of a field inspection and a noise measurement survey. The measurement survey appropriately covered the whole extent of the study area, focussing specifically on the identified noise sensitive/problem areas. Measurements of a neighbouring project from 2006 and 2010 have been summarised in this report. Measurements were taken at 15 monitoring sites in the study area, including one 24-hour measurements. The sound pressure level (SPL) (noise level) measurements were taken in accordance with the requirements of SANS 10103. A Type 1 Integrating Sound Level meter was used for the noise measurements complying too all regulations regarding valid measurements. All measurements were taken under dry weather and normal conditions;
- During the measurements at each of the points the noise character of the time of recording is described. This is an objective view from the listener regarding only noise perceived;
- The existing noise climate along the main road were measured and calculated according to the SANS 1210 guidelines. The traffic volumes and patters were established during the time of measurement. These noise levels were checked with the noise levels generated with the modelling software, CadnaA that will be used in modelling the impacts in the full impact assessment;
- Measurements was conducted at the sub-station and Bokpoort PV construction area, as they would impact on the baseline conditions;

Based on experiences the proposed scenarios that should be investigated in the full impact assessment are, as listed below:

a) **Baseline Noise Climate** – utilising the existing noise sources' sound power levels to replicate the noise levels as measured at the different locations in the study area;
b) **Construction Phase – *Earth clearing*** – the noise model replicating the typical conditions that would occur during the earth clearing and levelling stage of construction;
c) **Construction phase – *Assembly of all solar fields*** – the noise associated with the construction of the power tower and the installation of the different solar technologies;
d) **Operational Phase – *CSP Plant*** – the noise associated with day-to-day operation of the solar park (includes the traffic impact and heliostat cleaning schedule);
e) **Operational Phase – *Pump Station*** – the noise associated with the water being pumped from the river;
f) **Mitigated Scenario** – Construction phase ; and
g) **Mitigated Scenario** – Operational phase.

3 Legislative Background

In South Africa the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA) has been superseded by the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). However, the "noise control" regulations (on which SABS 0328:2000 was based) that were promulgated under sections 25 and 28 of ECA, and published in Government Notice No. GR 896 of 27 April 1990, will stay in force for the time being. The National Noise Control Regulations were adopted in 1998 by the different provinces and falls within the new National Environmental Management Act. Thus any activities that could have a substantial detrimental effect on the environment are included in the whole of South Africa.

The SANS 10328 standard forms the basis on which noise impact investigations should be conducted as prescribed in regulations published under the ECA, NEMA and the Environmental Management Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA) or any other noise control regulations. In terms of the NEMA, an environmental impact study and assessment have to be conducted before a new development or upgrade of an existing activity can be approved by the relevant authority.

The environmental impact investigation has to:

- identify all the issues that could have an effect on the environment,
- assess the impact of the identified issues on the environment, and
- identify possible alternatives and assess their impact on the environment.

Noise is an issue that has a significant effect on the environment and its inhabitants' behaviour and should therefore form part of all environmental impact studies. However, contrary to most of the other environmental issues that are assessed subjectively, the assessment of the impact of noise on the environment can be done scientifically and objectively by following the procedures and methodology described in the SANS 10328 document (See Section 3). The reaction responses to noise on the other hand are subjective as each person can preserve noise in a different way.

The following subsection will discuss the different regulations that are relevant to this project and will conclude with a summarised table indicating the target noise levels.

3.1 Noise Control Regulations

As mentioned above, the National Noise Control regulations were promulgated in 1992, there after the provinces of South Africa adopted and instituted the provincial noise by-law.

In terms of Regulation 2 (d) of the Noise Control Regulations:

> *"A local authority may, before changes are made to existing facilities or existing use of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests be conducted to the satisfaction of the local authority by the owner, developer, tenant or occupant of the facilities, land or buildings and that reports or certificates relating to the noise impact be submitted to the local authority, to the satisfaction of the local authority, by owner, developer, tenant or occupant."*

In terms of Regulation 3 (c) of the Noise Control Regulations:

> *"No person shall make changes to existing facilities or existing use of land or buildings or erect new buildings, if these will house or cause activities that will, after such changes or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority."*

In terms of Regulation 4 of the Noise Control Regulations:

> *"No person shall make, reduce, or cause a disturbing noise, or allow it to be made, produced or cased by any person, animal, machine, devise or apparatus or any combination thereof."*

3.2 South African National Standards (SANS)

SANS 10103 should also be adhered to for the measurements of noise levels at specific locations. This document prescribes the methodology of how a noise investigation should be conducted and also prescribes the selection of monitoring locations, placement of the microphone and specific equipment and calibration of the equipment.

The assessment of the noise levels is based on "Typical rating levels for noise in districts" (Table 1, below). These in/out-door noise level standards are not a standard as such, but are guidelines of typical noise values that can be experienced in the different regions of South Africa.

Table 1: Typical rating levels for noise in districts (adapted from SANS 10103:2008)

Type of District	Equivalent Continuous Rating level for Noise ($L_{Req,T}$) (dBA)					
	Outdoors			Indoors (with windows open)		
	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)
a) Rural	45	45	35	35	35	25
b) Suburban (with little road traffic)	50	50	40	40	40	30
c) Urban	55	55	45	45	45	35
d) Urban (with one or more of the following: workshops, business premises and main roads)	60	60	50	50	50	40
e) Central Business Districts	65	65	55	55	55	45
f) Industrial District	70	70	60	60	60	50

Table 2: Categories of community/group response (adapted from 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 community/group action
>15	Very Strong	Vigorous community/group action

NOTE: Overlapping ranges for the excess values are given because a spread in the community reaction might be anticipated.

a. $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:
1) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation);
2) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level of the ambient noise given in Table 1 of the code;
3) $L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from Table 2 of the code; or
4) $L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in the area because of the proposed development under investigation.

3.3 Summary of Target Noise Levels

It should be noted that in the different guidelines and standards, listed above, the impact of noise can be calculated on different "type" of calculations. In SANS 10328 the impact is derived from the change of the future noise levels and the typical rating noise level for the receptor (maximum permissible noise level as identified in Table 1). This type of impact can be described as the noise impact, however this excludes the baseline of the region that would impact on the cumulative noise levels.

The other "type" of calculation is based on the change in noise level estimated at the receptor (as found in Table 2). This calculates the change in noise level experienced by the receiver at a location. It binds with the theory of noise which states that any +3dBA change in noise level is a doubling of the noise sources. It should be noted that there are different categories from different institutions regarding this aspect of environmental noise. A summary is presented in the table below (Table 4), which also will summaries the environmental impact rating (regarding severity).

All the calculations are based on the noise level perceived in the outdoors environment. It is noted that the majority of complaints arise from residents during the night, these type of complaints are more characteristic to indoor noise levels. The indoor noise level will only be inspected once a receptors is identified as being effected. The indoor noise levels will be calculated and compared to the guidelines identified for the specific building.

Based on the sites locality (in the rural areas of the Northern Cape with a sparse population density) the typical noise level rating (also referred to as the maximum allowable noise level) for the study are is classed as Rural, unless specified other wise at receiver. It should be noted once the CSP is in operation the land use zoning of the pant will be reclassified to Industrial.

Table 3: Typical Rating Noise Level for this assessment

Equivalent continuous rating noise level (L_{Req})	Outdoor			Indoor		
	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)	Day/Night ($L_{Req,dn}$)	Day ($L_{Req,d}$)	Night ($L_{Req,n}$)
(A) Rural	45	45	35	35	35	25

Table 4: Environmental Impact Rating from the change in noise level

Change in Noise level	SANS 10103	WHO (IFC EHS Section 1.7)	Disturbing noise (Noise Regulations)	Environmental Impact Rating (Severity)
Δ +15 dBA	Strong Response "Threats of Community Action"	Significant	Disturbing noise	Very High
Δ +14 dBA				
Δ +13 dBA				
Δ +12 dBA				
Δ +11 dBA				
Δ +10 dBA	Medium Response "Widespread Complaints"			High
Δ +9 dBA				
Δ +8 dBA				
Δ +7 dBA				Medium
Δ +6 dBA				
Δ +5 dBA	Little Response "Sporadic complaints"		Not Disturbing	Low
Δ +4 dBA				
Δ +3 dBA		Insignificant		Very Low
Δ +2 dBA				
Δ +1 dBA				

** It should be noted that the WHO is only applicable to the closest receptor to the source, located offsite from the source.*
*** The environmental impact rating level will be used to determine the severity of the impact.*

4 Existing Environment

4.1 Site Locality

The Sand Draai Farm is located north of Groblershoop and east from the town called Gariep. The site falls within the Kheis Local Municipality, forming part of the Siyanda District Municipality located in the Northern Cape Province of South Africa.

The topographical feature that dominates the region is the Orange River located at the south western boundary of the Sand Draai farm. The Orange River is the life line for the region and the majority of houses are located on the flood line of the river and all are operating small irrigation farms. The area is flat with the majority of the slope on the farm is below 3%, the Skurweberg is located to the north east of the farm.

The area is dominated by agricultural farms, consisting out of irrigation farms close to the Orange River and small animal grazing farms, located away from the river. The farms located on the river are small compared to the vast areas of farms used for grazing. The farm houses are presented in the image below (Figure 2) and it present the higher density of houses on the river boundary.

There is an Eskom Substation located adjacent to the Bokpoort Farm, south from Sand Draai. The electricity generated by the Sand Draai project will connect with the national grid at the Eskom Sub-station.

It should be noted that the exact location of the solar fields are not yet known and based on initial discussions the solar fields will be located in the northern section of the farm. There are no small houses within a 3km radius from the solar fields located at this location.

4.2 Existing noise climate measurement methodology

Ambient sound level measurements were undertaken at the proposed Sand Draai CSP site area and the surroundings. The field survey measurements were taken on the 30th September and 2nd October 2014, with a 24hour measurement taken from 16:00 on the 30th September. The baseline measurements were done under normal circumstances as the area were not exposed to other external and/or unusual noises. The measurements recorded can be classified as the typical noise level at each of the points.

All sound level measurement procedures were taken according to the relevant South African Code of Practice (SANS 10103, SANS 10328, SANS 10210, SANS 10205, etc.). This included the selection of monitoring locations, microphone positioning and equipment specifications among others. The day- and night-time measurements were taken during the prescribed timeframes as in SANS 10103:2008, with daytime ranging from 06:00 to 22:00 and night-time ranging from 22:00 to 06:00, with the measurement interval of not less than 15 minutes.

The noise parameters recorded were in Z-,A- and C-weighted bands:

- L_{eq} The equivalent continuous sound level;
- L_{max} The maximum sound pressure level of a noise event;
- L_{min} The minimum sound pressure level of a noise event;
- L_{10} The noise level which is exceeded for 10% of the time;
- L_{90} The noise level which is exceeded for 90% of the time (typically referred to the background noise level);
- L_{peak} The peak noise level experienced during the measurement; and
- Octave Bands The noise level experienced is measured in different set frequency ranges ranging from the 32Hz band to 8 kHz band.

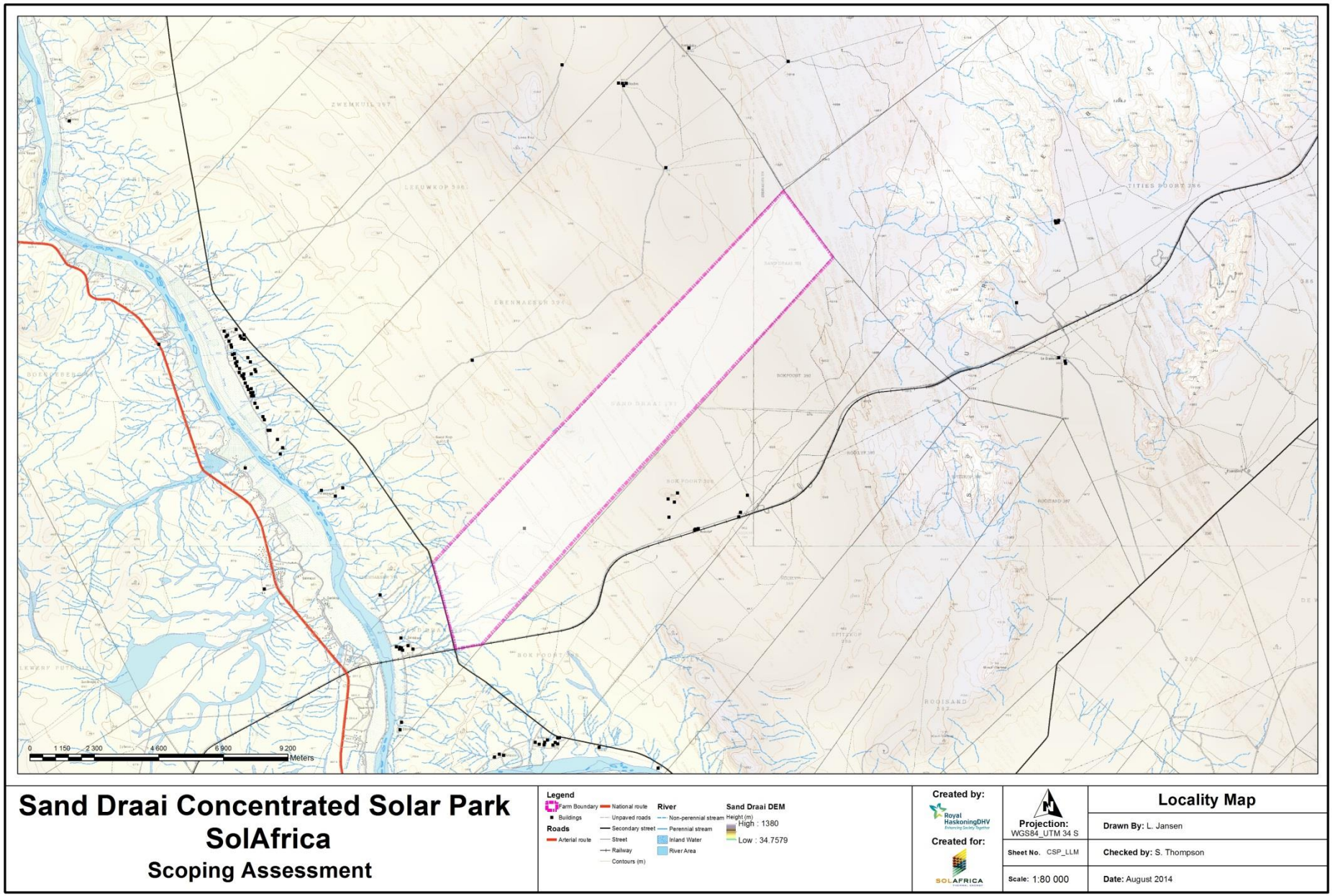


Figure 2: Site locality map, with proposed solar field locations in Sand Draai farm

The make and model, as well as serial number and calibration validity, of the sound level meter and calibrator are presented in Table 5. The calibration certificate will be made available on request. All monitoring equipment is classified as Class1/Type1 instruments according to the applicable SANS standards.

Table 5: Sound level meter and calibrator specifications

Sound level meter	Calibrator
Make & Model: CEL Instruments – CEL633C1	**Make & Model:** CEL Instruments – CEL
Serial No.: 2939299	**Serial No.:** 2539358
Calibration valid until: August 2015	**Calibration valid until**: August 2015

The figure below (Figure 3) indicates the different monitoring locations assessed during the baseline noise measurements. The previous noise monitoring locations used during the Bokpoort environmental noise impact assessment, that is applicable to this study, were reassessed and the results are presented in the report. The figure below also indicate the excluded previous noise monitoring locations.

The following table present the summarised results from the field measurements.

Table 6: Baseline measurement results

ID	Latitude	Longitude	Shortest distance to CSP boundary (km)	LAeq (dBA)	LAmax (dBA)	LAmin (dBA)	Target Guideline Value (dBA)
SD 01	-28.77870°	21.90311°	0.01	70.1	91.4	49.9	45
SD 02	-28.74497°	21.98175°	2.80	51.6	76.9	24.6	45
SD 03	-28.74088°	21.99488°	3.50	58.7	75.9	45.7	45
SD 04	-28.70860°	22.02750°	3.75	46.6	64.9	25.3	45
SD 05	-28.76110°	21.91703°	---	44.4	59.6	20.3	45
SD 06	-28.73608°	21.93417°	---	46.9	64.8	21.5	45
SD 07	-28.71336°	21.95647°	---	47.1	69.1	20.3	45
SD 08	-28.68877°	21.98127°	---	45.5	59.8	24.1	45
SD 09	-28.65310°	22.01247°	---	40.9	58.4	20.7	45
SD 10	-28.88492°	21.96455°	14.25	70.9	98.0	33.3	45
SD 11	-28.85001°	22.03131°	13.92	69.6	94.1	25.9	45
SD 12	-28.83528°	21.98609°	9.23	61.2	85.9	22.9	45
SD 13	-28.73776°	21.97593°	---	31.8	52.0	25.5	45
SD 14	-28.73397°	22.00043°	---	46.1	65.9	40.8	45

Table 7: Previous neighbouring monitored results

ID	Latitude	Longitude	Year of measurement	LAeq	LAmax	LAmin	Target Guideline Value (dBA)
B1	S 28 44.024''	E 21 58.500'''	2006	50.2	60.7	32.7	45
B2	S 28 44.022''	E 21.58.477''	2006	44.1	58.6	33.3	45
B3	S 28 44.276''	E 21 58.507''	2010	36.9	55.3	17.9	45
			2006	41.3	55.4	23.5	45
B6	S 28 47.193''	E 21 52.536''	2006	48.8	51.6	38.9	45
B7	S 28 44.421''	E 21 59.704''	2010	52.1	59.1	50.2	45
B8	S 28 42.818''	E 22 01.570	2010	36.7	58.7	19.5	45

* Only locations applicable to the Sand Draai CSP project were selected

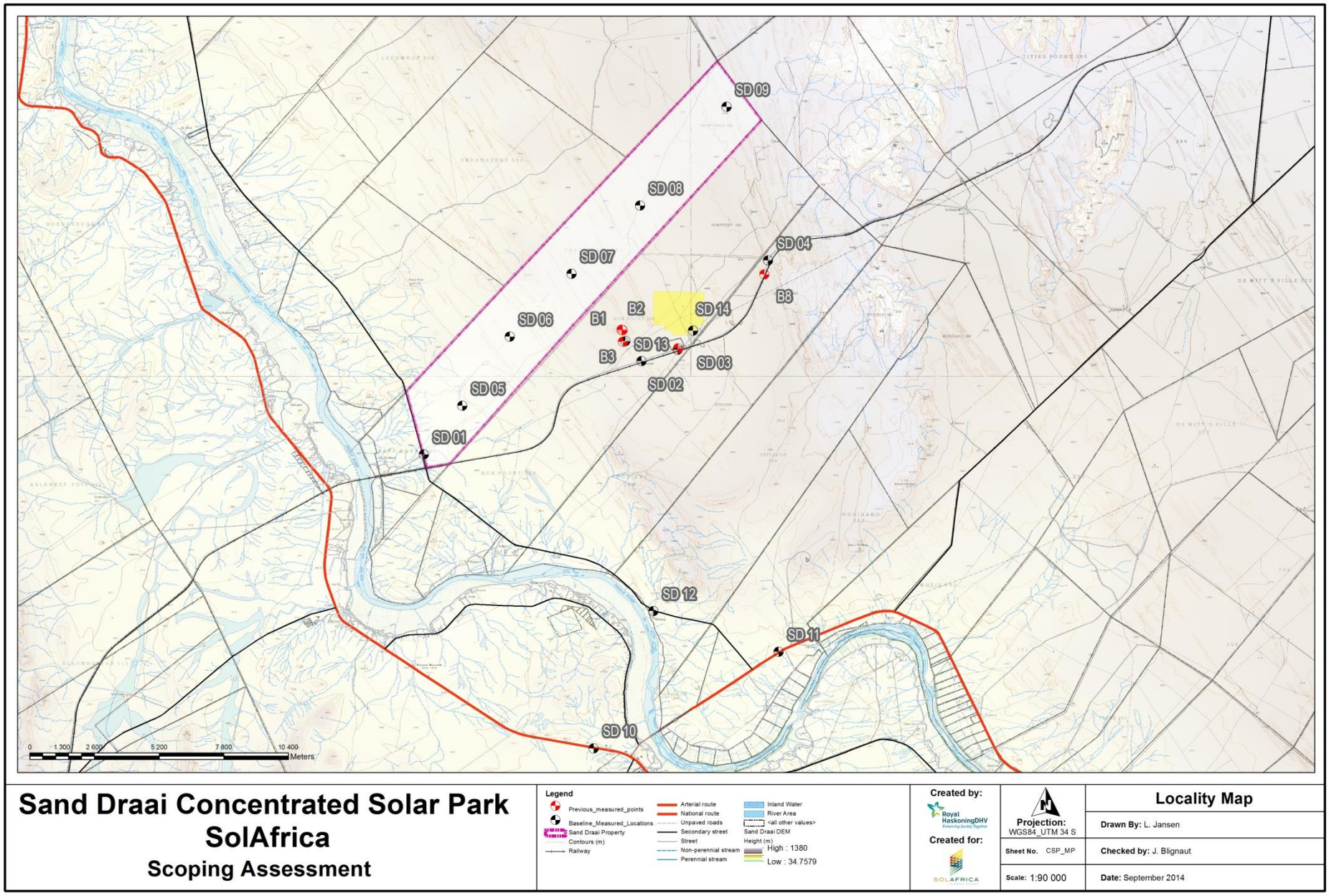


Figure 3: Map illustrating the locations of the different noise monitoring locations and existing noise sources

4.3 Existing Noise Sources

During the assessment, specific attention was given to identifying existing noise sources in the region of the study area. There were three noise sources identified in the region, roads, rail and the Bokpoort PV plant (currently under construction).

4.3.1 Roads

Some of the roads in the region are:

- National Route 10 (*N10*) – The road follows the Orange river from Upington to Groblershoop on the western bank of the river;
- National Route 8 (*N8*) – links the towns of Groblershoop with Griekwastad, the road passes through the southern section of the study area;
- District Gravel Road (*Gariep Road – DS112256*) – travels along the northern bank of the Orange river, connecting R64 with the N14 located north from the study area.
- *Loop 16 Access Road* – following the railway line (Saldana-Sishen) which passes through the southern and eastern side of the study area.

4.3.2 Railway

The Saldanha-Sishen railway line is aligned in a north-east to south-west direction through the southern section of the Sand Draai farm. There is a cross-over siding (Rooilyf) for ore carrying trains. The rail carriers 3 trains per day.

4.3.3 Bokpoort PV Plant

The Bokpoort site is located on the adjacent farm to the south of Sand Draai and north from the local substation. Currently the site is under construction and thus the site does emit noise. The site should be included in the investigation of the baseline noise climate of the region. Although the construction is a new and temporary activity, the activity will have an effect on the noise levels during the measurements.

The estimated noise level emitted from the construction are (during the time of measurement) is in the range of 40.8 – 65.9 dBA during the day, all construction is stopped during the night. The estimated sound power level of 90 dBA (distance corrected) will be used in the baseline noise model.

The table below summarises the different noise sources' sound power levels (dBA – distance corrected). The sound power levels listed in this table will be used in the propagation modelling to create an accurate baseline model scenario.

As indicated in Figure 3 above the noise sources are roads, railway and/or localised noise sources (in close proximity to the farmsteads). The vast sparse population density results in the fact that there are no receptors within a 5km radius of the site, however other receptors are listed below in the tables below.

Table 8: Existing noise sources in the region - Roads

	Vehicles per hour	Heavy vehicles (%)	Vehicle speed (km/h)	Sound Power Level (dBA)
Road – N10	150	13%	120	66.69
N8	90	14%	120	64.59
Griekwastad/Loop16	50	67%	70	66.33

* It should be noted that the measurements were recorded during off-peak hours and an increase of 35% was applied to recreate worst case conditions.

** Road traffic noise sound power levels are calculated following SANS 10210.

4.4 Identified sensitive receptors

The map (Figure x) indicates the sensitive areas, based on the information gathered from cadastral maps (2821DB, 2821DD, 2822CA and 2822CC), Google Earth and other Aerial Photography conducted in the past. It is noted that the information is old and that houses could have been constructed recently. The sensitive areas were established to the best available information at hand.

As the areas are spread out over the region and as there are, few sensitive areas located within 5km of the possible site. The table below present the relevant chosen sensitive areas selected for further analysis, included in the table are monitoring points that were measured during the baseline assessment.

Table 9: Identified receptor locations for further impact assessment

ID	Name	Maximum permissible sound level (LAeq) - dBA		Baseline Noise level (dBA)		Distance from CSP (km)
		Daytime	Night-time	Daytime	Night-time	
SR_01	Oribix Reserve	45	35	46.6	30.2	~5km
SR_02*	Bokpoort Farm stead	45	35	31.8	29.8	~5km
SR_03	SandDraai farm stead	45	35	61.2	28.7	~13km

* The closest receptor and will be used to calculate the PSL value.

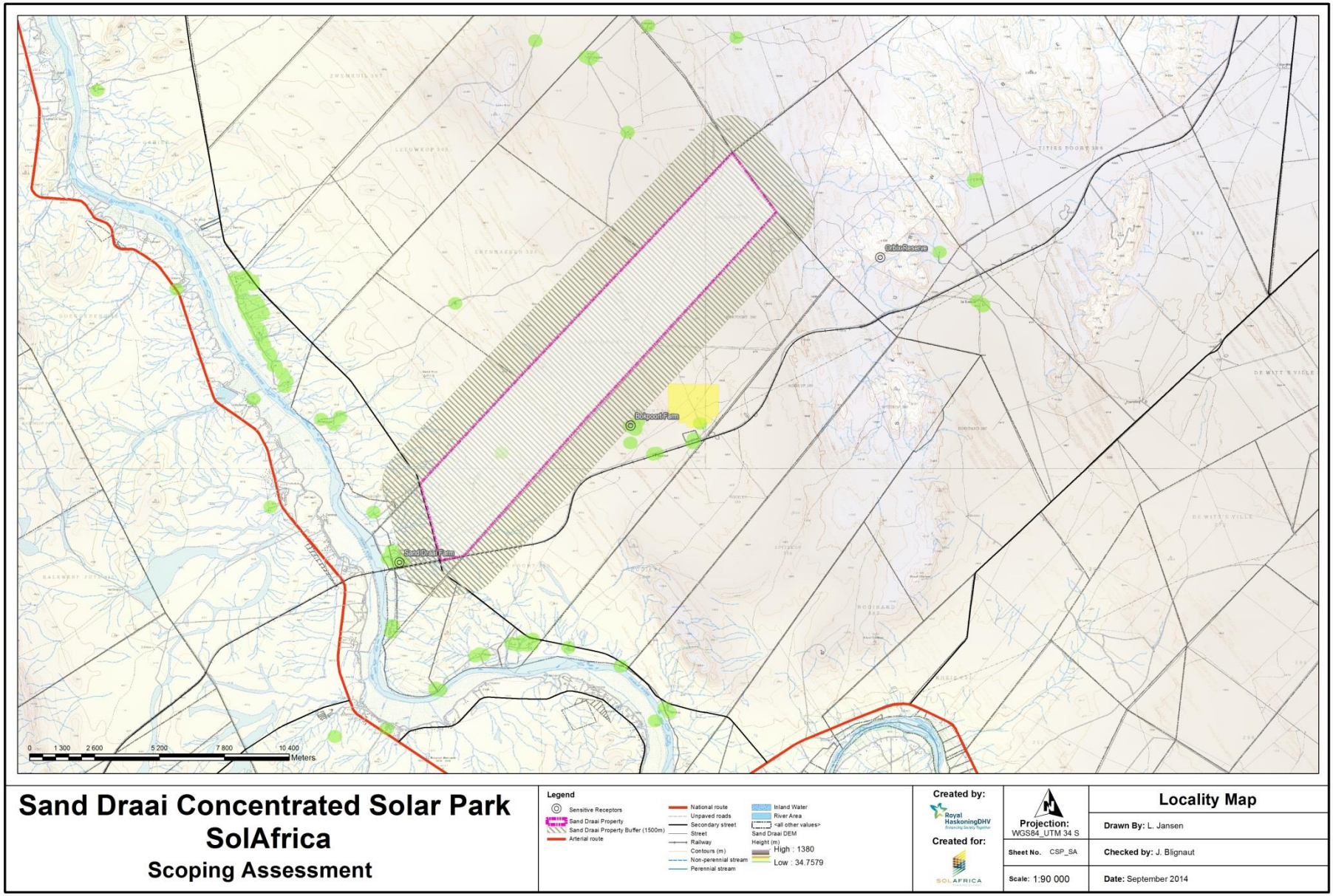


Figure 4: Map illustrating all applicable sensitive areas in the region of the Sand Draai Farm

4.5 Meteorological Conditions

The Sand Draai Farm is located in the semi desert province called the Northern Cape. The northern Cape and typically the area of the Sand Draai Farm experience predominantly summer rainfall, however there is some chaces of rain during the winter months as cold fronts move over the country. As the area is a semi desert area, the temperature will fluctuate largely during the day and night and from season to season. The provinces has a very sparse rainfall (ranging between 50 and 400mm per annum). The typical summer day-time temperature is in the range of 34°C to 40°C, often exceeding the 40°C mark in summer. The winter days are warm and the nights are very cold. The formation of dew and frost supplement the low rainfall in the region, with plant specifically adapted to capture the most moisture as possible. The formation of snow on mountains are possible during very cold winter days.

The closest South African Weather Services station for the Sand Draai farm is the Upington Station (UPINGTON WO), approximately 75km, north west from the sand draai farm. The environment at the Upington weather station is similar to the environment at sand draai and the data from the station is apporpiate for this assessment. Three years (2011 – 2013) historical hourly data was analysed and the average year (average from the three years) are presented in the table below (Table 10).

Table 10: Average Year (2011-2013) meteorological summary table

		Temperature Average	Temperature Max	Temperature Min	Rainfall	Cloud Cover	Atmospheric Pressure	Humidity	Wind Speed	Wind Direction
		°C	°C	°C	mm	tenths	mbar	%	m/s	° from north
January		28.8	36.7	20.7	38.5	3	916.3	33.7	3.6	231.9
February		26.9	34.6	19.5	77.6	4	917.5	44.0	3.3	299.2
March		25.8	33.8	18.1	70.9	3	919.1	40.4	3.2	296.0
April		19.7	28.0	12.0	25.1	3	922.3	46.9	3.0	5.8
May		15.8	24.9	8.4	12.1	2	923.7	47.3	3.2	339.4
June		11.4	20.6	4.2	17.3	2	925.2	51.7	3.1	335.9
July		11.2	20.5	3.7	6.7	2	926.6	49.4	2.9	338.8
August		13.4	22.7	5.0	1.3	2	923.7	39.3	3.5	288.2
September		17.2	26.9	7.7	0.4	1	923.1	28.6	3.3	248.9
October		21.3	30.0	12.2	7.5	2	920.1	25.7	3.7	231.3
November		25.0	33.8	15.6	6.7	2	918.4	22.4	3.9	229.9
December		26.6	34.5	18.7	36.1	3	917.6	35.0	4.0	242.9
Annual	Average	20.3	28.9	12.2	300.1	2.4	921.1	38.7	3.4	286.3
Winter		16.2	25.1	8.6	133.4	2.3	923.4	45.8	3.2	327.6
Summer		24.3	32.8	15.7	166.7	2.5	918.8	31.6	3.6	246.2

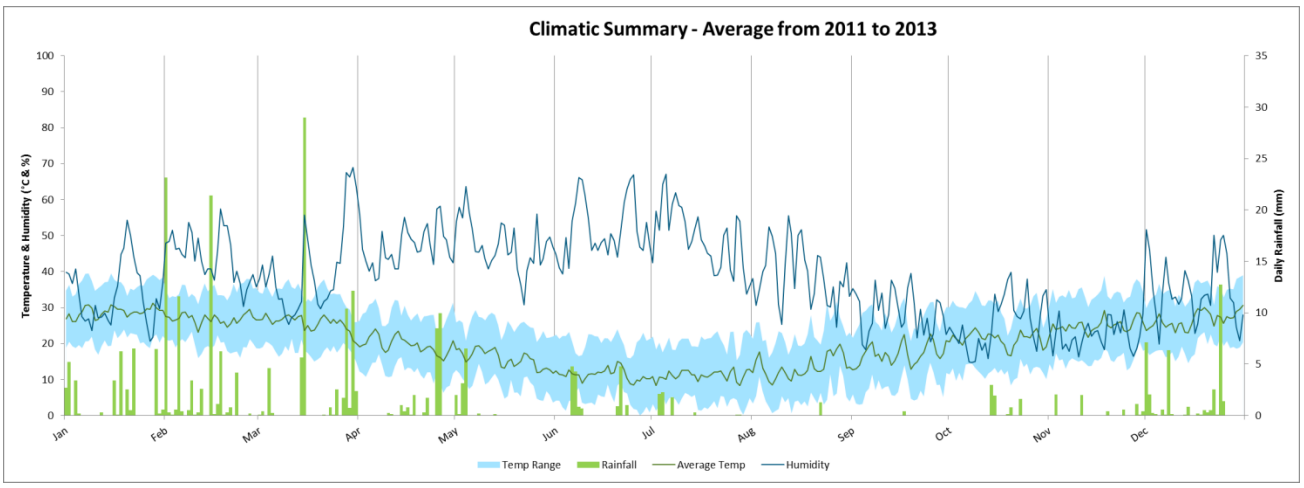


Figure 5: Climatic Summary for Upington WO for 2011-2013

The CadnaA modelling program makes use of wind statistics as calculated by the ISO9613, the wind direction is divided into 12 segments of 30° intervals. The table below indicates the frequency and average wind speed per segment over the historical three years.

Figure 6: Upington Wind Rose summary 2011 – 2013

Table 11: CadnaA Wind Statistics – 2011 to 2013 (Annual)

Segment (30° interval)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)
	Annual – Day/Night		Annual - Day		Annual - Night	
0 - 30	8.62%	4.60	5.94%	5.00	2.67%	3.60
30 - 60	6.49%	3.40	4.05%	3.70	2.44%	2.80
60 - 90	5.08%	2.70	2.72%	3.00	2.36%	2.50
90 - 120	5.02%	2.70	3.12%	2.90	1.90%	2.50
120 - 150	3.55%	3.10	2.62%	3.20	0.93%	3.10
150 - 180	3.18%	2.90	2.59%	2.90	0.59%	2.80
180 - 210	7.06%	3.10	5.42%	3.20	1.64%	3.00
210 - 240	17.88%	3.60	12.53%	3.80	5.34%	3.40
240 - 270	12.48%	3.60	8.54%	4.00	3.94%	2.70
270 - 300	6.37%	3.10	3.76%	3.70	2.60%	2.20
300 - 330	5.02%	3.60	3.66%	4.10	1.36%	2.30
330 - 360	7.35%	4.50	5.88%	5.00	1.47%	2.80

Table 12: CadnaA Wind Statistics – 2011 to 2013 (Summer)

Segment (30° interval)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)
	Summer – Day/Night		Summer - Day		Summer - Night	
0 - 30	3.08%	4.80	2.13%	5.20	0.96%	3.80
30 - 60	2.75%	3.80	1.72%	4.10	1.04%	3.20
60 - 90	2.13%	3.00	1.15%	3.10	0.99%	2.80
90 - 120	2.38%	3.00	1.48%	3.30	0.91%	2.70
120 - 150	1.97%	3.40	1.34%	3.30	0.63%	3.40
150 - 180	1.65%	3.00	1.27%	3.00	0.38%	3.10
180 - 210	4.30%	3.30	3.22%	3.30	1.08%	3.20
210 - 240	12.05%	3.80	8.18%	4.00	3.87%	3.50
240 - 270	7.55%	3.80	5.08%	4.30	2.47%	2.80
270 - 300	3.31%	3.30	2.05%	3.90	1.25%	2.30
300 - 330	2.29%	3.70	1.61%	4.20	0.68%	2.30
330 - 360	3.04%	4.50	2.38%	5.00	0.66%	2.70

Table 13: CadnaA Wind Statistics – 2011 to 2013 (Winter)

Segment (30° interval)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)	Frequency	Average wind speed (m/s)
	Winter – Day/Night		Winter - Day		Winter - Night	
0 - 30	5.54%	4.50	3.82%	5.00	1.72%	3.50
30 - 60	3.74%	3.10	2.34%	3.40	1.40%	2.60
60 - 90	2.95%	2.60	1.58%	2.80	1.37%	2.30
90 - 120	2.63%	2.50	1.64%	2.60	0.99%	2.30
120 - 150	1.57%	2.90	1.27%	2.90	0.30%	2.50
150 - 180	1.53%	2.70	1.31%	2.80	0.21%	2.40
180 - 210	2.76%	2.90	2.20%	2.90	0.56%	2.70
210 - 240	5.83%	3.30	4.36%	3.40	1.47%	3.00
240 - 270	4.93%	3.30	3.46%	3.60	1.47%	2.70
270 - 300	3.06%	2.80	1.71%	3.40	1.35%	2.10
300 - 330	2.73%	3.50	2.05%	3.90	0.68%	2.20
330 - 360	4.31%	4.60	3.51%	5.00	0.81%	2.80

5 Predicted Future Impacts

This section will list the different noise sources that can be expected to be located at the site during the lifetime of the project. The project can be divided into two phases, 1) Construction and 2) Operational. Each of these phases is characterised by significantly different processes. The subsections will described the planned sources per phase, in summary the expected scenarios that should be investigated will be listed and the end of this section. If alternatives are suggested from the findings at this stage it will be mentioned and presented in the conclusion.

5.1 Potential Noise Sources – Construction

As per this assessment, the following activities are viewed as construction activities, These activities can be investigated separately or combined for a process of period or scenario investigation.

- Earth Works: Site Clearing;
- Earth Works: Site levelling;
- Earth works: trench digging for laying of cables;
- Access road construction;
- Establishment and operating of site construction laydown area;
- Construction of buildings of any type (include the erection of solar panels);
- Transportation of construction workers and material;
- Construction camp;
- Water pipe line construction; and
- Transmission lines.

Blasting might be required during the site levelling and establishment of foundations for the tower or buildings. However the blasting noise impact is excluded from the final environmental noise impact assessment due to the following assumptions and justifications:

- Blasting might occur only during the construction phase and should only occur at the establishment of the base foundations for the CSP tower. Blasting will only occur over a very short time period and the impact will not last more than 1 minute;
- The nature of the project has no blasting in the operational phases;
- Blasting is highly regulated, controlled 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;
- People are generally more concerned over ground vibrations and air blast levels that might cause building damage than the impact caused by noise from the blast, this impact is also significantly reduced if the public is made aware off the time schedule blast would occur;

5.2 Potential Noise Sources – Operational

As per this assessment, the following activities are characteristic to operational procedures of CSP's. These activities can be investigated individually, combined (for a process), time-period or scenario investigation.

- Boiler start-up and operating noises (all associated activities);
- Salt and Water pumps;
- Cooling fans;
- Waste Water Treatment Works;
- Service trucks (Cleaning mirrors and PV's);
- Transformer Noises;
- Transmission line noises; and
- Workers commuting.

6 Conclusion

The project proposed will generate, much needed energy for the national grid from renewable energy, solar. The project is situated in the Northern Cape and is ideally located for high intense solar radiation. The project itself will provide a much needed boost for the local economy.

Following the national legislation, a full environmental impact assessment must be conducted before the project can start construction, this report forms part of the scoping phase of the application to gain environmental authorisation for this project. This report present the scoping phase for the Environmental Noise Impact Assessment. In Section 3 above a summary of the legal framework is provided and project specific guidelines are prescribed in section 3.3. The environmental impact significance rating methodology is described in Appendix A.

The baseline assessment of the region of the proposed project indicated that the region is very quite. The topography of the study area is flat and little to none vegetation covers the area. In the study area there are minimal noise generating sources (Roads, Railway and construction noise, was found to be present during the baseline monitoring). At the proposed site the closest existing receptor (farm house) is more than 1.5km away. The project itself will generate additional noise that could possibly effect the areas noise climate.

The impact expected to arise from this project can be divided into two phases, 1) Construction and 2) Operational. During the construction of the project, the noise will be limited to daylight hours (~06:00 to 18:00), and is likely to be only local to the proposed site of construction and assembly. The noise generated can easily be stopped and mitigated once found there is a nuisance associated with the activity.

The operational phase of the project will likely produce noise short before sunrise every morning (as the start-up boiler is active), after the project is running at optimum the boiler will be stopped. This activity is very short in duration and is easily mitigated, if found the activity will cause some nuisance. Other noise generating activities will be the cleaning of all heliostats.

6.1 Environmental Significance rating

6.1.1 Construction phase

As mentioned before in the report the noise generated by the construction of the site will vary and different noise sources that will impact on the cumulative noise profile generated from the site. The area impacted will be no further away from the sources than 1.5km. The noise audible at receiver will be benign and will not occur over a long period. It is unlikely that an impact might occur from the construction phase and in adding all other sources, it is unlikely for an impact to occur.

	Extent	Duration	Frequency	Intensity	Probability of occurrence	Total Rating
Construction phase - unmitigated	2 – The impact is possible to be audible off the farm	2 – Short term (less than a few months) of noises generated by construction	2 – Unusual for an impact to occur at receptors offsite from noise. locations	1 – low to negligible impact from the noises heard on the surrounding environment.	3 – impact is likely to occur	10 – Medium
Construction phase - unmitigated	2 – The impact is possible to be audible off the farm	1 – Short term (few days) it is likely that noise from the site is audible	1 – Very rare that an impact will occur from noise.	1 – low to negligible impact from the noises heard on the surrounding	1 – improbable – very unlikely that an impact might occur	6 - Medium

6.1.2 Operational phase

As mentioned before in the report the noise generated during the operational phase will be limited to daytime periods and shoul be less tat during the construction phase. The number of vehicles and people accessing the site will be less. The noise at this moment of time is rated viewing all cumulative noise sources.

The noise will be localised to the CSP plant area and is likely to extend over to the neighbouring farms, but no farm houses are located within 5km of the CSP plant area. The intensity of o noise impact is benign and the occurrence possibility of one is very rare.

	Extent	Duration	Frequency	Intensity	Probability of occurrence	Total Rating
Operational phase - unmitigated	2 - Local	1 – Short term	2 – Unusual	2 – Low	2 – Probable	9 – Medium
Operational phase unmitigated	2 - Local	1 – Short term	2 - Unusual	1 – Very low	1 - improbable	7 – Medium

6.2 Recommendations

It is of the opinion from Royal HaskoningDHV, that a full impact assessment regarding the propagation of noise, be conducted for this project. The data gathered from this scoping study should be used as a basis for the assessment. The environmental impact risk ratings should be expanded in more detail, with assessing different aspects of noise sources identified.

If any impact is expected form this project, applicable mitigation measures must be investigated and tested.

7 Way Forward

7.1 Environmental Noise Impact Assessment

The full impact assessment must take into account the data provided in this report. The following input data can be used in the modelling of the different scenarios.

- Scenario 01: Baseline
- Scenario 02: Construction Phase – Earth Clearing
- Scenario 03: Construction phase – Assembly Area
- Scenario 04: Operational Phase – CSP plant
- Scenario 05: Operational Phase – Project associated activities
- Scenario 06: Pumping Station

Additional scenarios must be presented to test and evaluate the efficiency of proposed mitigation measures.

The meteorological data to use in the CadnaA software is, for annual assessments, an average temperature of 20°C and 50% humidity. As the facility is not operational during the night period, the focus of the assessment should lay with daytime investigations. However, the proposed operational start and end times of activities must be stated. If an activity could pose a noise impact during the night, then it should be investigated. The wind profile data in Table 11 can also be used to determine the impact under the typical wind conditions of the area.

As with any modelling programs, it is advised to incorporate the terrain profile of the study area in the modelling software.

All calculated model results must be compared to the project specific guidelines as provide in section 3.3. The cumulative impact should also be calculated (taking into account the baseline noise level + new additional noise from this project).

Appendices

Appendix A – Environmental Impact Significance Rating Methodology

Appendix B – Baseline Monitoring Interim Report

Appendix A – Environmental Impact Significance Rating Methodology

1 ENVIRONMENTAL IMPACT ASSESSMENT APPROACH

1.1 Impact Assessment Methodology

The potential environmental impacts associated with the project will be evaluated according to its nature, extent, duration, intensity, probability and significance of the impacts, whereby:

- **Nature**: A brief written statement of the environmental aspect being impacted upon by a particular action or activity.
- **Extent**: The area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment phase of a project in terms of further defining the determined significance or intensity of an impact. For example, high at a local scale, but low at a regional scale;
- **Duration**: Indicates what the lifetime of the impact will be;
- **Intensity**: Describes whether an impact is destructive or benign;
- **Probability**: Describes the likelihood of an impact actually occurring; and
- **Cumulative**: In relation to an activity, means the impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.

Table 14: Criteria Used for the Rating of Impacts

CRITERIA	DESCRIPTION				
	5	4	3	2	1
EXTENT	**International (5)** International scale	**National (4)** The whole of South Africa	**Regional (3)** Provincial and parts of neighbouring provinces	**Local (2)** Within a radius of 2 km of the site boundaries	**Site (1)** Within the site boundaries
DURATION	**Permanent (5)** Mitigation either by man or natural process will not occur in such a way or in such a time span that the impact can be considered transient	**Long-term (4)** The impact will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter. The only class of impact which will be non-transitory	**Medium-term (3)** The impact will last for the period of the construction phase, where after it will be entirely negated	**Short-term (2)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few months)	**Short-term (1)** The impact will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (few days)
FREQUENCY	**Continuous (5)** Daily to a significant percentage every day	**Very Frequent (4)** Few times a week to daily	**Frequent (3)** Few times a month	**Unusual (2)** Once or twice every 5 years	**Very Rare (1)** Once or twice a decade
INTENSITY	**High (5)** Natural, cultural and social functions and processes are altered to extent that they permanently cease	**Medium High (4)** Natural, cultural and social functions and processes are altered to extent that they temporarily cease	**Medium (3)** Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way	**Low (2)** Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected	**Very Low (1)** Impact does not affects the environment in such a way that natural, cultural and social functions and processes are not affected
PROBABILTY OF OCCURANCE	**Definite (5)** Impact will certainly occur	**Very Likely (4)** Most likely that the impact will occur	**Likely (3)** The impact may occur	**Probable (2)** Likelihood of the impact materialising is low	**Improbable (1)** Likelihood of the impact materialising is very low

Significance is determined through a synthesis of impact characteristics. Significance is also an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

Table 15: Criteria for the rating of classified impacts

Low impact (0 -5 points)	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
Medium impact (6 -10 points)	Mitigation is possible with additional design and construction inputs.
Medium to High impact (11 -15 points)	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and/or operational phases. The effects of the impact may affect the broader environment.
High impact (16 - 20 points)	High consequences and mitigation is essential.
Extremely High	Permanent and important impacts. The design of the site may be affected. Intensive remediation is needed during construction and/or operational phases. Any activity which results in a "very high impact" is likely to be a fatal flaw.
Status	Denotes the perceived effect of the impact on the affected area.
Positive (+)	Beneficial impact.
Negative (-)	Deleterious or adverse impact.
Neutral (/)	Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the status quo – i.e. should the project not proceed. Therefore not all negative impacts are equally significant.	

Note: When a negative impact is recorded, it is important to note that a lower negative value (e.g negative 5) is *preferable* to a higher negative value (e.g. negative 7), as the higher negative value represents an impact of greater magnitude.

The suitability and feasibility of all proposed mitigation measures will be included in the assessment of significant impacts. This will be achieved through the comparison of the significance of the impact before and after the proposed mitigation measure is implemented. Mitigation measures identified as necessary will be included in an EMPr.

Appendix B – Baseline Monitoring Interim Report