Appendix Q: Noise

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

File Reference Number:	12/12/20/
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Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

PROJECT TITLE

ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED CONTINUOUS ASH DISPOSAL FACILITY FOR THE MATIMBAPOWER STATION IN LEPHALALE, LIMPOPO PROVINCE

Specialist:	Noise Impact Assessment		
Contact person:	Derek Cosijn		
Postal address:	P O Box 2756, Brooklyn Square		
Postal code:	0075	Cell:	082 600 6347
Telephone:	012 460 4481	Fax:	086 262 3089
E-mail:	dcosijn@gmail.com		
Professional affiliation(s) (if any)	Pr Eng, BSc (Civil Eng), FSAICE, MSAAI, EAPSA (Certified)		

Project Consultant:	Royal HaskoningDHV		
Contact person:	Prashika Reddy		
Postal address:	PO Box 25302, Monument Park, Gauteng, South Africa		
Postal code:	0105	Cell:	083 2848687
Telephone:	012 367 5973	Fax:	012 367 5878
E-mail:	prashika.reddy@rhdhv.com		

4.2 The specialist appointed in terms of the Regulations_

I,Derek Cosijn , declare that –

General declaration:

I act as the independent specialist in this application
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
I will comply with the Act, regulations and all other applicable legislation;
I have no, and will not engage in, conflicting interests in the undertaking of the activity;
I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
all the particulars furnished by me in this form are true and correct; and
I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Calyx Environmental cc t/a Jongens Keet Associates
Name of company (if applicable):

2015/04/16
Date:

NOISE IMPACT ASSESSMENT OF THE PROPOSED CONTINUOUS ASH DISPOSAL FACILITY FOR THE MATIMBA POWER STATION, LEPHALALE, LIMPOPO PROVINCE

(FINAL REPORT)

(July 2014)

REPORT PREPARED BY JONGENS KEET ASSOCIATES

PO Box 2756 Brooklyn Square 0075

Contact: D Cosijn

Phone/Fax: (012) 460-4481

Cell: 082 6006347

1 INTRODUCTION

1.1 Background

Matimba Power Station, which is located in Limpopo Province, close to Lephalale (formerly known as Ellisras) is a 3990MW installed capacity base load coal fired power station consisting of six generation units. Refer to Figure 1. Ash is generated as a by-product from the combustion of coal in the power station. This ash is currently being disposed of by means of a “dry-ashing” process on Eskom owned land approximately 3km south of the Matimba Power Station. The ash is being transported by means of an overland conveyor belt system. Eskom requires licensing of an additional ash disposal facility for its continuous operation in terms of the National Environmental Management Waste Act (NEMWA, Act 59 of 2008).

Royal HaskoningDHV has been appointed by Eskom Holdings SOC (Ltd) for the Environmental Impact Assessment (EIA) and Waste Management (WML) Licensing Process with an associated Environmental Management Programme (EMPR) for the continuous disposal of ash at the existing Matimba Power Station ash disposal facility or at an alternative site.

As part of the EIA, a noise impact assessment has been undertaken by Jongens Keet Associates (JKA). During the Scoping phase two alternative sites were identified as being possible for the future disposal of the ash. These sites and linear infrastructures route have been evaluated during the EIA phase. This report documents the findings of the noise impact assessment (NIA) of the development. The study was undertaken by Mr Derek Cosijn and Dr Erica Cosijn.

1.2 Terms of Reference

The terms of reference (TOR) are as follows:

i) A sufficiently detailed quantitative (by measurement) and qualitative assessment was to be undertaken within the area of influence of the planned Matimba Power Station Ash disposal facility project in order to enable a full appreciation of the nature, magnitude, extent and implications of the potential noise impact. This includes the areas affected by traffic generated by the power plant.

ii) Two sites were investigated. It is the understanding that either Alternative 1 or Alternative 2 will be used, but not both. Refer to Figure 1. A new proposed route for the overland conveyor to the Alternative 2 site is included in the assessment.

iii) The level of investigation was to be that of an EIA.

iv) All aspects of the investigation were to conform to the requirements of relevant environmental legislation and noise standards.

v) The potential impacts of the pre-construction, construction and operational phases of the project were to be assessed. The assessment was to indicate the potential cumulative impacts (noise impacts in context of the surroundings).

vi) Where relevant, appropriate noise mitigation measures were to be identified.

1.3 Study Area

The core study area of the noise impact assessment is that within the noise area of influence of the two alternative sites for the ash disposal facility as well as the linear infrastructures route towards Site Alternative 2. A larger noise study area extending from line of longitude 27°20'00" in the west to 27°45'00" in the east and line of latitude 23°35'00" in the north to 23°50'00" in the south was investigated. Refer to Figure 1.

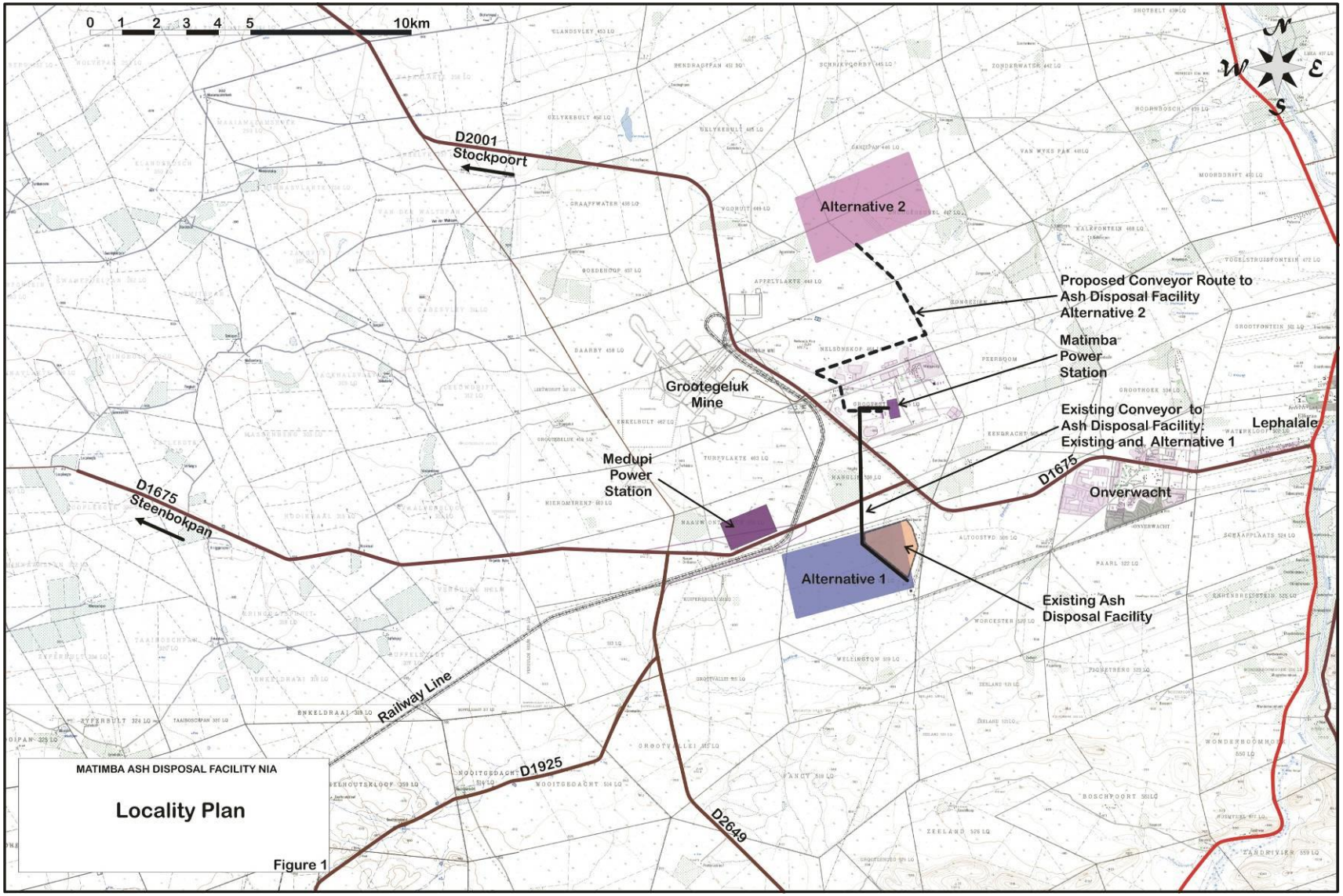

Figure 1 Locality Plan

1.4 The Matimba Power Station Ash Disposal Facility

1.4.1 *The Existing Situation*

Matimba Power Station is a coal fired power station and as such has a residue of ash (approximately 6 million tons of ash is produced annually) which requires to be handled as a waste product. The ash from Matimba Power Station is transported by overland conveyor to a disposal facility site 3km to the south of the power station (refer to Figure 1) where it is disposed of by means of a "dry ashing" process into a structurally sound and environmentally controlled ash disposal facility (dump/pile).

At this facility the moist ash is transferred to and distributed by a track mounted stacker/spreader system that systematically moves along the ash disposal facility building it up in layers until the maximum height is reached. Contaminated run-off and supernatant water from the disposal areas is retained in a return water dam. This water is used for dust suppression.

1.4.2 *The Proposed Ash Disposal Facility*

Matimba Power Station requires the existing ash disposal facilities to be expanded. Two alternatives sites are being considered (refer to Figure 1):

- Alternative 1 – South Facility: This will be an extension of the existing ash disposal facility westwards over Eskom owned land (Farm Zwartwater 507 LQ). It lies approximately 3km south of the Matimba Power Station. The existing overland conveyor system will be used to transport the ash to the disposal facility.
- Alternative 2 – North Facility: This will be a completely new ash disposal facility on portions of the farms Ganzepan 446LQ, Droogeheuvel 447LQ, Appelvlakte 448LQ and Vooruit 449LQ. It lies approximately 3km north of the Matimba Power Station. A new access road and overland conveyor system would need to be installed to transport the ash to this disposal facility.

1.5 Scope and Limitations

Although some of the technical details of the planned project have been determined, not all of the final specific noise characteristics of the various component plant machinery and equipment to be installed have been finalised. These data will only be available at tender stage. Conservative (worst-case scenario) predictions based on equipment baseline noise levels of typical plant that will be installed have therefore been made.

2 DETAILS OF THE STUDY AREA

Only the aspects which have an influence on the potential noise impact are dealt with in this Section.

2.1 Topography

The Waterberg area is mainly flat, with some rolling plains. It is bordered to the south-east by the Waterberg Mountain Range, the most prominent topographical feature in the district, and the Limpopo River to the north-west. There is a gentle fall of the land from east to west across the proposed development sites area towards the Limpopo River.

2.2 Roads

The main roads influencing the Matimba Ash disposal facility study area are (refer to Figure C1 in Appendix C):

i) Road D1675 is a surfaced road aligned in an east-west direction and linking Lephalale to Steenbokpan. It links from Road P84/1 (Route R510) in Lephalale to Road P16/2. The section of the road east of the intersection with Road D2001, namely the section through Onverwacht and Lephalale, is named Nelson Mandela Drive.
ii) Road D2001 is the main access to Matimba Power station from Road D1675 (Nelson Mandela Drive). It is a surfaced road on the section from its intersection with Road D1675 to Matimba Power Station and Grootegeluk Coal Mine. North of the Coal Mine it is a gravel road up to its intersection with Road P84/1 near the Stockpoort border post.
iii) Road D175 is a gravel road aligned in a north-south direction linking from the Stockpoort border post on the Limpopo River to Road P84/1 (Route 510). This road is aligned through Steenbokpan.
iv) Road D2286 is a gravel road linking from Road P16/2 in the west through to Road D175 north of Steenbokpan and that is aligned close to and follows the course of the Limpopo River.
v) Road D1925 is a gravel road that is aligned in a north-south direction through the eastern portion of the study area. It links to Road D2649 just south of Medupi Power Station.
vi) Road D2649 is a gravel road that links from D1675 just east of Medupi Power Station to Road P84/1 (Route R510) approximately 20km south of Lephalale.
vii) Road D2701 is a gravel road aligned in an east-west direction that links from Road P16/2 to Road D1925.

2.3 **Railway Lines**

The only railway line in the area is aligned through the south-eastern sector of the study area, linking from the Grootegeluk Coal Mine southwards to Thabazimbi. Its main use is the export of coal from the mine. There are at present usually two trains per day.

2.4 **Land Use**

The existing land uses in the area are:

i) Residential:
   a) Town of Lephalale (formerly known as Ellisras). The nearest section of the town to the study area namely Onverwacht Township lies approximately 4.5 kilometres to the east of the existing ash disposal facility.
   b) Marapong Township lies 650 metres to the north-east of Matimba Power Station.
   c) Babcock residential area lies 1500 metres to the north-west of Matimba Power Station.
   d) There are numerous farmhouses and farm labourer houses spread throughout the study area.
ii) Educational:
   a) There are several farm schools spread out through the study area.
   b) There are schools in Lephalale but these are too far away from the alternative sites of the ash disposal facility to be affected by the noise generated by this facility.
iii) Industrial:
   a) Matimba Power Station.
   b) Medupi Power station (presently under construction). Expected commissioning date is mid-2014.
   c) There is a small industrial area just to the north of Onverwacht.
iv) Mining: The Grootegeluk Coal Mine, which provides Matimba Power Station and will provide Medupi Power Station with coal, is located just to the west of Matimba Power Station.
v) Agriculture. The main land use in the study area and its environs is cattle and game farming.

vi) Tourism: There are several game lodges in the noise study area. Refer to Appendix D.

2.5 **Noise Sensitive Receptors**

It is the existing residential areas, farm houses, farm labourer dwellings, schools, game farms and game lodges in the study area that may defined as noise sensitive receptors (NSRs). Refer to Figure 2.

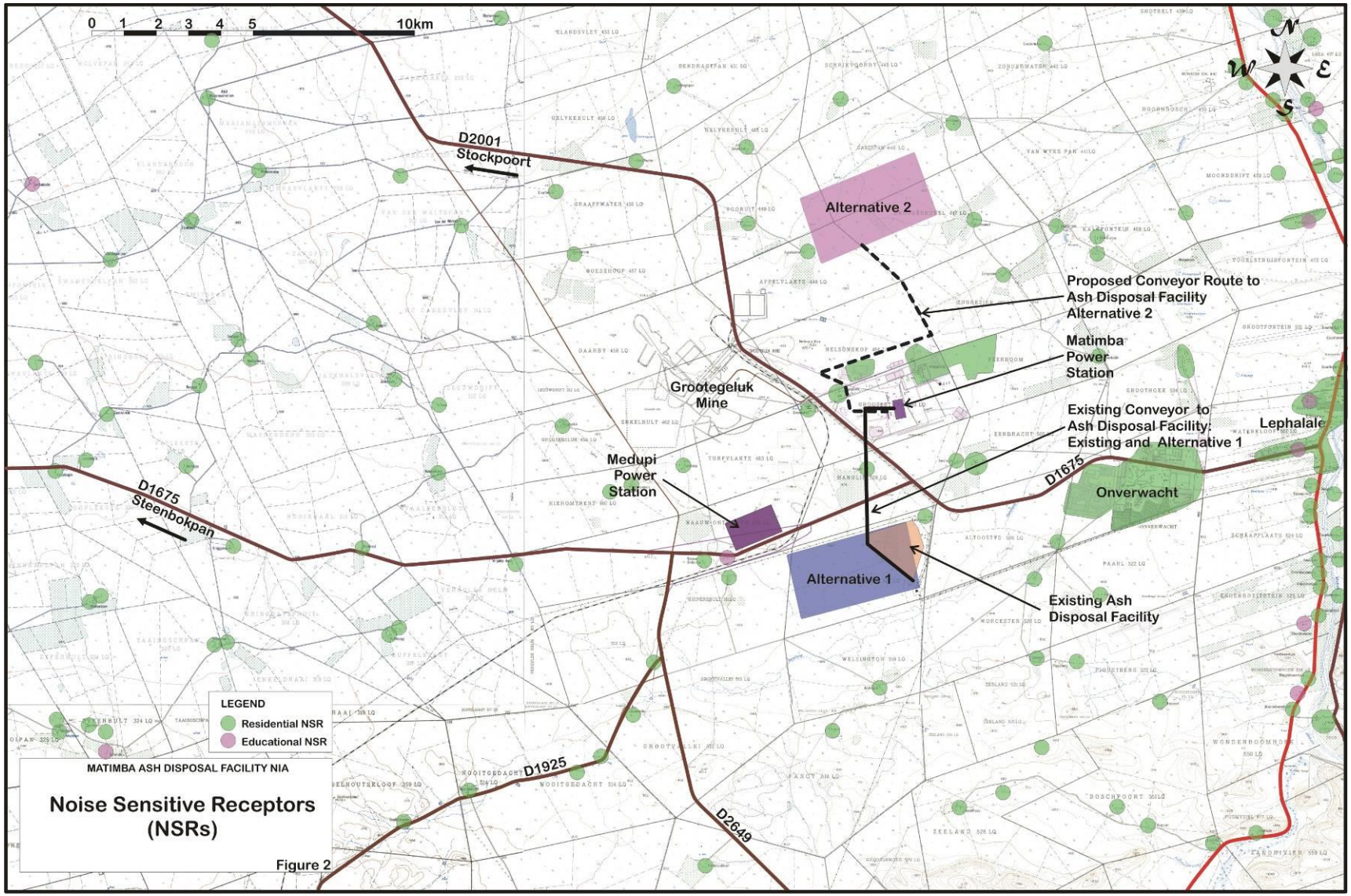

Figure 1: Noise Sensitive Receptors in the study area

For this study, the position of houses/dwellings on the farms was taken off 1:50 000 topographical cadastral maps and verified as far as possible using Google Earth. Even though the latest editions were used, the relevant maps are up to 34 years out of date and there may be new dwellings and/or some of the existing shown buildings may be derelict. During the field survey for the noise measurement survey, such aspects were noted where possible. The following 1:50 000 topographical cadastral maps were used:

- SOUTH AFRICA 1:50 000 Sheet 2327CB, STEENBOKPAN Second Edition 1980.
- SOUTH AFRICA 1:50 000 Sheet 2327DA, ELLISRAS Second Edition 1981 (partially revised from aerial photography in 1990).
- SOUTH AFRICA 1:50 000 Sheet 2327CD, ROOIPAN Second Edition 1980.
- SOUTH AFRICA 1:50 000 Sheet 2327DC, AFGUNS Second Edition 1980.

There is a requirement, because of this uncertainty, that the social impact assessment team and the public participation team verify the details of the indicated potential noise sensitive receptors in their interactions with the landowners.

2.6 Aspects of Acoustical Significance

There are no prominent topographical features in the area that will significantly influence the propagation of the noise from either of the alternative sites of the ash disposal facility.

One of the main meteorological aspects that will affect the transmission (propagation) of the noise is the wind. The wind can result in periodic enhancement downwind or reduction upwind of noise levels. The wind-rose for the Lephalale monitoring station has been used for assessing the wind conditions in the area. Analysis of the wind records for the area indicates that overall (day and night average) the main prevailing winds blow from the northeast (44%). Approximately 27.9% still periods are experienced annually.

Atmospheric temperature inversions also have a significant effect on the noise propagation character of the area. Temperature inversions tend to increase noise levels at some distance from a source. A temperature inversion is formed when air near the ground is cooler than the air above. This occurs mainly at night or to a lesser extent during cloudy days away from large bodies of water. Stable conditions with high humidity and very low velocity wind conditions are necessary. As cool air is denser than warm air, sound rays are refracted towards the cooler air, that is, towards the ground.

3 METHODOLOGY

3.1 General

The general procedure used to determine the noise impact was guided by the requirements of the Code of Practice South African National Standard (SANS) 10328 *Methods for Environmental Noise Impact Assessments.* The level of investigation was the equivalent of an EIA. A comprehensive assessment of all noise impact descriptors (standards) has been undertaken. The noise impact criteria used specifically, take into account those as specified in the SANS 10103 *The Measurement and Rating of Environmental Noise with Respect to Annoyance and Speech Communication* as well as those in the National Noise Control Regulations. The investigation of both the alternative ash disposal facility sites comprised the following:

i) Determination of the existing situation (prior to the development of the ash disposal facility).

ii) Determination of the situation during the construction phase.

iii) Determination of the situation during the operational phase.
iv) Assessment of the change in noise climate and impact.
v) Identification of mitigation measures.
vi) Comparison of the two alternative sites.

3.2 Determination of the Existing Conditions

This phase comprised the following:

i) The relevant technical details of the planned Matimba Power Station Ash disposal facility, the details of similar operating ash disposal facilities, the existing traffic patterns and the existing land use in the study area were reviewed in order to establish a comprehensive understanding of all aspects of the project that will influence the future noise climate in the study area.

ii) Using these data, the limits of the study area of the development site were determined and the potential noise sensitive areas, other major noise sources and potential problems in these areas were identified.

iii) Applicable noise standards were established. The National Noise Control Regulations and the SANS 10103 standards were applied.

iv) The baseline *noise climate* of the study area was determined by means of earlier field inspections and noise measurement surveys, namely during the noise impact assessments of the following projects:

- Matimba B Power Station (Medupi),
- Waterberg Area Power Stations,
- Grootegeluk Coal Mine.

The measurement surveys appropriately covered the whole extent of the study area, focussing specifically on potential noise sensitive/problem areas. Measurements were taken at 13 monitoring sites. The daytime and the night-time conditions were measured. The sound pressure level (SPL) (noise) measurements were taken in accordance with the requirements of the Code of Practice SANS 10103. A Type 1 Integrating Sound Level meter was used for the noise measurements. All measurements were taken under dry weather and normal traffic (that is mid-week/school term) conditions. Refer to Appendix B for details of the noise measurement survey.

v) On the general field inspection and at the same time as each individual measurement was being taken, the qualitative nature of the *noise climate* in the area of the measurement site was assessed and recorded. This comprised an appraisal of the general prevailing acoustic conditions based on the subjective response to the sounds as perceived by the listener (i.e. *auditory observation* by the surveyor), as well as identifying those noise incidents, which influenced the noise meter readings during that measurement period. This procedure is essential in order to ensure that that there is a *human* correlation between the noise as perceived by the human ear and that which is measured by the meter, as well as to establish any anomalies in the general ambient noise conditions.

vi) The existing noise climates along relevant main roads in the area as related to the current traffic volumes and patterns were established. These traffic noise levels were calculated using the South African National Standard SANS 10210 *Calculating and Predicting Road Traffic Noise* for the main roads in the area. The Year 2010 traffic was used as the baseline reference. The calculated 24-hour period noise indicators, as well as those for the daytime period and night-time period provided the main data for the impact assessment were established. The measured data

provided a field check of the calculated acoustic conditions. Refer to Section A2 of Appendix A for details of the noise impact criteria used.

vii) A general analysis of the rail traffic impact was undertaken. Refer to Section B7 in Appendix B for the likely rail traffic noise impact on the study area.

3.3 Assessment of Planning/Design Phase and Construction Phase Impacts

Aspects of the pre-design field surveys and construction activities that potentially will have a noise impact were identified and, where appropriate, mitigation measures have been recommended. The construction phase deals with construction and installation of the overland conveyor system to the new disposal facility, the return water dam, access roads, the pump station and the return-water pipeline from the ash disposal facility. The Alternative 2 Site will need the new infrastructure whereas the Alternative 1 Site already has this infrastructure in place.

3.4 Assessment of Operational Phase Impacts

The main focus of the operational phase assessment was to establish the nature, magnitude and extent of the potential change in *noise climate* in the study area directly related to and within the area of influence of the development site. The modelling of the noise propagation from a multi-noise source site such as the ash disposal facility is extremely complex and requires the careful consideration and input of many diverse parameters. The likely noise that will be generated by the operations was established and this was used to determine the noise profile (footprint) of impact.

The combined level of the noise from all these elements was calculated at various distances from the source noises by means of a propagation model in order to establish the noise contours. The model used was based on SANS 10357:2004, *The Calculation of Sound Propagation by the Concawe Method*. Note that the noise descriptor being calculated is the equivalent continuous A-weighted sound pressure level (ambient noise level) determined for the average condition. The following was taken into account:

i) The determination of the correction for atmospheric absorption which is representative of an average condition is complex as the interaction of the variables of atmospheric pressure, temperature, and humidity especially when related to the changes over a 24-hour cycle and a yearly cycle need to be considered. The correction also has to be related to various frequencies of the sound spectrum.

ii) Correction for the effect of ground surface, that is, the attenuating effect of vegetation.

iii) The determination of the correction for meteorological effects which is representative of an average condition is complex as the interaction of the variables of wind speed, incident solar radiation, time of day and cloud cover especially when related to the changes over a 24-hour cycle and a yearly cycle need to be considered. Conditions for both high wind and temperature inversion were checked.

iv) The effect of the topography of the core study area was reviewed.

v) With regard to the analysis, the ambient noise climates (noise profiles) that will be generated by virtually continuous operations at the ash disposal facility will be predicted. These will be for the unmitigated conditions.

vi) The noise footprint that will be calculated will be for the operations over the full period for the ash disposal facility. It is the ***total*** noise envelope covering the noise generated by the entire facility for ***all situations over the full operational phase of the facility***. It will indicate the worst situation that could occur at any specific receiver point. It is for this reason as well as the very conservative (i.e. worst meteorological conditions, hard ground, no barriers, etc) approach to the

analysis that the cumulative effects with any of the other noise zones of the ash disposal facility will not be plotted. If problems are anticipated at any one noise sensitive site then a more detailed analysis of that specific site will need to be undertaken.

vii) The ash disposal facility operations will not extend at one time over the whole area of the planned facility, but the area will be worked incrementally. This will mean that there will not be a static noise footprint from the operations, as say with a fixed feature such as a crusher. As well as moving in plan, the noise levels from the respective sections being worked will also vary (increase) as the height of the ash dump/pile increases. The given noise footprint thus calculated for the ash disposal facility operations is rather the total "noise envelope" covering all situations over the full operational period. It indicates the worst situation that could occur at any specific receiver point from the ashing operations over the lifetime of the facility.

viii) The noise generated by the overland conveyor system will be a linear source of noise. The areas between drive houses will have a relatively low noise profile, while the areas surrounding the drive houses will be fairly loud nodal noise sources.

3.5 Method of Assessing the Significance of Impact

This section outlines the method that has been used for assessing the significance of the potential environmental impacts. This procedure was provided by Royal HaskoningDHV.

The potential environmental impacts associated with the project will be evaluated according to it 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 1: ASSESSMENT CRITERIA FOR THE EVALUATION OF IMPACTS

CRITERIA	CATEGORY	DESCRIPTION
Extent	**National (4)**	The whole of South Africa
	Regional (3)	Provincial and parts of neighboring provinces
	Local (2)	Within a radius of 2 km of the construction site
	Site (1)	Within the construction site
Duration	**Permanent (4)**	Mitigation either by man o natural process will not occur in such a way or such a time-span that the impact can be considered transient
	Long Term (3)	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 (2)	The impact will last for the period of the construction phase, where after will be entirely negated.
	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
Intensity	**Very High (4)**	Natural, cultural and social functions and processes are altered to the extent that they permanently cease
	High (3)	Natural, cultural and social functions and processes are altered to the extent that the temporarily cease
	Moderate (2)	Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way
	Low (1)	Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected
Probability of Occurrence	**Definite (4)**	Impact will certainly occur
	Highly Probable (3)	Most likely that the impact will occur
	Possible (2)	The impact may occur
	Improbable (1)	Likelihood of the impact materializing is very low

Significance is determined through a synthesis of impact characteristics. Significance is 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.

This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person

making the judgement. For this reason, impacts of especially a social nature need to reflect the values of the affected society.

TABLE 2: THE SIGNIFICANCE RATING SCALE

Low impact (4 - 6 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 (7 - 9 points)	Mitigation is possible with additional design and construction inputs.
High impact (10 - 12 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.
Very high impact (13 - 16 points)	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.

4 FINDINGS AND ASSESSMENT OF IMPACT: GENERAL

The following conditions were observed in the study area and the following aspects were determined from the surveys, calculations of noise indicators and the predictive modelling undertaken for the assessment of the noise impact of the proposed ash disposal facility.

4.1 General Details

General aspects of note were as follows:

i) The main sources of noise in the area are from traffic on the main roads, Matimba Power Station, power station infrastructure remote from the facility (inclusive of the overland conveyor system and the activities at the ash disposal facility), Medupi Power Station (still under construction) and Grootegeluk Coal Mine. These noise sources are significant contributors to a degraded noise climate.

ii) The main noise sensitive receptors in the area are (refer also to Figure 2 and Section 2.6):

- Residential:
  - Town of Lephalale (formerly known as Ellisras). The nearest section of the town to the study area namely Onverwacht Township lies approximately 4.5 kilometres to the east of the existing ash disposal facility.
  - Marapong Township lies 650 metres to the north-east of Matimba Power Station.
  - Babcock residential area lies 1500 metres to the north-west of Matimba Power Station.
  - There are numerous farmhouses and farm labourer houses spread throughout the study area.
- Educational:
  - There are several farm schools spread out through the study area.
  - There are schools in Lephalale but these are too far away from the alternative sites of the ash disposal facility to be affected by the noise generated by this facility.

4.2 The Residual (Existing Ambient) Noise Climate

Measurements and *auditory observations* were taken at 13 main sites in order to establish the ambient noise conditions of the study area. For a detailed description of the main measurement sites and for more technical details of the measurement survey refer to Appendix B. Refer also to Figure B1 in Appendix B.

4.2.1 *Road Traffic Noise*

In order to complement the short-term noise measurements in the study area, the existing 24-hour residual noise levels related to the average daily traffic (ADT) flows on the main roads were also calculated. The noise levels at various offsets from the centreline of these roads are shown in Table 3. Refer to Table B2 in Appendix B for details.

TABLE 3: DEGRADED NOISE CLIMATE ALONGSIDE MAIN ROADS (L_{dn})

Road	Noise Levels Alongside Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA)											
	50m Offset			100m Offset			200m Offset			500m Offset		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
N Mandela Dr Ext	58.4	47.5	58.1	55.4	44.5	55.1	52.4	41.5	52.1	48.4	37.5	48.1
Sterkpoort Road	58.4	47.5	58.1	55.4	44.5	55.1	52.4	41.5	52.1	48.4	37.5	48.1
Steenbokpan Rd	47.7	34.7	46.9	44.7	31.7	43.9	41.7	28.7	40.9	37.7	24.7	36.9

4.2.2 *Rail Traffic Noise*

There is one railway line in the study area, namely that for the coal haul trains from the Grootegeluk Coal Mine to Thabazimbi. There are at present 2 trains per day. Noise from the pass-by of this type of train (drawn by diesel locomotives) peaks in the vicinity of 92dBA at a 30 metre offset from the track. Refer to Appendix B (Section B7) for details.

4.2.3 *Summary of Baseline Noise Climate*

In overview, the baseline situation with respect to the *noise climates* in the study area and the changes up to the present date (2013) was found to be as follows:

i) The areas relatively far from the main roads, Matimba Power Station, the Medupi Power Station construction activities and the Grootegeluk Coal Mine are generally very quiet. Most of the area has a typical rural *noise climate*.

ii) The main sources of noise in the area are from traffic on the main roads, Matimba Power Station, power station infrastructure remote from the facility (inclusive of the overland conveyor system and the activities at the ash disposal facility), Medupi Power Station (still under construction) and Grootegeluk Coal Mine. These noise sources are significant contributors to a degraded noise climate.

iii) With regard to traffic noise from Nelson Mandela Drive, existing residences in the residential areas of Lephalale (Ellisras) and Onverwacht, up to approximately a 500 metre offset from the road, are impacted (night-time conditions). In these areas the noise levels exceed acceptable suburban residential living conditions as specified in SANS 10103. Ideally the ambient noise level

should not exceed 50dBA during the daytime period (06h00 to 22h00) and 40dBA during the night-time period (22h00 to 06h00). Refer to the SANS 10103 standards as given in Appendix A.

iv) Ambient noise levels due to traffic in the areas along Steenbokpan Road (D1675) are not high and impact is not significant.

i) Noise levels from Matimba Power Station adversely affect the daytime noise climate at any residences in the surrounding area for up to a distance of 3000 metres around the facility base on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 6500 metres. Refer to Figure B2.

v) At present, Medupi Power Station is under construction. The predicted noise footprint when the power station is commissioned is estimated to adversely affect the daytime noise climate at any residences in the surrounding area for up to a distance of 4700 metres around the facility based on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 9500 metres. Refer to Figure B3. There will be cumulative effects between the noise from the Matimba and Medupi Power Stations that will enlarge the individual noise footprints of these two sources of noise.

vi) There are also noise sources from Matimba Power Station equipment at locations remote from the power station as well as other isolated (or infrequent) noise sources such as:

- The coal overland conveyor from the Grootegeluk Coal Mine to the power station
- The overland conveyor belt transporting the ash residue from Matimba power station to the existing ash disposal facility.
- Operations at the ash disposal facility that include the dumping and spreading of the ash, and the rehabilitation of the dump. The 35dBA noise contour of the ash disposal facility operations is presently positioned at an offset of 3250 metres from the dump. Refer to Figure B2.
- The sewage works serving the power station, which is located 3 kilometres to the north of the power station.

vii) The noise profile of Grootegeluk Coal Mine, which is a major source of noise in the area, is shown in Figure B4.

viii) The outer limit of influence (negative impact) of the Matimba Power Station, the Medupi Power Station (once commissioned) and the Grootegeluk Colliery Complex is shown in Figure B5. This shows the combined (not cumulative) 35dBA contour of these sources of noise.

ix) An intermittent source of noise is the coal haul trains on the railway line from the colliery to Thabazimbi. There are at present two trains per day.

5 NOISE STANDARDS/IMPACT CRITERIA

From these findings and observations it was considered appropriate to apply the following noise standards and impact criteria to the study area:

i) **Suburban residential**: the noise impact on the residences in Babcock, Marapong, Lephalale and Onverwacht should be determined on the basis of suburban residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 50dBA and that for the night-time period should not exceed 40dBA.

ii) **Rural residential**: the noise impact on the residences on farms in the area should be determined on the basis of rural residential district standards (SANS 10103), namely the daytime period ambient noise level should not exceed 45dBA and that for the night-time period should not exceed 35dBA. Measured levels indicate that parts of the (rural) study area are already severely degraded close to the main sources of noise.

iii) **Educational**: Noise levels at the schools should not exceed 50dBA (outdoor condition) with the provision that indoor classroom conditions do not exceed 40dBA.

The above indicates the ideal situation, where noise sensitive receptors are not already degraded by the existing (residual) noise climate. However, it is likely that the residual noise level at some of the noise sensitive receptors already exceeds the recommended maximum (e.g. next to major roads). In order to assess the actual noise impact at any particular site, therefore, the residual noise climate has to be taken into account when determining impact. Where the noise level for a particular site is presently lower than the maximum ambient allowed (as indicated in SANS 10103) the recommended maximum shall not be exceeded by the introduction of the intruding noise. Where the noise level for the site is presently at or exceeds the maximum level allowed, the existing level shall not be increased by more than that indicated as acceptable in SANS 10103 (refer to Table A3 in Appendix A).

6 FINDINGS AND ASSESSMENT OF THE PRE-CONSTRUCTION PHASE

Activities during the planning and design phase that normally have possible noise impact implications are those related to field surveys (such as investigation of founding conditions for large plant/equipment). As these activities are usually of short duration and take place during the day, generally they are unlikely to cause any major noise disturbance or nuisance in adjacent areas. It is assumed that the equipment is maintained in good order.

7 FINDINGS AND ASSESSMENT OF THE CONSTRUCTION PHASE

7.1 General

The potential noise climate was established in general for the construction of the infrastructure for transporting the ash, namely the overland conveyor system and the return water system. Construction camps (offices / lay down areas) are planned for on site.

Although not all the layout details have been finalised, general concepts have been used in the noise impact evaluation. These are adequate to provide a sound basis for the analysis of typical noise conditions and impacts that are likely to prevail on the project. Data related to construction have been sourced from various consultants, equipment manufacturers and contractors, British Standard BS 5228 and the experience that JKA has had working on similar sites.

The daily construction related traffic will vary over the period of the construction. It has been estimated that the construction activities at the site will on average generate no more than about 240 vehicle trips (two way trips) daily. The main percentage of the trips will be concentrated in the morning and evening peak periods.

7.2 Construction Noise Conditions

Construction will likely be carried out during the daytime only (07h00 to 18h00 or 20h00). It should however be noted that certain activities may occasionally extend into the late evening period, while others such as de-watering operations may need to take place over a 24-hour period. It is estimated that the basic development of the project will take place over a period of about 12 months.

It should be noted that if Alternative 1 is chosen, it may not be necessary to construct an overland conveyor and access roads, as the existing infrastructure will be used.

7.2.1 *Sources of Noise*

The following, where relevant, are likely to be the main construction related sources of noise for the project:

i) Construction camp establishment.
ii) The possible removal and demolition of existing infrastructure that is no longer needed or needs to be replaced.
iii) Earthworks to remove topsoil where relevant at the ash disposal facility site.
iv) Activities related to the relocation of services.
v) Excavation of building foundations and pipeline trenches. Blasting may be required in places but in general pneumatic breakers will be used where rock is encountered.
vi) Erection of shuttering for concrete works.
vii) Fixing of steel reinforcing.
viii) Placing and vibration of concrete. Poker vibrators will be used.
ix) Stripping of shuttering after concrete pour.
x) Erection of structural steelwork (overland conveyors).
xi) Finishing operations. Cladding, services installation, etc.
xii) Installation of overland conveyor and other plant and equipment.
xiii) General movement of heavy vehicles such as concrete delivery vehicles, mobile cranes, mechanical dumpers and water trucks (dust suppression) around the site.
xiv) De-watering pumps. A 24-hour operation may sometimes be necessary.
xv) Road construction equipment. Scrapers, dozers, compactors, etc. (Construction of the access roads).
xvi) Construction site fabrication workshops and plant maintenance workshops.
xvii) Concrete batching plant may be required.
xviii) Construction material and equipment delivery vehicles.

The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site. Typical noise levels generated by various types of construction equipment are given in Table 4. These noise levels assume that the equipment is maintained in good order. Conservative attenuation conditions (related to intervening ground conditions and screening) have been applied.

TABLE 4: TYPICAL NOISE LEVELS GENERATED BY CONSTRUCTION EQUIPMENT

Plant/Equipment	Typical Operational Noise Level at Given Offset (dBA)							
	5m	10m	25m	50m	100m	250m	500m	1000m
Air compressor	91	85	77	71	65	57	51	46
Compactor	92	86	78	72	66	58	52	46
Concrete mixer	95	89	81	75	69	61	55	49
Concrete vibrator	86	80	72	66	60	52	46	40
Mobile Conveyor belt	77	71	63	57	51	43	37	32
Crusher (aggregate)	90	84	76	70	64	56	50	44
Crane (mobile)	93	87	79	73	67	59	53	47
Dozer	95	89	81	75	69	61	55	49
Loader	95	89	81	75	69	61	55	49
Mechanical shovel	98	92	84	78	72	64	58	52
Pile driver	110	104	97	91	85	77	71	65
Pump	86	80	72	66	60	52	46	40
Pneumatic breaker	98	92	84	78	72	64	58	52
Rock drill	108	102	94	88	82	74	68	62
Roller	84	78	70	64	58	50	44	38
Trucks	87	81	73	67	64	60	57	54

Exact daytime period and night-time period continuous equivalent sound pressure levels are not possible to calculate with certainty at this stage as the final construction site layout, work programme for the various components, work *modus operandi* and type of equipment have not been finalised. Using baseline data from typical construction sites, the ambient noise conditions at various offsets from the following main construction activities are predicted (refer to Table 5):

- Noise from concrete batching plant (if required).
- General concrete construction.

TABLE 5: PREDICTED AMBIENT NOISE LEVELS AT GIVEN OFFSETS FROM SOME SPECIFIC CONSTRUCTION ACTIVITIES

Equipment	Sound pressure level at given offset(dBA)					
	500m	1000m	1500m	2000m	2500m	3000m
Concrete Batching Plant	53.6	46.0	41.1	37.5	34.7	32.3
Concreting Operations	57.2	49.1	43.9	40.1	37.1	34.6

7.2.2 ***Noise Impact***

The general nature of the noise impacts from the construction sites is predicted to be as follows:

i) Source noise levels from many of the construction activities will be high. Noise levels from all work areas will vary constantly and in many instances significantly over short periods during any day working period.

ii) Working on a worst case scenario basis, it is estimated that the ambient noise level from general construction activities could negatively affect noise sensitive sites within a distance of 1400 metres of the construction site. Note that this is the offset of the 45dBA noise contour from the construction. Refer to Table 4.

iii) Night-time construction could have a significant impact on noise sensitive sites within a radius of 3000 metres of the construction site.

iv) There are some short-term noises that may, at times, be heard beyond the indicated positions of the respective 35dBA contours, for example blasting. There are likely to be some significant noise nuisance effects from these intermittent loud noises on some people living in the area.

v) It has been estimated that the construction activities will on average generate about 240 vehicle trips (two way trips) daily. The main percentage of the trips will be concentrated in the morning and evening peak periods. In general, the construction traffic will have a relatively minor effect on the noise climate alongside the main external roads in the area. Because of the character of the traffic (namely heavy vehicles), there is likely to be some noise nuisance factor with the passing of each vehicle at noise sensitive receptors along the access routes.

vi) There are a number of noise sensitive receptors in the vicinity of the two alternative development sites that are likely to be affected by construction noise. The nature of the impact will be related to more to noise nuisance (annoyance) than to noise disturbance.

The general nature of the noise impacts from road construction (access roads) activities is predicted to be as follows:

i) The level and character of the construction noise will be highly variable as different activities with different plant/equipment take place at different times, over different periods, in different combinations, in different sequences and on different parts of the construction site.

ii) As no specific construction details or possible locations of major ancillary activity sites are available at this stage, the anticipated noise from various types of construction activities cannot be calculated accurately. In general at this stage, it can be said that the typical noise levels of construction equipment at a distance of 15 metres lie in the range of 75 decibels (dBA) to 100dBA (refer also to Table 3). Based on data from similar “linear” construction sites, a one-hour equivalent noise level of between 75dBA and 78dBA at a point 50 metres from the construction would be typical for the earthmoving phase.

iii) There are noise sensitive receptors in the vicinity of the two development sites that are likely to be affected by noise from the road construction.

It should be noted that higher ambient noise levels than recommended in SANS 10103 are normally accepted at the noise sensitive receptors as being reasonable during the construction period, provided that the very noisy construction activities (refer to Table 5) are limited to the daytime and that the contractor takes reasonable measures to limit noise from the work site. Note that it has been assumed that construction will generally take place from 06h00 to 18h00 with no activities (or at least no noisy construction activities) at night. From the details presently available, it appears that the construction noise

impact is not likely to be severe if good noise management procedures are applied on site and various mitigation measures implemented. Refer to Section 5.

8 FINDINGS AND ASSESSMENT OF THE OPERATIONAL PHASE

8.1 Sources of Noise

The main sources of background noise in the area will continue to be from:

i) Traffic on the main roads.
ii) Medupi Power Station.
iii) Matimba Power Station.
iv) Grootegeluk Coal Mine.
v) Linear infrastructure such as overland conveyors.
vi) General farming activities (not a major source of noise).

In general, it is not anticipated that the noise levels from these existing sources will increase significantly in the future, with the exception of road traffic noise and Medupi Power Station which is to be commissioned in mid-2014.

The noise generated by the new ash disposal facility and its ancillary works (including the overland conveyor) will be added to the noise climate prevailing in the area.

8.2 Noise Sensitive Areas

The existing noise sensitive receptors, which are likely or could possibly be impacted by some or all elements of the proposed ash disposal facility operations, are (refer to Figure 2 and Section 2.6):

- Various suburban and rural residences.
- Various schools in the study area.

8.3 General

For practical purposes of analysis, the project required to be subdivided into discrete noise zones, namely the two alternatives sites for the ash disposal facility, ash transportation and return water modes/routes.

i) Ash Disposal: The noise impact analysis of the ash disposal facility is described in Section 8.4.
ii) Transportation of Ash: The noise impact analysis of the transportation methods and routes is described in Section 8.5.
iii) Return Water: Refer to Section 8.6.

Each of the noise zones is subsequently analysed in more detail. All the calculated noise profiles as shown in Figure 3 (both alternatives are plotted on the same plan) and in Tables 6 to 8 reflect a worst condition scenario (conservative) approach. The noise levels given are for unmitigated conditions. In reality there will be greater attenuation with distance than shown where there are houses, other buildings, vegetation and terrain restraints in the intervening ground between the source and the receiver point.

The method of ash disposal is summarised in Table 6. The sources of noise are highlighted and the relevant sections further in the report are referenced.

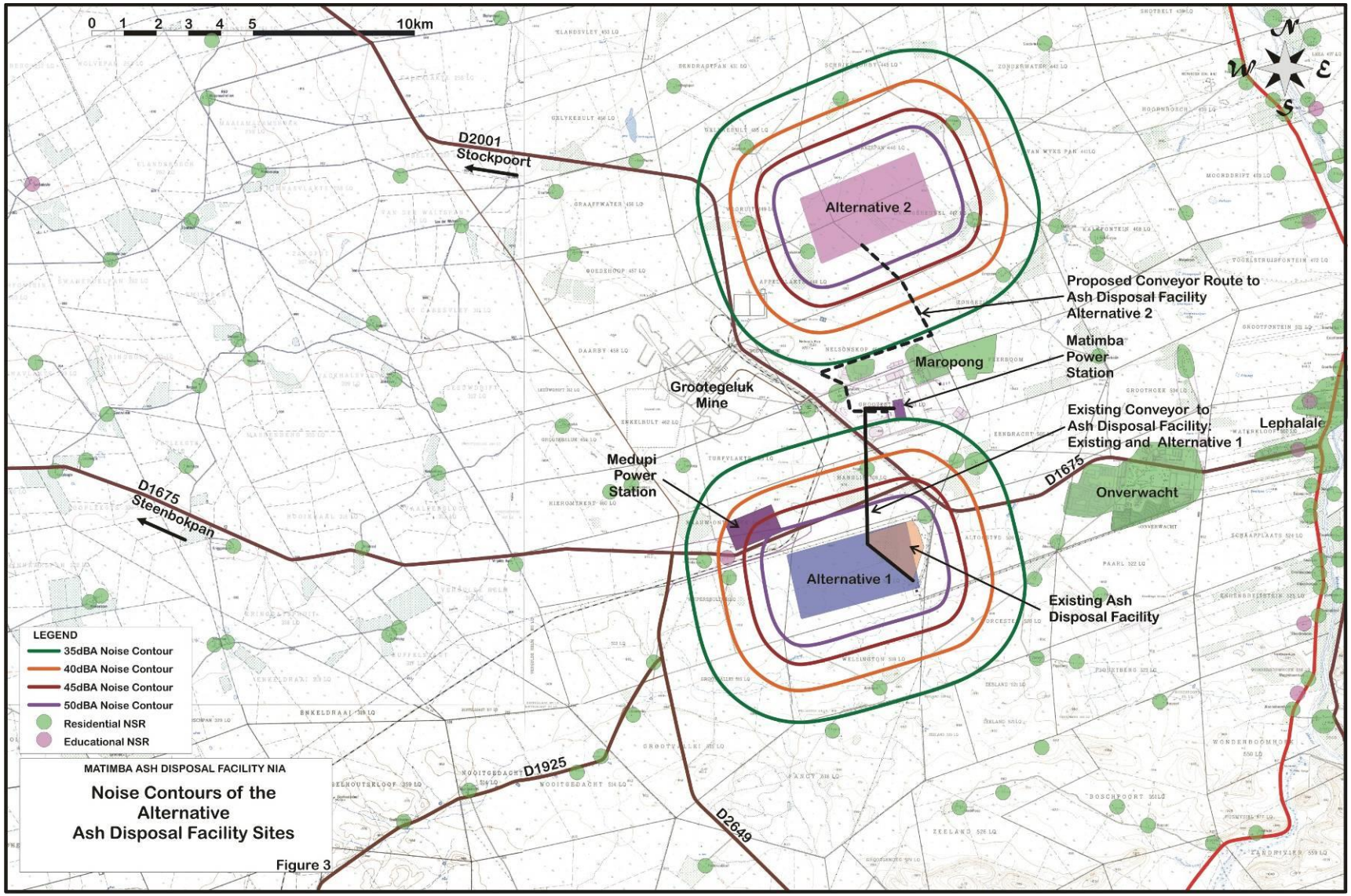

Figure 2: Noise Contours of the Alternative Ash Disposal Facility Sites

TABLE 6: SUMMARY OF NOISE RELATED DETAILS OF THE ASH DISPOSAL METHOD

Element of system	Description of element	Comments	Reference section
Ash loading bay	Ash loaded on to overland conveyor at power station	Noise from loading operation contained within the confines of the power station property. No additional noise impact expected.	
Conveyor system	Overland conveyor from power station to ash disposal facility. There are several conveyor belt drive houses (motors) on route to ash disposal facility	Main noise will be from conveyor drive houses. Noise from conveyor itself will be minor.	Tables 8 & 9 Section 8.4.2
Ash dump	Ash is distributed by a track mounted stacker that systematically moves along the ash dump building in layers until the maximum height is reached.	Noise sources are from conveyor drive house, stacker/spreader, front end loader, dozer and compactor	Section 8.4.1 Figure 3 Table 7
Return water dam		No noise associated with drainage of leachate from ash dump to return water dam	
Return water pumps	Pump system to recycle leachate for dust suppression and irrigation	Pump system located on return water dam. Pumps will be the main source of noise.	Section 8.5
Return water pipeline	Underground pipeline reticulation	No noise from pipeline during operational phase.	

8.4 **Ash Disposal**

Two alternatives sites are being considered (refer to Figure 1):

- Alternative 1 – South Facility: This will be an extension of the existing ash disposal facility westwards over Eskom owned land (Farm Zwartwater 507 LQ). It lies approximately 3km south of the Matimba Power Station.
- Alternative 2 – North Facility: This will be a completely new disposal facility on portions of the farms Ganzepan 446LQ, Droogeheuvel 447LQ, Appelvlakte 448LQ and Vooruit 449LQ. It lies approximately 3km north of the Matimba Power Station.

The ash disposal facility construction operations will not extend at one time over the whole site area, but the area will be worked incrementally. This will mean that there will not be a static noise footprint from the facility. As well as moving in plan, the noise levels from the respective sections being worked will also vary as the height of the disposal increases. As the height of the disposal increases, the overall noise footprint will increase, but at the same time, the noise sensitive sites closer to the disposal will be shielded from the noise. This is due to the shielding effect of the sides of the ash disposal.

The noise footprint shown is for the operations over the full period that the ash disposal facility will be worked. It is the ***total*** noise envelope covering the noise generated by the entire facility for ***all situations over the full operational phase of the ash disposal facility.*** It indicates the worst situation that could occur at any specific receiver point. It is for this reason as well as the very conservative (i.e. worst meteorological conditions, hard ground, no barriers, etc) approach to the analysis that the cumulative effects with any of the other noise zones of the ash disposal facility are not plotted. If problems are anticipated at any one noise sensitive site then a more detailed analysis of that specific site will need to be undertaken.

8.4.1 *Ash disposal facility Operations*

Noise from the ash disposal facility process is virtually continuous. The main sources of noise from the process will be from the following plant/equipment (refer also to Figure 3 and Table 7):

- Excavators, Front-end loaders and dozers
- Compactor
- Spreader
- Conveyor Drive house

TABLE 7: PREDICTED AMBIENT NOISE CONDITIONS FROM OPERATIONS AT THE MATIMBA POWER STATION PROPOSED ASH DISPOSAL FACILITY - UNMITIGATED

Time Period	Sound pressure level at given offset (dBA)						
	500m	1000m	1500m	2000m	2500m	3000m	3500m
Daytime $L_{Req,d}$ (06h00-22h00)	53.9	46.9	42.5	39.3	36.6	34.4	32.4
Night $L_{Req,n}$ (22h00-06h00)	53.9	46.9	42.5	39.3	36.6	34.4	32.4

8.4.2 *Transportation of Ash*

The ash will be transported by overland conveyor from the power station to the relevant facility. The noise profile of a conveyor drive house is given in Table 8, and that of an intermediate section (between drive houses) is given in Table 9. The overland conveyor to the ash disposal facility Alternative 1 is an existing facility and as such is part of the existing noise climate. The planned overland conveyor to the Alternative 2 Site will introduce a new source of noise into the area.

TABLE 8: PREDICTED AMBIENT NOISE CONDITIONS FROM OVERLAND CONVEYOR SYSTEM DRIVE HOUSE (UNMITIGATED)

Time Period	Sound pressure level at given offset (dBA)				
	500m	700m	1000m	1500m	2000m
Daytime (06h00 – 22h00) $L_{Req,d}$	48.3	45.0	41.4	37.0	33.6
Night-time (22h00 – 06h00) $L_{Req,n}$	48.3	45.0	41.4	37.0	33.6

TABLE 9: PREDICTED AMBIENT NOISE CONDITIONS FROM OVERLAND CONVEYOR BELT (BETWEEN DRIVE HOUSES) (UNMITIGATED)

Time Period	Sound pressure level at given offset (dBA)							
	10m	20m	30m	40m	50m	100m	150m	200m
Daytime (06h00 – 22h00) $L_{Req,d}$	60.1	54.1	50.5	48.0	46.0	39.9	36.2	33.6
Night-time (22h00 – 06h00) $L_{Req,n}$	60.1	54.1	50.5	48.0	46.0	39.9	36.2	33.6

8.5 **Return water dams**

A return water dam is one of the components of the ash disposal facility operation. Seepage water from the ash disposal facility is stored in a dam and is pumped back to various parts of the site for dust suppression. The main source of virtually continuous noise from the return water dam complex will be from the pumps. The noise footprint of the pump station is relatively small when compared to the noise generated by the stacking of the ash piles (refer to Table 10); that is the pump station 35dBA footprint is contained within the 45dBA footprint of the ash disposal facility. For the underground return pipeline, no noise will be generated above surface.

TABLE 10: PREDICTED AMBIENT NOISE CONDITIONS FROM PUMPS AT THE MATIMBA POWER STATION ASH DISPOSAL FACILITY (RETURN WATER DAMS - UNMITIGATED)

Time Period	Sound pressure level at given offset (dBA)						
	100m	200m	300m	400m	500m	550m	600m
Daytime $L_{Req,d}$ (06h00-22h00)	51.4	45.0	41.1	38.3	36.1	35.0	34.2
Night $L_{Req,n}$ (22h00-06h00)	51.4	45.0	41.1	38.3	36.1	35.0	34.2

8.6 **Analysis of the Operational Phase**

The development of a new ash disposal facility will not introduce a major noise impact factor into the area, the Alternative 1 site being less affected than the Alternative 2 site. Alternative 1 will have no significant impact on the area as the existing noise climate is already degraded by the noise from the Power Stations (Matimba and Medupi) and the Grootegeluk Mine. A portion of the 35dBA Noise Contour of Alternative 2 falls partly outside the existing noise footprint of the Matimba Power Station, Medupi Power Station and Grootegeluk Coal Mine Complex and will therefore extend the existing 35dBA baseline noise contour 3250 metres to the north of the Alternative 2 site. Refer to Figure 4.

The proposed conveyor belt to the Alternative 2 site, will not affect the overall noise footprint as indicated in Figure 4. It should, however, be noted that part of the conveyor route just west of the Matimba power station runs parallel to two other (existing) conveyor lines for a short distance and thus there will be cumulative effects on the Babcock residential area, but these should not exceed 3dBA.

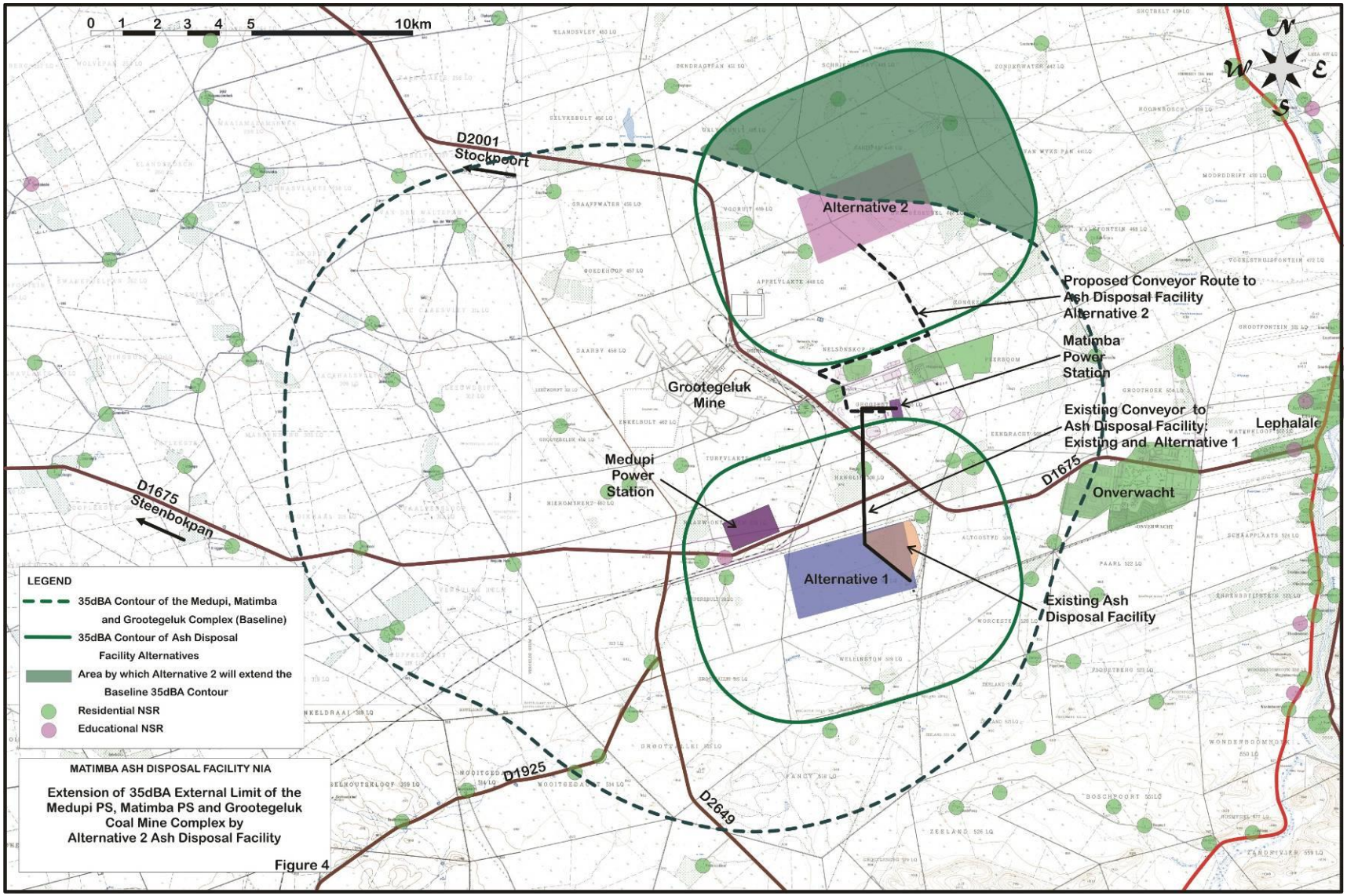

Figure 4: Extension of the External Limit of the Medupi PS, Matimba PS and Grootegeluk Coal Mine Complex by Alternative 2 Ash Disposal Facility

9 FINDINGS AND ASSESSMENT OF THE DECOMMISSIONING PHASE

The situation will be similar to aspects that occur in the construction phase. The dismantling of the conveyor systems and revegetation of the disposal will require the use of similar equipment as those during construction.

10 RISK RATING

Based on the procedure described in Section 3.5, the risk rating regarding environmental noise is as shown in Tables 11-13.

TABLE 11: NOISE IMPACT RISK ASSESSMENT FOR THE MATIMBA POWER STATION ASH DISPOSAL FACILITY PROJECT – CONSTRUCTION PHASE

Criteria	Impact			
	Alternative 1		Alternative 2	
	Unmitigated	Mitigated	Unmitigated	Mitigated
Extent	2	2	2	2
Duration	2	2	2	2
Intensity	1	1	1	1
Probability	2	2	2	2
Significance	7 - Medium	7 - Medium	7 - Medium	7 - Medium

TABLE 12: NOISE IMPACT RISK ASSESSMENT FOR THE MATIMBA POWER STATION ASH DISPOSAL FACILITY PROJECT – OPERATIONAL PHASE

Criteria	Impact			
	Alternative 1		Alternative 2	
	Unmitigated	Mitigated	Unmitigated	Mitigated
Extent	2.5	2.5	2.5	2.5
Duration	3	3	3	3
Intensity	2	2	2	2
Probability	3	3	3	3
Significance	10.5 - High	10.5 - High	10.5 - High	10.5 - High

TABLE 13: NOISE IMPACT RISK ASSESSMENT FOR THE MATIMBA POWER STATION ASH DISPOSAL FACILITY PROJECT – DECOMMISSIONING PHASE

Criteria	Impact			
	Alternative 1		Alternative 2	
	Unmitigated	Mitigated	Unmitigated	Mitigated
Extent	2	2	2	2
Duration	2	2	2	2
Intensity	1	1	1	1
Probability	2	2	2	2
Significance	7 - Medium	7 - Medium	7 - Medium	7 - Medium

The risk rating methodology is too general and thus, according to the criteria specified, the risk is rated to be the same for both alternative sites. Therefore, a more robust scale for comparison was considered necessary.

A five point rating system (positive rating) was applied to various noise aspects in order to compare the two alternative sites:

- 1 = not suitable for development (Impact of very high significance – negative).
- 2 = not preferred (Impact of high significance – negative).
- 3 = acceptable (Impact of moderate significance – negative).
- 4 = preferred (Impact of low or negligible significance – negative).
- 5 = ideal for development or positive impact.

The details of the rating analysis of the two alternatives are summarised in Table 14.

TABLE 14: RATING COMPARISON OF THE TWO ALTERNATIVE DEVELOPMENT SITES FOR THE MATIMBA POWER STATION ASH DISPOSAL FACILITY

Aspect for Rating	Rating for Alternative	
	Alternative 1	**Alternative 2**
Acceptability of site for project in relation to existing noise climate	4	3
Acceptability of site for project in relation to existing land use	5	3
Impact of construction noise	3	3
Impact of construction traffic along access road	3	3
Operational phase: impact on surrounding noise sensitive sites	3	3
General impact of operational phase traffic	4	4
Impact of conveyor routes	4	3
Impact on Marapong	4	4
Impact on Babcock residential	4	2
Impact on Onverwacht and Lephalale	4	4
Impact on rural farming areas	4	2
Expands the Matimba PS/Medupi PS/Grootegeluk 35dBA envelope	5	2
Total	47	36

The analysis indicates that, on the basis of noise, the better site for development of the additional ash disposal facility is Alternative 1. From a qualitative perspective the differences of each Aspect are marginal.

11 MITIGATION MEASURES

Potential noise mitigation measures for the project were assessed.

11.1 Pre-construction Phase

Local residents should be notified of any potentially noisy field survey works or other works during the planning and design phase and these activities should be undertaken at reasonable times of the day. These works should not take place at night or on weekends.

During this phase, consideration must be given to the noise mitigation measures required during the construction phase and which should be included in the tender document specifications and the design.

11.2 **Construction Phase**

The noise mitigation measures to be considered during the construction phase are as follows:

i) Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites.

ii) All construction vehicles and equipment are to be kept in good repair.

iii) Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators).

iv) Construction activities, and particularly the noisy ones, are to be contained to reasonable hours during the day and early evening.

v) With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the power station should liaise with local residents on how best to minimise the impact.

vi) Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum.

vii) In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (Act No 85 of 1993).

viii) Construction staff working in areas where the 8-hour ambient noise levels exceed 75dBA should wear ear protection equipment.

11.3 **Operational Phase**

The following noise mitigation measures, which will need to be considered where appropriate, are indicators of what needs to be done to reduce or control the noise generated by the operations at the proposed ash disposal facility:

i) The design of all major plant for the project is to incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (L_{Rdn}), namely a noise level of 70dBA (just inside the *property projection plane*, namely the property boundary of the power station and the boundary of the pipeline/conveyor servitude) as specified for industrial districts in SANS 10103. Refer to Appendix A. Notwithstanding this provision, the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the power station property and the boundary of the pipeline/conveyor servitude. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103.

ii) The latest technology incorporating maximum noise mitigation measures for components of the project should be designed into the system. When ordering plant and machinery, manufacturers should be requested to provide details of the sound power level (SPL). Where possible, those with the lowest SPL (most quiet) should be selected.

iii) The design process is to consider the insulation of particularly noisy plant and equipment.

iv) All plant, equipment and vehicles are to be kept in good repair.

v) Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00).

It should be noted that any mitigation measures taken at the development sites will limit the impacts in the specific areas designed for, but will not necessarily contribute to improving the degraded noise climates in adjacent areas where there is already a problem.

12 CONCLUSIONS

The following conclusions may be drawn from the foregoing analysis:

i) Residual noise levels across the study area vary significantly.

ii) The ambient noise levels alongside the main roads exceed the acceptable maximum ambient noise level standards as recommended in SANS 10103 with respect to rural, suburban and urban residential living and for other noise sensitive land uses. The noise climates in these areas can be defined as being severely degraded for these land uses.

iii) Other than the road traffic noise, the main noise sources in the area are the Grootegeluk colliery, the Matimba Power Station and the Medupi Power Station (when commissioned).

iv) The noise from the dry ash stacking will be virtually continuous.

v) The construction of the sections of the project (both Alternatives) will introduce a new loud noise source into the respective area of development..

vi) The Alternative 1 site of the proposed project lies on Eskom property and will have minor cumulative effects. The Alternative 2 site of the proposed project lies outside the Matimba Power station property and is located primarily in a rural agricultural area surrounded by more intensive residential, mining and industrial activities.

vii) The Alternative 1 site will make use of an existing conveyor system and will thus have no additional impact. A new conveyor system is proposed for the Alternative 2 site. The noise impact of the new conveyor system will have marginal impact along this route..

viii) There are numerous noise sensitive receptors in the study area that potentially might be impacted by the various ashing operations of the project.

ix) From a noise impact perspective the Alternative 1 Site is preferable to the Alternative 2 Site as Alternative 2 extends the noise area of impact.

x) There are mitigation measures that could be introduced to reduce or prevent some of the impacts.

13 RECOMMENDATIONS

The following are recommended:

i) The development of the ash disposal facility should take place on the Alternative 1 Site.

ii) The National Noise Control Regulations and SANS 10103:2008 should be used as the main guidelines for addressing any future noise issues on this project.

iii) Various measures to reduce the potential noise impact from the ash disposal facility and ancillary works are possible, and the mitigation measures indicated in Section 9 need to be considered.

iv) Once the details of the ash disposal facility are finalised and the actual sound power levels of plant and equipment are known, the position of the noise contours should be checked.

v) At commissioning of the facility, the noise footprint of each discrete element should be established by measurement in accordance with the relevant standards, namely SANS ISO 8297:1994 and SANS 10103. The character of the noise (qualitative aspect) should also be checked to ascertain whether there is any nuisance factor associated with the operations.

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vii) SOUTH AFRICAN NATIONAL STANDARD SANS 10328:2008, *Methods for Environmental Noise Impact Assessments*.

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APPENDIX A

GLOSSARY OF TERMS
AND
NOISE IMPACT CRITERIA

APPENDIX A: GLOSSARY OF TERMS AND NOISE IMPACT CRITERIA

A1. GLOSSARY OF TERMS

In order to ensure that there is a clear interpretation of this report the following meanings should be applied to the acoustic terminology:

- **Ambient sound level** or **ambient noise** means the totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. Note that ambient noise includes the noise from the noise source under investigation. The use of the word *ambient* should however always be clearly defined (compare with *residual noise*).
- **A-weighted sound pressure, in Pascals**: The root-mean-square sound pressure determined by use of frequency-weighting network A.
- **A-weighted sound pressure level (SPL) (noise level) (L_{pA}), in decibels**: The sound pressure level of A-weighted sound pressure is given by the equation:

  $L_{pA} = 10 \log (p_A/p_o)^2$ where:

  p_A is the A-weighted sound pressure, in Pascals; and

  p_o is the reference sound pressure (p_o = 20 micro Pascals (μPa))

  Note: The internationally accepted symbol for sound pressure level, dB(A), is used.
- **Controlled areas** as specified by the National Noise Control Regulations are areas where certain noise criteria are exceeded and actions to mitigate the noise are required to be taken. Controlled areas as related to roads, airports and factory areas are defined. These Regulations presently exclude the creation of *controlled areas* in relation to railway noise.
- **dB(A)** means the value of the sound pressure level in decibels, determined using a frequency weighting network A. (The "A"-weighted noise levels/ranges of noise levels that can be expected in some typical environments are given in Table A2 at the end of this appendix).
- **Disturbing noise** means a noise level that exceeds the outdoor equivalent continuous rating level for the time period and neighbourhood as given in Table 2 of SANS 10103:2004. For convenience, the latter table is reproduced in this appendix as Table A1.
- **Equivalent continuous A-weighted sound pressure level ($L_{Aeq,T}$)** means the value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, has the same mean-square sound pressure as a sound under consideration whose level varies with time.
- **Equivalent continuous rating level ($L_{Req,T}$)** means the equivalent continuous A-weighted sound pressure level during a specified time interval, plus specified adjustments for tonal character and impulsiveness of the sound and the time of day.
- **Equivalent continuous day/night rating level ($L_{R,dn}$)** means the equivalent continuous A-weighted sound pressure level during a reference time interval of 24-hours, plus specified adjustments for tonal character and impulsiveness of the sound and the time of day. (An adjustment of +10dB is added to the night-time rating level).
- **Integrating sound level meter** means a device that integrates a function of the root mean square value of sound pressure over a period of time and indicates the result in dBA.
- **Noise** means any acoustic phenomenon producing any aural sensation perceived as disagreeable or disturbing by an individual or group. Noise may therefore be defined as any *unwanted* sound or sound that is *loud, unpleasant or unexpected*.

- **Noise climate** is a term used to describe the general character of the environment with regard to sound. As well as the ambient noise level (quantitative aspect), it includes the qualitative aspect and the character of the fluctuating noise component.
- **Noise Control Regulations** means the regulations as promulgated by the National Department of Environmental Affairs.
- **Noise impact criteria** means the standards applied for assessing noise impact.
- **Noise level** means the reading on an integrating impulse sound level meter taken at a measuring point in the presence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation, and, if the alleged disturbing noise has a discernible pitch, for example, a whistle, buzz, drone or music, to which 5dBA has been added. (The "A"-weighted noise levels/ranges of noise levels that can be expected in some typical environments are given in Table A2 at the end of this appendix).
- **Noise nuisance** means any sound which disturbs or impairs or may disturb or impair the convenience or peace of any reasonable person considering the location and time of day. This applies to a disturbance which is not quantitatively measurable such as barking dogs, etc. (compared with disturbing noise which is measurable).
- **Residual sound level** means the ambient noise that remains at a position in a given situation when one or more specific noises are suppressed (compare with *ambient noise*).
- **Sound** means the aural sensation caused by rapid, but very small, pressure variations in the air. In quantifying the subjective aural sensation, "loudness", the letters dBA after a numeral denote two separate phenomena:
    - "dB", short for *decibel*, is related to the human's subjective response to the change in amplitude (or largeness) of the pressure variations.
    - The "A" denotes the ear's different sensitivity to sounds at different frequencies. The ear is very much less sensitive to low (bass) frequency pressure variations compared to mid-frequencies.

  The level of environmental sound usually varies continuously with time. A human's subjective response to varying sounds is primarily governed by the total sound energy received. The total sound energy is the average level of the fluctuating sound, occurring during a period of time, multiplied by the total time period. In order to compare the effects of different fluctuating sounds, one compares the average sound level over the time period with the constant level of a steady, non-varying sound that will produce the same energy during the same time period. The average energy of sound varying in amplitude is thus equivalent to the continuous, non-varying sound. The two energies are equivalent.
- **Sound exposure level or SEL** means the level of sound accumulated over a given time interval or event. Technically the sound exposure level is the level of the time-integrated mean square A-weighted sound for stated time or event, with a reference time of one second.
- **Sound (pressure) level** means the reading on a sound level meter taken at a measuring point.
- **SANS 10103** means the latest edition of the South African National Standard SANS 10103 titled *The Measurement and Rating of Environmental Noise with Respect to Land Use, Health, Annoyance and to Speech Communication*.
- **1SANS 10210** means the latest edition of the South African National Standard SANS 10210 titled *Calculating and Predicting Road Traffic Noise*.
- **SANS 10328** means the latest edition of the South African National Standard SANS 10328 titled *Methods for Environmental Noise Impact Assessments*.
- **SANS 10357** means the latest edition of the South African National Standard SANS 10357 titled *The Calculation of Sound Propagation by the Concawe Method*.

- Refer also to the various South African National Standards referenced above and the Noise Control Regulations for additional and, in some instances, more detailed definitions.

TABLE A1: TYPICAL NOISE RATING LEVELS FOR AMBIENT NOISE IN DISTRICTS (NOISE ZONES)

Type of District	Equivalent Continuous Rating Level for Noise ($L_{Req,T}$) (dBA)					
	Outdoors			Indoors with open windows		
	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)	Day-night ($L_{R,dn}$)	Daytime ($L_{Req,d}$)	Night-time ($L_{Req,n}$)
a) Rural districts	45	45	35	35	35	25
b) Suburban districts (little road traffic)	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
d) Urban districts (some workshops, business premises and main roads)	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

TABLE A2: NOISE LEVELS/RANGES OF NOISE LEVELS THAT MAY BE EXPECTED IN SOME TYPICAL ENVIRONMENTS

Noise Level dB(A)	Typical Environment	Subjective Description
140	30m from jet aircraft during take-off	
130	Pneumatic chipping and riveting (operator's position)	Unbearable
>120	Hearing damage possible even for short exposure	
120	Large diesel power generator	
105-120	Low level military aircraft flight	
110-120	100 m from jet aircraft during take-off	
110	Metal workshop (grinding work), circular saw	
105-110	High speed train at 300 km/h (peak pass-by level at 7,5m)	
90-100	Printing press room	Very noisy
95-100	Passenger train at 200km/h (peak pass-by level at 7,5m).	Very noisy
95-100	Freight train at 100 km/h (peak pass-by level at 7,5 m)	Very noisy
90-100	Discotheque (indoors)	
75-100	7,5 m from passing motorcycle (50 km/h)	
75-80	10 m from edge of busy freeway (traffic travelling at 120 km/h)	
80-95	7,5 m from passing truck (50 km/h)	
80	Kerbside of busy street	
70	Blaring radio	Noisy
70	3 m from vacuum cleaner	Noisy
60-80	7,5 m from passing passenger car (50 km/h)	
65	Normal conversation	
65	Large busy office	
60	Supermarket/small office	
50	Average suburban home (day conditions)	Quiet
40	Library	
40-45	Average suburban home (night-time)	
30-35	Average rural home (night-time)	
25-30	Slight rustling of leaves	
20	Background in professional recording studio	Very quiet
20	Forest (no wind)	
0-20	Experienced as complete quietness	
0	Threshold of hearing at 1000 Hz	

A2. NOISE IMPACT CRITERIA

The international tendency is to express noise exposure guidelines in terms of absolute noise levels. These guidelines imply that in order to ascertain an acceptable living environment, ambient noise in a given type of environment should not exceed a specified absolute level. This is the approach provided by the environmental guidelines of the World Bank and World Health Organisation, which specify 55dBA during the day (06:00 to 22:00) and 45dBA during the night (22:00 to 06:00) for residential purposes, determined over any hour. SANS 10103 conforms to the described international tendency. The recommended standards to be applied are summarised in Table A1.

Communities generally respond to a change in the ambient noise levels in their environment, and the guidelines set out in SANS 10103 provide a good indication for estimating their response to given increases in noise. The suggested severity criteria for the noise impacts are summarised in terms of the above guidelines in Table A3.

TABLE A3: CATEGORIES OF COMMUNITY/GROUP RESPONSE (CRITERIA FOR THE ASSESSMENT OF THE SEVERITY OF NOISE IMPACT)

Increase in Ambient Noise Level (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
Greater than 15dBA	Very strong	Vigorous community/group action

Changes in noise level are perceived as follows:

- *3dBA:* For a person with average hearing acuity, an increase in the general ambient noise level of 3dBA will be just detectable.
- *5dBA:* For a person with average hearing acuity an increase of 5dBA in the general ambient noise level will be significant, that is he or she will be able to identify the source of the intruding noise. According to SANS 10103 the community response for an increase of less than 5dBA will be ‘little’ with ‘sporadic complaints’. For an increase of equal or more than 5dBA the response changes to ‘medium’ with ‘widespread complaints’.
- *10dBA:* A person with average hearing will subjectively judge an increase of 10dBA as a doubling in the loudness of the noise. According to SANS 10103 the estimated community reaction will change from ‘medium’ with ‘widespread complaints’ to ‘strong’ with ‘threats of community action’.

In the National Noise Control Regulations which are applicable in Limpopo Province, an intruding noise is defined as ‘disturbing’ if it causes the ambient noise level to rise by 7dBA or more.

APPENDIX B:

DETAILS OF THE NOISE MEASUREMENT SURVEY AND EXISTING NOISE CLIMATE CONDITION ASSESSMENT

APPENDIX B: DETAILS OF THE NOISE MEASUREMENT SURVEY AND EXISTING NOISE CLIMATE CONDITION ASSESSMENT

B1. GENERAL

The technical details of the noise measurement survey and general *noise climate* investigation related to the potential noise impact of the Matimba Power Station ash disposal facility, which is located approximately 20 km to the west of Lephalale (formerly Ellisras) in the Limpopo Province, are dealt with in this Appendix.

The noise impact assessment was undertaken in accordance with the requirements of the South African National Standard (SANS) 10328 *Methods for Environmental Noise Impact Assessments*. Daytime and evening period noise measurements were taken at 13 main monitoring sites at appropriate locations in the study area in order to establish the residual (existing) *noise climate*.

B2. STANDARDS AND MEASUREMENT EQUIPMENT

The sound pressure level (SPL) (noise) measurements were taken in accordance with the requirements of the South African National Standard SANS 10103:2008 *The Measurement and Rating of Environmental Noise with Respect to Annoyance and Speech Communication*. A Type 1 Integrating Sound Level Meter, a Rion NA-28, was used for the noise measurements. The meter was calibrated at an accredited acoustical laboratory within the last 12 months. The calibration status of the meter was also checked before and after completion of the total measurement period of the day. A calibrated signal with a sound pressure level of 94,0dB at 1 kHz was applied to the meter. A Rion Sound Calibrator NC-74 was used.

For all measurements taken to establish the ambient noise levels, the equivalent noise level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) during that measurement period were recorded. The frequency weighting setting was set on “A” and the time weighting setting of the meters were set on *Impulse* (I). Measurement periods of a minimum of 10 minutes were used. In addition, the variation in instantaneous sound pressure level (SPL) over a short period was also measured at some of the Sites. For these latter measurements the time weighting setting of the meter was also set on *Impulse* (I).

At all the measurement sites, the meters were set up with the microphone height at 1,3 metres above ground level and well clear of any reflecting surfaces (a minimum of 3 metres clearance). For all measurements, a standard windshield cover (as supplied by the manufacturers) was placed on the microphone of the meter.

At the same time as each individual measurement was being taken, the qualitative nature of the *noise climate* in the area of the measurement site was assessed and recorded. This comprised an appraisal of the general prevailing acoustic conditions based on the subjective response to the sounds as perceived by the listener (i.e. *auditory observation* by the surveyor), as well as identifying those noise incidents, which influenced the noise meter readings during that measurement period. This procedure is essential in order to ensure that that there is a *human* correlation between the noise as perceived by the human ear and the noise, which is measured by the meter, as well as to establish any anomalies in the general ambient noise conditions.

At each measurement site a portable recording weather station, a Kestrel 4000 Pocket Weather Tracker (Serial No. 569322) was set up in the vicinity of the sound level meter and the wind speed, temperature,

humidity, barometric pressure, and altitude were recorded. The wind direction was determined by means of a compass; and the cloud cover was noted by direct observation.

B3. MEASUREMENT SITES

Noise measurements to establish current ambient noise conditions were taken at 13 sites in the power station study area as indicated in Figure B1 and Table B1.

B4. MEASUREMENT DATES/TIMES

General observation of the noise conditions in the study area as well as the site specific sound pressure level (noise) measurements and observations were taken as follows:

- Measurements 1 – 3 and 8 were taken by F Malherbe on behalf of JKA on Thursday 10 May 2012 and Friday 11 May 2012 during the daytime period from 09h00 to 16h00 and in the evening/night from 20h00 to 23h30.
- Measurements 4 – 7 and 9 – 14 were taken by JKA during a prior survey of the area on Monday 4 April to Wednesday 6 April 2005 during the daytime period from 09h30 to 17h00 and during the evening period from 19h30 to 22h30.

B5. NOISE MEASUREMENT DETAILS

The results of the residual noise condition measurement survey are summarised in Table B1. The equivalent sound pressure (noise) level (L_{Aeq}), the maximum sound pressure level (L_{Amax}) and the minimum sound pressure level (L_{Amin}) are indicated. Note that the equivalent sound pressure (noise) level may, in layman's terms, be taken to be the average noise level over the given period. This "average" is also referred to as the residual noise level (excluding the impacting noise under investigation) or the ambient noise level (if the impacting noise under investigation is included).

The weather conditions were such that the measurements to establish the ambient noise levels were not adversely affected and no specific corrective adjustments needed to be made.

TABLE B1: MEASURED CURRENT NOISE LEVELS IN THE MATIMBA ASH DISPOSAL FACILITY STUDY AREA

Site No	Location Description	GPS Co-ordinates	Date	Measured Sound Pressure Level (dBA)					
				Daytime Period			Evening Period		
				L_{Aeq}	L_{max}	L_{min}	L_{Aeq}	L_{max}	L_{min}
1	On road to farmhouse on Farm Jackhalsvley 309LQ	S23°39.548' E27°28.063'	May 2012	25.0	48.9	19.1	21.4	51.3	17.3
2	At entrance to Van der Walts Pan 310LQ	S23°36.409' E27°29.475'	May 2012	29.7	53.3	17.9	33.0	54.3	19.6
3	On road to farmhouse on Farm Gelykebult 455LQ	S23°35.899' E27°34.097'	May 2012	23.4	40.5	18.9	26.8	50.0	19.9
4	Entrance to Elandsbosch Safaris on Farm Vaalpensloop 313 LQ (Roux's Rus)	S23°42.550' E27°29.811'	Apr 2005	46.2	57.7	29.7	47.2	56.3	42.3
5	On the southern side and 10 metres from the centreline of the Steenbokpan Road at approximately the boundary between the farms Naauontkomen 509-LQ and Eenzaamheid 512-LQ.	S23°42.438' E27°32.711'	Apr 2005	45.1	57.1	37.3	39.6	42.3	33.3
6	Weekend Lodge (no permanent residents) on the farm Kuipersbult 511-LQ, situated south of the Afguns Road	S23°43.310' E27°32.551'	Apr 2005	36.2	46.7	30.2	35.1	44.1	28.7
7	Farmhouse on the farm Kromdraai 503-LQ, situated just west of the Afguns Road	S23°44.314' E27°32.528'	Apr 2005	36.9	46.6	28.7	38.1	48.1	28.1
8	On Road D2001 north of Grootgeluk Colliery approximately on the boundary between the farms Kalkvlakte 256 LQ and Onbelyk 257 LQ	S23°35.245' E27°27.941'	May 2012	43.4	57.6	28.6	38.7	42.6	32.3
9	In Marapong Township on eastern sidewalk of the road just south of the Marapong Private Hospital. The site is approximately 700 metres northeast of the existing power station.	S23°39.506' E27°37.064'	Apr 2005	50.2	68.2	42.5	53.2	61.1	51.6
10	In Onverwacht (North), on the northern sidewalk of Bergsig Street, 30 metres from the intersection with Ngoako Ramathlodi Road.	S23°40.829' E27°41.421'	Apr 2005	51.9	66.7	39.2	53.5	72.5	36.1
11	In Onverwacht (South), on the northern sidewalk of Waterlelie Road at the western extremity of the block from Zebra Street. The site is at the south-eastern extremity of the township.	S23°41.768' E27°40.053'	Apr 2005	43.8	57.6	36.6	45.4	51.6	31.0
12	On the access road to the Farm Peerboom 466-LQ (on the boundary with the farm Welgelegen 469-LQ).	S23°39.512' E27°40.634'	Apr 2005	44.3	58.4	23.6	-	-	-
13	Farm worker dwellings on the farm Hanglip 508-LQ, situated just north of the Steenbokpan Road, just west of the conveyor to the existing ash dump	S23°41.716' E27°35.973'	Apr 2005	56.4	58.4	54.2	56.1	58.7	53.9

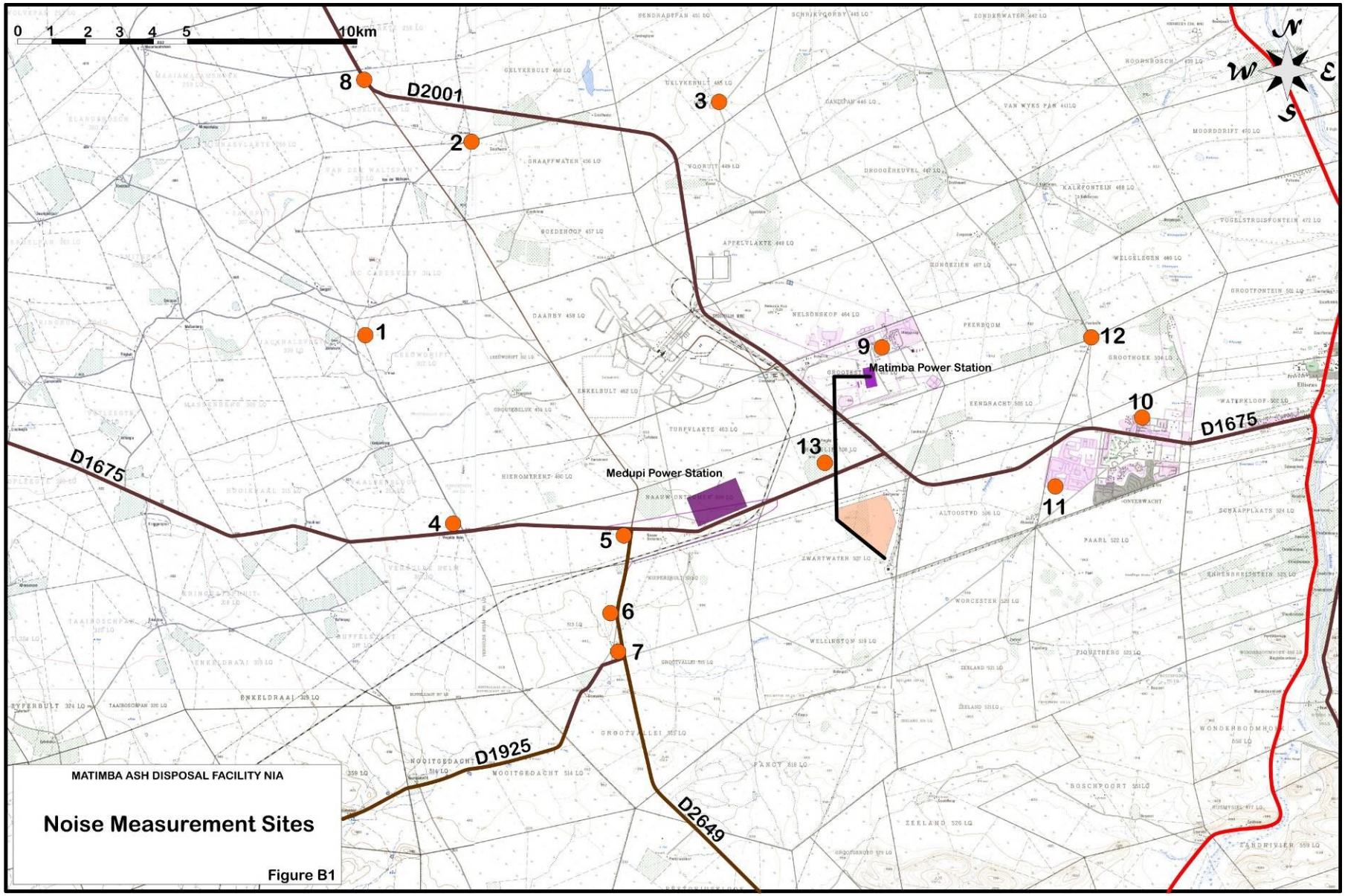

Figure B1: Noise Measurement Sites

B6. NOISE CLIMATE RELATED TO THE 24 HOUR ROAD TRAFFIC

In order to complement the short-term noise measurements in the study area, the 24-hour residual noise levels related to the average daily traffic (ADT) flows on Nelson Mandela Drive Extension, Sterkpoort Road and Steenbokpan Road were also calculated. Refer to Appendix C for a description of the roads. The traffic data were obtained from the Limpopo Road Agency (Pty) Ltd and the traffic impact assessments studies of the Medupi (Matimba B) and Waterberg Power Stations.

These calculated noise values provide an accurate base for the SANS 10103 descriptors. The noise levels generated from the traffic on these roads were calculated using the South African National Standard SANS 10210 *Calculating and Predicting Road Traffic Noise*. Typical situations were used for the calculation site. The Year 2005 provincial traffic data were used as the baseline for the calculations. This was the situation prior to the construction at the Medupi Power Station.

The noise levels at various offsets from the relevant road centrelines were established and are summarised in Table B2. The noise descriptors used are those prescribed in SANS 10103:2008, namely:

i) Daytime equivalent continuous rating (noise) level ($L_{Req,d}$) (L_d used in Table), namely for the period from 06h00 to 22h00).

ii) Night-time equivalent continuous rating (noise) level ($L_{Req,n}$) (L_n used in Table), namely for the period from 22h00 to 06h00).

iii) Day-night equivalent continuous rating (noise) level ($L_{R,dn}$) (L_{dn} used in Table), namely for the 24 hour period from 06h00 to 06h00).

The noise levels given are for generalised and the unmitigated conditions. There will be greater attenuation than shown with distance where there are houses, other buildings and terrain restraints in the intervening ground between the source and the receiver point. In particular, the thick vegetation in some areas will significantly reduce the noise with increasing distance from the road.

TABLE B2: BASELINE NOISE CLIMATE ADJACENT TO MAIN ROADS (YEAR 2012)

Road	Noise Levels Alongside Roads at Given Offset from Centreline (SANS 10103 Indicator) (dBA)											
	50m Offset			100m Offset			200m Offset			500m Offset		
	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}	L_d	L_n	L_{dn}
N Mandela Dr Ext	58.4	47.5	58.1	55.4	44.5	55.1	52.4	41.5	52.1	48.4	37.5	48.1
Sterkpoort Road	58.4	47.5	58.1	55.4	44.5	55.1	52.4	41.5	52.1	48.4	37.5	48.1
Steenbokpan Rd	47.7	34.7	46.9	44.7	31.7	43.9	41.7	28.7	40.9	37.7	24.7	36.9

B7. Noise Climate Related to Railway Traffic

There is one railway line in the study area, namely that for the coal haul trains from the Grootegeluk colliery to Thabazimbi. There are at present 2 trains per day. Noise from the pass-by of this type of train (drawn by diesel locomotives) peaks in the vicinity of 92dBA at a 30 metre offset from the track.

With the pass-by of each train there will be a fluctuation in sound pressure level ranging from the normal background noise for the area (residual noise level) to a maximum as the train passes and then reducing again to the residual level as the train moves away from the receiver point. The approximate maximum noise levels that will be experienced with the pass-by of a typical freight train at various offsets from the railway line and for various typical cross-section types are given in Table B3. These values were measured by Jongens Keet Associates, as well as from Nelson (1987) and UK Department of Transport (1995). Note that the noise levels for the sections at-grade and the sections on fill are the same. The values given are the unmitigated noise levels.

TABLE B3: TYPICAL MAXIMUM NOISE LEVELS FOR OPERATIONAL CONDITIONS ALONG THE GROOTEGELUK-THABAZIMBI RAILWAY LINE

Offset (m)	Maximum Pass-by Noise Level (L_{Amax}) (dBA)		
	At-grade/Fill Section	Cutting Section	
		3m Depth	7m Depth
25	93,3	81,5	77,9
50	88,3	75,7	71,1
100	82,2	69,3	64,3
200	75,6	62,6	57,4
300	71,9	58,9	53,4
500	66,5	53,5	48,0

i) The operations of the trains have the potential to adversely influence the noise climate of the areas along the railway corridor to a larger or lesser extent for significant distances from the tracks. The propagated noise will be attenuated with distance from the source, the nature of the ground cover on the intervening ground, and from screening by the natural topography and buildings. The wheel-rail generated noise is enhanced where the train is travelling on elevated structure.

ii) The character (qualitative aspect) of the railway operational noise will have many facets. The component of noise that will predominate at maximum operating speed will be the wheel-rail interaction noise. The noise from diesel locomotives will be much higher than that from electric locomotives. The noise from the locomotives will be slightly louder than that from the wagons. With the pass-by of each train, the perceived noise at any one receiver point within the area of influence of the train will fluctuate relatively rapidly from the normal background (ambient) noise level of the area to peak at the maximum, will then fall slightly once the locomotives have passed the closest point to the receiver to remain fairly constant at this level until the whole train has passed by the near-ground and then will fall back to the area's ambient level as the train moves into the far distance. This whole cycle can take place over a period of several minutes.

iii) The noise of the braking systems may sometimes be audible. There will possibly be some "flange squeal" (rail-wheel interaction) heard in areas where there are tight-radius track curves. There will also be mechanical banging sounds from the wagon couplings when the trains slow down or accelerate.

iv) In 2005 the railway line crossed the Steenbokpan Road at grade where it is mandatory that the trains sound a warning horn. Noise from these horn soundings can be as loud as 105dBA at 30 metres and 84dBA at 350 metres from the train. Steenbokpan Road now bridges over the railway line.

B8. BASELINE NOISE CLIMATE IN THE MATIMBA POWER STATION ASH DISPOSAL FACILITY STUDY AREA

In overview, the baseline situation with respect to the *noise climates* in the study area and the changes up to the present date (2013) was found to be as follows:

i) The areas relatively far from the main roads, Matimba Power Station and the Medupi Power Station construction activities are generally very quiet. Most of the area has a typical rural *noise climate*.

ii) The main sources of noise in the area are from traffic on the main roads, Matimba Power Station, power station infrastructure remote from the facility (inclusive of the overland conveyor system and activities at the ash disposal facility, Medupi Power Station (still under construction) and Grootegeluk Coal Mine. These noise sources are significant contributors to a degraded noise climate.

iii) With regard to traffic noise from Nelson Mandela Drive, existing residences in the residential areas of Lephalale (Ellisras) and Onverwacht, up to approximately a 500 metre offset from the road, are impacted (night-time conditions). In these areas, the noise levels exceed acceptable suburban residential living conditions as specified in SANS 10103. Ideally the ambient noise level should not exceed 50dBA during the daytime period (06h00 to 22h00) and 40dBA during the night-time period (22h00 to 06h00). Refer to the SANS 10103 standards as given in Appendix A.

iv) Ambient noise levels due to traffic in the areas along Steenbokpan Road (D1675) are not high and impact is not significant.

i) Noise levels from Matimba Power Station adversely affect the daytime noise climate at any residences in the surrounding area for up to a distance of 3000 metres around the facility base on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 6500 metres. Refer to Figure B2.

v) At present, Medupi Power Station is under construction. The predicted noise footprint when the power station is commissioned is estimated to adversely affect the daytime noise climate at any residences in the surrounding area for up to a distance of 4700 metres around the facility base on the rural standards that need to be applied for this area. At night the radius of impact increases to approximately 9500 metres. Refer to Figure B3. There will be cumulative effects between the noise from the Matimba and Medupi Power Stations that will enlarge the individual noise footprints of these two sources of noise.

vi) There are also noise sources from Matimba Power Station equipment at locations remote from the power station as well as other isolated (or infrequent) noise sources such as:

- The coal overland conveyor from the Grootegeluk Coal Mine to the power station
- The overland conveyor belt transporting the ash residue from Matimba power station to the ash disposal facility.
- Operations at the ash disposal facility that include the dumping and spreading of the ash, and the rehabilitation of the dump. The 35dBA noise contour of the ash disposal facility operations is presently positioned at an offset of 3250 metres from the dump. Refer to Figure B2.
- The sewage works serving the power station, which is located 3 kilometres to the north of the Matimba power station.

vii) The noise profile of Grootegeluk Coal Mine, which is a major source of noise in the area, is shown in Figure B4.

viii) The outer limit of influence (negative impact) of the Matimba Power Station, the Medupi Power Station (once commissioned) and the Grootegeluk Colliery Complex is shown in Figure B5. This shows the combined (not cumulative) 35dBA contour of these sources of noise.

ix) An intermittent source of noise is the coal haul trains on the railway line from the colliery to Thabazimbi. There are at present two trains per day.

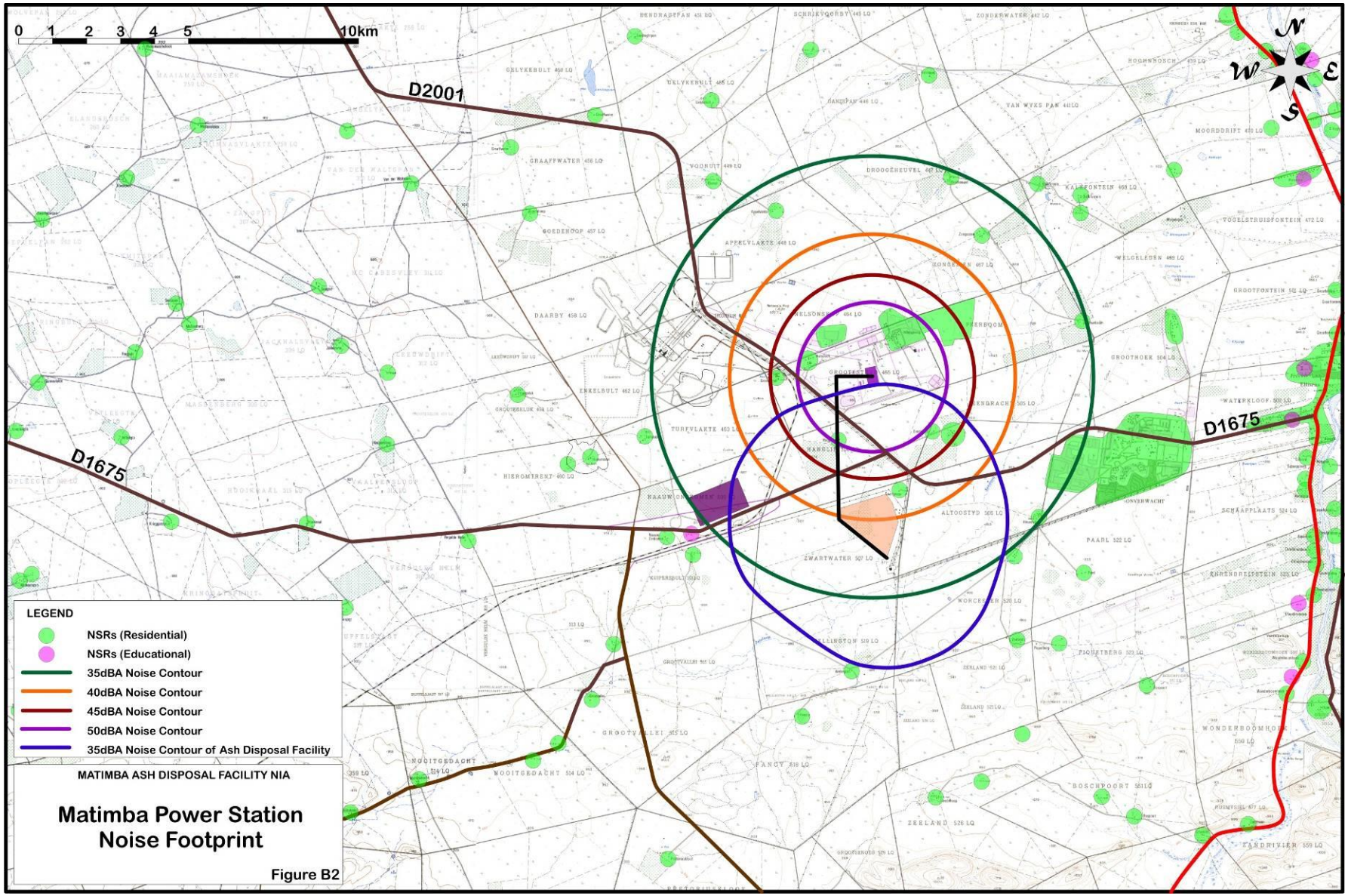

Figure B2: Matimba Power Station Noise Footprint

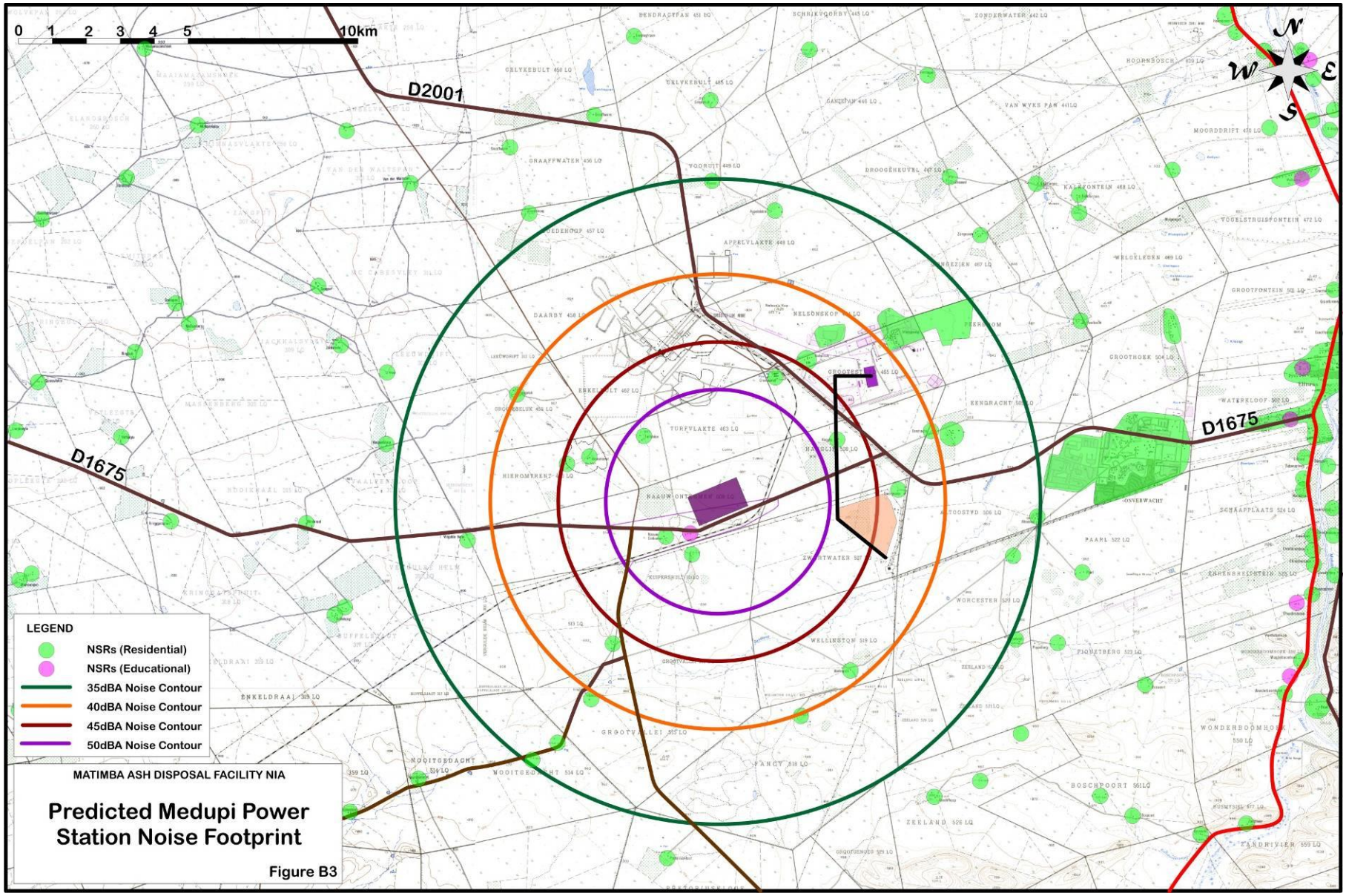

Figure B3: Predicted Medupi Power Station Noise Footprint

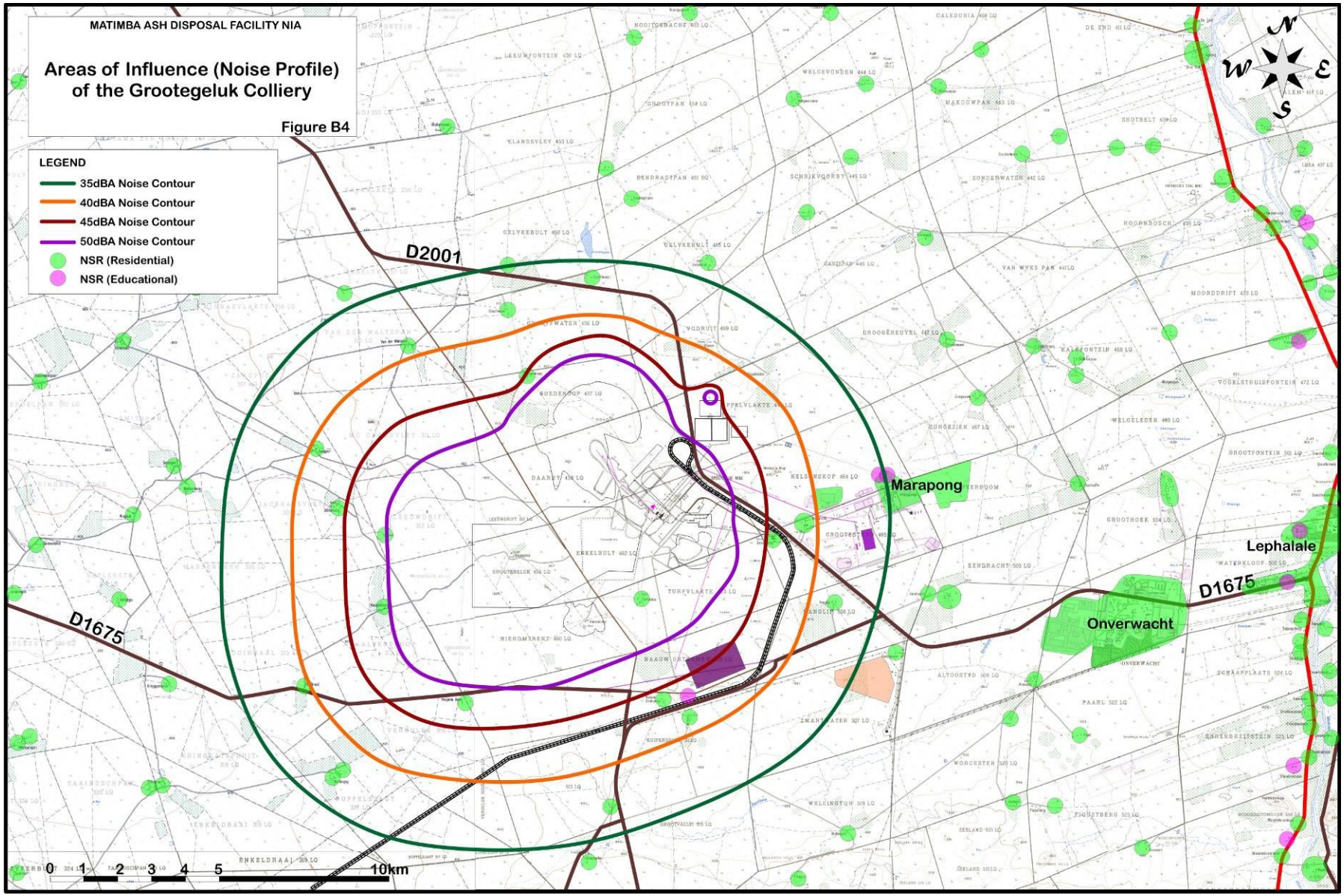

Figure B4: Areas of Influence (Noise Profile) of the Grootegeluk Colliery

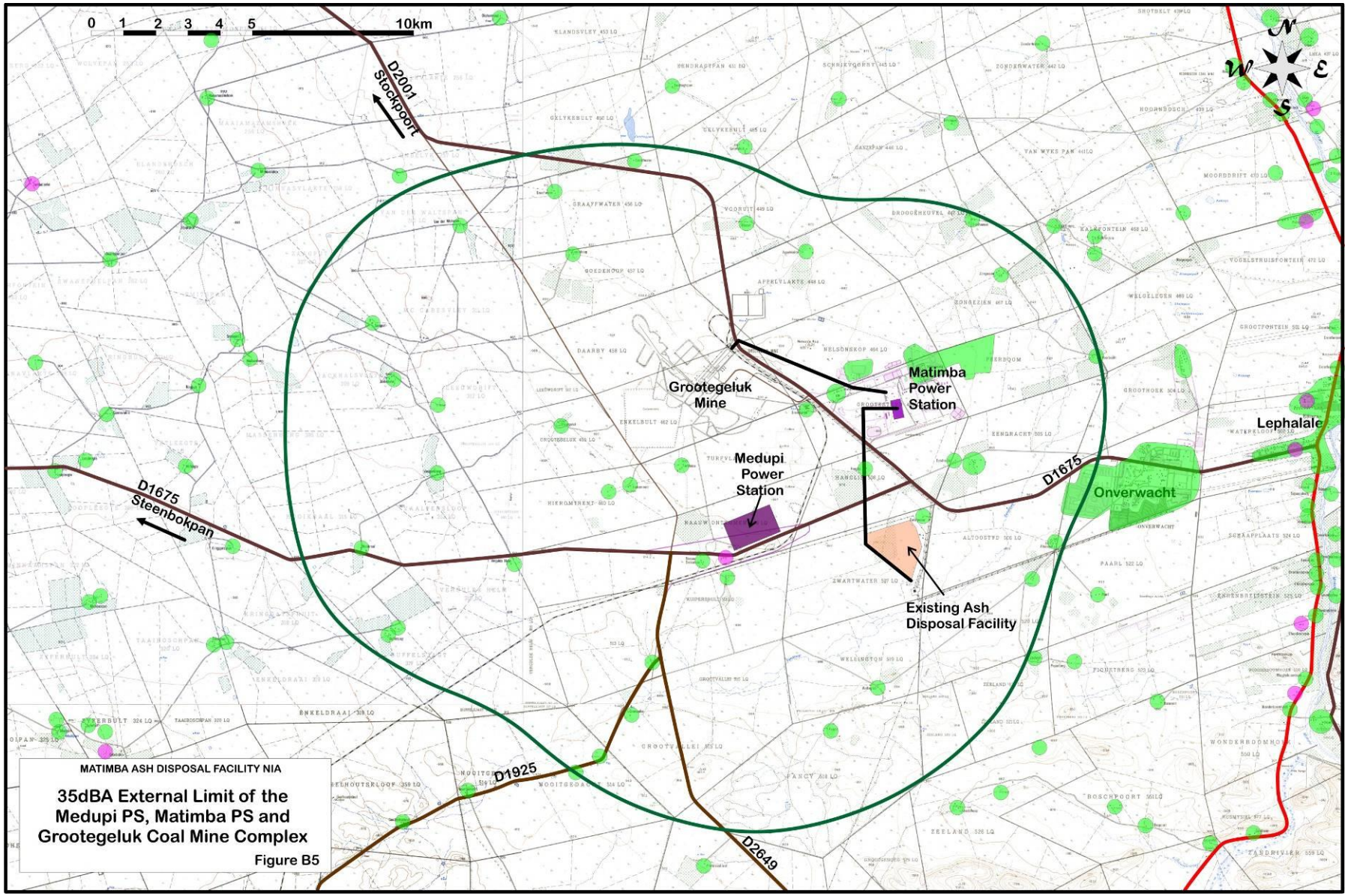

Figure B5: 35dBA External Limit of the Medupi Power Station, Matimba Power Station and Grootegeluk Coal Mine Complex

APPENDIX C

ROAD NETWORK IN THE STUDY AREA

APPENDIX C: ROAD NETWORK IN THE STUDY AREA

C1. ROAD DETAILS

The main roads influencing the study area are (refer to Figure C1):

i) Road D1675 (Steenbokpan Road) is a surfaced road aligned in an east-west direction and linking Lephalale to Steenbokpan. It links from Road P84/1 (Route R510) in Lephalale to Road P16/2. The section of the road east of the intersection with Road D2001, namely the section through the urban areas of Onverwacht and Lephalale, is named Nelson Mandela Drive.

ii) Road D2001 (Sterkpoort Road) is the main access to Matimba Power station from Road D1675 (Nelson Mandela Drive). It is surfaced road on the section from its intersection with Road D1675 to Matimba Power Station and Grootegeluk Colliery. North of the colliery it is a gravel road up to its intersection with Road P84/1 near the Stockpoort border post.

iii) Road D175 is a gravel road aligned in a north-south direction linking from the Stockpoort border post (Botswana) on the Limpopo River to Road P84/1 (Route 510). This road is aligned through Steenbokpan.

iv) Road D2286 is a gravel road linking from Road P16/2 in the west through to Road D175 north of Steenbokpan and that is aligned close to and follows the course of the Limpopo River.

v) Road D1925 is a gravel road that is aligned in a north-south direction through the eastern portion of the study area. It links to Road D2649 just south of Medupi Power Station.

vi) Road D2649 is a gravel road that links from D1675 just east of Medupi Power Station to Road P84/1 (Route R510) approximately 20km south of Lephalale.

vii) Road D2701 is a gravel road aligned in an east-west direction that links from Road P16/2 to Road D1925.

It is mainly the traffic on Roads D1675 and Road D2001 that are relevant to the study.

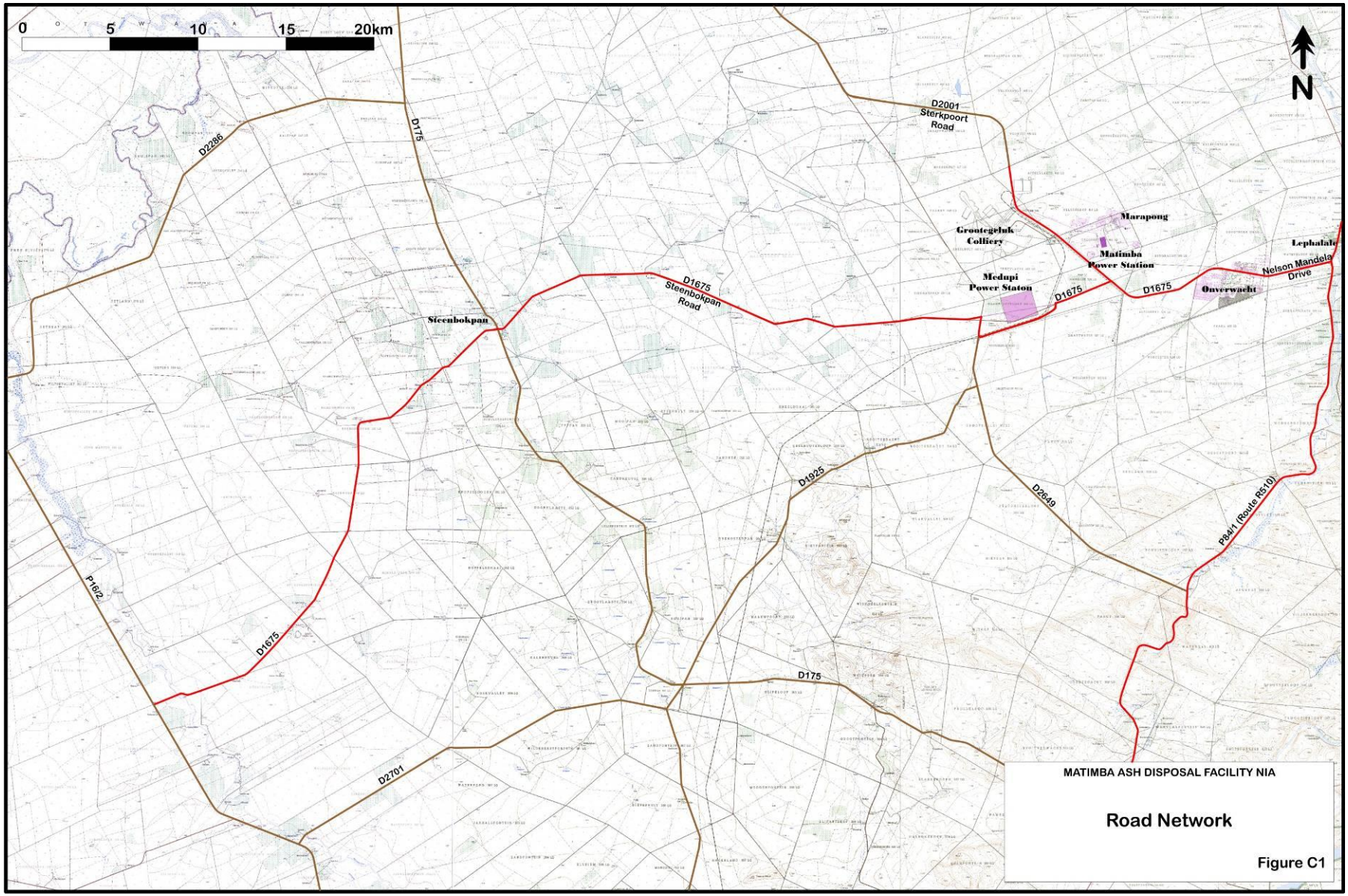

Figure C1: Road Network

APPENDIX D

IDENTIFICATION OF APPROPRIATE NOISE STANDARDS FOR NATURE RESERVES, GAME PARKS AND WILDERNESS AREAS

APPENDIX D: IDENTIFICATION OF APPROPRIATE NOISE STANDARDS FOR NATURE RESERVES, GAME PARKS AND WILDERNESS AREAS

This Appendix relates to the existing game lodges in the area.

A system-wide survey by the US National Park Service in the year 2000 revealed that as many visitors come to their parks to enjoy the natural soundscape (91%) as come to view the scenery (93%) (US National Park Service, 2000). However, it is necessary that soundscapes be categorized.

Soundscapes, that is, the combined sounds from natural and non-natural sources, are recognized as an important resource in national parks. The natural soundscape is generally comprised of two main sound categories - those from biological or those from physical sources. Organisms such as birds, frogs, and plants, etc. create biological sounds, while forces such as wind, rock fall, and rivers, etc. create physical sounds. These two types of sounds can be used to characterize different habitats. The specific soundscape characteristics are an important attribute of a National Park's natural systems, for non-natural sounds can obscure or disturb ecological functions, as well as adversely influence visitor experiences.

The concepts of *natural quiet, appropriate noise* and *inappropriate noise* are also mooted within the context of a national park's environments.

- **Natural quiet** does not imply silence. It rather implies that only the natural sound sources suitable to that specific locality are present, e.g. the subtle sound of wind blowing though a forest, the babble of water in a stream and the vocalizations of birds, amphibians and other animals, are all understood to be features of the natural soundscape. Yet equally valid components of natural quiet may include loud sounds like the rumble of an avalanche, an ice fall from a glacier, the howling wind, the cracking thunder during a summer storm, the crash of ocean waves, the powerful roar of a waterfall, etc.
- **Appropriate noises** are sounds that, even if causing elevated ambient levels, are generated by necessary activities fundamental to the basic operation of the park: transportation systems, visitors' centers, maintenance activities, recreational activities, etc.
- **Inappropriate noises** jeopardize the natural soundscape resource and purpose for which the park was created: loud radios, aircraft overflights, factories on the boundary of the park, etc.
- **Natural Quiet Spaces:** There is presently a growing awareness in countries worldwide of the importance of retaining the natural quiet to be found in wilderness areas, national parks, etc. and procedures to protect these areas are appearing in the policies and regulations of such countries. An example is the *Netherlands Wet Geluidhinder* that contains a clause concerning SILENT AREAS (*Stiltegebieden*) (which further in this report are called Natural Quiet Spaces): Natural Quiet Spaces are understood to mean land encompassing several kilometres or more in which the impact of noise due to human activities is so low as not to detract from the naturally occurring sounds in the area. These include natural areas of biological and ecological value such as national parks, wilderness areas, bird sanctuaries, as well as areas of natural beauty that cannot tolerate any increase in the naturally occurring levels of sound. (Jongens, 2003).

The study of available literature regarding various countries' approach to minimising man-made noise in Natural Quiet Spaces highlighted the following common principles (Jongens, 2003):

- Only naturally occurring sounds are to be heard.

- Noise criteria used for assessing and controlling noise in urban and suburban residential districts are not applicable to Natural Quiet Spaces.
- Humans visiting Natural Quiet Spaces automatically introduce noise into the space mainly produced by vehicles and, for example, during social interaction at a rest camp;
- Rest camps may have sources of noise including mechanical and electrical services such as fans/ac units, electrical generators, etc.
- All manmade sounds (instantaneous, as well as average) must be reduced to a minimum.

Under the State of Oregon's Environmental Standards for Wilderness Areas it is stated: "Subject to the permit requirements in OAR 340-013-0015, the Department may permit the emission of ... noise from any source or sources causing the maximum ambient sound pressure level to exceed 50 dBA at any point at least 50 feet [16m] from any source, but not to exceed 75 dBA at such distance." This can be interpreted as an attempt to encourage – with regulatory stick – people to respect the peace and quiet of a Natural Quiet Space. Electrical/mechanical plant attached to rest parks, hotels, etc must be suitably silenced to comply with this limit. The visitor will need to drive slowly to be able to stay within the 50 dBA limit thereby achieving two objectives: keeping noise levels as low as practical and not having vehicles racing about, spewing dust and scaring the animals. Encouraging/regulating low noise has an automatic influence on controlling the behaviour of people (Jongens, 2003).

It is therefore evident that in the game farms in the area there is a need for natural quiet areas isolated from areas where inappropriate noises dominate (such as lodges and rest camps).

The South African Acoustics Institute (SAAI) is trying to incorporate above standards in provincial noise control regulations.

References:

1. Jongens, AWD (2003) Comments on Proposed Amendment to the South African Noise Control Regulations. Unpublished Document.
2. US National Park Service (2000). Directors Order #47: *Soundscape Preservation and Noise Management*