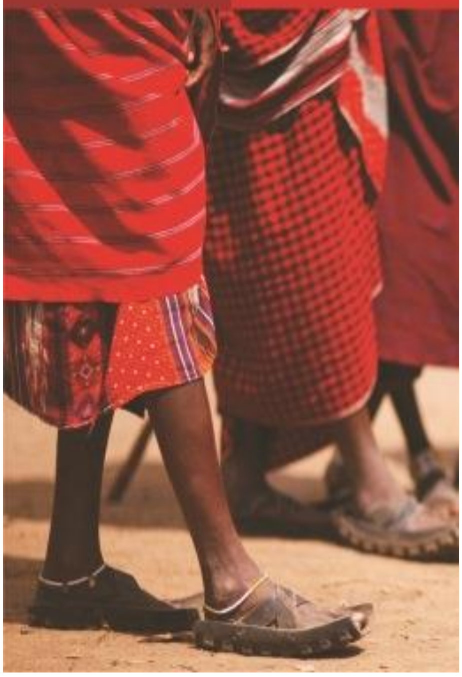

DIGBY WELLS
ENVIRONMENTAL

Environmental Authorisation for Dagsoom Twyfelaar Coal Mining Project, near Ermelo, Mpumalanga

Noise Impact Assessment Report

Project Number:

DAG5603

Prepared for:

Dagsoom Coal Mining (Pty) Ltd

October 2019

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This document has been prepared by Digby Wells Environmental.

Report Type:	**Noise Impact Assessment Report**
Project Name:	**Environmental Authorisation for Dagsoom Twyfelaar Coal Mining Project, near Ermelo, Mpumalanga**
Project Code:	**DAG5603**

Name	Responsibility	Signature	Date
Joel Maseki	Report Compiler		September 2019
F le R Malherbe	Noise Specialist		October 2019
Justin du Piesanie	Reviewer		October 2019

EXECUTIVE SUMMARY

Dagsoom Coal Mining (Pty) Ltd (hereinafter Dagsoom) owns a Prospecting Right (No. 1820 PR) over several properties in the Sheepmoor area near Ermelo in Mpumalanga, South Africa. Dagsoom propose to develop an underground mineable coal which can be sold either as raw or as a high-grade washed product to the inland and export markets.

Digby Wells Environmental (herein after Digby Wells) was appointed by Dagsoom to complete a Noise Impact Assessment as part of the Environmental and Social Impact Assessment (ESIA) for the Project. This report covers the predicted noise impacts from the various phases of the Project and the impact of these on sensitive receptors.

Although the coal mining and power generation industry has a presence in the larger area, the environment of the Dagsoom Project is rural. The area is crossed by the N2 from North West to South East. Due to the large volumes of traffic it carries, it constitutes the major source of continuous noise in the area which determines present ambient noise levels.

The introduction of a new noise source into the environment in the form of a mining operation will necessarily cause an increase in ambient noise levels.

The noise impact assessment included the following tasks:

- Identification of noise sources and potential noise sensitive receptors;
- Estimating the average daily ambient noise levels during the summer and winter by modelling the major sources of noise in the environment of the project;
- Assessment of the anticipated noise impacts associated with the project activities during the construction, operational, decommissioning and post-closure phases; and
- Recommending mitigation and management plans to minimise the expected impact.

The approach used in investigating the noise impacts is based on the guidelines published in SANS 10103 2.

A three-dimensional model to calculate the noise emissions and propagation from the mining operation was developed. The propagation of noise was calculated in accordance with the CONCAWE method as specified in SANS 103576. This method is an internationally accepted procedure for the calculation of noise propagation over long distances.

A further model was developed to estimate the existing ambient noise levels, based on Annual Average Daily Traffic number.

In addition, the activities and key sources of noise that were modelled encompasses the construction, operational and closure phases of the Project.

The noise impacts were presented as contours of the resulting total future ambient noise levels and the increases in existing ambient noise levels, superimposed on a scaled satellite image of the Project area and its environment.

The modelled noise propagation maps were used to determine the expected noise impacts. The following conclusions are drawn from the results of this noise impact study:

- For the construction and operational phases of the Project, the noise propagation contours indicate higher noise impacts fall within the mine boundary. These are the contours indicating the resulting total ambient noise levels during day- (06:00 – 22:00) and night-time (22:00 to 06:00), 55 dBA and 45 dBA, respectively, and a 5 dBA increase in ambient noise level);
- The future ambient noise levels in the environment close to the mine property boundaries will fall within the guideline levels of 55 dBA and 45 dBA during day- (06:00 – 22:00) and night-time (22:00 to 06:00), respectively;
- The magnitude of the noise impacts is mostly negligible or insignificant at most. No existing dwellings will be affected;
- The severity of the noise impact during both the construction and operational phases of the mine will be VERY LOW; and
- Due to the very low severity of the noise impacts no specific noise mitigating measures are proposed.

The noise specialist does not object to the Project going ahead from a noise perspective as envisaged impacts are negligible.

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AAHT	Annual Average Hourly Traffic
dB	Decibel
dBA	A-weighted Decibel
ESIA	Environmental and Social Impact Assessment
FEL	Front End Loader
hr	Hour
IFC	International Finance Corporation
ISO	International Standards Organisation
kPa	Kilo Pascal (1000 Pascal)
K	Potassium
L_{A90}	A-weighted 90 percentile sound pressure level
L_{Aeq}	Equivalent A-weighted sound pressure level
m/s	Meters per second
pW	Pico Watt (10^{-12} Watt)
SANS	South African National Standard
RHD	Relative Humidity
t	Tonne
tpa	Tonnes per annum
tpm	Tonnes per month
WHO	World Health Organisation
W/m^2	Watt per square meter
°C	Degrees Celsius

1 Introduction

Dagsoom Coal Mining (Pty) Ltd (hereinafter Dagsoom) owns a Prospecting Right (No. 1820 PR) over several properties in the Sheepmoor area near Ermelo in Mpumalanga, South Africa. Dagsoom propose to develop an underground mineable coal which can be sold either as raw or as a high-grade washed product to the inland and export markets.

Digby Wells Environmental (hereinafter Digby Wells) was appointed by Dagsoom to complete a noise impact assessment as part of the Environmental and Social Impact Assessment (ESIA) for the Project. This report covers the predicted noise impacts from the various phases of the Project and the impact of these on sensitive receptors.

1.1 Project Background and Description

Coal mining and power generation industry has a presence in the larger area, but the environment of the Dagsoom Project is rural. The Dagsoom Project is located on the farm Twyfelaar in Mpumalanga Province, South Africa, approximately 40 km south-east of Ermelo. The area is crossed by the N2 from North West to South East. Due to the large volumes of traffic it carries, it constitutes the major source of continuous noise in the area which determines present ambient noise levels. The local setting is illustrated in Figure 1-1.

The introduction of a new noise source into the environment in the form of a mining operation will necessarily cause an increase in ambient noise levels. This formed the basis for this assessment to determine future impacts on nearby communities such as at Sheepmoor.

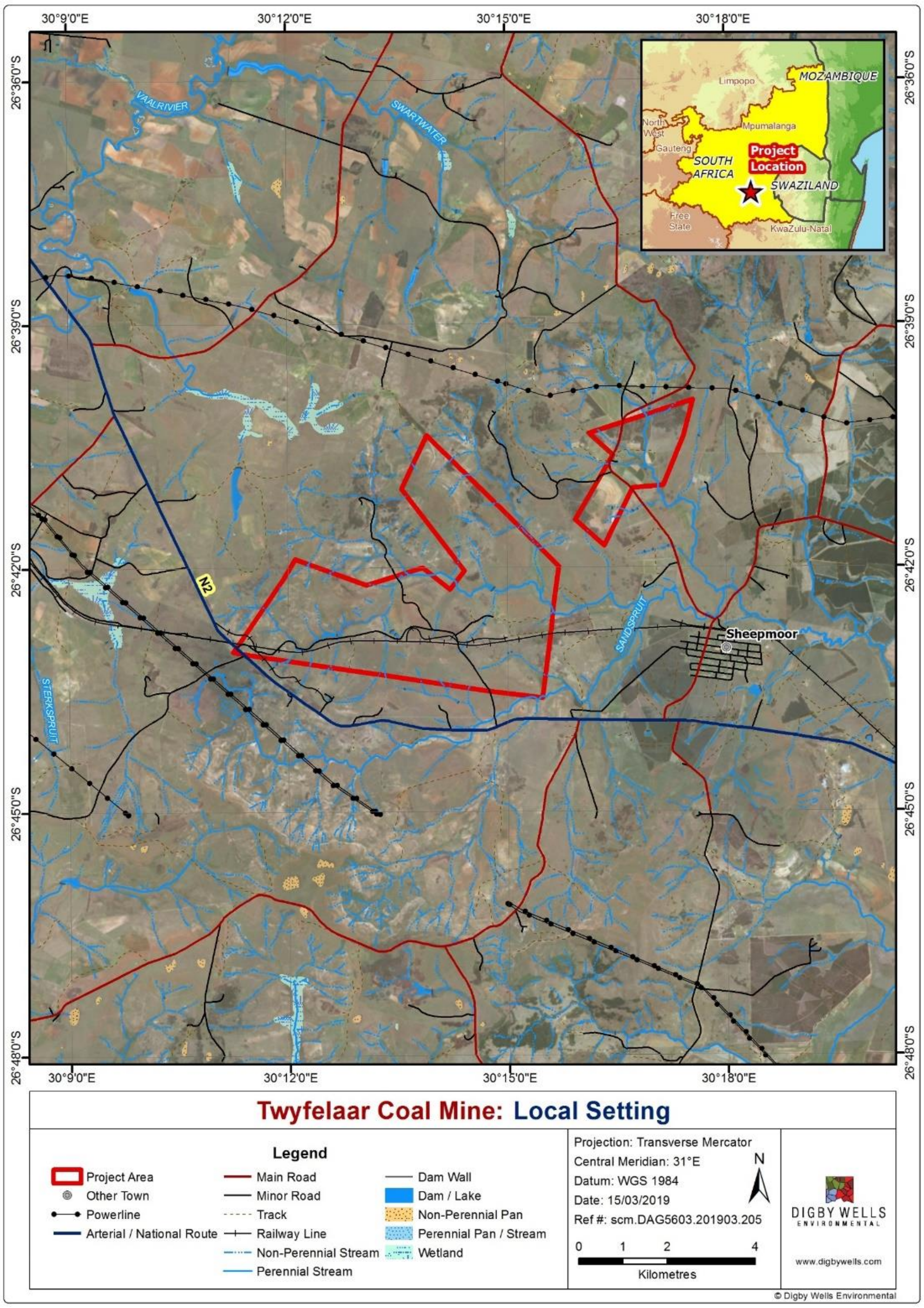

Figure 1-1: Local setting for the Dagsoom Project

Three options were identified as suitable for the Dagsoom Project and are briefly described below. All three options are based on a run-of-mine (ROM) throughput of 408 000 tonnes per annum (tpa). They are:

1.1.1 Option 1

This option involves mining, stockpiling, hauling and selling ROM material to a local customer that can process the product for the export market. The ROM product is hauled by road to the customer. Apart from the mining processes, which are likely to be drill and blast operations, a

ROM stockpile and a product load-out facility are required. A 100% yield is assumed, and the ROM product is hauled to the customer at a rate of 408 000 tpa.

1.1.2 Option 2

This option involves mining, stockpiling, crushing and selling the processed product to a local customer, possibly Eskom. The crushing process enables a possibility of screening the product into different product size classes. The product is hauled per road to the customer. A 100% yield is assumed, and the ROM product is hauled at a rate of 408 000 tpa.

1.1.3 Option 3

This option involves mining, stockpiling, crushing, screening, washing and selling an upgraded product to the export market. The estimated production rate is 287 232 tpa of export quality coal. The ROM product is hauled to a train load-out station, from where the coal is transported to the Richards Bay Coal.

1.2 Scope of Work

This Environmental Noise Impact Assessment entailed the following tasks:

- Identification of noise sources and potential noise sensitive receptors;
- Estimating the average daily ambient noise levels during the summer and winter by modelling the major sources of noise in the environment of the project;
- Assessment of the anticipated noise impacts associated with the project activities during the construction, operational, decommissioning and post-closure phases; and
- Recommending mitigation and management plans to minimise the expected impact.

The approach used in investigating the noise impacts is based on the guidelines published in SANS 10103.

2 Details of the Specialists

Joel Maseki has an MSc (Geography & Environmental Science), working as a specialist with the Atmospheric Sciences & Noise Department at Digby Wells Environmental. He has authored several academic articles (i.e. journals and conference publications), with experience in conducting air quality and noise surveys across different industries.

François Malherbe is an “Associate with Digby Wells Environmental”. He is a registered Professional Engineer. He has a B.Sc. Eng (Electrical Engineering) and an M.Eng. (Electronic Engineering), specialising in Acoustics. He has worked as an engineer at the Laboratory for Vibration and Acoustics of the South African Bureau of Standards (SABS) between 1986 and 1999. During this period, he has gained experience in a very wide field of acoustics, including environmental noise measurements, specialised measurements in the laboratory and *in situ*, and the modelling of industrial, road, rail and aircraft noise. In 1999 he started his own consulting firm, François Malherbe Acoustic Consulting cc, and has since then taken part in a large number of major environmental, transport and industrial projects in South Africa, Zimbabwe, Botswana, Lesotho, Namibia, Zambia, the DRC, Republic of Congo, Malawi, Kenya, Uganda, Mozambique, Senegal, Mauritius and Burkina Faso.

3 Assumptions and Limitations

The following assumptions were made:

- Option 3 involves considerably more mechanisation than both options 1 and 2. It was decided to model Option 3 since it had to assumed that it will cause the highest noise emission levels of the three. Therefore, Option 3 will represent a worst-case scenario;
- The meteorological data supplied on https://www.worldweatheronline.com/ermelo-weather-history/mpumalanga/za.aspx is representative for the purpose of this noise study;
- Initial modelling results indicated that the maximum noise impact will occur during the winter (July) when cold meteorological conditions favour the propagation of noise over longer distances. Therefore, the calculations were made assuming these meteorological and atmospheric conditions;
- The equipment and operational procedures had to be assumed, based on previous experiences. Therefore, it had to be assumed that the sound power emission levels of equipment and processes used for the calculations are representative of those that will be employed on the Project;
- Traffic flow on the N2 for modelling purposes was based on the information found on the internet. This data is dated 2013 and a growth rate of 3% was assumed to estimate traffic flow in 2019;
- All the activities during construction and production take place simultaneously at all the locations of the mining operation, therefore no specific sequence of events was modelled;
- The hauling of mined coal to the surface is done by an underground conveyor system;
- During construction all activities take place at ground level; and
- Haulage was calculated for an estimated 408 000 tpa.

4 Relevant Legislation, Standards and Guidelines

4.1 South African National Standard SANS 10103

South African National Standard (SANS) 10103 is the document that specifies the methodology for measuring and assessing environmental noise in South Africa. Table 4-1 of this document provides guidelines of typical ambient noise levels that may be expected in different types of districts and the estimated community reaction to increases in ambient noise levels. SANS 10103 is in line with the World Health Organisation guideline (WHO, 1999) and conforms to the requirements of the International Standards Organisation (ISO) 1996 Parts 1 and 2.

Furthermore, Table 5 in SANS 10103 provides estimates of a community's reaction to an increase in ambient noise levels. This table is reproduced in Table 4-2.

Table 4-1: Acceptable rating levels for noise in districts (from Table 2 in SANS 10103, 2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]	$L_{R,dn}$[a]	$L_{Req,d}$[b]	$L_{Req,n}$[b]
Residential Districts						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
Non-Residential Districts						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50

Table 4-2: Estimated community reaction to increases in ambient noise levels (from Table 5 in SANS 10103, 2008)

Excess ($\Delta L_{Req,T}$)[a] dBA	Estimated community or group response	
	Category	Description
0 to 10	Little	Sporadic complaints
5 to 15	Medium	Widespread complaints
10 to 20	Strong	Threats of community or group action
>15	Very strong	Vigorous community or group action

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

a $\Delta L_{Req,T}$ should be calculated from the appropriate of the following:

1) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS $L_{Req,T}$ of the residual noise (determined in the absence of the specific noise under investigation);

2) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the maximum rating level for the ambient noise given in table 1;

3) $\Delta L_{Req,T}$ = $L_{Req,T}$ of ambient noise under investigation MINUS the typical rating level for the applicable district as determined from table 2; or

4) $\Delta L_{Req,T}$ = Expected increase in $L_{Req,T}$ of ambient noise in an area because of a proposed development under investigation.

5 Methodology

5.1 Noise Baseline Measurements

The baseline noise investigation was carried out in from the 2nd to the 5th of September 2019. The noise specialist used the "A Cirrus", Optimus Green, precision integrating sound level meter to collect baseline noise measurements. The instrument was field calibrated with a Cirrus, sound level calibrator. The locations of the noise measurements and weather conditions recorded during the study are given in Table 5-1 below. In addition, photographs of the sampling locations are provided from Figure 5-1.

Table 5-1: Noise Measurement Locations

Location	Coordinates		Category of receptor	Weather conditions
Twyfelaar portion 298 IT	26°42'47.6"S	30°14'42.6"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 20%
Private farm	26°42'09.3"S	30°13'29.6"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 30%
Twyfelaar portion 298	26°42'43.99"S	30°13'36.07"E	Residential	Clear Sky, wind speed <5m/s, Humidity: 80%

Figure 5-1: Noise measurement

Right to left (Twyfelaar Portion 298 IT, Private Farm, Twyfelaar Portion 298)

5.2 Modelling of Noise

The following section provides the methodology used to model the predicted noise impacts from the mine activities.

5.2.1 Existing Ambient Noise Levels

The pre-development ambient noise levels were estimated by projecting the resulting road traffic noise levels onto a base of 36 dBA. The result was used as the reference scenario to determine the impact of the noise emissions from the Dagsoom Project.

5.2.2 Description of the Modelling Method: Road Traffic Noise

The noise emissions from road traffic on the N2 were modelled in accordance with the procedures specified in SANS 10210. The model took account of the following:

- The predicted sound power noise emission levels of equipment and processes;
- The attenuation of noise as a function of distance due to geometrical spreading;
- The excess attenuation due to the absorption of noise energy by the air and ground; and
- The effect the topography had on the propagation of road traffic noise.

The assumed traffic flow conditions are given in Appendix A.

5.2.3 Description of the Modelling Method: Mining Operation

A three-dimensional model for the calculation of the noise emissions and propagation from the mining operation was developed. The model took account of the following:

- The predicted sound power noise emission levels of equipment and processes;
- The attenuation of noise as a function of distance due to geometrical spreading;
- The excess attenuation due to the absorption of noise energy by the air and ground;
- The effect that meteorological conditions and other atmospheric factors have on the propagation of noise;
- The screening against the propagation provided by the topography; and
- The key operational parameters of the mining activities during construction and operation, for example the number of haul truck movements per hour, the physical location of equipment and their work factors.

The propagation of noise was calculated in accordance with the **CON**servation of **C**lean **A**ir and **W**ater in **E**urope (CONCAWE) method as specified in SANS 10357. This method is an internationally accepted procedure for the calculation of noise propagation over long distances.

A list of the sound power noise emission levels of the equipment and processes and the assumed meteorological conditions used in the calculations are given in Appendix A of this report.

5.2.4 Modelled Phases of the Mining Project

The phases of the mining project that were modelled are summarised in Table 5-2.

Table 5-2: Modelled Phases of the Mining Operation

Phase	Description	Activities	Noise sources
1	Construction	▪ All activities at ground level and taking place at all the locations; ▪ Clearing of vegetation; ▪ Earthworks; ▪ Dumping; ▪ Grading and rolling of roads; and ▪ Construction of infrastructure, process platforms and adits.	▪ Bulldozer D9T; ▪ Grader 16M; ▪ Excavator 390; ▪ Roller BW219; ▪ FEL 996 ▪ Bell D40 ADT; and ▪ General construction noise.
2	Operation	▪ Plant fully operational; ▪ Handling of ROM materials; ▪ Acoustic screening provided by the topography; ▪ Hauling of coal to the surface by conveyor; and ▪ 24/7 operations.	▪ Crushing and screening circuit; ▪ Washing plant; ▪ Load bin; ▪ FEL 996; ▪ Transport truck; ▪ Bulldozer D9T; ▪ Rail loading facility; and ▪ General noise
3	Decommissioning	▪ Disassembling of plants and other infrastructure; ▪ Breaking of platforms ▪ Earthworks	▪ Bulldozer D9T; ▪ FEL 996; and ▪ General noise.

5.2.5 Presentation of the Noise Impacts

The noise impacts were presented as contours of the future resulting total ambient noise levels and the increases in existing ambient noise levels, superimposed on a scaled satellite image of the Project area and its environment (Section 7.2).

The contours calculated for resulting total ambient noise levels were:

- 40 dBA;
- 45 dBA;
- 50 dBA;
- 55 dBA; and
- 60 dBA.

SANS 10103 provides a guideline for estimating community response to an increase in the general ambient noise level caused by an intruding noise. If Δ is the increase in noise level, the following criteria are of relevance:

- $\Delta \leq 0$ dB: An increase of 0 dB or less will not cause any response from the community;
- $\Delta = 1$ dB: Any increase of less than 1 dB is negligible;
- 0 dB $< \Delta \leq$ 10 dB: An increase of between 0 dB and 10 dB will elicit ‘little’ community response with ‘sporadic complaints’. However, between 5 dB and 10 dB the strength of the response will gradually change to ‘medium’ with ‘widespread complaints’;
- $\Delta = 3$ dB: For a person with average hearing acuity an increase of less than 3 dB in the general ambient noise level will not be noticeable. Therefore, 3 dB is a useful

‘significance indicator’ that will be used in this study to assess whether a noise impact is significant or not;

- 5 dB < Δ ≤ 15 dB: An increase of between 5 dB and 15 dB will elicit a ‘medium’ community response with ‘widespread complaints’. It is also worth noting that an increase of 10 dB is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 10 dB the community reaction will gradually change to ‘strong’ with ‘threats of community action’; and
- 15 dB < Δ: For an increase in excess of 15 dB the community response will gradually increase in strength to ‘very strong’ with ‘vigorous community action’.

The overlapping ranges of community responses reflect the fact that there is no clear-cut transition from one community response to another. Instead the transition is more gradual and may differ substantially from one scenario to another, depending on many variables. For the purpose of this noise impact study the increase in the ambient noise level was expressed as contours of:

- Δ = 0 dB;
- Δ = 1 dB;
- Δ = 3 dB (significance indicator);
- Δ = 5 dB;
- Δ = 10 dB; and
- Δ = 15 dB.

6 Results

6.1 Baseline Noise Levels

The noise time history graphs (Figure 6-1 to Figure 6-3) and results from that investigation were used to obtain estimates of a baseline noise level for the environment of the proposed Project. Table 6-1 summaries the results obtained at each location in comparison with the regulatory limits.

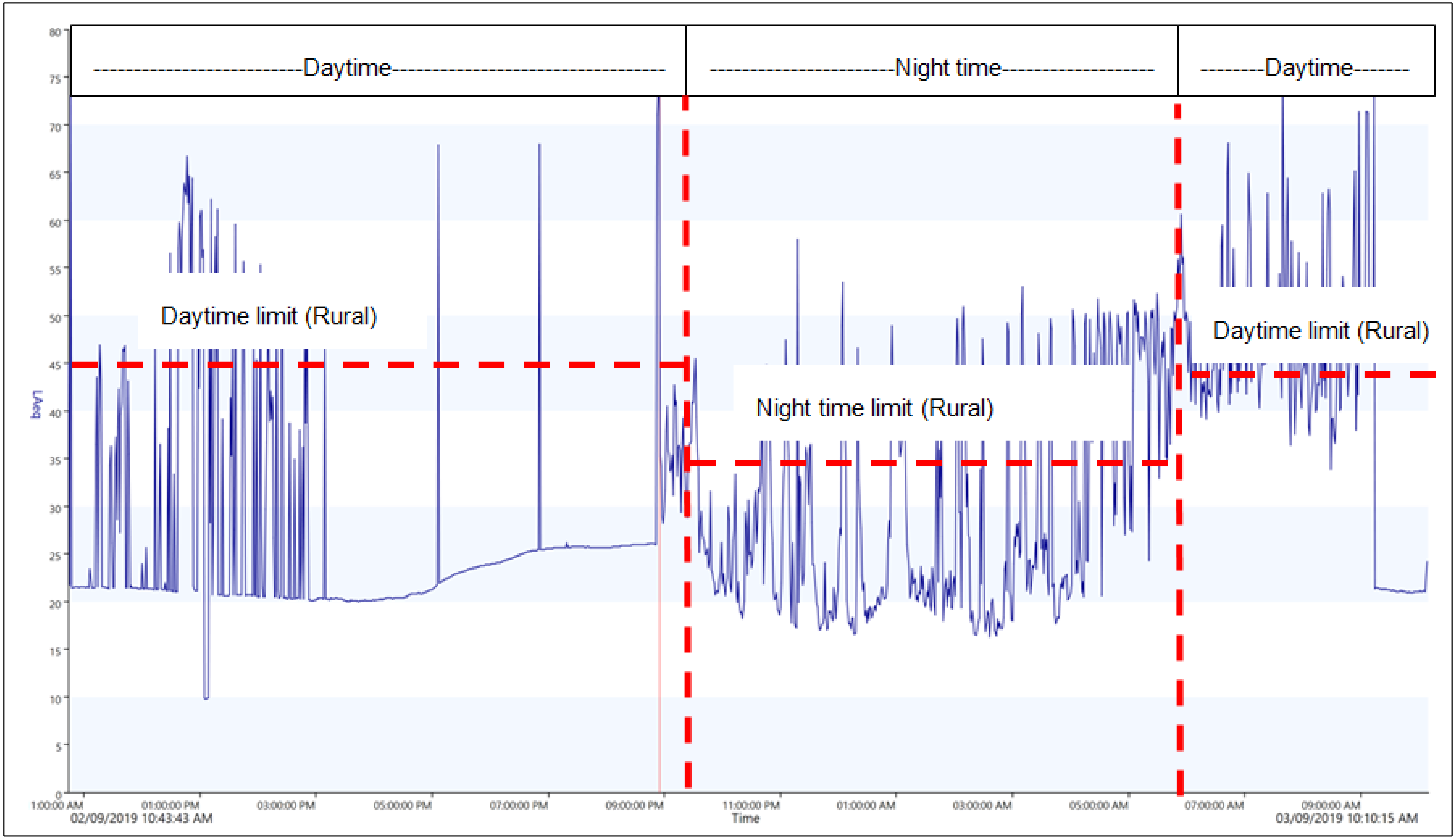

Figure 6-1: Noise time history graph at Twyfelaar Portion 298 IT

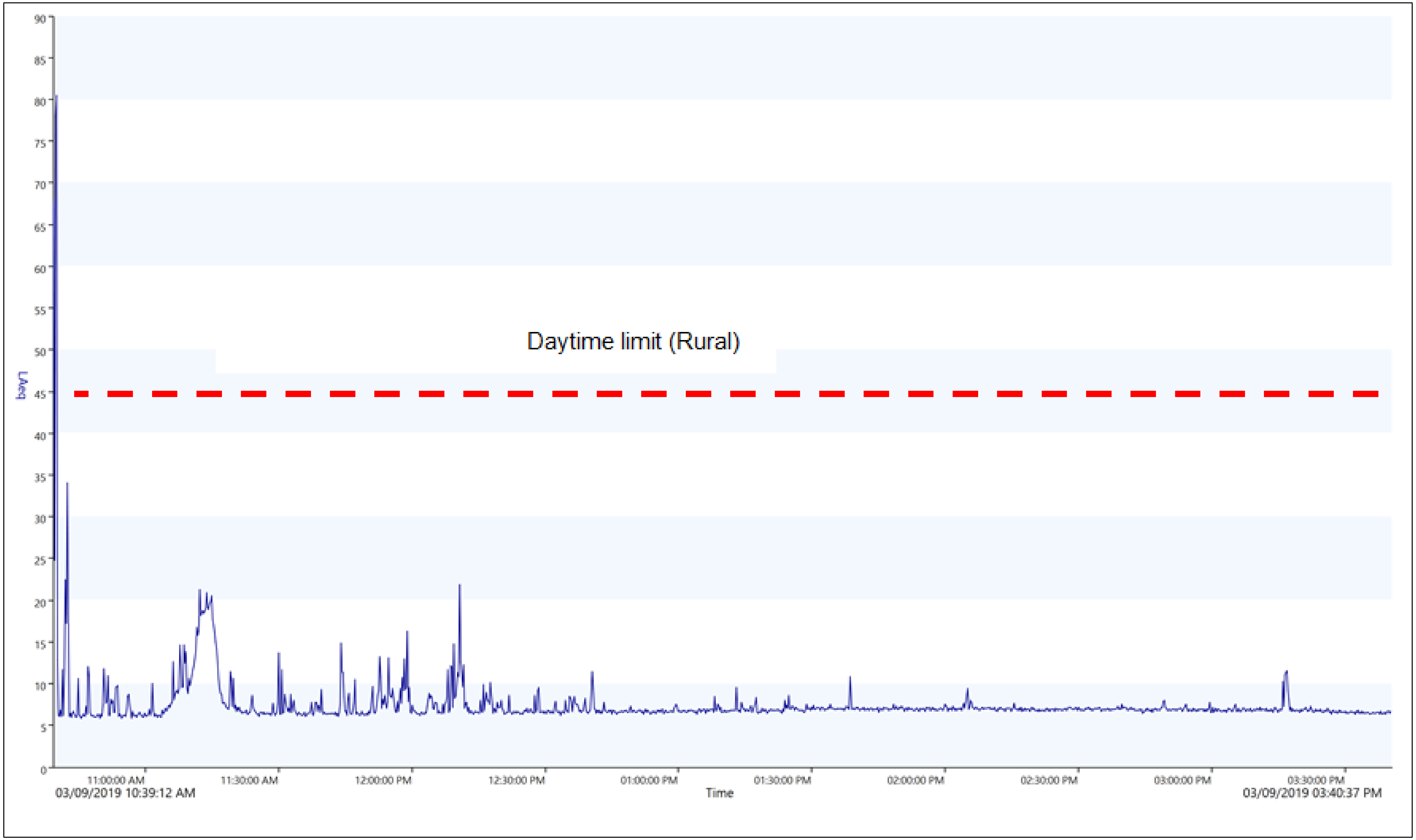

Figure 6-2: Noise time history graph at a Private Farm

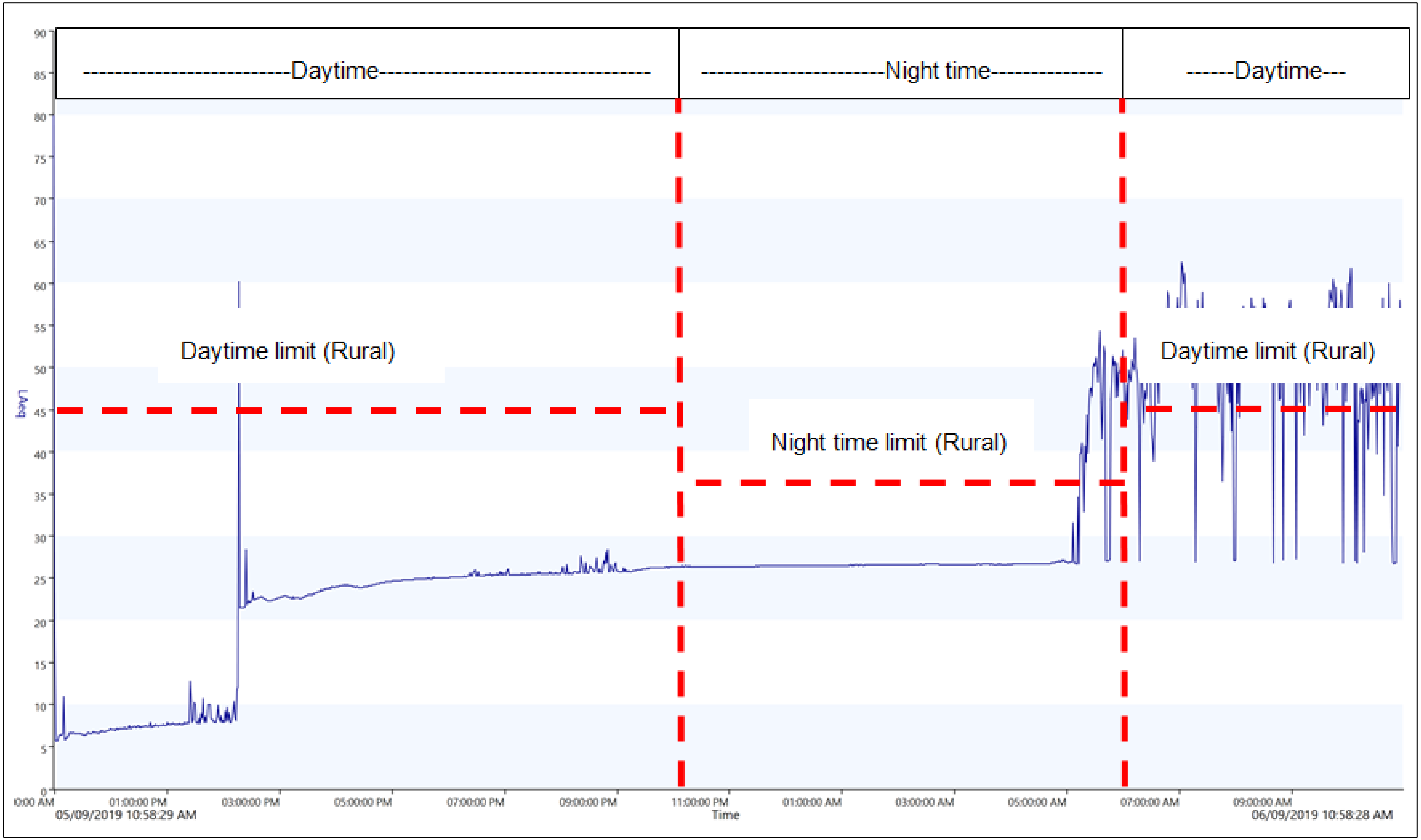

Figure 6-3: Noise time history graph at Twyfelaar

Table 6-1: Results of the Baseline Noise Measurements

<table>
<tr><th rowspan="2">Location ID</th><th colspan="7">SANS 10103:2008 – Rural district Guidelines</th></tr>
<tr><th>Type of receptor</th><th>Period</th><th>Acceptable rating level dBA</th><th>L_{Aeq} dBA</th><th>L_{A90}</th><th>Maximum/Minimum dBA</th><th>Date</th></tr>
<tr><td rowspan="2">Twyfelaar portion 298 IT</td><td rowspan="2">Residential</td><td>Daytime</td><td>45</td><td>55</td><td rowspan="2">20</td><td rowspan="2">93/16</td><td rowspan="2">02/09/2019</td></tr>
<tr><td>Night time</td><td>35</td><td>43</td></tr>
<tr><td>Private farm (Molton Mpheti)</td><td>Residential</td><td>Daytime</td><td>45</td><td>51</td><td>20</td><td>91/4</td><td>03/09/2019</td></tr>
<tr><td rowspan="2">Twyfelaar farm portion 298 (Communal farm)</td><td rowspan="2">Residential</td><td>Daytime</td><td>45</td><td>53</td><td rowspan="2">20</td><td rowspan="2">91/4</td><td rowspan="2">05/09/2019</td></tr>
<tr><td>Night time</td><td>35</td><td>38</td></tr>
<tr><td></td><td colspan="7">Indicates current LAeq levels above either the daytime rating limit or the night-time rating limit</td></tr>
</table>

The results of the baseline noise survey at three sampling points have shown that the noise levels were above SANS 10103:2008 guidelines for ambient noise in rural district for daytime (45 dBA) and for night time (35 dBA) respectively. However, LA90 for the three sites were at 20 dBA and below the recommended limits for day time and night time. The main intrusive noise sources impacting on the background soundscape in the area included the trains transporting coal, and cattle. Various parts of a train produce noise, especially the train wheels, which produces a different amount of noise.

It is important to indicate that measurements of Twyfelaar farm portion 298 were partially influenced by the rain during the night time and the second period of daytime. With the train identified as the major source impacting the environmental noise background, mining and related activities can represent a cumulative addition to the ambient noise levels.

6.2 Noise Model Results

Results of the noise assessment are provided per phase of activity (construction, operation and decommissioning) in the following sections. Prior to the aforementioned, an assessment of the existing noise baseline was modelled.

6.2.1 Existing Ambient Noise Levels

The modelled existing ambient noise levels are presented in Figure 6-4.

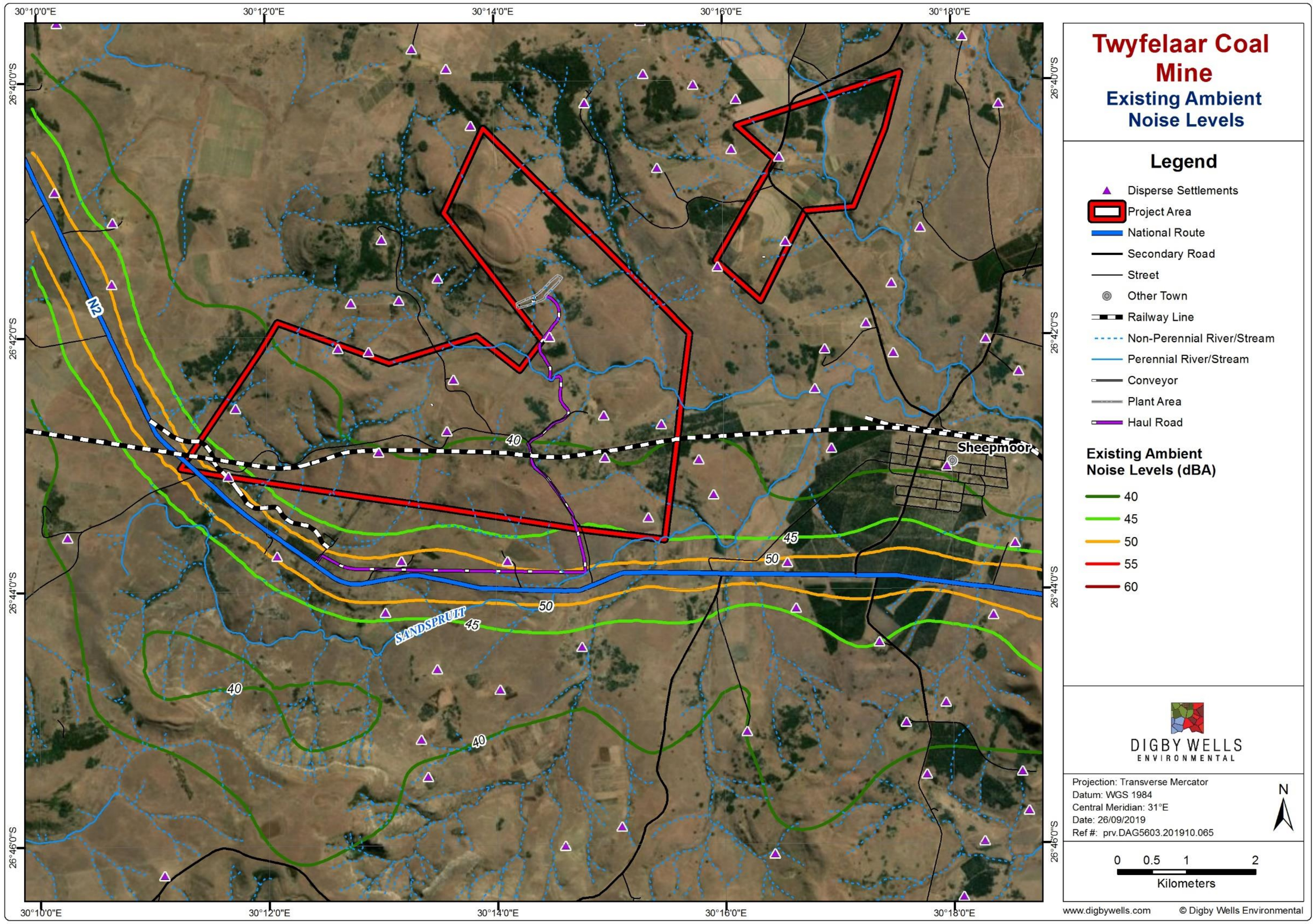

Figure 6-4: Modelled existing ambient noise levels

6.2.2 Construction Phase

The noise impact contours generated for the baseline and construction phase are given in Figure 6-5 and Figure 6-6

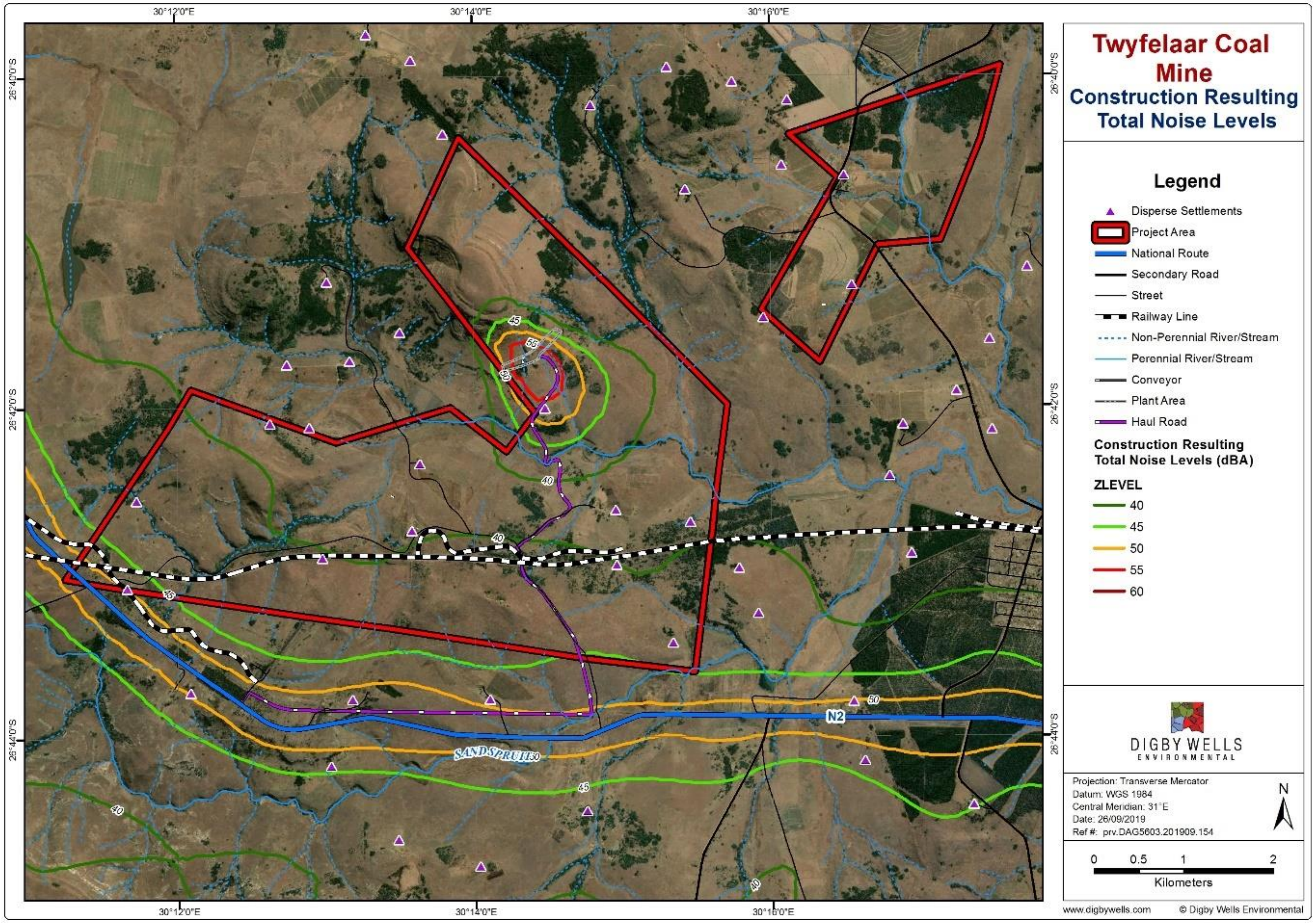

Figure 6-5: Construction: Noise impact expressed as the resulting total ambient noise levels

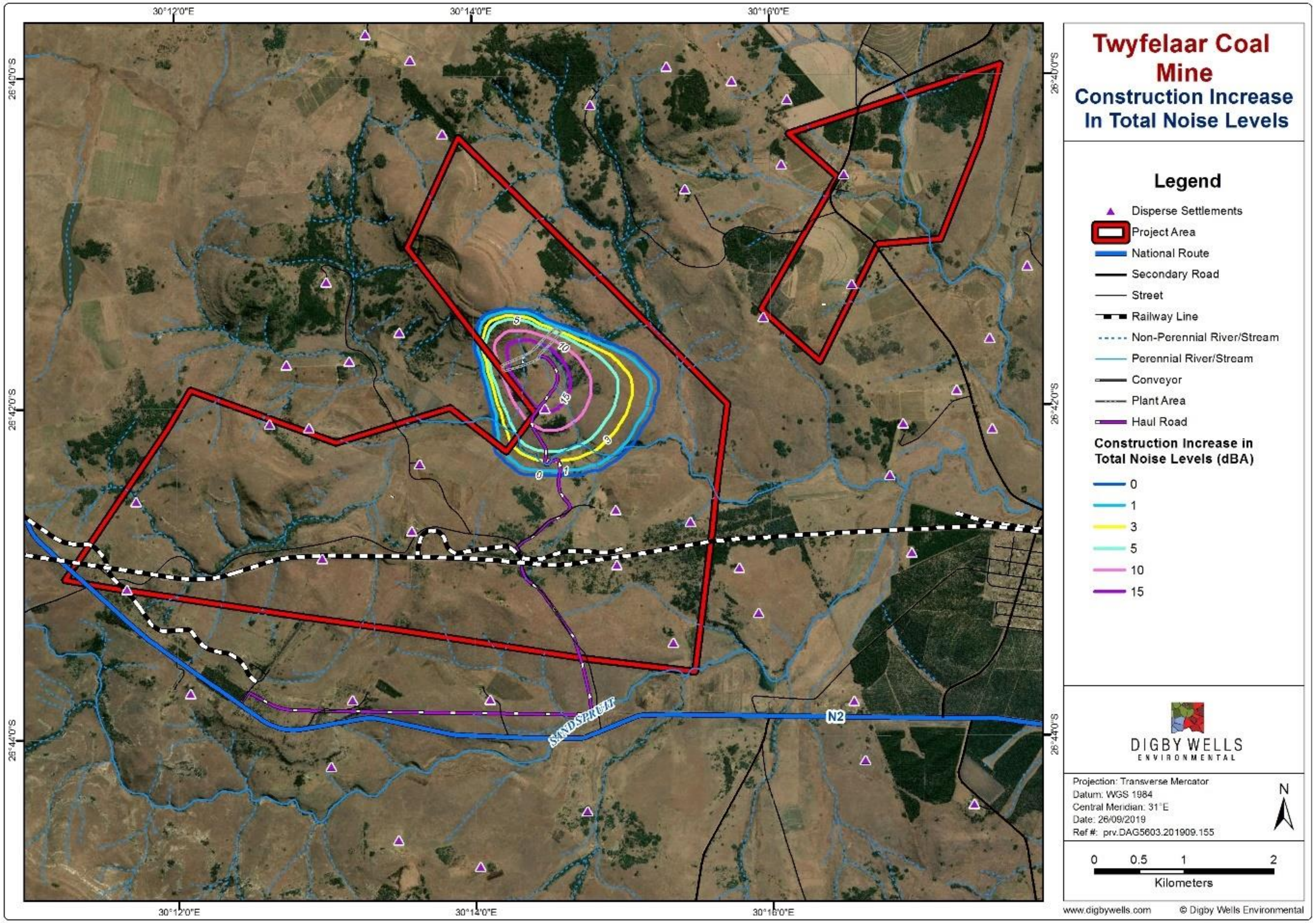

Figure 6-6: Construction: Noise impact expressed as increase in ambient noise level

The following remarks are relevant to these noise impacts:

- The resulting total ambient noise levels (Figure 6-5) show that the noise contours are located either inside the Dagsoom Project boundaries or close to them;
- The resulting increase in ambient noise levels (Figure 6-6) will not affect any existing homesteads outside the Dagsoom Project boundaries;
- According to the SANS 10103 [2] there will be no community reaction to the expected increase in ambient noise levels during construction; and
- Therefore, the impact that the Dagsoom Project will have on existing ambient noise levels during construction is negligible.

6.2.3 Operational Phase

The noise impact contours generated for the operational phase of the Project are provided in Figure 6-7 and Figure 6-8.

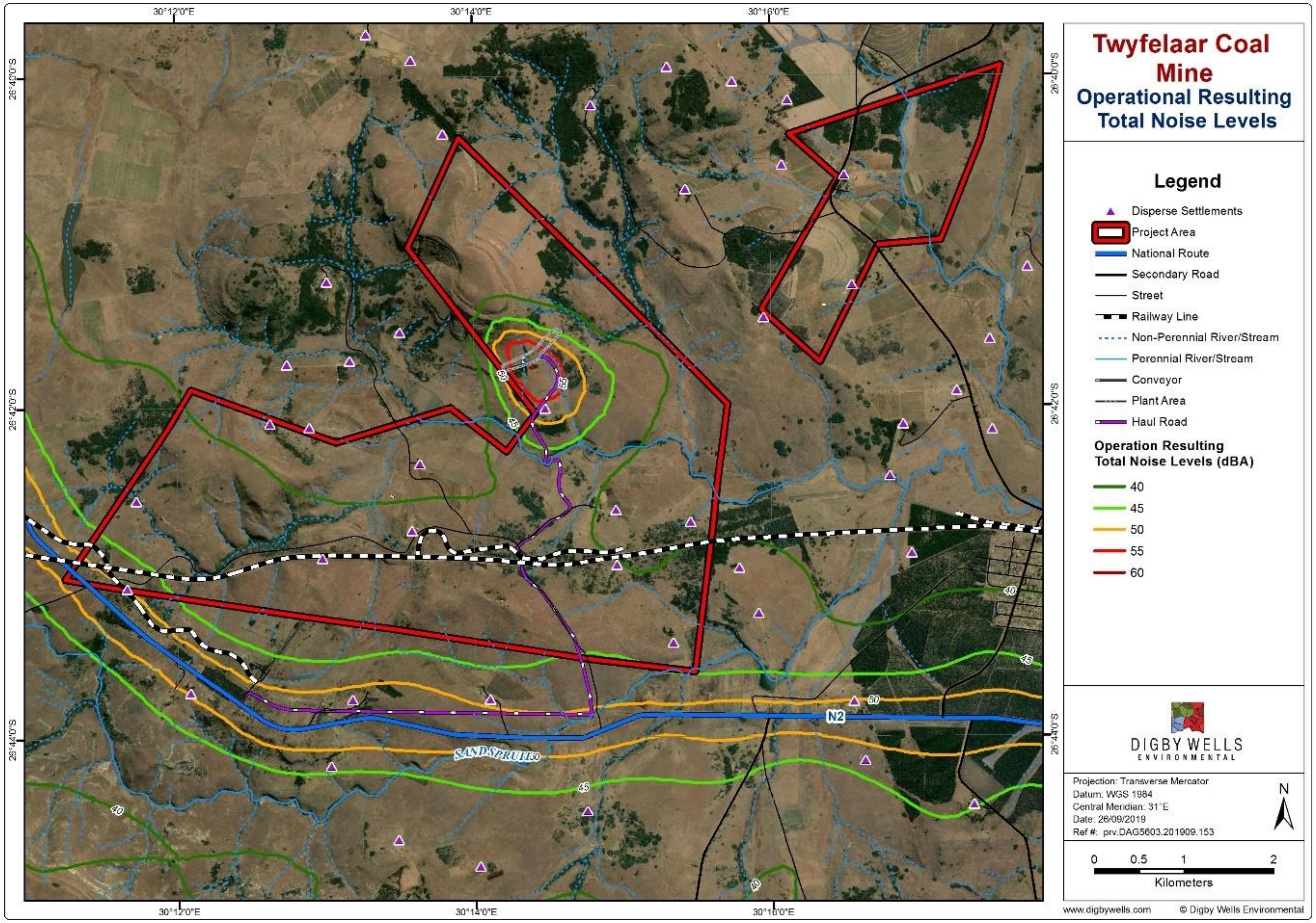

Figure 6-7: Operations: Noise Impact Expressed as the Resulting Total Ambient Noise Levels

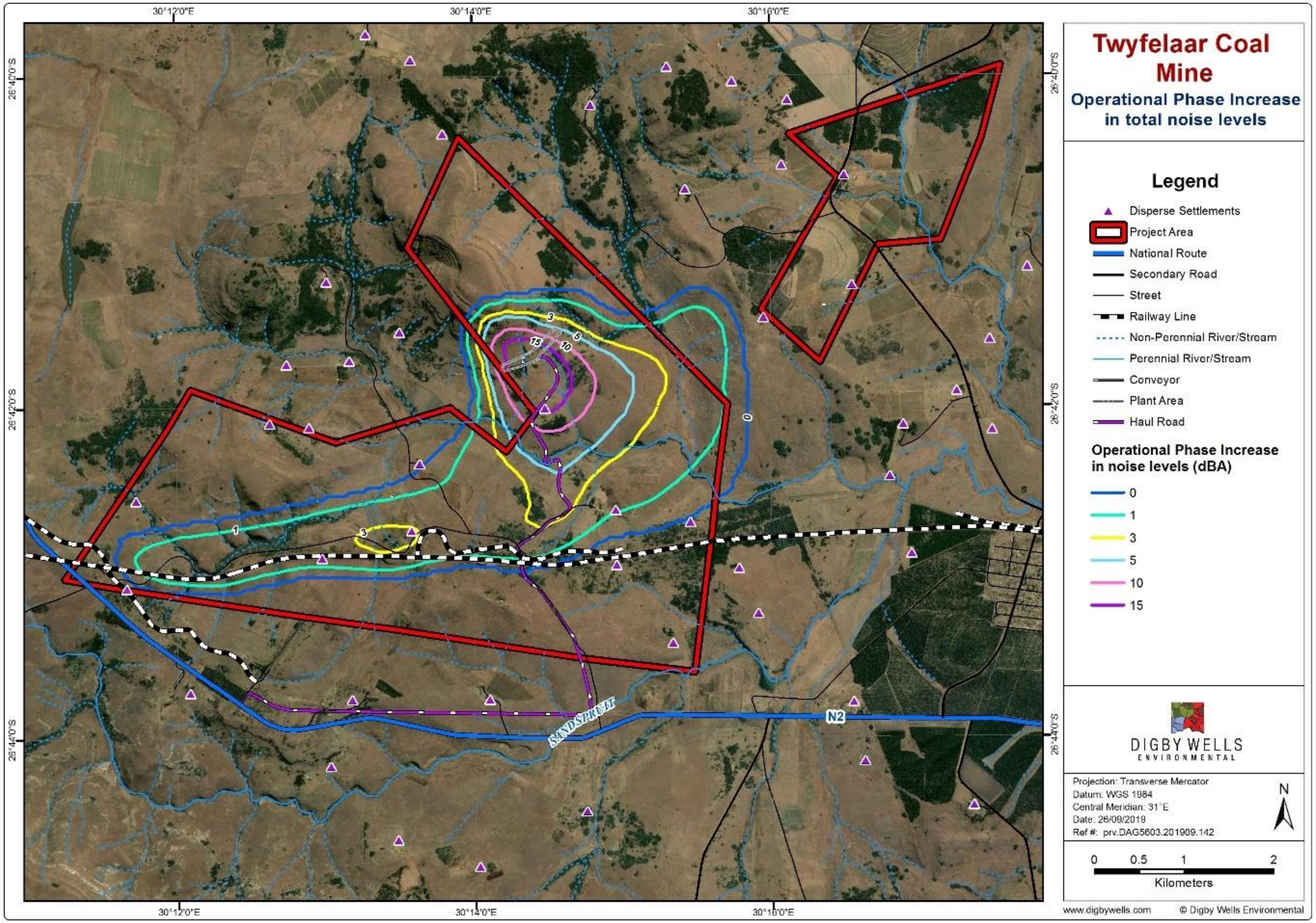

Figure 6-8: Operations: Noise Impact Expressed as the Increase in Ambient Noise Levels

The following is relevant to the noise impact contours and how these affect sensitive receptors:

- The resulting total ambient noise levels (Figure 6-7) show that the noise contours are located either inside the Dagsoom Project boundaries or close to them;
- The resulting increase in ambient noise levels (Figure 6-8) will not affect any existing homesteads outside the Dagsoom Project boundaries;
- According to SANS 10103 there will be no community reaction to the expected increase in ambient noise levels during operations; and
- Therefore, the impact that the Dagsoom Project will have on existing ambient noise levels during operations is negligible.

6.2.4 Closure

The noise impact contours generated for the closure phase of the Project are provided in Figure 6-9 and Figure 6-10.

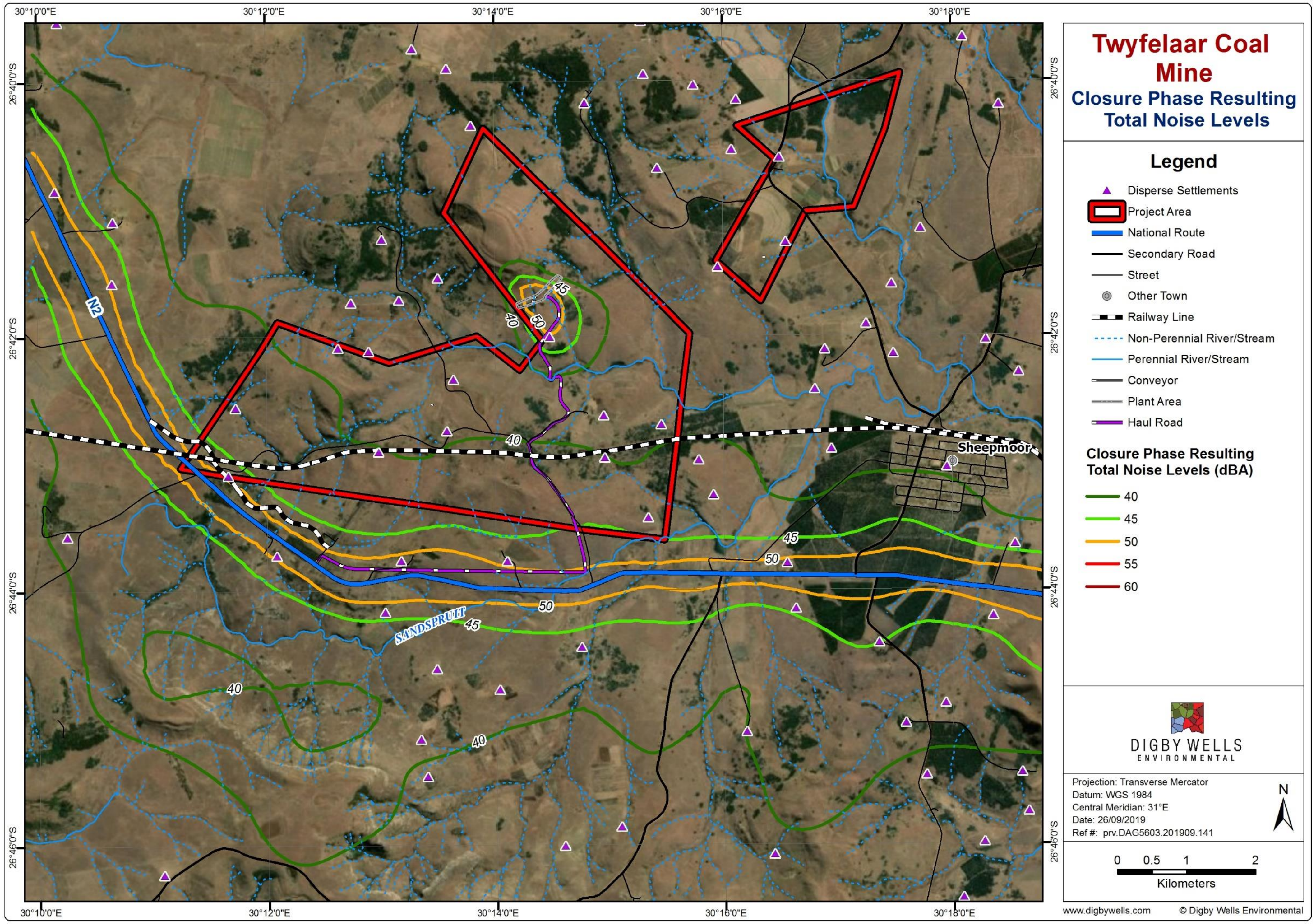

Figure 6-9: Closure: Noise Impact Expressed as the Increase in Ambient Noise Levels

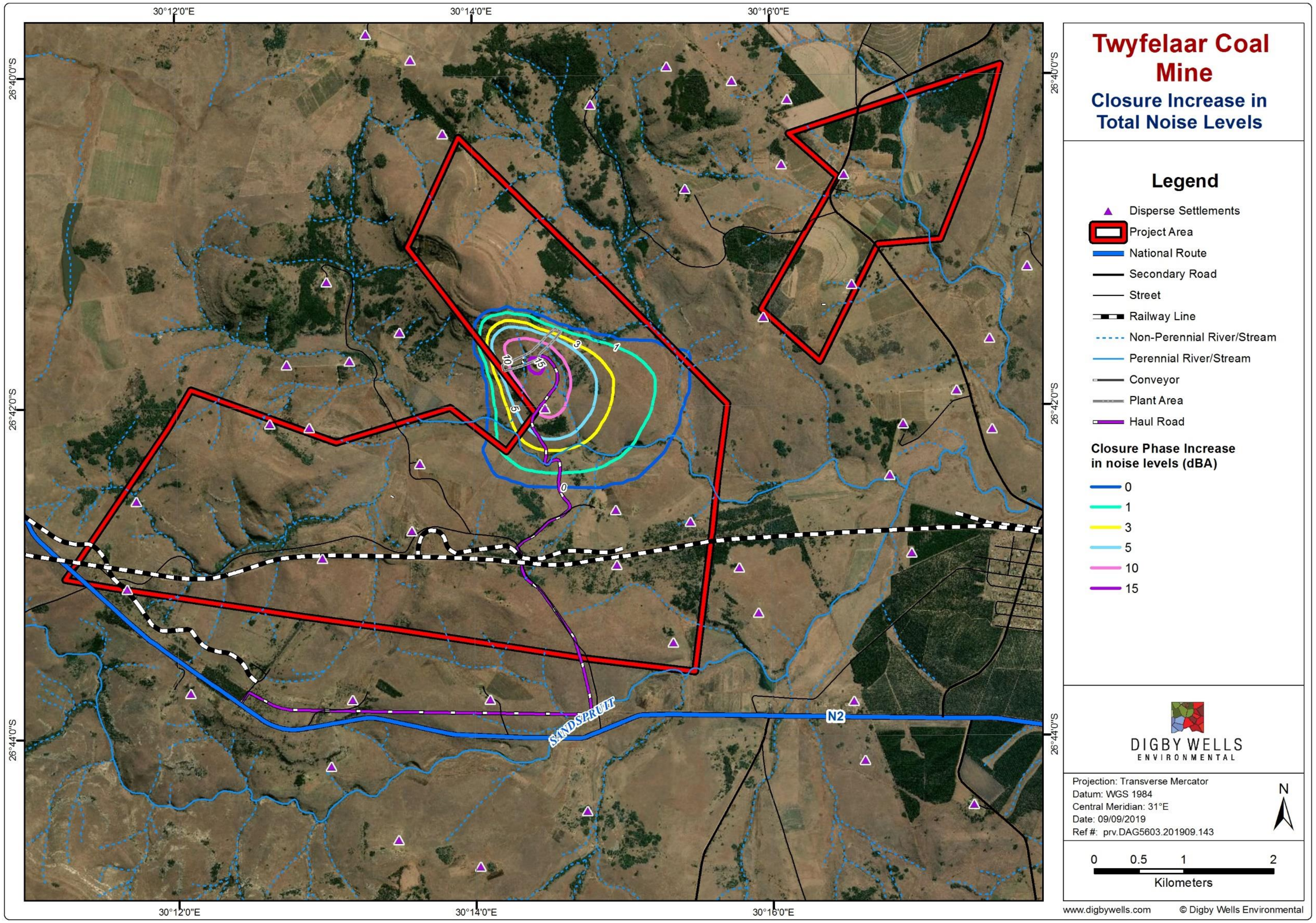

Figure 6-10: Closure: Noise Impact Expressed as the Increase in Ambient Noise Levels

The following is relevant to the noise impact contours and how these affect sensitive receptors:

- The resulting total ambient noise levels (Figure 6-9) show that the noise contours are located either inside the Dagsoom Project boundaries or close to them;
- The resulting increase in ambient noise levels (Figure 6-10) will not affect any existing homesteads outside the Dagsoom Project boundaries;
- According to SANS 10103 there will be no community reaction to the expected increase in ambient noise levels during operations; and
- Therefore, the impact that the Dagsoom Project will have on existing ambient noise levels during operations is negligible.

7 Impact Assessment

The expected noise impacts have been assessed as per the methodology in the section below.

7.1 Methodology

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

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

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

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

The matrix calculates the rating out of 147, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 7-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of eight categories (Table 7-1). The probability and the description of the significance ratings is presented in Table 7-2 and Table 7-3.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e. there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

Table 7-1: Impact Assessment Parameter Ratings

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and/or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent The impact is irreversible, even with management, and will remain after the life of the project.	Definite There are sound scientific reasons to expect that the impact will definitely occur. > 80% probability
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to high sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond Project Life The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost Certain/Highly Probable It is most likely that the impact will occur. < 80% probability

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	Positive Impacts (Nature = +1)			
5	Serious loss and/or damage to biological or physical resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/Region Will affect the entire province of region.	Project Life (> 15 years) The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely The impact may occur. < 65% probability
4	Serious loss and/or damage to biological or physical resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/items of cultural significance.	Average to intense natural and/or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long Term 6-15 years and the impact can be reversed with management.	Probable Has occurred here or elsewhere and could therefore occur. < 50% probability

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
3	Moderate loss and/or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium Term 1-5 years and the impact can be reversed with minimal management.	Unlikely Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. < 25% probability
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experienced by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short Term Less than 1 year and is reversible.	Rare/Improbable Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. < 10% probability

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to common place structures.	Some low-level natural and/or social benefits felt by a very small percentage of the baseline.	Site Specific Limited to specific isolated parts of the site.	Immediate Less than 1 month and is completely reversible without management.	Highly Unlikely/None Expected never to happen. < 1% probability

Table 7-2: Probability/Consequence Matrix

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

Table 7-3: Significance Rating Description

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

7.1.1 Construction Phase

This section specifically discusses the activities included in the construction phase and the significance of their impact on the ambient noise levels at the nearby villages.

7.1.1.1 Impact Description

The project activities that have been assessed as part of the construction phase are as follows:

- Site clearing, including the removal of topsoil and vegetation;
- Stockpiling of overburden; and
- Construction of mining infrastructure, i.e. the haul road, services, processing plant, rail loading facility and administration offices.

The construction noise dispersion modelling results indicate that the noise impact caused by the construction activities will be negligible.

7.1.1.2 Impact Ratings

The noise impact during the construction phase of the project compared to the existing baseline has been assessed and is provided in Table 7-4

Table 7-4: Potential Noise Impacts of the Construction Phase

<table>
<tr><td colspan="4">Activity and Interaction: Site clearing, and the construction of infrastructure will result in the generation of noise.</td></tr>
<tr><td colspan="4">Impact Description: Noise will emanate from the machinery, and vehicles during the site preparation, haul road construction as well as processing plant construction activities and may exceed the South African standard SANS 10103 [2]</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Dimension</td><td>Rating</td><td>Motivation</td><td>Significance</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>Noise will be produced for the duration of the construction phase.</td><td rowspan="5">Negligible (negative) – 18</td></tr>
<tr><td>Extent</td><td>Limited to project footprint and immediate surrounding (2)</td><td>It is expected that during construction, noise will be limited to the Project footprint and its immediate surrounding.</td></tr>
<tr><td>Intensity</td><td>Minimal - negative (-1)</td><td>It is expected that during construction, noise will increase the ambient noise at the Project site less than 3dB, which is insignificant. It will be less than 1 dB</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>It is unlikely that noise will impact on the community of Sheepmoor</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Vehicles to be serviced as per their design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;
▪ Regulate vehicle speeds on the access and haul roads; and
▪ Switch off equipment when not in use.</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Dimension</td><td>Rating</td><td>Motivation</td><td>Significance</td></tr>
</table>

Activity and Interaction: Site clearing, and the construction of infrastructure will result in the generation of noise.			
Duration	Medium term (3)	Noise will be produced for the duration of the construction phase	Negligible (negative) – 15
Extent	Limited to project footprint (1)	It is expected that during construction, noise will be limited to the Project footprint and its immediate surrounding.	
Intensity	Minimal - negative (-1)	It is expected that during construction, the noise emissions will have a negligible impact on existing ambient noise levels in the project's immediate environment.	
Probability	Unlikely (3)	It is unlikely that noise will impact on any of the existing dwellings.	
Nature	Negative		

7.1.2 Operational phase

This section specifically discusses the activities included in the operational phase and the significance of their impact on the ambient noise levels in the immediate environment of the project.

7.1.2.1 Impact Description

The project activities that have been assessed as part of the operational phase are as follows:

- Operation of the process plant;
- Handling of coal and discard materials including transport along the haul road to the rail loading station and stockpiling at the ROM pad; and
- Acoustic screening provided by the topography of the larger area.

The results indicate that the expected noise during the operational activities will not cause a noise impact at sensitive receptors and will comply with the SANS 10103 guidelines.

It is recommended that the following occupational health and safety mitigation measures are implemented on site:

- All areas within the workspace identified as noise zones should be demarcated as such with correct signage to indicate what Personal Protective Equipment (PPE) should be worn by site personnel;
- The client should supply workers, who need to work in demarcated noise zones, with correct hearing protectors; and
- Workers should be exposed to high noise levels for shorter periods of time or personnel should be rotated between a low noise process and higher noise zones.

7.1.2.2 Impact Ratings

The noise impact during the operational phase is rated by comparing the results of the expected operational noise and the existing baseline noise measurements. Table 7-5 summarises the ratings and indicates the final significance of the operational noise impact on the surrounding sensitive receptors.

Table 7-5: Potential Noise Impacts of the Operational Phase

<table>
<tr><td colspan="4">Activity and Interaction: Mining and Processing of Ore</td></tr>
<tr><td colspan="4">Impact Description: Noise will emanate from the crusher, screening and washer plants and hauling of coal. However, the noise levels will not exceed the SANS 10103 guidelines in the immediate environment of the mining operation boundaries.</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Noise will be produced for the duration of the operational phase</td><td rowspan="4">Negligible (negative) – 24</td></tr>
<tr><td>Extent</td><td>Limited to project footprint and immediate surrounding (2)</td><td>It is expected that during operations increases in ambient noise levels in excess of 3 dB will only occur in close proximity of the mining property boundary. No dwellings will be affected.</td></tr>
<tr><td>Intensity</td><td>Minimal - negative (-1)</td><td>Noise causes due to its very nature a negative impact.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>It is unlikely that noise will have a significant impact on any dwellings in the environment of the mining operation.</td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">▪ Vehicles re to be serviced to the design requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers;
▪ Switch off equipment when not in use;
▪ Regulate the speed of vehicles traveling on access and haul roads.</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Noise will be produced for the duration of the operational phase.</td><td rowspan="5">Negligible (negative) – 18</td></tr>
<tr><td>Extent</td><td>Limited to project footprint and immediate surrounding (2)</td><td>It is expected that during operations once mitigation is implemented, noise will be limited to the project footprint and its immediate surrounding.</td></tr>
<tr><td>Intensity</td><td>Minor - negative (-2)</td><td>It is expected that during operations, noise will have a minor impact</td></tr>
<tr><td>Probability</td><td>Improbable (2)</td><td>It is improbable that noise will impact in the mining operation’s larger environment.</td></tr>
<tr><td>Nature</td><td colspan="2">Negative</td></tr>
</table>

7.1.3 Decommissioning Phase

The decommissioning activities will mainly involve dismantling of the plant and offices and the rehabilitation of the infrastructure platforms and haul road.

7.1.3.1 Impact Description

It is expected that the decommissioning activities will have a negligible impact due to the limited and less machine intensive activities being undertaken on site compared with the construction and operational phases; therefore, the impact significance is likely to be lower.

Decommissioning activities should be restricted to daylight hours to keep the night-time noise levels to a minimum. Mining related machinery and vehicles should be switched off when not in use.

7.1.3.2 Impact Ratings

Table 7-6 summarises the impact significance of the decommissioning phase of the Project.

Table 7-6: Potential Noise Impacts of the Decommissioning Phase

Activity and Interaction: Removal of infrastructure and surface rehabilitation			
Impact Description: Noise will emanate from the machinery and vehicles undertaking the decommissioning and rehabilitation activities.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase.	Negligible (negative) – 10
Extent	Limited (2)	It is expected that during decommissioning noise will be limited to site and its immediate surroundings.	
Intensity	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact.	
Probability	Improbable (2)	It is expected that that noise will improbably impact on the surrounding receptors.	
Nature	Negative		
Mitigation/Management Actions			
▪ Restrict decommissioning activities to daylight hours (06:00 – 18:00); ▪ Regularly service decommissioning related machines and vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; ▪ Regulate speed limits on access roads; and ▪ Switch off equipment when not in use.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase.	Negligible (negative) – 8
Extent	Isolated (1)	It is expected that if recommended management measures are implemented, noise will be limited to certain part of the site.	

Intensity	Minimal - negative (-1)	It is expected that during decommissioning noise will have a minimal impact.	
Probability	Improbable (2)	It is expected that that noise will improbably impact on the surrounding receptors.	
Nature	Negative		

8 Conclusions

The following conclusions are drawn from the results of this noise impact study:

- For both the construction and operational phases the contours indicating higher noise impacts, i.e. 45 dBA/55 dBA (resulting total ambient noise level) and 5 dB (increase in ambient noise level) fall in close proximity to the relevant activities;
- The future ambient noise levels in the closest dwellings will fall within the guideline levels of 55 dBA and 45 dBA;
- The noise impacts are mostly nil, negligible or insignificant at most, at all sensitive receptors; and
- The severity of the noise impact during both the construction, operational and closure phases of the mine will be **VERY LOW**.

9 Recommendations

Due to the very low severity of the noise impacts, the noise specialist does not object to the Project going ahead. However, it is recommended that the mine management put mitigation measures in place to further limit noise propagation once operational.

10 References

Scorpion Mineral Processing South Africa Ltd, Processing Report for the Dagsoom Coal Project

SANS 10103:2008 'The measurement and rating of environmental noise with respect to annoyance and to speech communication', Edition 6.

Guidelines for Community Noise, World Health Organisation, Geneva, 1999

ISO 1996-1, Acoustics – Description, measurement and assessment of environmental noise – Part 1: Basic quantities and assessment.

ISO 1996-2, Acoustics – Description, measurement and assessment of environmental noise – Part 2: Determination of environmental noise levels.

SANS 10357:2004 'The calculation of sound propagation by the Concawe method'. Edition 1.2.

SANS 10210:2004 'Calculating and predicting road traffic noise', Edition 2.2.

Appendix A: Modelling Data

The sound power emission levels of the equipment and processes are provided below:

Equipment	Sound power level (dB re 12pW) in octave frequency band, Hz							dBA
	63	125	250	500	1000	2000	4000	
Bulldozer, D9	100.0	118.0	111.0	109.0	107.0	103.0	97.0	109
FEL 966	111.5	107.0	100.8	101.1	96.8	97.0	95.8	101
Backactor	113.0	111.2	103.6	101.3	97.6	93.8	89.0	101
Grader 140H	102.2	107.6	108.6	105.8	102.2	98.8	92.8	105
Vibrating roller	104.1	111.0	101.3	103.6	104.3	103.3	96.8	106
ADT	108.2	108.0	106.8	106.9	104.0	101.8	98.7	106
Drill	104.0	114.0	116.0	111.0	109.0	107.0	101.0	111
Crusher	104.1	107.6	110.5	109.3	105.1	100.1	92.3	110
Screen	92.6	92.5	91.1	89.5	93.0	91.9	86.8	97.2
Open wash plant	117.5	107.3	104.3	105.2	105.2	100.5	100.2	109
Load bin	96.4	103.7	98.2	95.2	95.0	93.2	91.9	97.4
Belt drive and distributor	102.3	103.7	106.7	104.8	104.3	101.2	95.1	108
Railway loading plant	95.0	100.0	103.0	105.0	105.0	100.0	100.0	105
Ventilation system	113.6	104.5	100.6	100.8	100.8	96.5	96.0	105
Transport truck	90.0	101.0	102.0	105.0	105.0	104.0	99.0	106
General noise	100.0	103.0	103.0	101.0	98.0	95.0	89.0	103

The assumed meteorological conditions are given below:

Parameter	Value
Temperature	18 °C
RHD	78%
Static air pressure	102 kPa
Wind direction	SE
Wind speed	2 m/s
Solar irradiation	528 W/m^2
Cloud cover	1/8
Ground conditions	70% soft

The assumed traffic flow data

Parameter	Value
Q (AAHT)	311 vehicles/hr
Average speed	100 km/h
% Heavy vehicles	15%
Wind direction	SE
Wind speed	2 m/s
Solar irradiation	528 W/m^2
Cloud cover	1/8
Ground conditions	70% soft