DRAFT IMPACT REPORT

In terms of the

National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended & Environmental Impact Regulations 2014

Prepared for

Colenso Power (Pty) Ltd

August 2015

Prepared by

EcoPartners

REPORT NR: DUN 1503EEI4

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Regulation	Section in Report
An environmental impact assessment report must contain the information that is necessary for the competent authority to consider and come to a decision on the application, and must include-	
(a) details of- (i) the EAP who prepared the report; and (ii) the expertise of the EAP, including a curriculum vitae;	Section 1.2.2 & Appendix A
(b) the location of the activity, including: (i) the 21 digit Surveyor General code of each cadastral land parcel; (ii) where available, the physical address and farm name; and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Section 2.1
(c) a plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is- (i) a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken; (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken;	Figure 2.13
(d) a description of the scope of the proposed activity, including- (i) all listed and specified activities triggered and being applied for; and (ii) a description of the associated structures and infrastructure related to the development;	Section 2.2
(e) a description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context;	Section3
(f) a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred location;	Section 4
(g) a motivation for the preferred development footprint within the approved site;	Section 6.1
(h) a full description of the process followed to reach the proposed development footprint within the approved site, including: (i) details of the development footprint alternatives considered;	Section 1.2.2 & Section 6.1
(ii) details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs; (iii) a summary of the issues raised by interested and affected parties,and an indication of the manner in which the issues were incorporated, or the reasons for not including them;	Section 7 & Appendix N
(iv) the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 5 & Appendices D - M
(v) the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts-(aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated;	Section 9.3 Appendices D - M
(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	Section 9.2

Regulation	Section in Report
(vii) positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	Section 6.1 Section 9.4 - 9.16 Appendices D - M
(viii) the possible mitigation measures that could be applied and level of residual risk;	Section 9 Appendices D - M
(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such; and	N/A
(x) a concluding statement indicating the preferred alternative development location within the approved site;	Section 6.1
(i) a full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred location through the life of the activity, including-(i) a description of all environmental issues and risks that were identified during the environmental impact assessment process; and(ii) an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures;	Section 9
(j) an assessment of each identified potentially significant impact and risk, including- (i) cumulative impacts; (ii) the nature, significance and consequences of the impact and risk; (iii) the extent and duration of the impact and risk; (iv) the probability of the impact and risk occurring; (v) the degree to which the impact and risk can be reversed; (vi) the degree to which the impact and risk may cause irreplaceable loss of resources; and (vii) the degree to which the impact and risk can be mitigated;	Section 9.4 - 9.16 Appendices D - M
(k) where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report;	Section 8 Appendices D - M
(l) an environmental impact statement which contains- (i) a summary of the key findings of the environmental impact assessment: (ii) a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers; and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Section 12
(m) based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation; (n) the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;	Section 13
(o) any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation	Section 12
(p) a description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;	Section 10

Regulation	Section in Report
(q) a reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation; (r) where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised;	Section 12
(s) an undertaking under oath or affirmation by the EAP in relation to: (i) the correctness of the information provided in the reports; (ii) the inclusion of comments and inputs from stakeholders and I&APs; (iii) the inclusion of inputs and recommendations from the specialist reports where relevant; and (iv) any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties;	Section 1.2.2 Appendix A
(t) where applicable, details of any financial provisions for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;	Not Applicable
(u) an indication of any deviation from the approved scoping report, including the plan of study, including- (i) any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and (ii) a motivation for the deviation;	Section 9.1
(v) any specific information that may be required by the competent authority; and (w) any other matters required in terms of section 24(4)(a) and (b) of the Act.	Section11 Appendix O
1. (1) An **EMPr** must comply with section 24N of the Act and include	
(a) details of (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.2.2 & Appendix A
(b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 14
(c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	Appendix O
(d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including- (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post closure; and (v) where relevant, operation activities;	Section 13 & Section 16
(e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	Section 13

Regulation	Section in Report
(f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to - (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices;	Section 16
(iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	N/A
(g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f); (h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	Section 17
(i) an indication of the persons who will be responsible for the implementation of the impact management actions;	Section 16
(j) the time periods within which the impact management actions contemplated in paragraph(f) must be implemented; (k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	Section 16
(l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 18
(m) an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 19
(n) any specific information that may be required by the competent authority.	Section 20

Acronyms and Abbreviations:

#	Acronym / Abbreviation	Description / Full text
1	AC	Alternating Current
2	ADT	Average Daily Traffic
3	ADTT	Average Daily Truck Traffic
4	AFOLU	Agriculture, Forestry and Other Land Use
5	AIA	Archaeological Impact Assessment
6	APAC	APelser Archaeological Consulting
7	AQA	Air Quality Act
8	^{o}C	Degree Celsius
9	CAGR	Compounded annual growth rate
10	CAPEX	Capital expenditure
11	CBD	Central Business District
12	CEMS	Continuous Emissions Monitoring System
13	CO	Carbon monoxide
14	CO_2	Carbon dioxide
15	DEA	Department of Environmental Affairs
16	dBA	Decibel
17	DM	District Municipality
18	DMR	Department of Mineral Resources
19	DOE	Department of Energy
20	DOT	Department of Transport
21	DWS	Department of Water and Sanitation
22	EAP	Environmental Assessment Practitioner
23	EAR	Enviro-Acoustic Research
24	EBH	Existing Bore Hole
25	EC	Electric Conductivity
26	ECA	Environmental Conservation Act
27	ED	Enterprise Development
28	EHS	Environmental Health Safety
29	EIA	Environmental Impact Assessment
30	EMP	Environmental Management Programme
31	EP	Equator Principles
32	Er	Eroded soils
33	Es	Escourt
34	ESP	Electrostatic Precipitator

#	Acronym / Abbreviation	Description / Full text
35	EU	European Union
36	FGD	Flue Gas Desulphurisation
37	FTE	Full-time equivalent
38	GDP	Gross Development Product
39	GDP-R	Gross Domestic Product per Region
40	GHG	Greenhouse Gases
41	GN	Government Notice
42	GRA	Groundwater resource assessment
43	GWh	Gigawatt - hours
44	H_2	Hydrogen
45	H_2SO_4	Sulphuric Acid
46	Ha / ha	Hectares / hectares
47	HIA	Heritage Impact Assessment
48	HIV/AIDs	Human immunodeficiency virus infection and acquired immune deficiency syndrome
49	hr	Hour
50	I& APs	Interested and Affected Parties
51	IFC	International Finance Corporation
52	IPCC	Intergovernmental Panel on Climate Change
53	IPPPP	Independent Power Produced Procurement Programme
54	IRP	Integrated Resource Plan
55	Km	Kilometers
56	kV	Kilo Volt
57	KZN	KwaZulu Natal
58	KZNDT	Kwazulu Natal Department of Transport
59	l/s	Litre per second
60	LC	Leachable Concentration
61	LCT	Leachable Concentration Threshold
62	LED	Local Economic Development
63	LM	Local municipality
64	m	Meters
65	m^3/a	Cubic meter per annum
66	mbgl	Meters below ground level
67	m/d	Meters per day
68	mg	Miligrammes
69	mg/m2/day	Milligrammes per square meters per day

#	Acronym / Abbreviation	Description / Full text
70	min	Minutes
71	mm	Millimetre
72	Mm^3/a	Cubic metric meters per annum
73	m/s	Meter per second
74	Ms	Mispah
75	Mt	Megatonnes
76	MW	Mega Watt
77	NaOCl	Sodium Hypochlorite
78	N3TC	N3 Toll Concession (RF) Proprietary Limited
79	N_2H_4	Hydrazine
80	$N_2H_4.NH_3$	Hydrazine Hydrate Ammonia Mix
81	NaOH	Sodium Hydroxide / Caustic Soda
82	NEMA	National Environmental Management Act
83	NCRs	Noise Control Regulations (under Section 25 of the ECA)
84	NDP	National Development Plan
85	NGA	National Groundwater Archive
86	NGP	New Growth Path
87	NGPF	New Growth Path Framework
88	NMT	Non-motorized transport
89	NO_2	Nitrogen Dioxide
90	NOx	Nitrogen oxides
91	OPEX	Operational Expenditure
92	PCD	Pollution Control Dam
93	PGDP	Provincial Growth and Development Plan
94	PF	Pulverised Fuel
95	pH	Power of Hydrogen
96	PM	Particulate matter
97	ppb	Parts per billion
98	PPP	Public Private Partnership
99	PPP	Public Participation Process
100	RFP	Request for Qualification and Proposal
101	SABS	South African Bureau of Standards
102	SAHRA	South African Heritage Resources Agency
103	SANAS	South African National ?/ Standards
104	SANRAL	South African National Roads Agency
105	STATS SA	Statistics South Africa

#	Acronym / Abbreviation	Description / Full text
106	SDF	Spatial Development Framework
	SED	Socio-Economic Development
107	SMME	Small, Medium and Micro Enterprises
108	SO_2	Sulphur dioxide
109	Ss	Sterkspruit formation
110	SSD	Shoulder Sight distance
111	TC	Total Concentration
112	TCT	Total Concentration Threshold
113	TDM	uThukela District Municipality
114	TSP	Total Suspended Particles???
115	U-EDE	Urban-Econ Development Economics
116	UNFCCC	United Nations Framework Convention on Climate Change
117	UPS	Uninterruptable Power Supply
118	USA	United States of America
119	Va	Valsriver formation
120	VIP systems	Pit Latrine without ventilation
121	WARMS	Water resource management system
122	WHO	World Health Organisation
123	WTW	Water treatment works
124	µg/m3	Micro grams per cubic meter
125	WCMA	Water Catchment Management Area
126	WMA	Water Management Area

PART A: ENVIRONMENTAL IMPACT REPORT

ENVIRONMENTAL IMPACT REPORT

1 INTRODUCTION

1.1 BACKGROUND TO PROJECT

In December 2014, after Eskom implemented Stage 3 load shedding, Government intervened to relieve pressure on the national grid. The last time the country experienced such power cuts, was in 2008 when national rotational load shedding was implemented. In the second week of January 2015, Eskom was forced to introduce Stage 1 load shedding which meant it had to load shed up to 1000 MW.

The national power system remains under pressure as Eskom is at times unable to produce the full amount of electricity the country needs. This is mostly due to maintenance and unexpected breakdowns at power stations. The country's energy situation is receiving Government's highest priority and everything possible is being done to minimise disruptions in the supply of electricity.

The updated IRP2010 (Department of Energy, 2013) projected that an additional 81 100MW of generation capacity will be required to support the country's economic development and ensure adequate reserves over the next twenty years. The updated document suggests that about 2 450 MW of new coal-fired power stations will need to be established by 2030 aside from the committed builds, a drop from 6 250 MW that was originally planned.

The Department of Energy was mandated with the responsibility of ensuring private-sector participation in power generation through a competitive bidding process and that diversified primary energy sources be developed within the electricity sector without hindrance.

Colenso Power (Pty) Ltd is applying for environmental authorization for the proposed Colenso 1050 MW Coal Fired Power Station, Coal Mine and Associated Infrastructure near Colenso, KwaZulu Natal Province.

The development of the project commenced in 2009, with the proving of the coal resources on farms: The Shaws and Gannahoek, Brakfontein and Schurfdepoort, originally conducted by the Dunrose Group, a private resource exploration, development and production company.

In 2010, a Special Purpose Vehicle (SPV) was formed (Colenso Power (Pty) Ltd) to develop the coal resource as part of an integrated power project. The project includes the establishment of a coal mine, the construction of a power station and development of associated infrastructure to run the mine and power station.

The development falls within the Emnambithi/Ladysmith and Umtshezi local municipalities but is centrally located to Imbabazane, Okhahlamba and the Indaka local municipalities as well. The identified location is considered to be very desirable due to the proximity of economically minable coal, a reliable water source (Thukela River), logistics infrastructure (road and rail) and an electrical transmission network to allow for the evacuation of the electricity generated by the project.

The overall authorisation process for the project will be split in two, based on the different authorisations required for each of these listed activities:

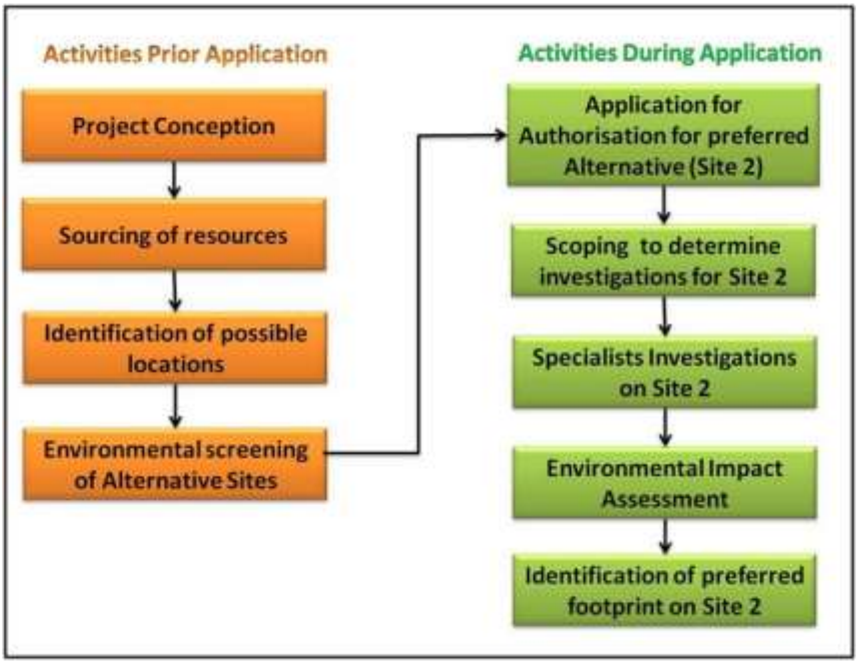
a) Integrated Environmental Authorisation Application for the proposed Coal fired power station and associated infrastructure to be submitted to the national Department of Environmental Affairs. (Hereafter referred to as the proposed power station / the project)
b) Mining right application to be submitted to the regional office of the Department of Mineral Resources.

This report relates to the Integrated Environmental Authorisation Application to the National Department of Environmental Affairs for the proposed power station and associated infrastructure (bullet point (a) above).

1.2 Process Followed

A number of steps are taken before and during the application process to determine the development footprint of a project. Figure 1-1 shows the steps followed for this project.

Figure 1-1: Process followed



Source: EcoPartners, 2015

The proposed development of the power station and associated infrastructure will require authorisation from a number of government departments prior to commencement.

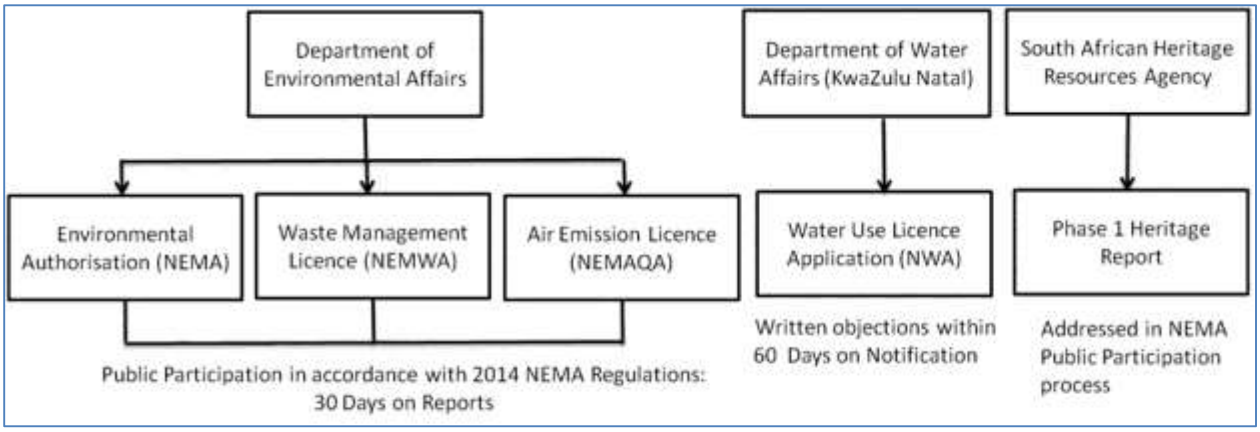
One public participation process will be carried out for the power station application to ensure adherence to the various legal requirements for the different legal processes. Although cognisance of relevant legislation is taken, the following table details the relevant environmental authorisations, which are required. The requirements in terms of public participation are presented in Figure 1-2.

Table 1-1: Environmental Authorisations Required for the Proposed Project

Authorisation	Responsible Department	Relevant Act
Environmental Authorisation	DEA	NEMA
Waste Management License	DEA	NEMWA
Air Quality Licence	DEA	NEMAQA
Water Use License	DWS	NWA
Heritage	SAHRA	NHRA

Source: EcoPartners, 2015

Figure 1-2: Authorisations required and associated Public Participation requirements



Source: EcoPartners, 2015

The zoning of the area will also need to be changed to accommodate the change of land use in the area. This application does not form part of the zoning application, the zoning process will only be started when the approvals for the other requirements have been addressed.

SiVest completed the site selection process, a number of specialist studies were completed and it considered the various site alternatives (Alternative site 1; Alternative site 2 and Alternative site 3). Alternative 1 and Alternative 3 triggered environmental concerns that could not be mitigated, while site alternative 2 provided opportunities for further assessment. SiVest submitted a previous application for this project in 2014, but the application lapsed. EcoPartners was appointed as the EAP for the project.

1.2.1 Competent Authority

For most renewable energy projects the competent authority in terms of the regulations would be the Provincial Minister and hence the Provincial department responsible for environmental management. However, as noted by the DoE in their procurement documentation, “projects under the IPP Procurement Programme, are now treated as Strategically Important Developments ("SIDs"), due to their potentially significant contribution to the national economy. Accordingly applications for environmental authorisations under NEMA in respect of these projects may generally be made directly to the national Department of Environment Affairs ("DEA") instead of to the provincial department responsible for environmental affairs." This was confirmed in a pre-application meeting with the national Department of Environmental Affairs.

1.2.2 Details of Environmental Assessment Practitioner

Environmental Assessment Practitioner (EAP): Charlaine Baartjes

Managing Director of EcoPartners

Qualifications: MBA; MSc.(Geol)., BSc(Ed)IV; Cert. (Tax)

Charlaine Baartjes has applied for more than thirty authorisations ranging from Section 20 and 21 Applications in terms of Environment Conservation Act, Section 24 Applications in terms of the National Environmental Management Act to Section 39 (regulation 52) Applications in terms of the Mineral and Petroleum Resources Development Act. She has 20 years applied experience on environmental matters.

Table 1-2: Details of Environmental Assessment Practitioner

Project Consultant:	EcoPartners (Pty) Ltd
Contact person:	Charlaine Baartjes
Postal address:	PO Box 73513, Fairland, Johannesburg, 2030
Telephone:	011 431 2251
E-mail:	charlaine@ecopartners.co.za
Fax:	086 628 5060
Experience:	Refer CV (Appendix A)
Qualifications:	MBA; MSc. (Geol)., BSc(Ed)IV; Cert. (Tax)

This report was compiled by San Oosthuizen and reviewed by Charlaine Baartjes.

San Oosthuizen: M.Sc Zoology

San has 17 years' experience in the environmental field. She has experience in the Mining (Platinum), Petro-chemical, Land development, Consulting, and Engineering fields. In her career she has applied for a number of authorisations ranging from Section 24 Applications in terms of the National Environmental Management Act and Section 39 (regulation 52) Applications in terms of the Mineral and Petroleum Resources Development Act (refer Appendix A for her CV).

1.2.3 EIA Process

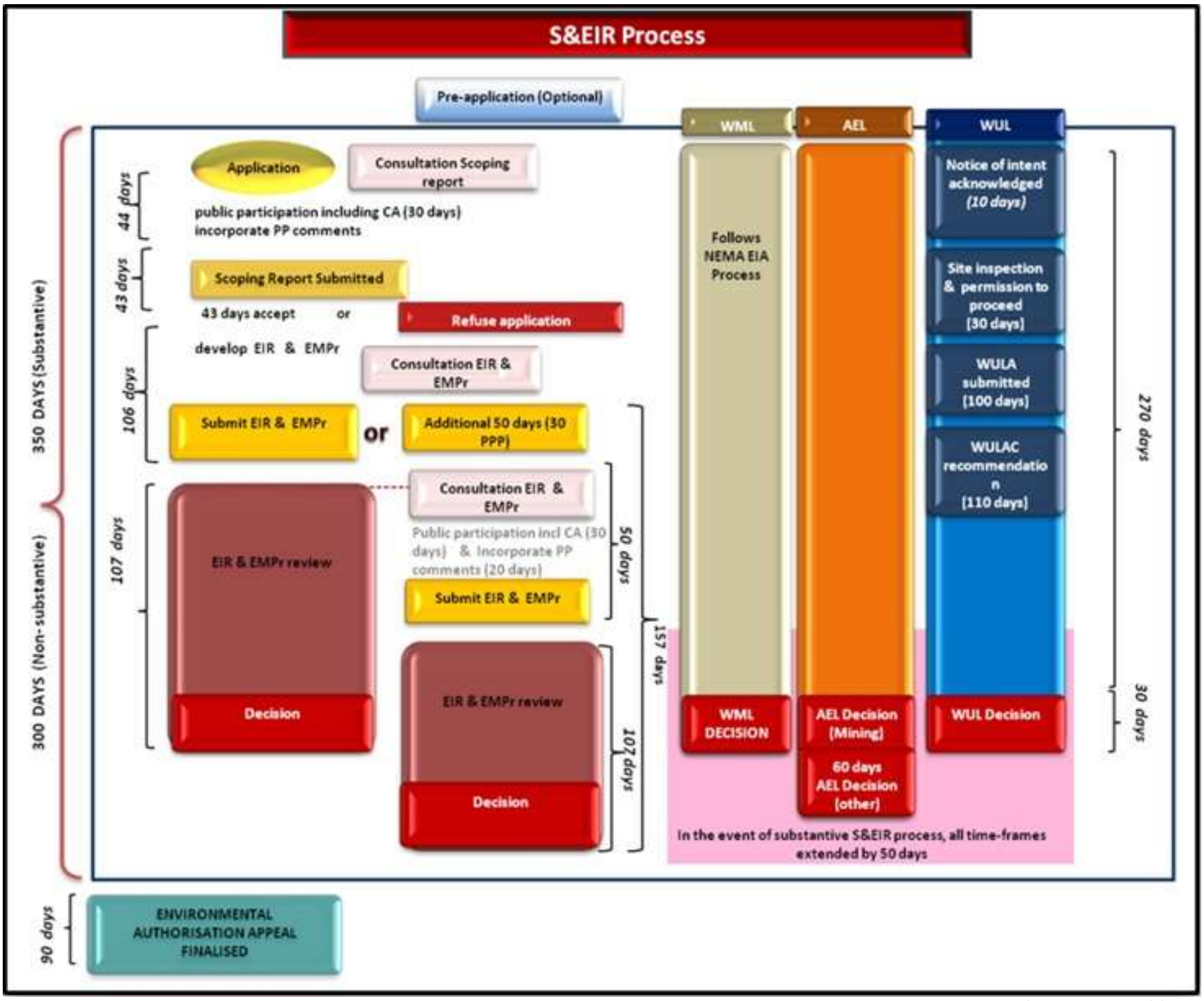
An Integrated Application was submitted to national Department of Environment Affairs. Figure 1-3 below provides a schematic representation of the process.

1.2.3.1 Application Process to date

An initial application to the National Department of Environmental Affairs was brought with Reference number: DEA/EIA14/12/16/3/3/2/575. Under this reference number SiVest appointed various specialists for the investigation of alternatives and to evaluate the three alternative site locations proposed. No Public Participation was embarked on.

Colenso Power (Pty) Ltd approached EcoPartners in November 2014 to do the Scoping Report and the Environmental Impact assessment using various specialists. According to the applicant it was agreed with DEA that a new submission can be made and that the reference number will remain the same. An EA application form was compiled and submitted to the Department of Environmental Affairs 20 November 2014 using the existing reference number.

Figure 1-3: Scoping & Environmental Impact Report Process



Source: DEA, 2014

EcoPartners embarked on the notification process with the publication of newspaper notices (see Chapter 8) using the original reference number. This was necessitated by the legal requirement in the 2010 EIA Regulations that no Public Participation Process may be conducted between the period of 15 December and 2 January. Subsequent to the publication of the newspaper notices, a letter from DEA was received whereby it was indicated that the application made by SiVest has lapsed and that the project has been issued a new reference number (DEA/EIA14/12/16/3/3/2/764).

Early January 2015 the notification process was continued by means of written notification letters and the placement of site notices. Both reference numbers were used to ensure that there is no confusion, both references relate to the same project, although it might be different phases.

After the legislative changes coming into effect 8 December 2014, the need to discuss the project with DEA was identified, in order to establish how the changes in law will affect the application. At a meeting on 11 February 2015 it was decided that the best way forward was to submit an application under the 2014 EIA regulations which resulted in the need to split the power station application form the mine application. A new EA application was submitted to DEA 25 March 2015. In the acknowledgement letter a new reference number (the current one - DEA/EIA/14/12/16/3/3/3/201) was allocated to the project.

Note that it was agreed at a pre-application meeting with DEA that the Public Participation that has been conducted since the submission of the first application by EcoPartners will still be valid.

The final Scoping Report was submitted to the Department on 19 May 2015 and accepted on the 7th of July 2015 (refer Appendix C).

This document is the Draft Environmental Impact report that will be available for comment to relevant stakeholders and all registered I&APs

1.2.4 Specialists Studies

To ensure a comprehensive environmental authorisation process, technical studies were undertaken for potential impacts associated with the proposed project as described in the Plan of Study for EIA presented in the final Scoping Report submitted to DEA in May 2015.

The details of the Specialist appointed by EcoPartners and studies undertaken are presented in the table below. All the reports are attached Appendices to this document (refer Table 1-3)

Table 1-3: Details of Specialists

Organisation	Person	Component	Appendix
Rayten Engineering Solutions	Claire Wray & Sophia Valsamakis	Air Quality	Appendix D
AGES EC (Pty) Ltd	Jan Myburgh	Geo-hydrological	Appendix E
Storm Water Solutions	Phillip Lourens	Surface Water Assessment & Conceptual Stormwater Management Plan	Appendix F
ARC-Institute for Soil, Climate and Water	Dr Gary Patterson	Soil & Agricultural Potential	Appendix G
Zone Land Solutions	Dr. Savel Regan Daniels	Freshwater	Appendix H
	Dr. Johannes J. Le Roux and Mr. Jan-Hendrik Keet	Vegetation	Appendix H
	SW van der Merwe	Fauna	Appendix H
Urban-Econ Development Economists	Elena Broughton & Mariette Steynberg	Socio-economic	Appendix I
Enviro Acoustic Research	Morné de Jager	Noise	Appendix J
MetroGIS	Lourens du Plessis	Visual	Appendix K
Sturgeon Consulting (sub - Contracted by Zone Land Solutions)	Sarah Larratt and Barend du Preez	Traffic Assessment	Appendix L
A Pelser Archeological Consultants	Anton Pelser	Heritage	Appendix M

1.3 REPORT LAYOUT

This document fulfils the requirements of Appendix 3 and Appendix 4 of the NEMA EIA Regulations of 2014.

This EIR_EMP document has been compiled in a diligent, comprehensive and independent manner, and includes the following:

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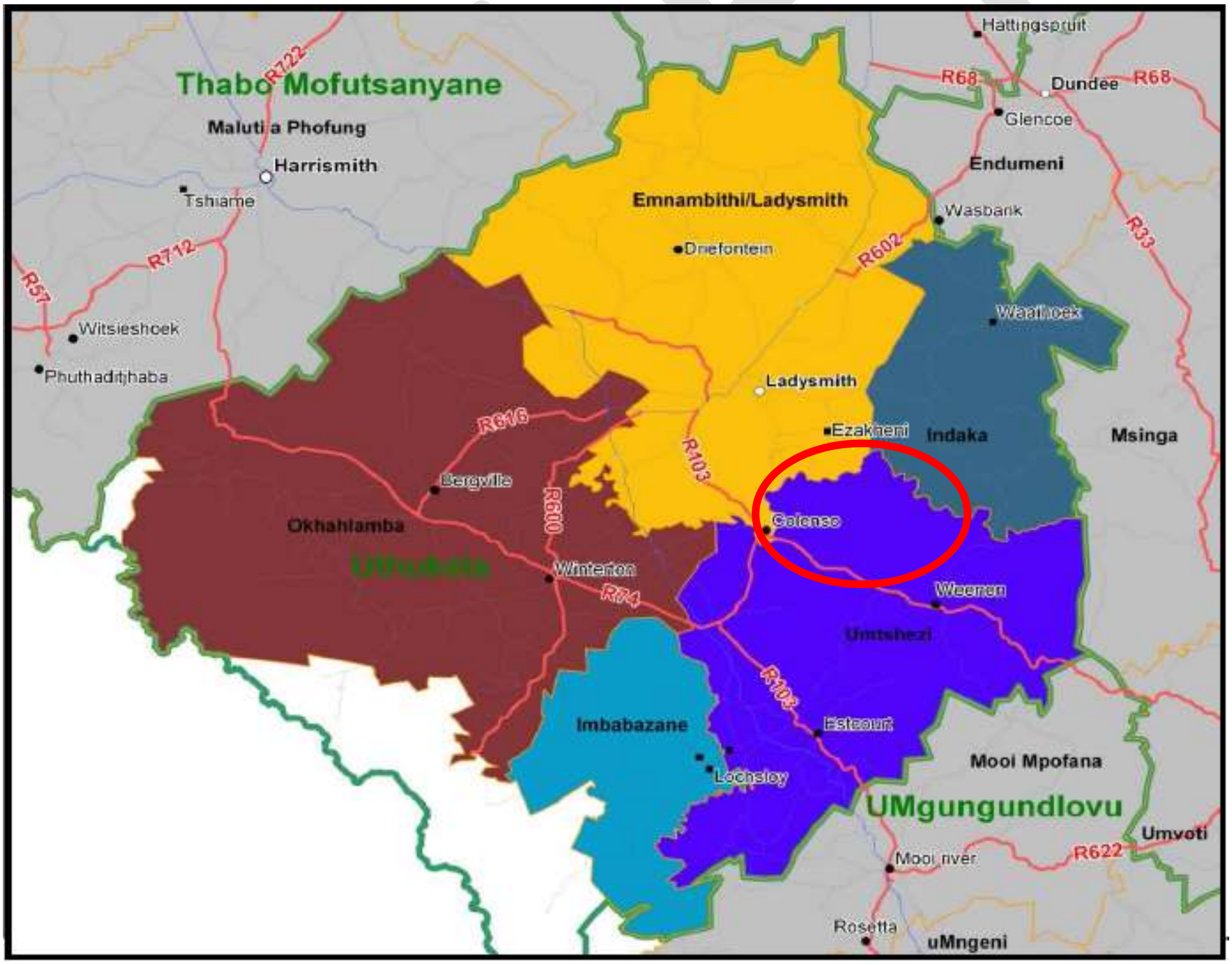
2 PROJECT DESCRIPTION

2.1 LOCATION DESCRIPTION

The proposed location for the development of the Colenso Coal Fired Power Station and associated infrastructure is close (approximately 12-18 km east-north-east) to Colenso town within the Uthukela District Municipality and the Umtshezi Local Municipality in the KwaZulu Natal Province (Refer Figure 2-1). The proposed power station site is situated south of the Tugela (Thukela) River, on the farm Schufde Poort 1147, potion 1. The associated infrastructure is typically linear developments that follows different routes to either the link the proposed project site to the National grid, transport routes or supply of services.

The closest towns to the proposed project site are Colenso and the Ezakheni settlement located south of the Ladysmith town. These two closest towns fall within the Emnambithi / Ladysmith Local Municipality (LM). However, the overall project site is located on the boundary with the Indaka and Emnambithi LMs.

Figure 2-1: Regional location map of the proposed Colenso Coal fired power station and mine



2.1.1 Towns & Settlements

Colenso, including Nkanyezi Township, is located in the southern tip of the Emnambithi/Ladysmith LM, on the border with the Umtshezi municipality. The town was established on the banks of the Thukela River (in 1855 to serve as a stopover point between Durban and Johannesburg), it forms part of the famous Battlefields Route and has a rich history and many historic remnants (Isibuku se Africa, 2012). The town was further developed by Eskom (then Escom) to support the Colenso coal-fired power station that was constructed in 1926 and decommissioned in 1985, when the refurbishment of the power station became too expensive. (www.eskom.co.za) Eskom provided all infrastructure including water, electricity and the road network to the town. Today, the town mainly caters for local residents within the region, there was no significant industrial development, since the decommissioning of the Colenso Power Station.

Ezakheni, a township north of the proposed project site, is one of the oldest settlement in the Emnambithi/Ladysmith municipality, situated about 25 kilometres from the Ladysmith CBD. It was established, in part, as a response to the industrial decentralisation program. The program led to the establishment of Ezakheni Industrial Township as a means to meet the housing requirements of people who were coming to work in and around the Ladysmith area.

2.1.2 Infrastructure

Infrastructure and structures in and around Colenso include mainly residential housing, a railway line and station, some municipal and services offices, and Eskom distribution/transmission infrastructure (i.e. the Bloukrans substation and a large number of power lines).

Figure 2-2: Power lines & Cooling Towers (of decommissioned Power Station)

Source: MetroGIS, Visual Assessment (2015)

The proposed power station site is located at the end of the provincial road, D488. Existing road infrastructure is well developed in the area. Upgrades and extensions to the existing infrastructure will be implemented to accommodate the additional traffic volumes, if necessary. This means, possible upgrading of certain municipal, district and provincial routes, associated intersections and construction of new link roads, access roads and intersections where required.

Table 2-1: Major Routes

Road Link	Type of	Function Road	Condition	Classification
Provincial Main Roads				
P1-10 (R103)	N3TC	Link between Ladysmith and Colenso	Paved	Single carriageway
P12-3 (R74)	KZNDT	Links Harrismith with Kwadukuza, via Colenso	Paved	Single carriageway
P544	SANRAL	Provides a link between P1-10 and P319 (Ezakheni)	Paved	Single carriageway
District Roads				
D488	TDM	Link between Inkanyezi in Colenso and Farm 1147/1	Gravel, Unpaved	Single carriageway

Source: Sturgeon Consulting, Traffic Impact Report (2015)

2.1.3 Farm Portions

The proposed power station will be located on portion 1 of the Farm Schufde Poort 1147.

The proposed infrastructure associated with the power station development will cross over:

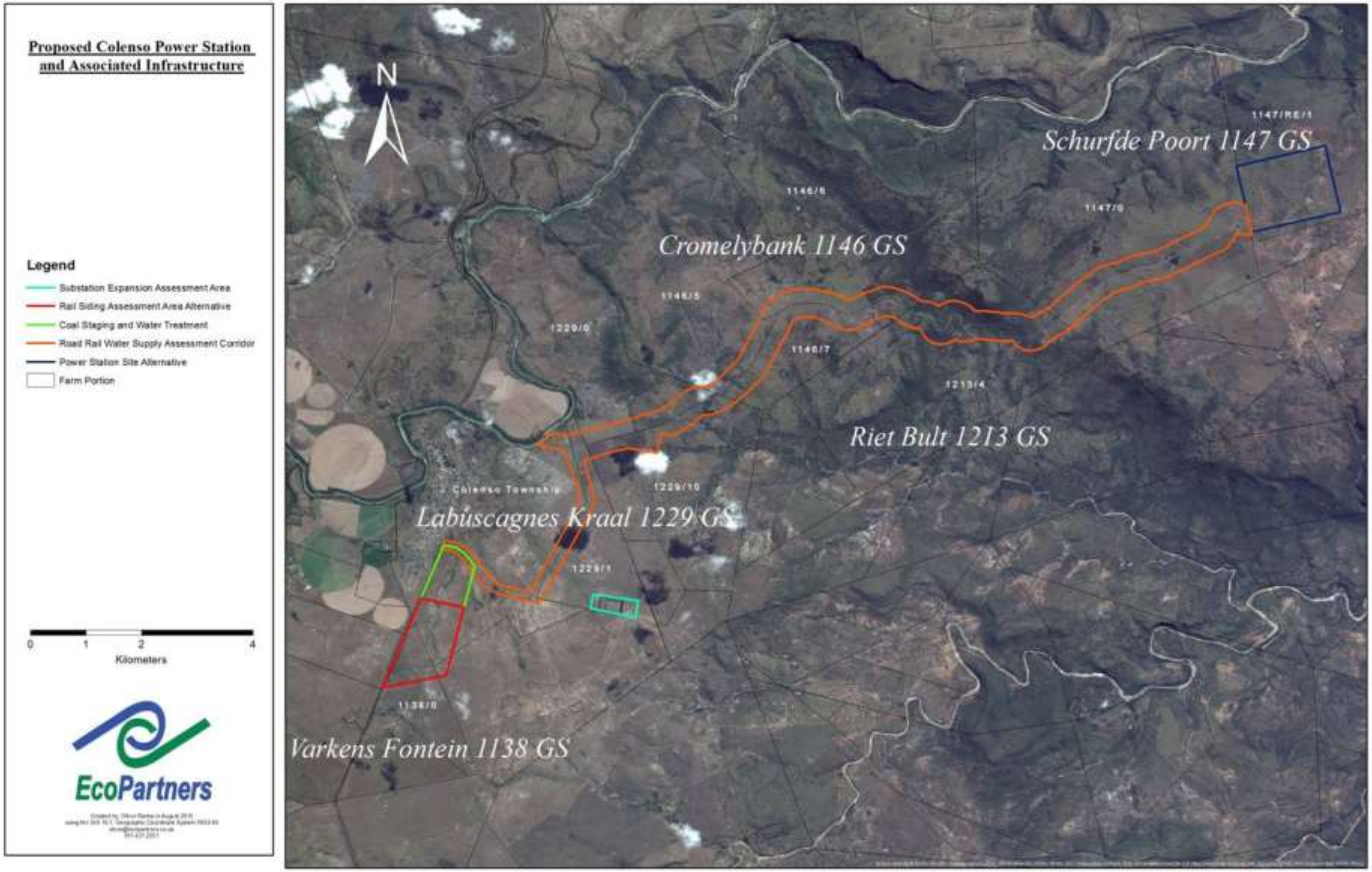
- Portion 1 of the Farm Labuschagne's Kraal 1229
- Portion 10 of the Farm Labuschagne's Kraal 1229
- Remainder of the Farm Labuschagne's Kraal 1229
- Farm Varkens Fontein 1138
- Portion 5 of the Farm Cromleybank 1146
- Portion 6 of the Farm Cromleybank 1146
- Portion 7 of the Farm Cromleybank 1146
- Portion 4 of the Farm Riet Bult 1213
- Remainder of the Farm Schurfde Poort 1147

The table below list the 21 digit Surveyor General code of each cadastral land parcel included as part of the application. Please refer Table 2-2.

Table 2-2: 21 Digit Surveyor General codes for each cadastral land parcel

POWER STATION																				
Portion 1 of the Farm Schurfde Poort 1147																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	4	7	0	0	0	0	1
INFRASTRUCTURE																				
Portion 1 of the Farm Labuschagne's Kraal 1229																				
N	0	G	S	0	0	0	0	0	0	0	0	1	2	2	9	0	0	0	0	1
Portion 10 of the Farm Labuschagne's Kraal 1229																				
N	0	G	S	0	0	0	0	0	0	0	0	1	2	2	9	0	0	0	1	0
Remainder of the Farm Labuschagne's Kraal 1229																				
N	0	G	S	0	0	0	0	0	0	0	0	1	2	2	9	0	0	0	0	0
Farm Varkens Fontein 1138																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	3	8	0	0	0	0	0
Portion 5 of the Farm Cromleybank 1146																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	4	6	0	0	0	0	6
Portion 6 of the Farm Cromleybank 1146																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	4	6	0	0	0	0	6
Portion 7 of the Farm Cromleybank 1146																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	4	6	0	0	0	0	7
Portion 4 of the Farm Riet Bult 1213																				
N	0	G	S	0	0	0	0	0	0	0	0	1	2	1	3	0	0	0	0	4
Remainder of the Farm Schurfde Poort 1147																				
N	0	G	S	0	0	0	0	0	0	0	0	1	1	4	7	0	0	0	0	0

Figure 2-3: Farm portions affected by proposed power plant & associated infrastructure



2.2 ACTIVITY DESCRIPTION

2.2.1 Scope of Project

The scope of the project includes the construction of a Pulverised Fuel Coal-fired Power Station and associated infrastructure:

The construction of the **Power station** will include the construction of the following components:

1. Turbine building
2. Boiler
3. Main control Building
4. Electric Precipitator
5. C.I.D. Fan & Motor
6. Chimney
7. Gas storage house
8. Absorber
9. Transformer (Auxiliary and Back up)
10. Transformer (Step-up/take off & Start-up)
11. Demineralised Water Storage tank
12. Bottom Ash Silo
13. Fly Ash Silo
14. Ash Control house
15. Fly Ash Exhauster area
16. CEMS Enclosure
17. Waste Water treatment plant
18. Waste Water Treatment building
19. Coal unloading area
20. Condensate tank
21. Lay-down area
22. Storm water pond
23. Coal stack (210 m high)
24. Administration Building
25. Workshop and Stores
26. Substation
27. Gate keeper post
28. Weigh bridge
29. In-plant coal stock yard and storage
30. Lime storage area

The construction or upgrading of the **associated infrastructure** will include the construction of the following components.

1. Upgrade of access road and
2. Construction of internal roads.
3. Construction of overland coal conveyors / rail-veyors (to coal storage areas).
4. Upgrade or construction of water supply pipeline.
5. Connection of amenities including potable water, sanitary and sewer utilities.
6. Construction of sewage treatment plant.
7. Construction of ash storage facility.
8. Ash storage facility toe trenches.
9. Construction of water storage reservoir for raw water supply.
10. Construction of raw water treatment plant.
11. Construction of zero effluent/evaporation ponds.
12. Construction of return water dam / recycling pond
13. Construction of conveyor / rail-veyor system.

2.2.2 Overview of Project

The project involves the construction of a pulverised fuel coal-fired power station and associated infrastructure. The proposed power station will make use of conventional coal fired technology which includes the following:

- A coal fired boiler producing steam;
- A multi cylinder reheat steam turbine which converts the heat in the steam to a mechanical drive to turn a synchronous Alternating Current (AC) alternator which generates electricity;
- Mechanical draft air cooled condensers to condense the steam turbine exhaust;
- A feed water system which processes the condensate from the air cooled condenser and returns it to the boiler; and
- Electricity from the alternator will be fed to a transformer where the voltage will be increased to either 275 kV or 400 kV for injection into the national transmission system.

It is anticipated that the power generation facility will be developed in 3 phases. The final gross capacity of the power station is expected to be 1050 MW. Table 2-3 provides details on the proposed power station and infrastructure and also include services required. Please refer Appendix C for a schematic layout of the power station.

Table 2-3: Proposed project at a glance

Component	Description /Dimensions
Location of site	Schurfde Poort 1147 Portion 1
Municipality Jurisdiction	Umtshezi Local Municipality
Electricity Generation Capacity	Phase 1 - 350 MW Phase 1 - 350 MW Phase 3 - 350 MW Total 1050 MW
Proposed Technology	Pulverized Fuel Boiler Dry Cooling Dry Ash Disposal

Component	Description /Dimensions
	ZLED (zero liquid effluent discharge) Plant
Area covered by proposed development footprint	Power Plant - 52 ha Ash Stockpile - 9 ha Coal stockpile - 8 ha
Extent of broader site	270 ha
Stack height	210 m
Coal handling details	Anthracite coal will be provided via conveyor / rail-veyor from the planned coal mine to be established to the west of the site. Additional anthracite coal will be provided form mines in the area via conveyor / rail-veyor from a rail siding located south of Colenso. Length of conveyor / rail-veyor - To be supplied 420 tonnes per hour
Coal stockpile capacity	352 000 (planned for 35 days of operation)
Limestone storage & handling	To be supplied 56 tonnes per hour
Feed water	70 tonnes per hour for 1050MW Most of this water will be retained on site, treated and reused as boiler water. Approximately 95% of boiler blow down can be treated and reused meaning that the water supply is reduced from 70 tonnes per hour to 84,000 litres per day.
Ash dump details	Dry ash disposal - Slurry paste - water content of 15% or less taken out by conveyors to stacker
Site access road	The site will be accessed via D488. The road will be upgraded.
Grid connection	Location and route of grid connection to be determined by Eskom (excluded from this application)
Services required	Refuse Disposal - All waste generated on site will be collected by contractor for disposal at appropriate licenced landfill site. Sanitation - During Construction: Portable toilets and showers with zero discharge will be used. During operation a waste water treatment facility will be operated on site Water - 700,000 m^3/ a for the first phase of 350MW, increasing to 2.1 million m^3/ a for 1050MW. Including human consumption - 1million litres per day. Electricity - 105 MW auxiliary power
Pipeline for water supply	It is intended that water will be abstracted from the weir at Colenso or alternatively supplied by the municipality.
Raw water storage reservoir & pump station	Raw water storage will be on site and will hold 3 days' supply of raw water (5000 m^3)
Water treatment	Daily treatment capacity 1 700 m^3/day
Waste water treatment plant	Daily throughput capacity 500 m^3/day

Source: Information from Mott MacDonald (2015)

The space requirements for the area occupied by the power plant include the boiler/turbine hall, dry cooling system, flue gas treatment systems, exhaust ducting and stack, switchgear & electrical building, control room and administration building, workshop and warehouse/stores building, water treatment works (including makeup/demineralised water treatment), ash handling (silos, conveyors, etc.), chemical storage, site drainage and waste water treatment and onsite laboratory. Allowance is also made for site internal roads, security and access.

2.2.2.1 *What makes Anthracite different?*

Anthracite is mined from the oldest geological formations, and therefore has spent the longest time underground and been subjected to the most pressure and heat, making it the most compressed and hardest coal. Hard coals contain greater potential to produce heat energy than do the softer, geologically "newer" coals.

Anthracite is the hardest and most brittle of all coals, and when burned, produces a very hot blue flame. Anthracite is considered the cleanest burning of all coal types. Anthracite produces more heat and less smoke than other coals.

Anthracite contains a great deal of fixed carbon (80 to 95 percent) and very low sulfur and nitrogen (less than 1 percent each). Volatile matter is low at approximately 5 percent, with 10 to 20 percent ash possible. Moisture content is roughly 5 to 15 percent. It is slow burning and difficult to ignite because of its high density, so few pulverized coal fired plants burn it (www. energy.about.com).

2.2.3 Listed activities to be authorised

The activities required for the development and operation of the proposed power station and associated infrastructure requires authorisation in terms of a number of National Environmental Legislation listed activities. Please refer to Section 3 for a description of the relevant legislative requirements associated with the proposed project.

The activities that require authorisation can be sorted into the following broad categories (refer Figure 2-13 for locations of these activities):

A. Generation of electricity
B. Vegetation Clearance
C. Use, storage, transport and treatment of water / waste water / effluent
D. Storage & handling of dangerous goods
E. Roads
F. Waste handling

The project will be described according to these activities.

2.2.3.1 *Generation of electricity*

The project will have a generation capacity of 1 050 MW, of which 945 MW will be connected to the national grid while the remaining 105 MW will be used to supply auxiliary electricity. The project will be developed in three phases with 350 MW to be established during each phase.

The following is a basic description of the process flow for the generation of electricity (refer Appendix C for a schematic process flow diagramme):

- **Fuel**: When required by the boiler, a stacker-reclaimer serves coal onto a conveyor system which transports the coal to the day silos next to the boiler. The coal is then drawn from the day silos directly into the boiler building for combustion;

- **Pulverised Fuel Coal Boiler** (PF) (consisting of air intake fans, blowers, steam venting, coal pulveriser, etc.): Coal is first crushed from where it is fed into a pulveriser that is then heated before the coal dust is blown directly into the boiler. A PF system does not require cyclones after the boiler but will require other air quality management systems.
- **Smoke stacks**: Gases that are released from combustion in the furnaces are filtered (containing mitigation like High Frequency Electrostatic Precipitator (ESP), Flue Gas Desulphurisation (FGD), Denitrification) and then released into the atmosphere through smoke stacks;
- **Ash disposal**: Ash is removed from the exhaust gasses and could be disposed on ash-dams near the power station or alternatively removed from the site where it can be used (e.g. brick making or road building). Disposal could be either hydraulic or via conveyor belt / rail-veyor system;
- **Cooling** (consisting of large cooling fans): The proposed power plant will be designed with dry cooling technology in order to significantly reduce water consumption;
- **Turbine and generator** (comprising of steam turbine generators): The high pressure steam is piped to the turbines, causing the blades to turn. The movement of the steam through the turbines causes the thermal (heat) energy to be converted to mechanical energy. The turbine is linked to the rotor of the generator. The rotor is an electromagnet which spins inside large coils of copper to generate electricity, which is essentially what is produced by a power station;

The power plant will require a stockpile of coal for periods of interruption to the coal supply. Typically, between 30 and 45 days coal supply needs to be stored on the site. The coal handling plant will generally be enclosed and / or fitted with dust suppression equipment.

Anthracite coal is classified as higher grade coal as it typically consists of higher fixed carbon and lower volatile matter contents compared to bituminous or subbituminous coal which are commonly used as fuel input into coal fired power stations in South Africa. Anthracite coal also has higher ignition and ash fusion temperatures compared to bituminous or subbituminous coal which makes it harder to ignite therefore largely influencing the type of boiler system that can be used (USEPA, 1996).

Emissions from anthracite coal will mainly include emissions of PM, SOx , NOx , CO and trace amounts of organic compounds and elements. Bituminous or subbituminous coal typically have higher volatile matter and sulphur contents compared to anthracite coal which subsequently results in higher emissions of PM, SOx , NOx and CO. Combustion of anthracite coal compared to bituminous or subbituminous coal would also result in less smoke as there is less volatile matter content in anthracite coal (USEPA, 1996).

Emissions generated from coal combustion depends on the type and composition of coal being used, the design and type of boiler, the boiler firing conditions, fuel load, type of control devices used and the level of equipment maintenance.

Table 2-4: Relevant listed activities related to generation of electricity

Notice	Activity	Description
GN 983 of 4 December 2014	67	Phased activities for all activities listed i. listed in this Notice, which commenced on or after the effective date of this Notice; or ii. similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity may be below a threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.
GN 984 of 4 December 2014	2	The development and related operation of facilities or infrastructure for the generation of electricity from non-renewable resource where the electricity output is 20 megawatts or more.
GN 984 of 4 December 2014	28	Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004),
GN 893 of 22 November 2013	Category 1, Subcategory 1.1:	Solid Fuel Combustion Installations;
GN 893 of 22 November 2013	Category 5, Subcategory 5.1:	Storage and Handling of Ore and Coal;

2.2.3.2 Vegetation clearance

The total area proposed for the power station covers 270 ha. The space requirements for the area occupied by the power plant relates to approximately 58.5 ha. Based on the technology and design of the power station it is anticipated that 819 700 tonnes of ash will be produced annually. Should the ash be disposed to an ash dump, the area required for the dump will cover an additional 70.56 ha. The total area to be cleared of vegetation thus calculates to 129.06 ha.

During the construction phase, the area required for development will be cleared of all vegetation and topsoil will be stripped to a depth of 500 mm or depth of refusal, in areas where construction will be taking place. Should the ash dump be developed the total area to be cleared is 1,290 600 m^2 (this is 129.06 ha) and an approximate volume of 654 300 m^3 topsoil, if it is assumed that 500 mm is removed.

The soil will be stockpiled to a height of 5 m in order to reduce the erosion potential and will be actively vegetated. It is anticipated that the topsoil will be stockpiled at the south western corners of the site, but the final location of the stockpiles will be determined by the contractor and will be informed by the environmental conditions on site (e.g. wind direction, drainage, location of sensitive receptors). A further area to clear vegetation in order to stockpile the topsoil, will require a maximum area of 13.086 ha.

Note that the preferred option reduce the ash dump to 9 ha and vegetation clearance is therefore reduced to 67.5 ha. To cater for any contingencies this application is applying for the clearance of 96.6 ha (refer Figure 2-4), it is indicated by the yellow block.

Figure 2-4: Area to be cleared of vegetation

Source: Site selection based on evidence from specialists (EcoPartners, 2015)

Note that the area to be cleared of vegetation associated with the upgrading of the road and the installation of pipeline and rail-veyors are not included in the calculation as linear activities are excluded from the listed activities associated with vegetation clearance.

Table 2-5: Relevant listed activities related to vegetation clearance

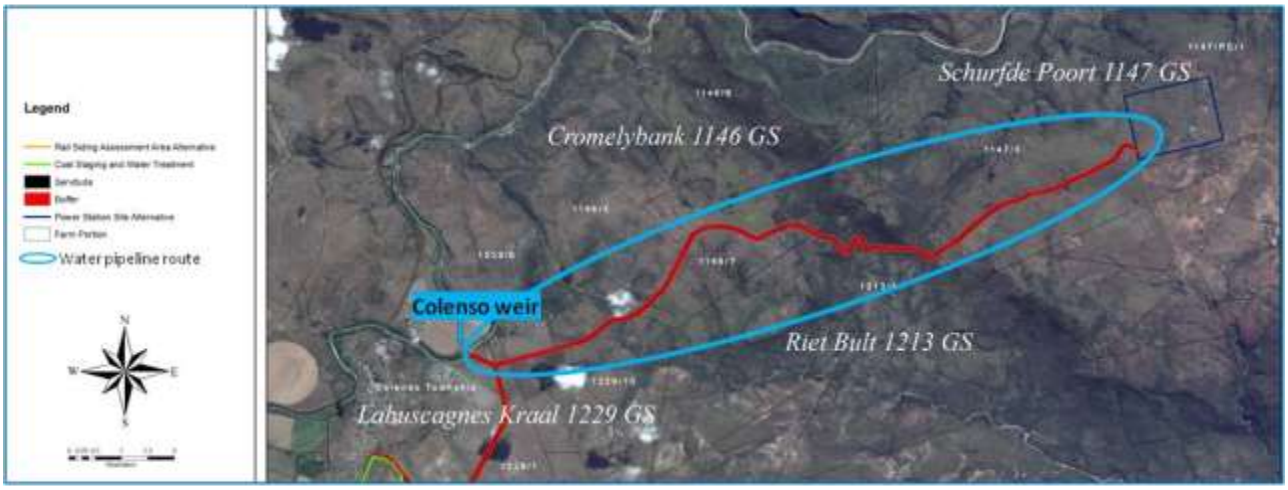
Notice	Activity	Description
GN 983 of 4 December 2014	28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes.
GN 984 of 4 December 2014	15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.
GN 985 of 4 December 2014	12(d)(v) & (xii)	The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.

2.2.3.3 Use, storage, transport and treatment of water / waste water / effluent

Raw water to the power station, will be supplied from the Thukela River. Due to the topography of the Power Station, various supporting infrastructure, for the water supply will be considered. To successfully extract water from the Thukela River, weirs, Abstraction Works, Primary treatment, Pumping Stations and Pipelines will be required. If possible, existing water abstraction infrastructure will be utilised or upgraded. Water extracted from the Thukela River, to be supplied to the Power Station, will undergo primary treatment to remove debris, fish, solids and other large substances prior to delivery to the site. The weir at the Colenso Water Treatment Works will be utlised to abstract the water. An alternative will be the supply of water from the municipality, depending on the agreement with the various authorities.

Water will be transported via pipelines to the proposed power station site. The pipelines will follow the roads and will be constructed inside the road reserve (please refer Figure 2-5). This might, however, still trigger activity 19 of GNR 983, as there might be the moving of material of five cubic metres when constructing a pipeline across a water course in the road reserve

Figure 2-5: Water abstraction point & pipeline



Source: Geotheta Geotechnical Engineers, verbal communication (2015)

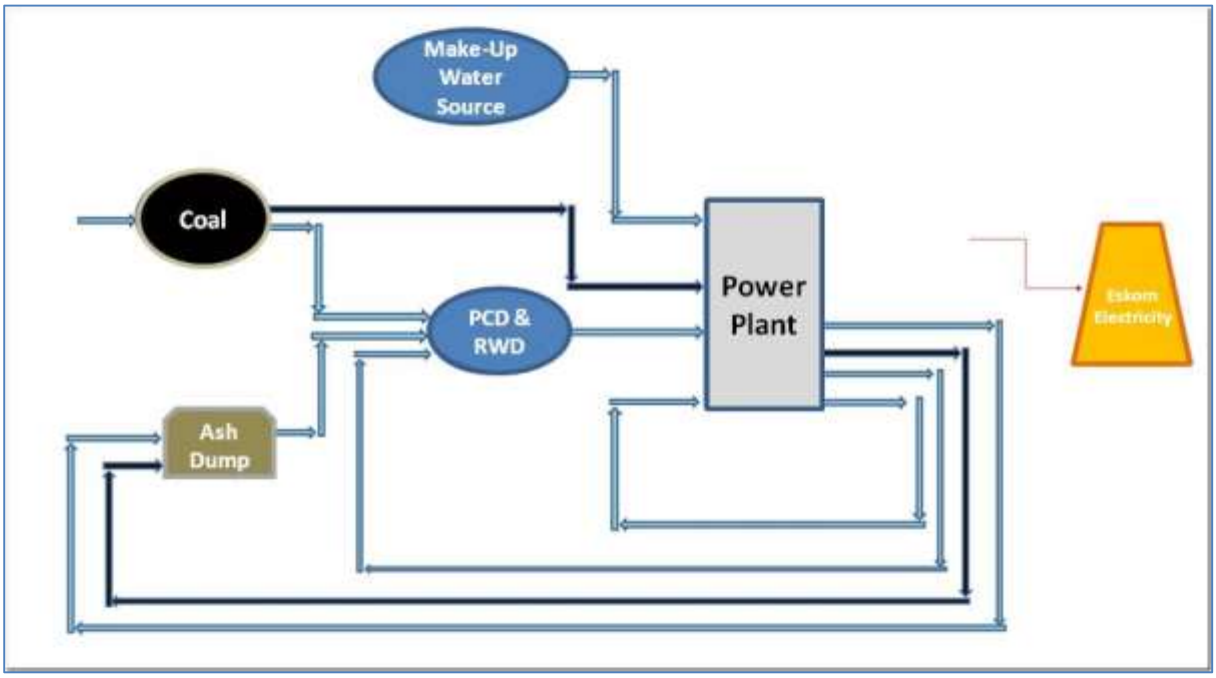
The 1050 MW plant is assumed to require approximately 70 tonnes of water per hour as into the boiler feed water system to cover for the losses due to boiler blowdown (This is known as make-up water). With the zero liquid discharge requirement that will be adopted by the plant, most of this water will be retained on site, treated and reused as boiler water. Raw water can be supplied at any quality as the water treatment plant will be installed to ensure that the boiler make up water quality meets the requirements in order to generate steam from it.

It is estimated that approximately 95% of boiler blowdown can be treated and reused meaning that the water supply is reduced from 70 tonnes per hour to 84,000 litres per day at full capacity.(Mott MacDonald, 2015).

Water will be required for ash conditioning and the dry ash will consist of 15% water by mass for successful ash handling. This gives an average water requirement for ash disposal of approximately 17 tonnes per hour and 420 tonnes per day (Mott MacDonald, 2015).

Refer Figure 2-6 for a simplified diagramme representing water flow at the power station.

Figure 2-6: Simplified water flow diagramme



Source: Storm Water Solutions, Surface Water Assessment (2015)

Component Balance

The Component Balance (CB) of a system is used to analyse each individual component within the Water Balance (WB). The CB shows every specific inflow and outflow of each component within the WB. The WB merely shows a summary of the cumulative inflows and outflows of the system and its components. The CB allows the operation to manage each component. As soon as each component is managed and balanced optimally the WB can be balanced and managed optimally.

The component balance for the power station was assessed by Storm Water Solutions during a normal full operational cycle year of the Plant (refer Figure 2-8). Note that for this exercise the location of the ash dump was placed outside of Alternative Site 2 (*The geographical area does not influence the calculation of the impact of the storm water run-off, the worst case scenario was calculated in order to understand the most significant impact that can result from the activity*). This was necessitated by the presence of a man-made dam and associated drainage area which resulted in lack of space within Alternative Site 2 for both the power plant and the ash dump while avoiding these areas. (*The reduction of the ash dump (as provided for in the preferred alternative, ensure that the ash stockpile can be placed in the Alternative Site 2 area.)*

During the mature operational phase the Plant will be completely isolated from an external water source and will only use re-cycled water already existing in the system. Please note that when the operations starts in the initial few years, water from an external water source will be required until a fully optimized volume within the cycle is obtained. The cumulative total of this volume of water should be equal to the total water required for operation at the Plant.

Water for Dust Suppression purposes are usually taken from the Return Water Dam. For this specific CB analyses no water is used for Dust Suppression at the RWD and most water is rather stored;

Excess water available at the PCD can either be used for Dust Suppression or a 2 or 3 series PCD design could be adopted to cater for additional storage;

The capacity of the PCD and RWD was assumed as follows:

- Just below the 50 000 m^3 and 5 m dam wall height thresholds for dam safety requirements; i.e. 45 000 m^3 at a dam wall height of 4.5 m;
- Please note that these dam sizes are not final and once the placement of the additional infrastructure is known the sizes can be finalised; and
- Please note that the PCD and the RWD was lumped together in the WB diagram and assessment as this water will ultimately be used for the same purpose. This type of analyses also simplifies the shortcomings of the system in terms of outstanding infrastructure locations.

Water Balance

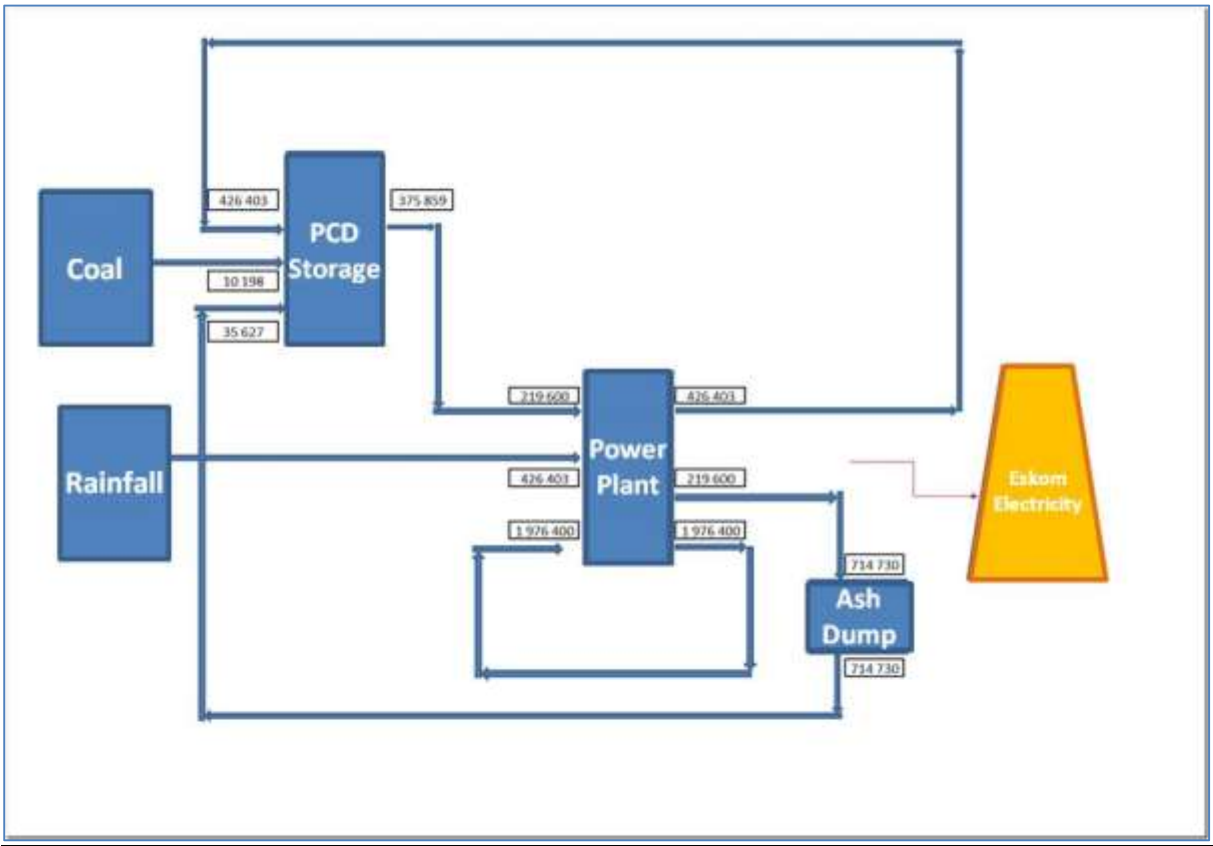
The Water Balance (WB) of a development project is used to illustrate the cumulative flow of water through the system. The WB aims to ultimately provide 1 cumulative flow for each component within the system.

Figure 2-7 illustrates the proposed high level Water Balance for the Colenso Coal Power Plant Project.

If the preferred alternative is implemented, the requirement for ash conditioning will change. The stockpile of ash will also be significantly smaller. Water will be required for the manufacturing of bricks and the subsequent wetting to harden the bricks. The maximum requirement for water will be 10 % water by mass for successful ash handling to manufacture bricks, harden bricks and apply dust suppression methodologies. This translates to approximately 11.5 tonnes per hour and 280 tonnes per day (EcoPartners, 2015)

A water storage tank will be installed that will have 3 days reserve of raw water for ash conditioning (approximately 8m x 8m tank).

Figure 2-7: Water Balance proposed for the power station



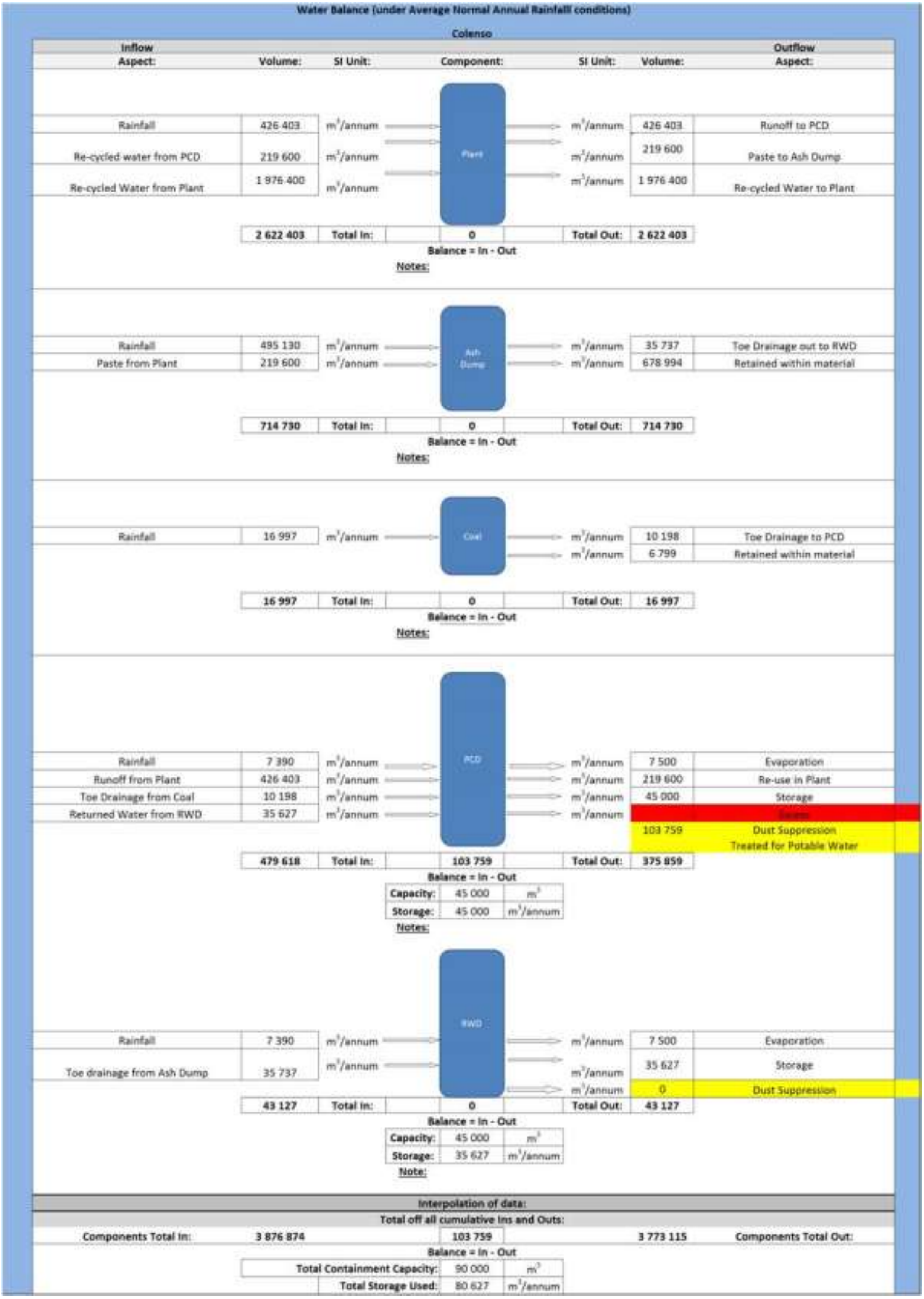
Source: Storm Water Solutions, Surface Water Assessment (2015)

Storm water run-off from the power station and from the ash dump at the power station will be intercepted and treated for re-use in the processes or evaporated where appropriate. Storm water control dams and control measures will need to be constructed.

The plant and ash dump / stockpile will be isolated by means of berms and channels and all dirty water will be collected, contained, and controlled within a Return Water Dam (RWD) / Pollution Control Dam (PCD) while clean water is diverted around this dirty area (refer Figure 2-9). The size of the PCD is approximately 130m x 180m

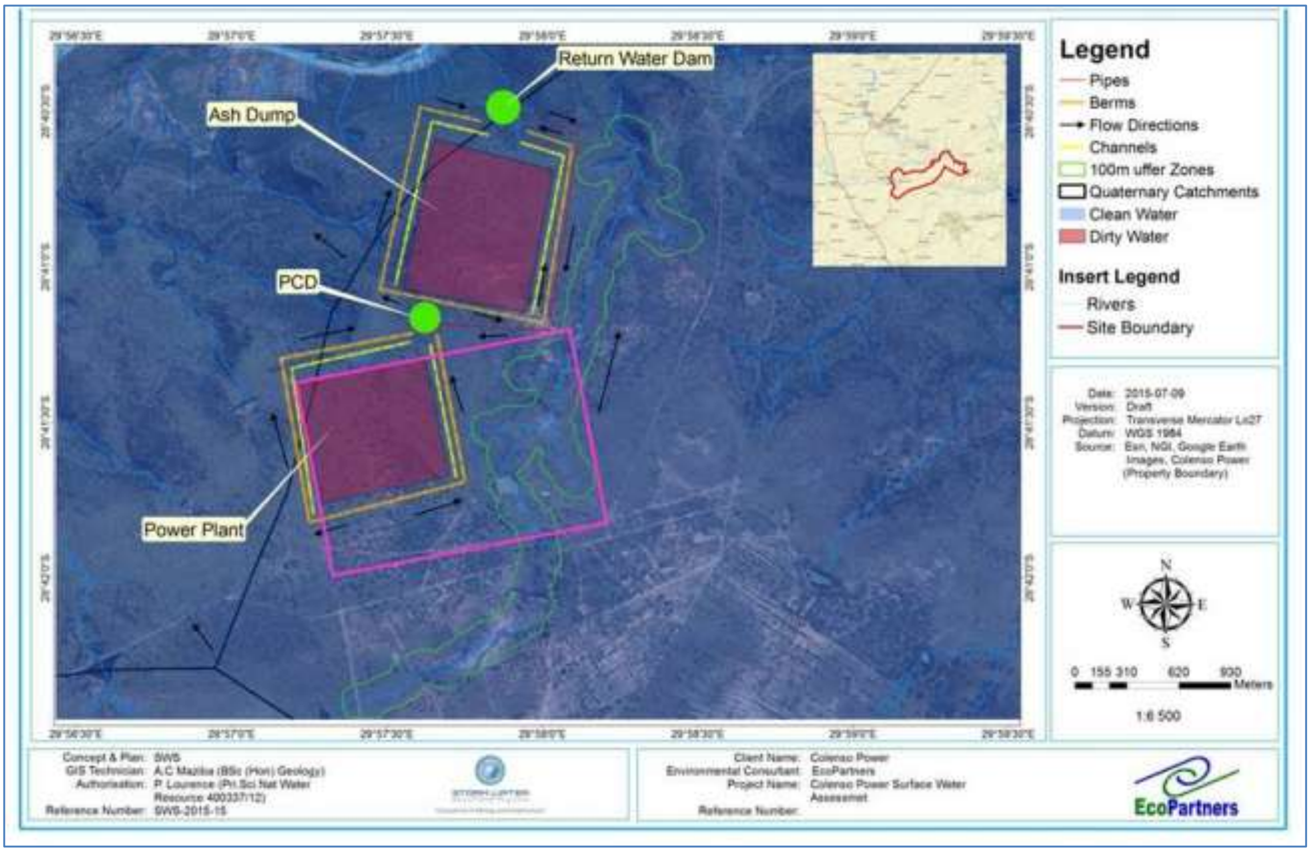
Water will also be consumed on-site for human use (approximately 25 l/person/day). A waste water treatment facility will be constructed. Approximately 480m^3/day potable water will be consumed per day.

Figure 2-8: Component Balance for the power station



Source: Storm Water Solutions, Surface Water Assessment (2015)

Figure 2-9: Conceptual SWMP of Power Plant



Source; Storm Water Solutions, Surface Water Assessment (2015)

Table 2-6: Relevant listed activities related to use, storage, transport and treatment of water

Notice	Activity	Description
GN 984 of 4 December 2014	25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15000 cubic meters or more.
GN 983 of 4 December 2014	12 (i)(ii)(v)(vi)(xi)	The development of: (i) canals; (ii) channels;; (v) weirs; (vi) bulk storm water outlet structures; (xi) infrastructure or structures covering 50 square meters or more where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse.
GN 983 of 4 December 2014	13	The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50 000 cubic meters or more, unless such storage fails within activity 16 in Listing Notice 2 of 2014
GN 983 of 4 December 2014	19 (i)	The infilling or depositing or placing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – (i) a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving - (a) will occur behind a development setback; *(N/A)*

Notice	Activity	Description
		(b) is for maintenance purposes undertaken in accordance with a maintenance management plan; *(N/A)* or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies. *(N/A)*
GN 984 of 4 December 2014	16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 meters or higher or where the high-water mark of the dam covers an area of 10 hectares or more.
GN 984 of 4 December 2014	6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent
GN 985 of 4 December 2014	2(d)(viii) & (xii) (aa)	The development of reservoirs for bulk water supply with a capacity of more than 250 cubic meters
GN 985 of 4 December 2014	14 (i)(ii)(iv)(v)(vi) (x)(xii) (a)(c) (d)(vii)	The development of- (i) canals exceeding 10 square meters in size (ii) channels exceeding 10 square meters in size; (iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square meters in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square meters in size; (vi) bulk storm water outlet structures exceeding 10 square meters in size; (x) buildings exceeding 10 square meters in size; (xii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs- (a) within a watercourse; (c) if no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.

Note that these activities will also require authorisation under the National Water Act (Act 36 of 1998). A separate Water Use Licence will be submitted to the Provincial Department of Water and Sanitation.

The generation or release of emissions, pollution or effluent as a result of the development of the proposed facility which requires a permit or licence in terms of national or provincial legislation includes:

1. An air emission license (National legislation)
2. A waste management license (National – Hazardous; Provincial – General waste)
3. A Water Use License (21 (g) disposing of waste in a manner which may detrimentally impact on a water resource)
4. A Water Use License (21 (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;)

2.2.3.4 Storage & handling of dangerous goods

An emergency diesel generator will be required in order to provide power for the plant's essential services in the event the plant becomes disconnected from the electrical supply grid. The emergency diesel generator would start automatically in order to charge the plant uninterruptable power supply system (UPS) which will allow the plant to shut-down in a safe and controlled manner and allow the plant to monitored whilst it is shut-down until the grid connection is re-established. This generator would be provided with a small dedicated fuel tank.

The following chemicals uses would be typical for a power plant of this size and type.

Table 2-7: Chemicals likely to be used as part of the power plant

Chemical	Nature / Composition	Function On Plant	Estimated Annual Usage	Method Of Storage
Sodium Hypochlorite	NaOCl, / 10% to 15% Aqueous Solution	Water treatment to prevent the build-up of organic growth in water tanks and pipework	Small	Semi bulk container
Caustic Soda Liquor	NaOH, 5-50% Liquid Sodium Hydroxide	Ion Exchange, Resin Regeneration, Water Treatment Plant	200 Tonnes pa	Semi bulk container
Sulphuric Acid >50%	H_2SO_4 , 96% Liquid	Ion Exchange, Resin Regeneration, Water Treatment Plant	120 Tonnes pa	Semi bulk container
Hydrochloric acid (@ 33% w/w)	HCl in water (H_2O)	Ion Exchange, Resin Regeneration, Water Treatment Plant	200 Tonnes pa	Semi bulk container
Hydrazine	N_2H_4 Reduced to 4.9% Aqueous Solution	Oxygen scavenger for boiler feed water treatment	35 tonnes of 35% annually	Specialist storage and handling kit required
Carbohydrazide	98.0% min CH_6N_4O	Oxygen scavenger for boiler feed water treatment	24 tonnes p.a.	Large drums
Hydrazine Hydrate 7.5%w/w / Ammonia Mix	$N_2H_4.NH_3$	Boiler feedwater treatment	28 tonnes	Specialist storage and handling kit required
Ammonium Hydroxide	NH_4OH	Boiler feedwater corrosion control	35 tonnes	Semi bulk container
Hydrogen	H_2 ,	Gas Alternator	130,000 m3	Cylinders
Gas Oil	Complex mixture of paraffinic, olefinic and aromatic hydrocarbons C7 to C35, Liquid	Coal Plant Vehicles, Mobile Plant and emergency and black start (if any) Generators	466,000 litres	Bulk tank

Source: Mott MacDonald (2015)

The chemical storage areas will have appropriate fire detection and prevention equipment which complies with the local and the NFPA codes and standards. The delivery areas will be designed to contain any spills and have sufficient physical barriers and different connection fittings to prevent accidental cross contamination. Spill clean-up kits, Personal Protective Equipment and panic showers will be available.

Drains from areas of potential contamination will be designed to ensure any spills are directed to a place where they can be contained and controlled.

The plant will be subject to a rigorous HAZOP (Hazard and Operability) study during the design stage and again for the operational stage.

Table 2-8: Relevant listed activities related to Storage & handling of dangerous goods

Notice	Activity	Description
GN 983 of 4 December 2014	14	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic meters;
GN 984 of 4 December 2014	4	The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity or more than 500 cubic meters.
GN 985 of 4 December 2014	10(d)(ix) & (xii)(bb)	The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such a storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic meters

2.2.3.5 Roads

The proposed access to the power station will be from the D488 road (see Figure 2-10).

Figure 2-10: D488 Access road

Source: Sturgeon Consulting, Traffic Assessment (2015)

Development traffic will most probably access the D488 through the Colenso town from either the R74 or R103 and via Inkanyezi or via the gravel access road to the east of Colenso. See Figure 2-11.

The access off the R74 to the east of Colenso addresses access to the site via the district road, D488, off R74. This route will allow for an industrial access route and a personnel/employee access route to the power station. If this is to be the preferred access road, it is recommended that this road will need to be upgraded to allow for the turning movements of large industrial vehicles and traffic control.

Figure 2-11: Possible Access Routes

Source: Sturgeon Consulting, Traffic Assessment (2015)

The required shoulder sight distance (SSD) for heavy vehicles along roads with a posted speed limit of 100km/h is 300 meters and along 80 km/h roads it is 240 meters and for 60 km/h is 180 meters based on the geometric design guidelines of the UTG. The available SSD at the R74 access (east of Colenso town) and the access into Colenso town are both acceptable. The SSD at the R103 intersection into Colenso town is also acceptable and safe for the existing posted speed limits along this road.

It is suggested that the preferred route to the proposed site is off the R74 to the east of Colenso. This route will have the least impact on the roads within Colenso town as well as on the roads through the Inkanyezi Township.

Table 2-9: Relevant listed activities related to roads

Notice	Activity	Description
GN 983 of 4 December 2014	19 (i)	The infilling or depositing or placing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from – (i) a watercourse; but excluding where such infilling, depositing, dredging, excavation, removal or moving - (a) will occur behind a development setback; *(N/A)* (b) is for maintenance purposes undertaken in accordance with a maintenance management plan; *(N/A)* or (c) falls within the ambit of activity 21 in this Notice, in which case that activity applies. *(N/A)*
GN 983 of 4 December 2014	24 (ii)	The development of - (ii) a road with a reserve wider than 13.5 meters, or where no reserve exists where the road is wider than 8 meters
GN 984 of 4 December 2014	27 (ii) (iii)	The development of - (ii) a road administered by a provincial authority; (iii) a road with a reserve wider than 30 meters
GN 985 of 4 December 2014	4(d)(viii) & (xii)(aa)	The development of a road wider than 4 meters with a reserve less than 13,5 meters
GN 985 of 4 December 2014	18(d)(viii) & (xii)(aa)	The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer.

2.2.3.6 Waste handling

Ash Storage and Disposal

The requirement for ash storage is very site specific and depends on a number of issues, such as:

- the ash content of the coal;
- the general operation of the plant;
- the proximity of local landfill sites; and
- the proximity of a potential ash user.

Measures would have to be incorporated to collect any leachate for treatment prior to disposal.

Plant ash is likely to be designated as a hazardous waste and as such its use/disposal will be controlled by the regulations applicable to South Africa.

It is likely, that measures to prevent the pollution of ground water will be required. Typically a double barrier system can be specified whereby one barrier may be a minimum thickness of low permeable material (e.g. clay) complemented by a second barrier consisting of an impermeable membrane. Other combinations are possible, such as multiple layers of membrane, but clay may be more economic if readily available.

Ash removed from the boilers will be treated before transportation in closed conveyors to the ash disposal site. Recycling options for the ash are currently being considered and is assessed and described in the EIA phase.

Barrier design

In terms of the National Environmental Management Waste Act (Act 59 of 2008), the ash dump will likely be seen as a hazardous waste landfill site The ash generated by the power plant will need to be assessed (within one hundred and eighty (180) days of generation) according to the methodology described in the National Norms and Standards (GN 635 Of 23 August 2013) to determine the waste type. The type of waste determine the landfill barrier requirements.

To assess the waste classification for the purpose of disposal to landfill the following are required:

- identification of chemical substances present in the waste; and
- sampling and analysis to determine the total concentrations (TC) and leachable concentrations (LC) of the elements and chemical substances that are specified in Sections 6 of Norms and Standards.

Total Concentration Threshold Limits (from TCT1 to TCT2) and Leachable Concentration Thresholds limits (from LCT0 to LCT3) for the various chemical substances and elements are provided in Section 6 of the Norms and Standards.

Waste types:

Based on the assessment of the particular waste destined for disposal to landfill, the type of waste is determined as follows:

- Wastes with any element or chemical substance concentration above LCT3 or TCT2 limits as provided in Section 6 of the Norms and Standards are **Type 0 Wastes**
- Wastes with any element or chemical substance concentration above the LCT2, but below or equal to the LCT3 limits, or above the TCT1 but below or equal to the TCT2 limits as provided in Section 6 of the Norms and Standards are **Type 1 Wastes**
- Wastes with any element or chemical substance concentration above LCT1 but below or equal to the TCT1 limits are **Type 2 Wastes**
- Wastes with any element or chemical substance concentration above the LCT0 but below or equal to the LCT1 limit and all TC concentrations below or equal to the TCT1 Limits are **Type 3 Wastes**

Wastes with all elements and chemical substance concentration levels for metal ions and inorganic anions below or equal to the LCT0 and TCT0 limits, and with all chemical substance concentrations also below set concentration limits for organics and pesticides are **Type 4 Wastes**

Note that if a particular substance in a waste is not listed with corresponding LCT and TCT limit provided in Section 6 of the Norms and Standards, and the waste has been classified as hazardous based on the health or environmental hazard characteristics of the particular element or chemical substance the waste is considered to be a **Type 1 Waste**.

Barrier requirements

Waste assessed in terms of the Norms and Standards for Assessment of Waste for Landfill Disposal must be disposed to a licenced landfill as follows:

Table 2-10: Waste Disposal requirements

Waste Type	Landfill Disposal requirements
Type 0 Wastes	The disposal of Type 0 waste to landfill is not allowed. The waste must be treated and re-assessed.
Type 1 Wastes	Type 1 waste may only be disposed of at a Class A landfill designed in accordance with GN 636 of 23 August 2013.
Type 2 Wastes	Type 2 Wastes may only be disposed of at a Class B landfill designed in accordance with GN 636 of 23 August 2013.
Type 3 Wastes	Type 3 waste may only be disposed of al a Class C Landfill designed in accordance with GN 636 of 23 August 2013.
Type 4 Wastes	Type 3 waste may only be disposed of al a Class D Landfill designed in accordance with GN 636 of 23 August 2013.

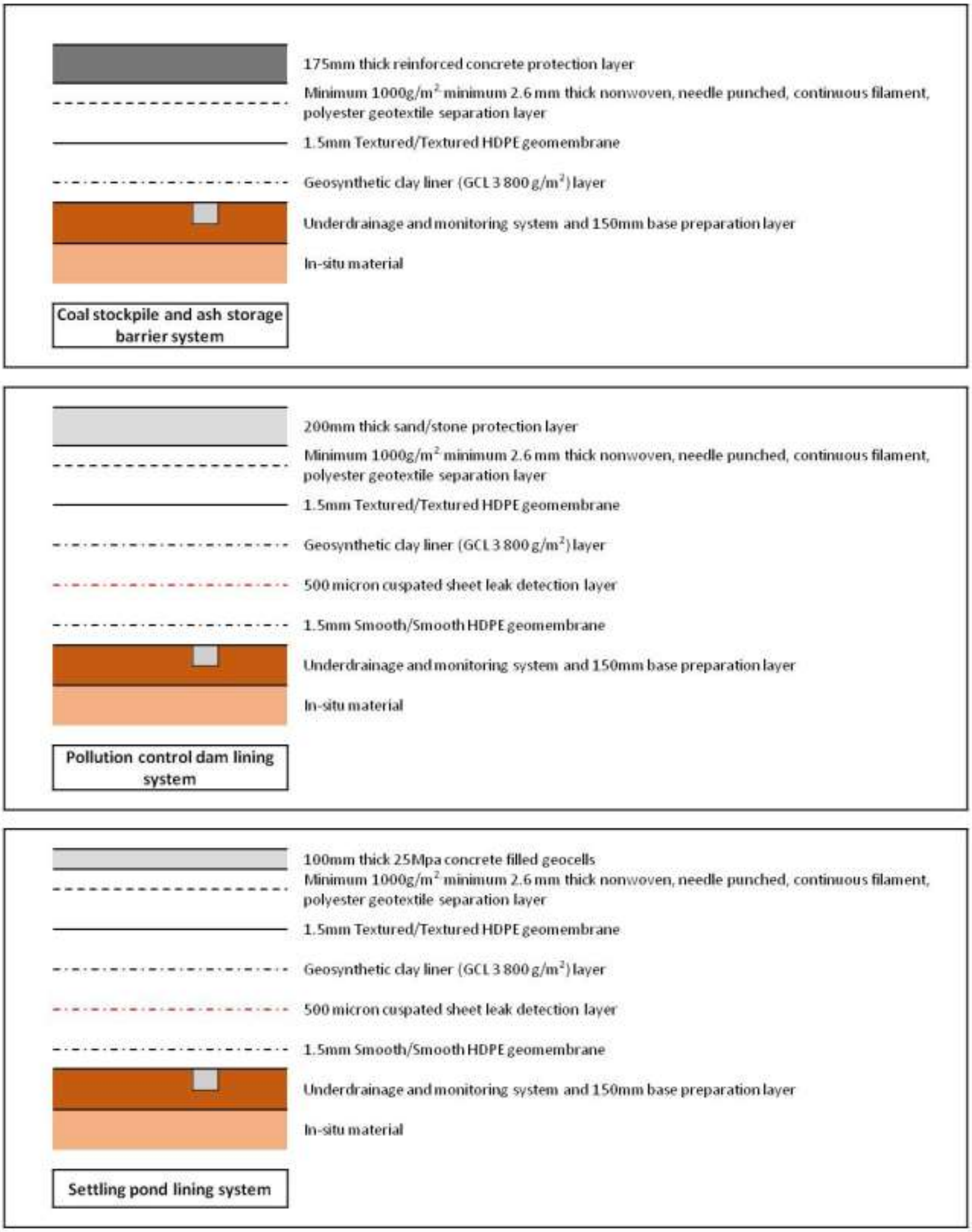
Source: GNR 635; 23 August 2013

It is anticipated that the barrier design for the ash dump will either need to be according to the design of a Class B or C landfill site. However, there is not much difference between the requirements for a Class B and a Class C liner except for the thickness of the clay layer between the liner and the original ground (600mm for Class B and 300mm for Class C). The regulation allows that the clay layer can be replaced with a geosynthetic clay liner (GCL).

Liners will be required at the coal stockpile, ash storage stockpile, settling pond and pollution control dam and ash storage sites. Please see Figure 2-12 below for barriers recommended for these sites. The type of waste determine the barrier design requirements.

For this project the estimated ash storage area for 25 years operation is approximately 70 hectares, the ash will be disposed of to land and will remain on the site after closure. The implication is that the closure plan must specifically provide for the adequate care and maintenance of the site. Once the site is capped, the risk to the environment reduce significantly. Note that the preferred option will be to utilise the ash by manufacturing bricks or a similar product that will prevent the leaching of harmful substances to the environment. This will reduce the footprint of the ash storage area to 9 ha. The stockpile will be managed as a stack and reclaim area and 9 ha provide for the storage capacity of a year for the worst case scenario.

Figure 2-12: Landfill barrier design



Source: Geotheta Geotechnical Engineers, (2015)

Waste sorting

Waste will be separated at source into appropriate labeled containers.

Waste storage

Waste storage areas for the temporary storage of general and hazardous waste that may arise from the electricity generation activities will need to be constructed. The waste storage and handling facilities will be constructed in accordance with the requirements of Section 21 – 25 of the NEMWA and will also take cognisance of the National norms and standards for the storage of waste (Notice 926 of 29 November 2013).

It must be noted that no waste (except for the ash dump, if this option is selected) will be disposed of at the proposed power station site.

Table 2-11: Relevant listed activities Related to waste storage

Notice	Activity	Description
GN 921 of 29 November 2013	Category A Activity 2	The sorting, shredding, grinding, crushing, screening or bailing of general waste at a facility that has an operational area in excess of 1000m ^{2}
GN 921 of 29 November 2013	Category A Activity 3	Ash (general waste - dependent on classification) will be recycled into bricks or a similar product at a facility that has an operational area in excess of 500m2
GN 921 of 29 November 2013	Category A Activity 12	The construction of facilities for Category A Activity 2 listed in above
GN 921 of 29 November 2013	Category B Activity 2	Ash (hazardous dependent on classification) in excess of 1 ton per day, will be reused and recycled into bricks or a similar product.
GN 921 of 29 November 2013	Category B Activity 4	Ash (hazardous dependent on classification) in excess of 1 ton per day (calculated as a monthly average) will be treated prior to disposal on the ash dumps.
GN 921 of 29 November 2013	Category B Activity 7	Ash (hazardous dependent on classification) generated will be disposed to land in ash dumps.
GN 921 of 29 November 2013	Category B Activity 8	Ash (general waste - dependent on classification) will be disposed to land covering an area in excess of 200m2 and with a total capacity exceeding 25 000 tons.
GN 921 of 29 November 2013	Category B Activity 10	The construction of facilities for Category 4 & 7 activities listed above

2.2.4 Other activities

2.2.4.1 Grid connections

The electrical interconnection will be defined by Eskom.

There are two different possibilities based on the existing electrical infrastructure in the area

- Connection to 275 kV national transmission system.
- Connection to 400 kV national transmission system.

The power plant will be connected to the high voltage national transmission system. The power plant will be connected to a high voltage substation. The configuration will consist of a double bus bar substation with two outgoing feeders for the interconnection to the transmission system. The voltage level will be 275 kV or 400 kV. At the power plant each generator will be connected to a generator step-up transformer using isolated phase bus ducts and a unit auxiliary transformer to feed the power plant auxiliary system.

Note that Eskom would undertake all studies associated with the development of the lines and the grid connections are therefore excluded from this application.

2.2.4.2 Railways

In terms of rail it will entail the construction of a new rail siding near Colenso for the off-loading and handling of coal from fuel source(s) other than that provided by the Colenso mine, and for other bulk consumables (such as lime).

Note that TRANSNET would undertake all studies associated with the development of the siding and this activity is therefore excluded from this applications

2.2.4.3 Conveyors/Rail-veyors

A conveyor or rail-veyor system will be constructed to convey the coal on the mine area and from the new mine along a route from the mine to the Power Station. This system will run along an alignment for approximately 17.8km. Note that coal is not considered a dangerous goods and therefore the listed activity for the bulk transportation of dangerous goods using funiculars or conveyors will not be triggered.

2.2.5 Listed activities considered and the reasons why it is not relevant to the project

Activities

Table 2-12: Listed activities considered and reason why not relevant to project

Relevance to the project	Notice	Activity	Listed Activity	Reason
Electricity Generation	GN 983 of 4 Dec 2014	2	The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where- (i) the electricity output is more than 10 megawatts but less than 20 megawatts; or (ii) the output is 10 megawatts or less but the total extent of the facility covers an area in excess of 1 hectare.	More than 20 megawatts of electricity will be generated
Rail-veyors / Conveyors will need to be constructed to transport coal (anthracite) from the mine or the rail siding to the power station	GN 983 of 4 Dec 2014	7 (iii)	The development and related operation of facilities or infrastructure for the bulk transportation of dangerous goods- (iii) in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day.	Coal (anthracite) is not classified as a “dangerous good”

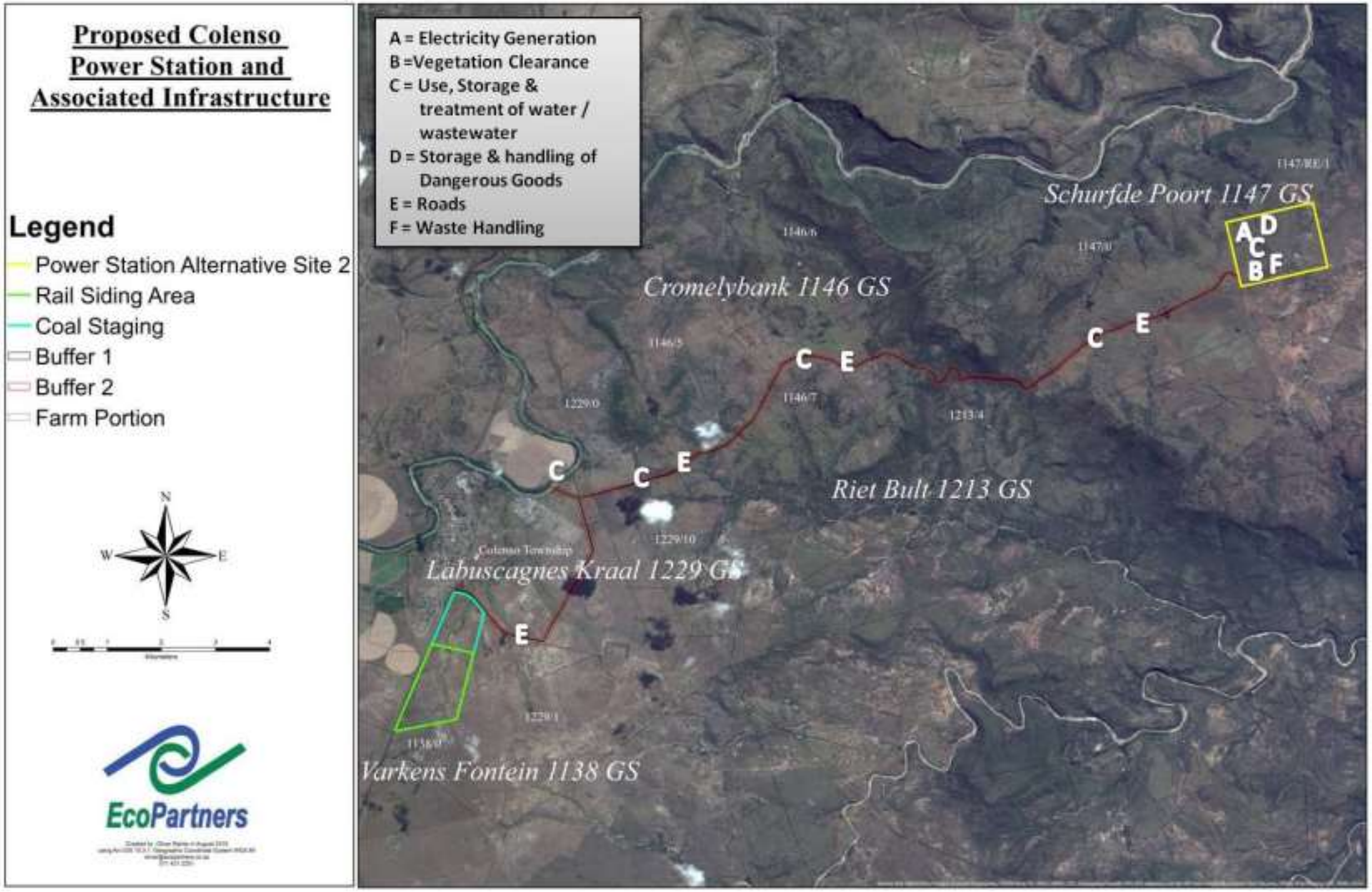
Relevance to the project	Notice	Activity	Listed Activity	Reason
Pipelines connecting the power station to the water supply	GN 983 of 4 Dec 2014	9	The development of infrastructure exceeding 1 000 metres in length for the bulk transportation of water or storm water- (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of water or storm water or storm water drainage inside a road reserve; or (b) where such development will occur within an urban area.	The water pipeline will not exceed an internal diameter of 0.36 metres; or have a peak throughput of 120 litres per second or more
Development of sewage infrastructure	GN 983 of 4 Dec 2014	10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes - (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.	The sewage pipeline will not exceed an internal diameter of 0.36 metres; or have a peak throughput of 120 litres per second or more
Development of sewage infrastructure	GN 983 of 4 Dec 2014	10	The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes - (i) with an internal diameter of 0.36 metres or more; or (ii) with a peak throughput of 120 litres per second or more; excluding where- (a) such infrastructure is for bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes inside a road reserve; or (b) where such development will occur within an urban area.	The effluent or process water pipeline will not exceed an internal diameter of 0.36 metres; or have a peak throughput of 120 litres per second or more

Relevance to the project	Notice	Activity	Listed Activity	Reason
Connection of the power station to the grid	GN 983 of 4 Dec 2014	11	The development of facilities or infrastructure for the transmission and distribution of electricity- (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts; or (ii) inside urban area or industrial complexes with a capacity of 275 kilovolts or more.	This component of the project is the responsibility of Eskom. The cumulative impacts was considered by the specialists and as part of this report.
Development of sewage infrastructure	GN 983 of 4 Dec 2014	25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a <u>daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres</u>.	It is unlikely that the sewage infrastructure will have a <u>daily throughput capacity of more than 2 000 cubic metres.</u>
Development of plant water treatment plant	GN 983 of 4 Dec 2014	25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a <u>daily throughput capacity of more than 2 000 cubic metres but less than 15 000 cubic metres</u>.	The treatment of effluent or boiler blow-down water is likely to exceed, the maximum quantity
Clearance of vegetation	GN 983 of 4 Dec 2014	27	The clearance of an area of 1 hectares or more, but <u>less than 20 hectares of indigenous vegetation</u>, except where such clearance of indigenous vegetation is required for – (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	More than <u>20 hectares of indigenous vegetation,</u> will need to be cleared for the proposed development
Connection of the power station to the grid	GN 984 of 4 Dec 2014	9	The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	This component of the project is the responsibility of Eskom. The cumulative impacts was considered by the specialists and as part of this report.
Development of rail siding	GN 984 of 4 Dec 2014	12	The development of railway lines, stations or shunting yards excluding - (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; or (iii) additional railway lines within the railway line reserve.	The development of the rail siding will be addressed by TRANSNET.

2.3 ACTIVITY MAP

Refer to Figure 2-13 for the Activity Map that indicates the locations of the activities for the various authorisations required.

Figure 2-13: Activity Map



3 LEGAL FRAMEWORK

3.1 NATIONAL LEGAL FRAMEWORK

3.1.1 The Republic of South Africa Constitution Act ("the Constitution")

The Constitution of the Republic of South Africa (Act No. 108 of 1996) (the Constitution), the supreme law in South Africa, contains far reaching clauses relevant to the environment including the environmental right, the administrative justice clause, the access to information right as well as the liberalisation of locus standi rule. In terms of Section 24, a positive obligation is placed on the State to give effect to the environmental right. The environmental right states that:

"Everyone has the right -

- To an environment that is not harmful to their health or well-being; and
- To have the environment protected, for the benefit of present and future generations,
- through reasonable legislative and other measures that:
- Prevent pollution and ecological degradation;
- Promote conservation; and
- Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."

The application of this clause in the report will imply that each "environmental aspect" is considered separately and cumulatively. Noise is used as an example to illustrate the point. In the context of noise, a determination of what level of noise is harmful to well-being, is required. The general approach of the common law is to define an acceptable level of noise as that which the reasonable person can be expected to tolerate in the particular circumstances. The subjectivity of this approach can be problematic which has led to the development of noise standards. "Noise pollution" is specifically included in Part B of Schedule 5 of the Constitution, which means that noise pollution control is a local authority competence, provided that the local authority concerned has the capacity to carry out this function. As part of this report noise has been assessed based on the legal requirement criteria, as well as the specified recommendations and mitigation requirements to ensure that noise do not "cause harm to anyone's health or well-being". In the event that it is not possible to mitigate, avoidance is recommended, in that case, alternative technology or alternative site lay-out or alternative approaches were recommended.

It is also important to note that in the "right to an environment clause" include that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development. Throughout this report, consideration was given to the impact on the environment in relation to the requirements for energy, the need for justifiable economic and social development, and the ecological sustainability of the Coal fired power station.

3.1.2 The Environment Conservation Act

The Environment Conservation Act ("ECA") (Act No. 73 of 1989) allows the Minister of Environmental Affairs and Tourism ("now the Ministry of Water and Environmental Affairs") to make regulations regarding noise, among other concerns.

3.1.2.1 Noise Control Regulations

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

Subsequently, in terms of Schedule 5 of the Constitution of South Africa of 1996 legislative responsibility for administering the noise control regulations was devolved to provincial and local authorities. Provincial Noise Control Regulations exist in the Free State, Gauteng and Western Cape provinces.

It should be noted that the National Noise Control Regulations defines:

"controlled area"

means a piece of land designated by a local authority where, in the case of--

c) industrial noise in the vicinity of an industry-

the reading on an integrating impulse sound level meter, taken outdoors at the end of a period of 24 hours while such meter is in operation, exceeds 61 dBA; or

the calculated outdoor equivalent continuous "A"-weighted sound pressure level at a height of at least 1,2 meters, but not more than 1,4 meters, above the ground for a period of 24 hours, exceeds 61 dBA;

"disturbing noise"

means noise level which exceeds the zone sound level or, if no zone sound level has been designated, a noise level which exceeds the ambient sound level at the same measuring point by 7 dBA or more.

"zone sound level"

means a derived dBA value determined indirectly by means of a series of measurements, calculations or table readings and designated by a local authority for an area. This is the same as the Rating Level as defined in SANS 10103.

In addition: In terms of Regulation 2 (d):

"A local authority may –

before changes are made to existing facilities or existing uses of land or buildings, or before new buildings are erected, in writing require that noise impact assessments or tests are conducted to the satisfaction of that local authority by the owner, mine, tenant or occupant of the facilities, land or buildings or that, for the purposes of regulation 3(b) or (c), reports or certificates in relation to the noise impact to the satisfaction of that local authority are submitted by the owner, mine, tenant or occupant to the local authority on written demand";

In terms of Regulation 3 (c):

"No person shall –

make changes to existing facilities or existing uses of land or buildings or erect new buildings, if it shall in the opinion of a local authority house or cause activities which shall, after such change or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority";

In terms of Regulation 4 of the Noise Control Regulations:

"No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof".

3.1.3 The National Environmental Management Act

The National Environmental Management Act ("NEMA") (Act No 107 of 1998) is South Africa's overarching environmental statute concerned with integrated environmental management (IEM) and the underlying principles by which environmental management must be undertaken. Its primary objective is to provide for co-operative governance, thus binding all organs of State by establishing principles for decision making on matters affecting the environment, institutions that will promote co-operative governance, and procedures for coordinating environmental functions exercised by organs of State and to provide for matters connected therewith (Government Gazette, 1998).

The NEMA provides for the Constitutional right to an environment that is not harmful to the health and well- being of South African citizens, the equitable distribution of natural resources, sustainable development, environmental protection, and the formulation of environmental management frameworks (Government Gazette, 1998). Section 2 of NEMA sets out principles for sustainable integrated environmental governance; the principles are further detailed in subsequent sections of NEMA.

In terms of Section 24 (2) of NEMA the Minister, or an MEC with the concurrence of the Minister, may identify-

(a) activities which may not commence without environmental authorisation from the competent authority;

The following regulations were made pertaining to impact assessments and came into effect on 8 December 2014:

- Regulation 982 – EIA Regulations
- Regulation 983 - Regulations Listing Notice 1 – Activities that require a Basic Assessment Process
- Regulation 984 – Regulations Listing Notices 2 – Activities that require full EIA Process
- Regulation 985 – Regulation Listing Notice 3 – Activities in specific identified geographical areas that requires authorisation

In terms of this project the listed activities that will likely apply, in terms of Section 24(2) and 24(D) of the NEMA, authorisation is required for the listed activities presented in Table 3-1:

Table 3-1: GN 983 & 984: 2014 Listed Activities associated with the project

Activity Number	Description	Applicability to project
Listed Activity as described in GN 983, 4 December 2014 (Listing Notice 1)		
9(i)(ii)	The development of facilities or infrastructure exceeding 1000 meters	Pipelines for the conveyance of water and / or sewage will need to be constructed. These

Activity Number	Description	Applicability to project
	in length for the bulk transportation of water, sewage or storm water - (i) with an internal diameter of 0,36 meters or more; or (ii) with a peak throughput of 120 liters per second or more.	pipelines will exceed 1km in length and could exceed a diameter of 0.36 meters and the peak throughput could be more than 120 liters per second. These pipelines will likely be constructed in the road reserve. The detail design is not finalised and is dependent on the outcome of the impact assessment.
12 (i)(ii)(v)(vi)(xi)	The development of: (i) canals; (ii) channels;; (v) weirs; (vi) bulk storm water outlet structures; (xi) infrastructure or structures covering 50 square meters or more where such construction occurs within a watercourse or within 32 meters of a watercourse, measured from the edge of a watercourse.	Water will be required and the abstraction of water will require the building of weirs, canals, channels and infrastructure or structures covering 50 square meters or more within 32 meters of a water course. Storm water control measures may also include canals, channels and bulk storm water outlet structures to be constructed within 32 m of a water course.
13	The development of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic meters or more, unless such storage fails within activity 16 in Listing Notice 2 of 2014	The operation will require water and facilities will need to be constructed for the storage of water. It is anticipated that the combined capacity of the facilities will be more than 50 000 cubic meters of water. Note that the detail design is not finalised and is dependent on the outcome of the impact assessment.
14	The construction of facilities or infrastructure for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 but not exceeding 500 cubic meters;	Storage of dangerous goods facilities will be required. The combined capacity will be more than 80 cubic meters and could be less than 500 cubic meters. The detail design is not finalised and is dependent on the outcome of the impact assessment. (Also see Activity 4 GN R 984)
19(i)	The infilling or depositing of any material more than 5 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic meters from: (i) a watercourse	During the proposed development water courses may be crossed in the road reserve for the pipelines and road upgrade, it may be possible that more of 5 cubic meters of soil could be removed or moved from the water course.
24 (ii)	The development of - (ii) a road with a reserve wider than 13.5 meters, or where no reserve exists where the road is wider than 8 meters	A road will be constructed to facilitate the mining of the coal. Various access roads will also be required. These roads could be wider than 8 meters. Also see Activity 27 and Activities 4 & 18 of GN R 546
67	Phased activities for all activities listed i. listed in this Notice, which commenced on or after the effective date of this Notice; or ii. similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices; where any phase of the activity may be below a	The triggering of phased activities may exceed specific thresholds.

Activity Number	Description	Applicability to project
	threshold but where a combination of the phases, including expansions or extensions, will exceed a specified threshold.	
Listed Activity as described in GN 984, 4 December 2014 (Listing Notice 2)		
2	The development and related operation of facilities or infrastructure for the generation of electricity from non-renewable resource where the electricity output is 20 megawatts or more.	The project entails the construction of a 1050 MW coal fired power station.
4	The development of facilities or infrastructure, for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity or more than 500 cubic meters.	Storage of dangerous goods facilities will be required. The combined capacity could be more than 500 cubic meters. The detail design is not finalised and is dependent on the outcome of the impact assessment. Also see Activity 14 GN R 983
6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent	The proposed mining activities will generate or release emissions, pollution or effluent for which permits and licenses are required (i.e. WULA, AEL).
15	The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) maintenance purposes undertaken in accordance with a maintenance management plan.	More than 20ha of indigenous vegetation clearance will be required.
16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 meters or higher or where the high-water mark of the dam covers an area of 10 hectares or more.	A dam will be constructed and the dam wall could be higher than 5 meters. The detail design is not finalised and is dependent on the outcome of the impact assessment.
25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15000 cubic meters or more.	A waste water and /or sewage treatment plant may be constructed. The daily throughput capacity of the facility could be more than 15 000 cubic meters. The detail design is not finalised and is dependent on the outcome of the impact assessment. See also Activity 25 of GNR 983.
27 (ii) (iii)	The development of - (ii) a road administered by a provincial authority; (iii) a road with a reserve wider than 30 meters	A road may be constructed that will be managed by the provincial authority or with a reserve wider than 30 meters

Activity Number	Description	Applicability to project
28	Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004),	The power station will require an Air Emission Licence.

The proposed site falls within a Critical Biodiversity Area CBA 3 - Optimal area as identified by the KZN C-Plan. The following activities are triggered due to the specific geographical locality of the proposed project. Authorisation will be required development in critical biodiversity areas.

The following activities listed in GN 985 are triggered by the development. (Refer Table 3-2)

Table 3-2: GN 985: 2014 Listed Activities associated with the project

Activity Number	Description	Applicability to project
Listed Activity as described in GN 985, 4 December 2014 (Listing Notice 3)		
2(d)(viii) & (xii) (aa)	The development of reservoirs for bulk water supply with a capacity of more than 250 cubic meters	A facility will be constructed for bulk water supply. The facility could exceed 250 m^3 in capacity. The facility could be located within 10km of a Nature Reserve and could be in Critical biodiversity Areas.
4(d)(viii) & (xii)(aa)	The development of a road wider than 4 meters with a reserve less than 13,5 meters	A road will be constructed to facilitate the transport of coal to the power station. Various access roads will also be required. These roads will be wider than 4 meters and could be located closer than 10 km for Nature Reserve and could be in Critical biodiversity Areas. Also see Activities 22(ii) and 47 of GN 545 and Activity 19 of GN R 546
10(d)(ix) & (xii)(bb)	The development of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such a storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic meters	Storage of dangerous goods facilities will be required. The combined capacity could exceed 80 cubic meters and could be stored within 100m of a water course and within critical biodiversity areas. The detail design is not finalised and is dependent on the outcome of the impact assessment. See also Activity 4 GN R 983 and Activity 4 of GN 984
12(d)(v) & (xii)	The clearance of an area of 300 square meters or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.	More than 300 square meters of indigenous vegetation will be cleared and this could be in critical biodiversity areas and/ or sensitive areas
14 (i)(ii)(iv)(v)(vi) (x)(xii) (a)(c)	The development of- (i) canals exceeding 10 square meters in size (ii) channels exceeding 10 square meters in size;	Canals, Channels, dams, weirs, bulk storm water outlet structures, buildings and/or infrastructure structures could have a footprint of 10 square meters or more. The development of these structures could occur

(d)(vii)	(iv) dams, where the dam, including infrastructure and water surface area exceeds 10 square meters in size; (v) weirs, where the weir, including infrastructure and water surface area exceeds 10 square meters in size; (vi) bulk storm water outlet structures exceeding 10 square meters in size; (x) buildings exceeding 10 square meters in size; (xii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs- (a) within a watercourse; (c) if no development setback has been adopted, within 32 meters of a watercourse, measured from the edge of a watercourse.	within a water course or within 32 meters of a water course. These structures/buildings could be located within critical biodiversity areas.
18(d)(viii) & (xii)(aa)	The widening of a road by more than 4 meters, or the lengthening of a road by more than 1 kilometer.	It is anticipated that certain existing roads will be upgraded. The upgrading could consists of the widening and lengthening of the roads. These roads could be located closer than 10 km for Nature Reserve and could be in Critical biodiversity Areas.

NEMA defines “pollution” to include any change in the environment, including noise. A duty therefore arises under section 28 of NEMA to take reasonable measures while establishing and operating any facility to prevent noise pollution occurring. NEMA sets out measures which may be regarded as reasonable. They include the following measures:

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

In terms of section 23 and 24G the act requires that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made.

Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation’s cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

3.1.4 The National Environmental Management: Air Quality Act

The National Environmental Management: Air Quality Act (AQA) (Act No. 39 of 2004) has shifted the approach of air quality management from source-based control to receptor-based control. The main objectives of the Act are to:

- Give effect to everyone's right 'to an environment that is not harmful to their health and well-being'
- Protect the environment by providing reasonable legislative and other measures that (i) prevent pollution and ecological degradation, (ii) promote conservation and (iii) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The Act makes provision for the setting and formulation of National ambient air quality standards for 'substances or mixtures of substances which present a threat to health, well-being or the environment'. More stringent standards can be established at the provincial and local levels.

The control and management of emissions in the AQA relates to the listing of activities that are sources of emissions and the issuing of emission licences. Listed activities are defined as activities which 'result in atmospheric emissions and are regarded as having a significant detrimental effect on the environment, including human health'. Listed activities have been identified by the Minister of the Department of Environmental Affairs and atmospheric emission standards have been established for each of these activities. These listed activities now require an atmospheric emission licence to operate. The issuing of emission licences for Listed Activities will be the responsibility of the Metropolitan and District Municipalities.

In addition, the Minister may declare any substance contributing to air pollution as a priority pollutant. Any industries or industrial sectors that emit these priority pollutants will be required to implement a Pollution Prevention Plan. Municipalities are required to 'designate an air quality officer to be responsible for coordinating matters pertaining to air quality management in the Municipality'. The appointed Air Quality Officer is responsible for the issuing of atmospheric emission licences.

Section 34 of the National Environmental Management: Air Quality Act (Act 39 of2004) makes provision for:

(1) the Minister to prescribe essential national noise standards -
  (a) for the control of noise, either in general or by specified machinery or activities or in specified places or areas; or
  (b) for determining –
    (i) a definition of noise
    (ii) the maximum levels of noise

(2) When controlling noise the provincial and local spheres of government are bound by any prescribed national standards.

This section of the Act is in force, but no such standards have yet been promulgated. Draft regulations have however, been promulgated for adoption by Local Authorities.

An atmospheric emission licence issued in terms of section 21 may contain conditions in respect of noise.

3.1.4.1 Listed Activities and Minimum Emission Standards

The South African Air Quality Act requires all persons undertaking listed activities in terms of Section 21 of the Act to obtain an Atmospheric Emission Licence. The Listed Activities and Associated Minimum Emission Standards was issued by the Department of Environmental Affairs on 31 March 2010 (Government Gazette No 33064) with a draft amended list of activities published on 23 November 2012 (Government Gazette No 35894).

Proposed operations at the Colenso power station is considered a listed activity and therefore require an Atmospheric Emission Licence to operate. Based on the information provided, the following listed activities were identified for the Colenso power station:

- Category 1, Subcategory 1.1: Solid Fuel Combustion Installations;
- Category 5, Subcategory 5.1: Storage and Handling of Ore and Coal;

New plants must comply with the new facilities minimum emission standards on the date of publication of the Notice (i.e. 1 April 2010). Existing plants must comply with the minimum emission standards for existing plants within 5 years of the date of publication of the Notice (i.e. 31 March 2015).

3.1.4.2 Ambient Air Quality Standards

South African National ambient air quality standards, including allowable frequencies of exceedance and compliance timeframes, were issued by the Minister of Water and Environmental Affairs on 24 December 2009 (Refer Table 3-3). National standards for $PM_{2.5}$ were established by the Minister of Water and Environmental Affairs on 29 June 2012.

Table 3-3: National Ambient Air Quality Standards for Criteria Air Pollutants

Pollutant	Averaging Period	Concentration (µg/M³)	Frequency of Exceedance
The values indicated in blue are expressed in parts per billion (ppb).			
Sulphur dioxide (SO_2)	10 minutes	500 (191 ppb)	526
	1 hour	350 (134 ppb)	88
	24 hours	125 (48 ppb)	4
	1 year	50 (19 ppb)	0
Nitrogen dioxide (NO_2)	1 hour	200 (106 ppb)	88
	1 year	40 (21 ppb)	0
Particulate Matter (PM10)	24 hours	75	4
	1 year	40	0
Particulate Matter (PM2.5)	24 hours	65[(1)]; 40[(2)]; 25[(3)]	0
	1 year	25[(1)]; 20[(2)]; 15[(3)]	0
Ozone (O_3)	8 hours (running)	120 (61 ppb)	11
Benzene (C_6H_6)	1 year	10 (3.2 ppb); 5 (1.6 ppb)	0
Lead (Pb)	1 year	0.5	0
Carbon monoxide (CO)	1 hour	30 000 (26 000 ppb)	88
	8 hour (calculated on 1 hourly averages)	10 000 (8 700 ppb)	11

Notes:
(1) Immediate compliance required until the 31 December 2015.
(2) Compliance required by 1 January 2016 – 31 December 2029.
(3) Compliance required by 1 January 2030.

Source: GNR 1210 (2009)

3.1.4.3 Dust Deposition Standards

The South African Department of Environmental Affairs issued National dust control regulations for South Africa on 1 November 2013 (Refer Table 3-4). The purpose of the regulations is to prescribe general measures for the control of dust in all areas in South Africa. The regulations prohibits activities which give rise to dust in such quantities and concentrations that the dust fall at the boundary or beyond the boundary of the premises where it originates exceeds -

- 600 mg/m^2/day averaged over 30 days in residential areas measured using reference method ASTM D1739.
- 1200 mg/m^2/day averaged over 30 days in non-residential areas measured using reference method ASTM D1739.

Table 3-4: Dust Fallout Regulations

Restriction Areas	Dust Fallout Rate (Mg/M2/Day, 30 Days Average)	Permitted Frequency of Exceeding Dust Fall Rate
Residential area	D < 600	Two within a year, not sequential months
Non-residential area	600 < D < 1200	Two within a year, not sequential months

Source: GNR 827 (20013)

Any entity that exceeds the applicable dust fallout standards should develop and implement a dust management plan. The dust management plan must:

- Identify all possible sources of dust within the affected site;
- Detail the best practicable measures to be undertaken to mitigate dust emissions;
- Develop and implementation schedule;
- Identify the line management responsible for implementation;
- Incorporate the dust fallout monitoring plan;
- Establish a register for recording all complaints received by the person regarding dust fall, and for recording follow up actions and responses to the complainants.
- An implementation progress report should also be compiled at certain intervals.

3.1.4.4 Greenhouse Gas Emissions

As of 14 March 2014 the South African Department of Water and Environmental Affairs released draft regulations to declare greenhouse gases as priority air pollutants, in terms of section 29 (1), read with section 57 (1) of the National Environmental Management: Air Quality Act (Act No. 39 of 2004). The following six greenhouse gases were identified as priority air pollutants in South Africa:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulphur hexafluoride (SF6)

Activities which are considered to be a greenhouse gas emission source and involve the release of greenhouse gases are summarised in Table 3-5 below. A person who conducts one of the identified activities will be required to measure their greenhouse gas emissions and report on them annually. Draft National Greenhouse Gas Emission Reporting

Regulations were released on the 11 May 2015 under Government Gazette No. 38779, Notice 411 of 2015.

A person, who conducts an activity which involves the release of greenhouse gases, declared as priority air pollutants, in excess of 0.1 Megatonnes (10^9 kg) (Mt) or more annually or measured as $CO_{2\text{-eq}}$ will be required to submit a pollution prevention plan. The South African Department of Water and Environmental Affairs also published draft national pollution prevention plans regulations, in terms of section 29 (3), 53 (0) and (p), read with section 57 (1) (a) of the National Environmental Management: Air Quality Act (Act No. 39 of 2004). The purpose of these regulations is to provide the requirements for pollution prevention plans which came into effect 31 March 2015.

Table 3-5: Sources and Activities for Greenhouse Gas Emitters

Emission Source	Activities	
Fuel combustion (both stationary and mobile)	Energy Industries: Electricity and heat production Petroleum Activity (refineries) Manufacturing Industries and Construction: Chemicals	Transport Sector: Civil aviation Road transportation Railways Water-borne navigation Other Sectors: Commercial/Institutional Residential Agricultural/Forestry/Fishing
Fugitive emissions from fuels	Surface and underground coal mining Processing of coal Storage of coal and wastes Processing of solid fuels Leakage of natural gas and the emissions of methane during coal mining and flaring during oil/gas extraction and refining.	
Industrial processes and other product use	Mineral Production: Cement production Lime production Glass production Chemical Production: Ammonia production Nitric acid production Carbide production Titanium dioxide production	Metal Industry: Iron production Steel production Ferroalloys production Aluminum production Lead production Zinc production
Agriculture, Forestry and other land use	Livestock: Enteric fermentation Manure management Land: Forest land Cropland Grassland Wetlands Settlements Other land use	Aggregate sources and non-CO_2 emissions on land: Biomass burning Liming Urea application Direct N_2O emission from managed soils Indirect N_2O emission from managed soils Indirect N_2O emission from manure management
Waste Management	Solid waste disposal Wastewater treatment and discharge Industrial waste disposal	

Source: GN 172 (2014)

3.1.5 The National Environmental Management Biodiversity Act

In line with the Convention on Biological Diversity, the National Environmental Management Biodiversity Act (Act No. 10 of 2004) (NEMBA) aims to legally provide for biodiversity conservation, sustainable use and equitable access and benefit sharing. The Act establishes the South African National Biodiversity Institute (SANBI). The NEMBA creates a basic legal framework for the formation of a national biodiversity strategy and action plan and the identification of biodiversity hotspots and bio-regions which will then be given legal recognition. It imposes obligations on landowners (state or private) governing alien invasive species as well as regulates the introduction of genetically modified organisms. Furthermore, the Act serves to regulate bio-prospecting, making provision for communities to share the profits of any exploitation of natural materials involving indigenous knowledge.

Specific restricted activities are defined by the NEMBA as, inter alia:

In relation to a specimen of a listed threatened or protected species:

1. Hunting, catching, capturing or killing any living specimen of a listed threatened or protected species by any means, method or device whatsoever, including searching, pursuing, driving, lying in wait, luring, alluring, discharging a missile or injuring with intent to hunt, catch, capture or kill any such specimen;
2. Gathering, collecting or plucking any specimen of a listed threatened or protected species;
3. Picking parts of, or cutting, chopping off, uprooting, damaging or destroying, any specimen of a listed threatened or protected species;
4. Having in possession or exercising physical control over any specimen of a listed threatened or protected species; and
5. Conveying, moving or otherwise trans-locating any specimen of a listed threatened or protected species.

In relation to a specimen of an alien species or listed invasive species:

1. Importing into the Republic, including introducing from the sea, any specimen of an alien or listed invasive species;
2. Having in possession or exercising physical control over any specimen of an alien or listed invasive species;
3. Growing, breeding or in any other way propagating any specimen of an alien or listed invasive species, or causing it to multiply; and
4. Conveying, moving or otherwise trans-locating any specimen of an alien or listed invasive species.

One of the objectives of this Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and to ensure the sustainable use of indigenous biological resources.

Chapter 4, Part 2 (Threatened and Protected Species Regulations) of NEMBA provides for listing of species that are threatened or in need of protection to ensure their survival in the wild, while regulating the activities, including trade, which may involve such listed threatened or protected species and activities which may have a potential impact on their long-term survival. In February 2007, this was achieved as the Minister of DEA published a list of Critically Endangered, Endangered, Vulnerable and Protected Species, according to

Section 56(1) of the Act. In April 2013 new draft regulation identifying these species were published for comments.

3.1.6 The National Environment Management: Waste Act

The National Environmental Management Waste Amendment Act (Act No. 26 of 2014) regulates waste management in order to protect health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development. It is important to realise that an important environmental impact associated with proposed developments is the generation of waste.

The definition of waste has been amended by NEMWA:

"**general waste"** is defined as waste that does not pose an immediate hazard or threat to health or to the environment, and includes-

- domestic waste;
- building and demolition waste;
- business waste;
- inert waste; or
- any waste classified as non-hazardous waste in terms of the regulations made under section 69,and includes non-hazardous substances, materials or objects within business, domestic, inert, building and demolition wastes as outlined in the expanded description of waste generated by specific operation sectors.

‘‘**hazardous waste**’’ is defined as any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within business waste, residue deposits and residue stockpiles and are further explained in terms of waste generated by specific operation sectors.

The following will be applicable to the project:

7. Wastes from thermal processes - (a) hazardous portion of wastes from power stations and other combustion plants

According to Section 19(1) of the NEM: Waste Act the Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.

Waste management activities were published in GN 921, November 2013 and the proposed development will trigger a number of activities listed in these regulations which requires compliance with the required standards and/or a Waste Management Licence.

Waste management activities are divided into the following categories:

- **Category A** - A person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct a **basic assessment process**, as stipulated in the environmental impact assessment regulations made under section 24(5) of the NEMA, 1998 (Act No. 107 of 1998) as part of a waste management licence application

- **Category** B - A person who wishes to commence, undertake or conduct an activity listed under this Category, must conduct an **environmental impact assessment process**, as stipulated in the environmental impact assessment regulations made under section 24(5) of the NEMA, 1998 (Act No. 107 of 1998) as part of a waste management licence.
- **Category C** - A person who wishes to commence, undertake or conduct a waste management activity listed under this Category, must comply with the **relevant requirements or standards** determined by the Minister listed below-
  - (a) Norms and Standards for Storage of Waste, 2013; or
  - (b) Standards for Extraction, Flaring or Recovery of Landfill Gas, 2013; or
  - (c) Standards for Scrapping or Recovery of Motor Vehicles, 2013.

Error! Reference source not found. list the Waste Management Activities in terms of GN 921 of 29 November 2013 that may be applicable to the project.

Table 3-6: GN 921: 2013 Listed activities

Activity number	Description	Applicability to project
Category A Activity 2	The sorting, shredding, grinding, crushing, screening or bailing of general waste at a facility that has an operational area in excess of 1000m2	General waste (to be sent to recyclers) will be sorted in an area in excess of 1000m2
Category A Activity 3	The recycling of general waste at a facility that has an operational area in excess of 500m2, excluding recycling that takes place as an integral part of an internal manufacturing process within the same premises.	Ash (general waste - dependent on classification) will be recycled into bricks or a similar product at a facility that has an operational area in excess of 500m2
Category A Activity 12	The construction of facilities of activities listed in Category A of this Schedule (not in isolation to associated activity)	The construction of facilities for Category A Activities 2, & 3 listed in above
Category B Activity 2	The reuse and recycling of hazardous waste in excess of 1 ton per day, excluding reuse or recycling that takes place as an integral part of an internal manufacturing process within the same premises.	Ash (hazardous dependent on classification) in excess of 1 ton per day, will be reused and recycled into bricks or a similar product.
Category B Activity 4	The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage.	Ash (hazardous dependent on classification) in excess of 1 ton per day (calculated as a monthly average) will be treated prior to disposal on the ash dumps.
Category B Activity 7	The disposal of any quantity of hazardous waste to land.	Ash (hazardous dependent on classification) generated will be disposed to land in ash dumps.
Category B Activity 8	The disposal of general waste to land covering an area in excess of 200m2 and with a total capacity exceeding 25 000 tons.	Ash (general waste - dependent on classification) will be disposed to land covering an area in excess of 200m2 and with a total capacity exceeding 25 000 tons.
Category B Activity 10	The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity)	The construction of facilities for Category B activities 2, 4, 7 & 8 listed above

The following legislation promulgated in terms of NEMWA are also applicable:

- National Norms and Standards for assessment of waste to landfill, GN 636 of 23 August 2013
- Waste classification and Management Regulations, GN 634 of 23 August 2013
- National Waste Management Strategy, GN 344 of 4 May 2012
- Norms and Standards for the Storage of Waste, GN 926 of November 2013
- Fee structure for Waste Management Licences, GN 142 of 28 February 2014
- National Waste Information Regulations, GN 625 of 13 August 2012

3.1.7 National Water Act

In terms of the National Water Act (Act No. 36 of 1998) (NWA), a person who wishes to use, or who uses water in a manner that is not a Schedule 1 use, not covered under a General Authorisation, or in a manner that is not regarded or declared as, an existing lawful use, may only use that water under the authority of a licence

The water uses which generally have to be authorised are listed under section 21 of the NWA. The water uses which are likely to be applicable to the proposed activity are highlighted below:

21(a): Taking water from a water resource;
21(b): Storing water;
21(c): Impeding or diverting the flow of water in a watercourse;
21(d): Engaging in a stream flow reduction activity;
21(e): Engaging in a controlled activity;
21(f): Discharging waste or water containing waste into a water resource through a pipe, canal, sewer or other conduit
21(g): Disposing of waste in a manner which may detrimentally impact on a water resource;
21(h): Disposing in any manner of water which contains waste from, or which has been heated in any industrial or power generation process;
21(i): Altering the bed, banks, course or characteristics of a watercourse;
21(j): Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people;
21(k): Using water for recreational purposes.

The following legislation related to the NWA is also applicable:

- Registration of Water Use, GN 1352 of 12 November 1999
- General Authorisations, GN 398 of 26 March 2004
- Establishment of the Thukela Catchment Management Agency, GN 900 of 15 September 2006.

3.1.8 Conservation of Agricultural Resources Act

The Conservation of Agricultural Resources Act (Act No. 43 of 1983) (CARA) includes the use and protection of land, soil, wetlands and vegetation and the control of weeds and invader plants. This is the only legislation that is directly aimed at conservation of wetlands in agriculture. The Act aims to prevent agricultural practices that contribute to the degradation of the environment.

CARA aims to protect the prevailing natural agricultural resources of South Africa from change of land use away from agriculture. This is especially important where high potential soils are present.

With regards to soil erosion, the primary legislation applicable to erosion of soil is the CARA. The objectives of this Act are to provide for the conservation of the natural agricultural resources of South Africa through maintaining the production potential of land, by the combating and prevention of erosion and weakening or destruction of the water sources, and by the protection of the vegetation and the combating of weeds and invader plants.

In 1984, regulations were passed in terms of the CARA regulations declaring about 50 species “weeds” or “invader plants”. On 30 March 2001 the Minister of Agriculture promulgated an amendment to these regulations. This amendment now contains a comprehensive list of species that are declared weeds and invader plants dividing them into three categories. These categories are as follows:

- Category 1: Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled, or eradicated where possible.
- Category 2: Declared invader species that are only allowed in demarcated areas under controlled conditions and prohibited within 30 m of the 1:50 year floodline of any watercourse or wetland.
- Category 3: Declared invader species that may remain, but must be prevented from spreading. No further planting of these species is allowed.

In terms of the amendments to the regulations under the CARA, landowners are legally responsible for the control of alien species on their properties.

3.1.9 The Fencing Act

The aim of the Fencing Act (Act No. 31 of 1963) is to consolidate the laws relating to fences and the fencing of farms and other holdings. When a landowner erects a fence in a designated area, he/ she may insist that the adjacent owner contribute towards the erection or maintenance costs. In areas where contributions are not mandatory / have not been published in the Government Gazette, a contribution can be claimed from the adjacent owner if the fence offers beneficial use for such a person. The Act also makes provision for a mechanism to deal with disputes between adjacent owners regarding a contribution towards erecting or repairing a fence.

Of specific importance, section 17 requires that any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to the protection of flora.

3.1.10 The Hazardous Substances Act

The object of the Hazardous substances Act (Act No.15 of 1979) is inter alia to ‘provide for the control of substances which may cause injury or ill health to, or death of, human beings by reason of their toxic, corrosive, irritant, strongly sensitising or flammable nature or the generation of pressure thereby in certain circumstances; for the control of electronic products; for the division of such substances or products into groups in relation to the degree of danger; for the prohibition and control of such substances.'

In terms of the Act, substances are divided into schedules, based on their relative degree of toxicity, and the Act provides for the control of importation, manufacture, sale, use, operation, application, modification, disposal and dumping of substances in each schedule.

Dangerous substances contained on-site during the construction and operational phases of the proposed power station will need to be management in accordance with the Act and material safety data sheets (MSDS) will need to accompany all dangerous goods (hydrocarbons, cleaning chemicals, paints, etc.).

3.1.11 The National Heritage Resources Act

According to the National Heritage Resources Act (Act No 25 of 1999) the following is protected as cultural heritage resources:

- Archaeological artifacts, structures and sites older than 100 years
- Ethnographic art objects (e.g. prehistoric rock art) and ethnography
- Objects of decorative and visual arts
- Military objects, structures and sites older than 75 years
- Historical objects, structures and sites older than 60 years
- Proclaimed heritage sites
- Grave yards and graves older than 60 years
- Meteorites and fossils
- Objects, structures and sites of scientific or technological value.

The National Estate includes the following:

- Places, buildings, structures and equipment of cultural significance
- Places to which oral traditions are attached or which are associated with living heritage
- Historical settlements and townscapes
- Landscapes and features of cultural significance
- Geological sites of scientific or cultural importance
- Sites of Archaeological and palaeontological importance
- Graves and burial grounds
- Sites of significance relating to the history of slavery
- Movable objects (e.g. archaeological, palaeontological, meteorites, geological specimens, military, ethnographic, books etc.)

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

- The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
- The construction of a bridge or similar structure exceeding 50m in length

- Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
- Re-zoning of a site exceeding 10 000 m^2
- Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the mentioned act states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of this act deals with archaeology, palaeontology and meteorites. The act states that no person may, without a permit issued by the responsible heritage resources authority (national or provincial)

- destroy, damage, excavate, alter, deface or otherwise disturb any
- archaeological or palaeontological site or any meteorite;
- destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
- trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or
- bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.
- alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

- ancestral graves
- royal graves and graves of traditional leaders
- graves of victims of conflict
- graves designated by the Minister

- historical graves and cemeteries
- human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

- destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;
- destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or
- bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the Ordinance on Excavations (Ordinance no. 12 of 1980) (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated to) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the Human Tissues Act (Act 65 of 1983 as amended).

3.2 National Frameworks, Standards & Guidelines

3.2.1 National Climate Change Response White Paper 2011

The South African Climate change response is recorded in the White Paper published in 2011. In it the government acknowledges that South Africa is energy-intensive, even more than similar developing countries. It is important for the economy to grow and there is a reliance on coal, liquid and natural gas sources of fuel in order to execute this mandate. The vision set for itself however is to deal with climate change on multiple fronts so that the impact is alleviated.

The White Paper acknowledges though the fragility of South Africa's economy in respect of GHG emissions and reduction. It states: *there are also secondary economic impacts. As a significant global emitter with a heavy reliance on coal-based energy, South Africa may be economically vulnerable to measures taken both internationally and nationally, to reduce GHG emissions. The sectors that are particularly vulnerable are those that are emissions-intensive, and trade-exposed, and may include iron and steel, non-ferrous metals, chemicals and petrochemicals, mining and quarrying, machinery and manufacturing, some agricultural exports, as well as transport services and tourism. Potential economic risks emerge from the impacts of climate change regulation, the application of trade barriers, a shift in consumer preferences, and a shift in investor priorities*.

The programme that the Colenso Power Station project will best fit into is the Carbon Capture and Sequestration Flagship Programme run by the DoE and looking at adapting sequestration technology. The modalities of how the Colenso Power Plant can fit into this programme are still to be established.

3.2.2 New Growth Path Framework (NGPF)

Government adopted the New Growth Path (NGP) as the framework for economic policy and the driver of the country's jobs strategy. The purpose of the series is to stimulate a constructive discussion about the country's economic priorities in order to identify actions that the private sector, organised labour and government can undertake jointly and in their respective areas and to build support for strong partnerships in the society to address the jobs and economic challenges.

The New Growth Path must provide bold, imaginative and effective strategies to create the millions of new jobs South Africa needs. It must also lay out a dynamic vision for how we can collectively achieve a more developed, democratic, cohesive and equitable economy and society over the medium term, in the context of sustained growth. The strategy sets out critical markers for employment creation and growth and identifies where viable changes in the structure and character of production can generate a more inclusive and greener economy over the medium to long run. To that end, it combines macroeconomic and microeconomic interventions.

3.2.3 National Development Plan 2030

As with the New Growth Path Framework (Department of Economic Development, 2010) the National Development Plan 2030 (National Planning Comission , 2011) confer that all regions are to seize advantage of the natural resources endowed to them towards achieving these aims, but in a sustainable and equitable manner. These action plans of the government focus firstly on the creation of decent employment opportunities through the support of labour-intensive sectors and secondly on ensuring long-term growth through the support of advanced industries. The NDP 2030 sets a target of creating approximately 11 million new jobs and achieving an annual average economic growth rate of 5.4% by 2030. Of critical importance to these policy documents and more specifically, to achieving the goals sought, is a leap toward growing and developing the green economy.

The National Development Plan 2030 seeks to ensure that half of all new electricity generating capacity is provided through renewable energy resources. Related to this objective, is the importance of transitioning towards a low carbon economy, which is in line with international protocols and ambitions.

The National Development Plan specifically refers to some key policy issues to guide appropriate actions to improve the management, use and conservation of water. The geographic areas where such strategic planning decisions are necessary on general economic and social development grounds, as well as for environmental protection and it includes some of the areas where a high concentration of prospective projects is expected.

The NDP refers to:

- Mpumalanga Highveld coal fields - a balance between environmental protection, agriculture, energy requirements and water resources is required.

- Lephalale and surrounds - water requirements and sources for mining and energy investments must be considered.
- Olifants River (Limpopo/Mpumalanga) - careful consideration of the balance between mining, agriculture and nature conservation is required.

3.2.4 Integrated Resource Plan (IRP) 2010-2030

Although the renewable energy sector remains high on government agenda, it should, however, be noted that the anticipated increase in energy demand by 2030 highlighted in the Integrated Resource Plan (IRP) 2010-2030 (Department of Energy, 2011) and later affirmed in the updated version of 2013 implies that the non-renewable energy sector still has a role to play in energy production within the country in the future, albeit its contribution towards energy generation capacitates in the future is to diminish in light of the increasing contribution by alternative energy technologies. The updated IRP2010 (Department of Energy, 2013) suggests that about 2 450 MW of new coal-fired power stations will need to be established by 2030 aside from the committed builds, a drop from 6 250 MW that was originally suggested in the IRP2010.

3.2.5 Integrated Policy Action Plan (2014/2015-2016/2017)

In support of the deployment of coal-fired power stations in the future, the Integrated Policy Action Plan (2014/2015-2016/2017) (the dti, 2014) has identified the leveraging of the government’s capital (CAPEX) and operational (OPEX) expenditure programmes and promoting localisation in the private sector as one of its key focus areas. One of the milestones set for the implementation of this programme is undertaking a detailed analysis for possible designation of coal-fired power station components. This means that government envisages that deployment of coal-fired power stations will still be significant considering the investigated opportunity for localisation.

3.2.6 Noise Standards

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

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

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

3.2.7 Integrated Environmental Management Information Series

The following documents provides guidance on the Environmental Impact Assessment process.

Table 3-7: Integrated Environmental Management Information Series

Series Number	Title
Information Series 0:	Overview of Integrated Environmental Management
Information Series 1:	Screening
Information Series 2:	Scoping
Information Series 3:	Stakeholder Engagement
Information Series 4:	Specialist Studies
Information Series 5:	Impact Significance
Information Series 6:	Ecological Risk Assessment
Information Series 7:	Cumulative Effects Assessment
Information Series 8:	Cost Benefit Analysis
Information Series 9:	Life Cycle Assessment
Information Series 10:	Strategic Environmental Assessment
Information Series 11:	Criteria for determining Alternatives in EIA
Information Series 12:	Environmental Management Plans
Information Series 13:	Review in Environmental Impact Assessment
Information Series 14:	Environmental Auditing
Information Series 15:	Environmental Impact Reporting
Information Series 16:	Environmental Economics

3.2.7.1 Integrated Environmental Management Guideline Series, 2010

The following documents provides guidance on Integrated Environmental management.

Table 3-8: Integrated Environmental Management Guideline Series

Series Number	Title	Available/Not Available
Guideline Series 1	Environmental Management Co-operation Agreements	
Guideline Series 2	NEMA S24G (ECA applications)	
Guideline Series 3	NEMA S24G	
Guideline Series 4	Strategic Environmental Assessment	
Guideline Series 5	Companion to the NEMA EIA Regulations 2010	Available; NEMA, GN 805 of 10 October 2012
Guideline Series 6	Environmental Management Framework	Available; NEMA, GN 806 of 10 October 2012
Guideline Series 7	Public participation in the EIA process	
Guideline Series 8	Handbook for authorities on handling appeals in terms of NEMA S43	
Guideline Series 9	Need and Desirability	Available; NEMA, GN 891 of 20 October 2014

3.2.7.2 National Environmental Impact Assessment and Management Strategy (EIMS) – Still in Draft

The following draft guideline documents are available.

Table 3-9: Draft EIMS documents

Theme	Title
Theme 1	Governance and administration
Subtheme 1	Procedures and organisational structures
Subtheme 2	Knowledge and information

Subtheme 3	Public participation
Subtheme 4	Monitoring and enforcement
Subtheme 5	Quality assurance and independence of EAP's
Theme 2	Capacity, Skills and transformation
Subtheme 6	Representative demographics within service providers and civil society
Subtheme 7	Empowerment of marginalised communities
Subtheme 8	Skills of EAPS and government officials
Theme 3	Impacts and instruments
Subtheme 9	Existing and new environmental impact management tools
Subtheme 10	Co-operative governance: EIAM tools
Subtheme 11	Quality management: EIAM tools

3.3 REGIONAL POLICY FRAMEWORK

3.3.1 Nature Conservation Ordinance

The Nature Conservation Ordinance (Ordinance 15 of 1974) has been supplemented by the KwaZulu-Natal Nature Conservation Management Act. The Nature Conservation Ordinance, (122) however, is still in place in conjunction with the other legislation.

The Ordinance makes extensive provision for protected areas (including private nature reserves) and protection of flora and fauna. The KZN Nature Conservation Ordinance No. 15 of 1974 also contains plant schedules (schedule 10, 11 and 12) for protected indigenous flora requiring permits for removal.

3.3.2 Kwazulu Natal Nature Conservation Act

The KwaZulu-Natal Nature Conservation Board is established as a juristic entity in terms of the KwaZulu-Natal Nature Conservation Management Act, (Act No. 7 of 1997) and has as its primary functions the management of nature conservation, not only within the Province of KwaZulu-Natal but also within protected areas in the Province. The Board is also charged to direct the development and promotion of ecotourism facilities within the protected areas.

The KwaZulu-Natal Nature Conservation Service (KZN Wildlife) is likewise established in terms of the above Act and essentially comprises the staff compliment of the Nature Conservation authority in KwaZulu-Natal. KZN Wildlife therefore carries out the day to day operation of the nature conservation in KwaZulu-Natal and as such is accountable to the Board. The above Act is essentially enabling Legislation creating the legal structures necessary to carry out the above mentioned functions.

3.3.3 KwaZulu Natal Nature Conservation Amendment Act

The KwaZulu Natal Nature Conservation Amendment Act (Act No. 7 of 1999) lists specially protected indigenous animals and plants and provides certain legal protections for the scheduled species so as to assist Conservation officials in the protection of Biodiversity. It also deals with professional hunting and non-indigenous species and sets out a system of permitting for certain activities. The Amendment Act also designates the powers of KZN Wildlife officials and provides for the appointment of Honourary Officers who provide their services free of charge. The Amendment Act also specifies categories of protected areas and provides a mechanism for the proclamation and de-proclamation of protected areas.

Although the KwaZulu-Natal Nature Conservation Amendment Act, which prescribes the law relating to the protection of flora and fauna, has been passed, until such time as regulations necessary to supplement the Amendment Act are finalised the Amendment Act will not be enacted and the law enforcement provisions are still dealt with by the remaining sections of the Natal Nature Conservation Ordinance 15 of 1974 and the KwaZulu Nature Conservation Act, 1992. Once the Amendment Act is put into operation the above mentioned Ordinance and the KwaZulu Nature Conservation Act, 1992 will be entirely repealed.

3.3.4 Kwazulu-Natal Systematic Conservation Plan (KZNSCP)

The process of conservation planning involves extensive mapping of vegetation types, transformation, species data, ecological processes and threats. This information is then used to identify Critical Biodiversity Areas (CBAs) and Critical Ecological Support Areas (CESAs). A CBA is considered significant and that it needs to be kept in a near natural state to ensure the continued functioning of ecosystems. A CBA represents the best choice for achieving biodiversity targets. CESAs are not essential for achieving targets, but they play a vital role in the continued functioning of ecosystems.

Ezemvelo KZN Wildlife developed three conservation plans for the province:

- KZN Marine Systematic Conservation Plan 2012
- KZN Freshwater Systematic Conservation Plan 2007
- KZN Terrestrial Systematic Conservation Plan 2010

Critical Biodiversity Area 3 Optimal (Previously: Biodiversity Priority Area 3)

CBA 3 Optimal areas are identified through systematic conservation planning software which represent the best localities out of a potentially larger selection of available PU's that are optimally located to meet both the conservation target but also the criteria defined within the Decision Support Layers. Using C-Plan, these areas reflect the negotiable sites with an Irreplaceability score of less than 0.8. This does not mean they are of a lower biodiversity value however, only that there are more alternate options available within which the features located within can be met. Even though these areas may display a lower Irreplaceability value or selection frequency score than the previous categories, it must be noted that these areas, together with the above two categories, collectively reflect the minimal reserve design required to meet the Systematic Conservation Plans targets and as such, they are also regarded as CBA areas.

3.3.5 KZN Heritage Act 4 of 2008

The KZN Heritage Act (Act No. of 2008) has the purpose to provide for the conservation, protection and administration of both the physical and the living or intangible heritage resources of the Province of KwaZulu-Natal; to establish a statutory Council to administer heritage conservation in the Province; to determine the objects, powers, duties and functions of the Council; to determine the manner in which the Council is to be managed, governed, staffed and financed; to establish Metro and District Heritage Forums to assist the Council in facilitating and ensuring the involvement of local communities in the administration and conservation of heritage in the Province; and to provide for matters connected therewith.

Amafa / Heritage KwaZulu Natal is the provincial heritage conservation agency for KwaZulu Natal. Amafa was established as a statutory body in terms of the KZN Heritage Act of 1997, replaced by the KZN Heritage Act of 2008. The Council of Amafa is appointed by the Premier of KZN, and is funded through a grant from the same department. It has offices in Pietermaritzburg, Durban and Ulundi.

Amafa manages several major heritage projects such as the Isandlwana Battlefield, Border Cave archaeological site and the KwaZulu Cultural Museum. Amafa administers the permit process for demolition and alteration of protected structures in KZN. As of April 2013 this is an online process performed by the SAHRIS facility.

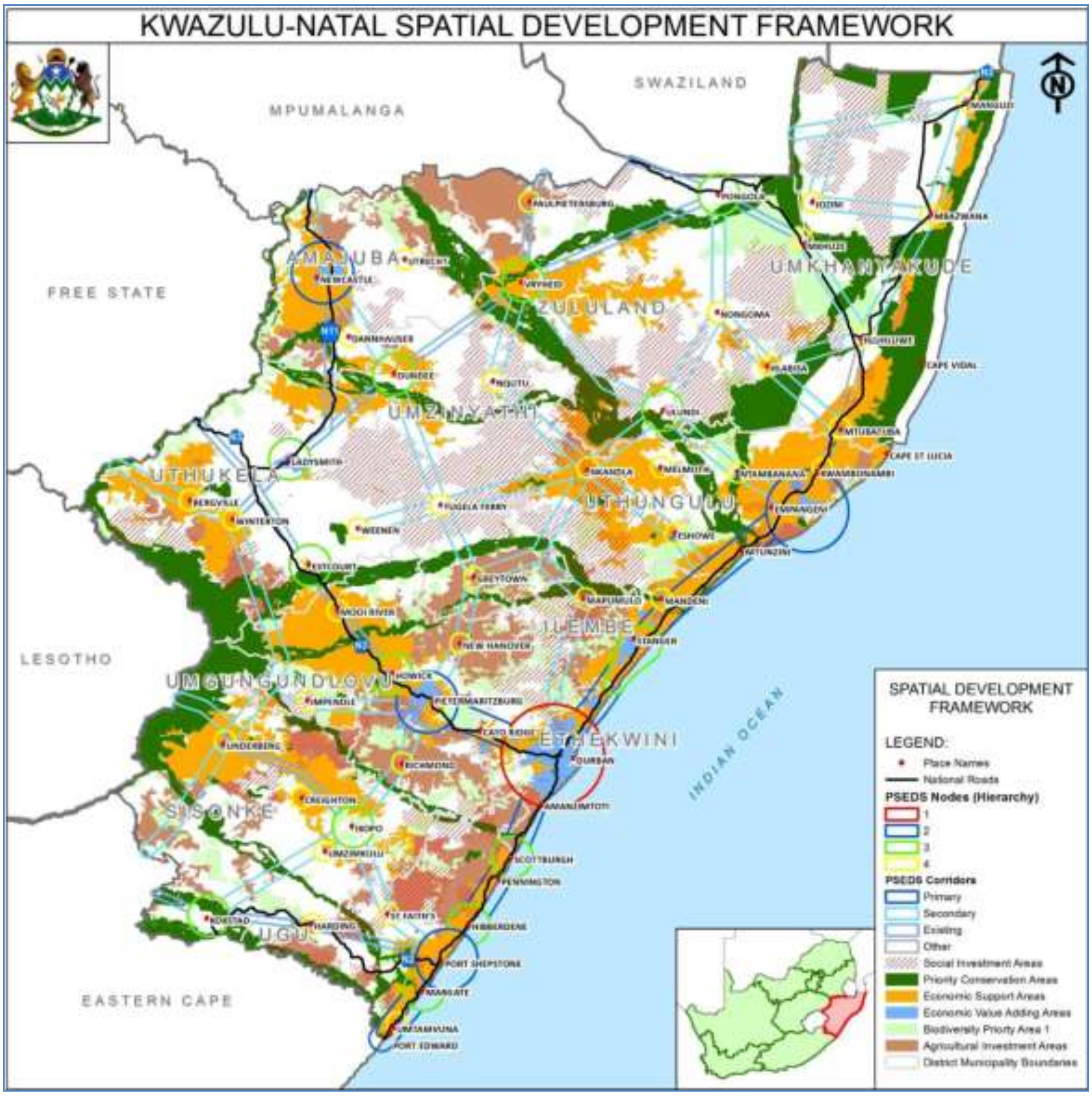
3.3.6 KwaZulu-Natal Provincial Growth and Development Plan (2013)

From the provincial perspective, the KwaZulu-Natal Provincial Growth and Development Plan (2013) aims to free the province of poverty, inequality and unemployment by the year 2030. Among some of the top strategic goals that form part of this provincial plan and vision are job creation, developing strategic infrastructure, and adopting environmental sustainability. In line with the NDP 2030, job creation is the number one strategic goal in the province. SMME, entrepreneurial, and knowledge economy development together with the agriculture, trade and investment sectors top the provincial government agenda in terms of job creation.

The plan explicitly states that the KwaZulu-Natal Province has insufficient electricity infrastructure to meet the rising demands of both industry and household consumers. As part of the remedy, the province envisages to invest a lot of effort in strategic infrastructure, which also covers the area of energy production. However, it should be noted that the province prioritises renewable energy over non-renewable energy projects. As part of the environmental sustainability goal, the KwaZulu-Natal PGDP clearly outlines the province's plans to pursue alternative energy generation and the need to reduce reliance on fossil fuels thereof. Development of hydro-electrical energy projects is of priority within the province. It is further believed that the province can unlock opportunities for job creation and economic growth in the green economy sector.

Although the development of renewable energy projects is high on the provincial agenda while that of fossil energy projects is of low priority, it should, however, be noted that this does not mean that such project should not be implemented in the province. Furthermore, development of a project with high labour-absorption capacity in the proposed Colenso area is of importance in the area to stimulate its economic development and improve the livelihoods of the people. A review of the KwaZulu-Natal Provincial Spatial Development Framework signaled that the proposed project area is marked a medium-to-low economic potential area with no significant economic activities.

Figure 3-1: The KwaZulu Natal Provincial Spatial Development Framework



Source: KZN Provincial Planning Comission (2011)

3.4 LOCAL POLICY FRAMEWORK

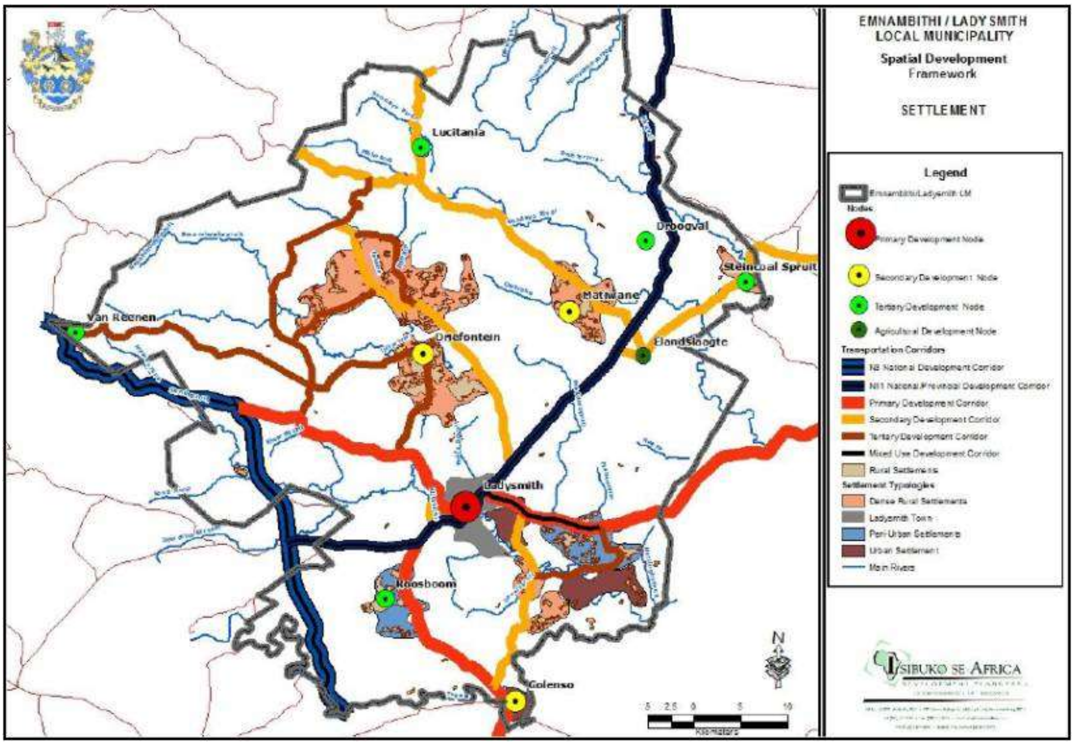
The following local government strategic documents are applicable to the delineated study areas:

- Uthukela District Municipality Integrated Development Plan 2008/2009
- Emnambithi/Ladysmith Local Municipality Integrated Development Plan 2013-2014
- Emnambithi/Ladysmith Local Municipality Spatial Development Framework 2012
- Emnambithi/Ladysmith Local Municipality Integrated LED Strategy 2010
- Emnambithi/Ladysmith Local Municipality Economic Development Strategy
- Umtshezi Local Municipality Integrated Development Plan 2011-2012
- Umtshezi Local Municipality Spatial Development Framework 2008
- Umtshezi Local Municipality LED Strategy and Plan
- Indaka Local Municipality Integrated Development Plan 2013/2014 to 2017/2018
- Indaka Local Municipality Spatial Development Framework 2010

A review of the district and local municipality policies revealed that most challenges currently bedeviling the area include basic service provision, prevalence of HIV/AIDS, crime, unemployment, and poverty. In order to curb the aforementioned socio-economic challenges and boost economic development as well as job creation, the municipalities identified agriculture, tourism and manufacturing (industrialisation) as key priority sectors for development. Rural and SMME development are also priority areas for the Emnambithi and Indaka LMs. The Emnambithi/Ladysmith LM SDF also recommends the rehabilitation of the town of Colenso, which falls within the vicinity of the proposed project site. The development of the town is said to having been decreased due to the closure of the previously located in the area power station, which belonged to the Eskom fleet.

It should be noted though that the Emnambithi/Ladysmith LM has quite a number of natural and cultural attractions of high touristic value. Some of the natural attractions include the Drakensberg Mountain, archaeological sites, and nature reserves, UThukela Biosphere Reserve, Thukela Catchments and Thukela River. The Emnambithi/Ladysmith LM SDF states that the municipality only contains one formally protected area, i.e. the Thukela Drift Nature Reserve, which in relation to the proposed project area is situated northwest of Colenso and in close proximity to the dismissed Alternative Site 3. Furthermore, the Emnambithi/Ladysmith LM SDF recommends that future development in Colenso should focus on developing an irrigation scheme for farmers located along Thukela River and also the development of the associated industries. It further recommends the redevelopment of the electricity generation infrastructure in the municipality.

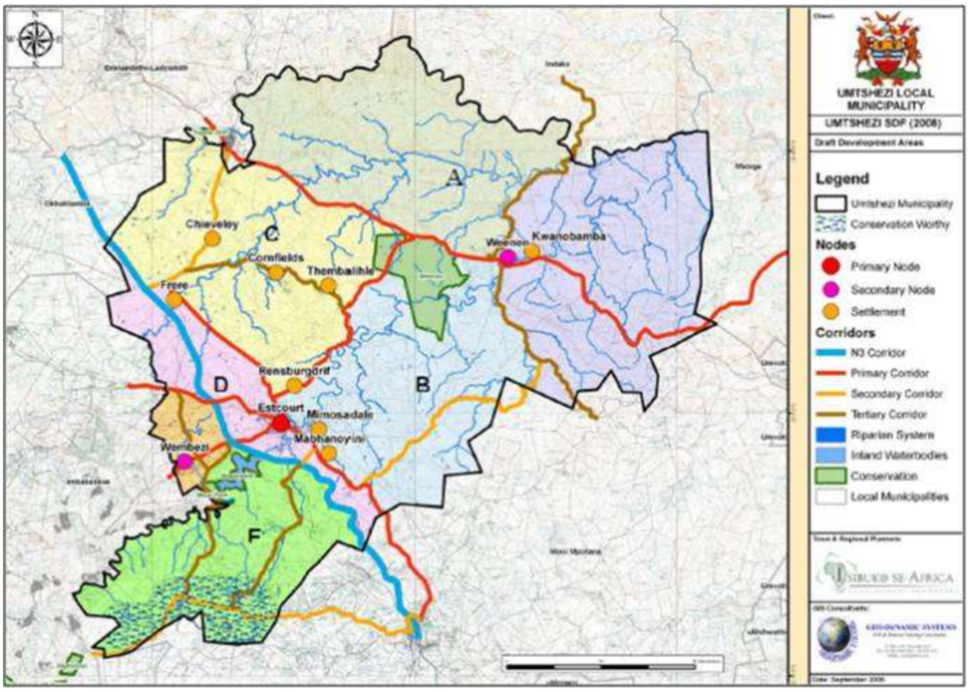
Figure 3-2: The Emnambithi/Ladysmith Local Municipality Spatial Development Framework



Source: Isibuku se Africa (2012)

The portion of the project that falls within the Umtshezi LM falls within the zone that is suitable for game farming and tourism and includes high profile and productive land. The municipality also has a number of conservation areas, but they are located far away from the proposed project site which is in the north-western part of the municipality.

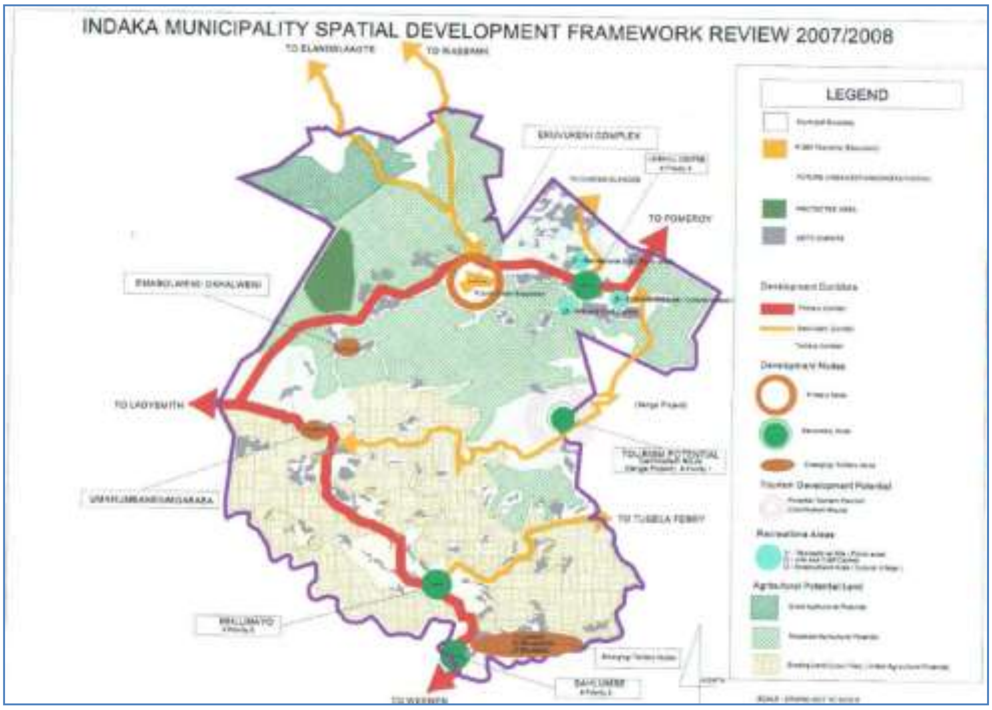
Figure 3-3: The Umtshezi Local Municipality Spatial Development Framework



Source: Isibuku se Africa (2012)

As far as the Indaka LM area is concerned, areas that border with the project site across the Thukela River are mainly marked as low and poor land potential zones, showing a limited agricultural potential of that land. A small portion of the land across the river from the project site is also demarcated for agricultural transformation. Also, it should be noted that the local municipality is predominantly rural with no major towns in the area.

Figure 3-4: The Indaka Local Municipality Spatial Development Framework



Source: The Indaka LM (2010)

Overall, it can be concluded that the policies reviewed largely support the development of a coal-fired project in the area as it could uplift the local economy and create opportunities for creation of new employment positions and improve the livelihoods of the people. However, there is a need to see to that the development of the proposed project does not negatively affect tourism activities mostly within the Thukela Catchments and Thukela River, since these are the identified places of high touristic value falling closer to the proposed project site.

The Umtshezi LM, where the power station site and the mine are proposed to be established are also located in the area where game farming and tourism activities can be explored. Lastly, development of the project should not conflict with or affect the potential to develop irrigation schemes along the Thukela River.

3.4.1 Model Air Quality Management By-law for adoption and adaptation by Municipalities

Model Air Quality Management By-Laws for adoption and adaptation by municipalities was published by the Department of Water and Environmental Affairs in the Government Gazette of 2 July 2010 as Government Notice 579 of 2010.

The main aim of the model air quality management by-law is to assist municipalities in the development of their air quality management by-law within their jurisdictions. It is also the aim of the model by-law to ensure uniformity across the country when dealing with air quality management challenges. Therefore, the model by-law is developed to be generic in order to deal with most of the air quality management challenges. With Noise Control being covered under the Air Quality Act (Act 39 of 2004), noise is also managed in a separate section under this Government Notice.

> **IT IS NOT** the aim of the model by-law to have legal force and effect on municipalities when published in the Gazette; and
>
> **IT IS NOT** the aim of the model by-law to impose the by-law on municipalities.

Therefore, a municipality will have to follow the legal process set out in the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000) when adopting and adapting the model by-law to its local jurisdictions.

3.5 International Legislative Framework

3.5.1 United Nations Framework Convention on Climate Change (UNFCCC)

South Africa is a party to both the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto Protocol, having acceded to the Convention in 1997 and ratified the Kyoto Protocol in 2002. As a signatory, the country has to comply to and participate in meetings and discussions of the UNFCCC and its Kyoto Protocol.

3.5.2 Kyoto Protocol

The UNFCCC is the main global response to climate change. The associated Kyoto Protocol is an international agreement that classifies countries by their level of industrialisation and commits certain countries to Greenhouse Gas (GHG) emission-reduction targets.

South Africa is a Non-Annex I country (developing country) and a signatory to the Kyoto Protocol. South Africa has ratified the Kyoto Protocol on 31.7.2002, but, as a developing country does not have targets under the protocol. The Kyoto Protocol commits Annex 1 (developed) countries to reduce GHG emissions to 5 per cent below 1990 levels by 2012.

The Kyoto Protocol has had two commitment periods, the first of which lasted from 2005-2012, and the second 2013-2020. The Kyoto has been amended so that the second period started 1 January 2013 and the first commitment period ended on 31 December 2012. The length of the second commitment period will be eight years.

The first national Greenhouse Gas (GHG) inventory in South Africa was prepared in 1998, using 1990 data. It was updated to include 1994 data and published in 2004 (DEA, 2013).

Key categories refer to the emission sources which contribute about 95% of the total GHG emissions in the country. The key categories were identified by carrying out the Intergovernmental Panel on Climate Change (IPCC) Tier 1 level and trend assessment with the 2000 and 2010 GHG inventories. The Level Assessment showed the key categories for 2010 (excluding the Land sub-sector) to be Energy industries (solid fuels), Road transportation, Manufacturing and construction (solid fuels) and Enteric fermentation; while the Trend Assessment (base year being 2000) indicated them to be Other sectors (solid fuels), Other emissions from energy production, Enteric fermentation, and Iron and Steel production. If the Land sector is included then "Forest land remaining forest land" becomes the 14th key category in the Level Assessment and the 4th category in the Trend Assessment.

In 2010 the total GHG emissions in South Africa were estimated to be at 579 256 Gg CO_2 eq (excl. Land sub-sector) (Table 3-10). Emissions, excluding the Land sub-sector, steadily increased by 24.9% between 2000 and 2010. Including the Land sub-sector, which is estimated to be a net carbon sink, leads to greater annual fluctuations in the total CO_2 emitted (Table 3-10)

Table 3-10: Trends and levels GHG emissions for South Africa between 2000 and 2010

	Energy	IPPU	AFOLU (excl. land)	AFOLU (incl and) (Gg CO_2 eq.)	Waste	Total (excl. Land)	Total (incl. Land)
2000	381 790	29 961	39 565	9 037	12 434	463 750	433 221
2001	383 620	28 652	39 725	12 772	13 122	465 118	438 166
2002	392 107	30 368	38 916	16 060	13 789	475 180	452 324
2003	421 121	30 987	36 995	10 310	14 477	503 581	476 895
2004	439 835	32 548	37 049	19 545	15 179	524 611	507 107
2005	433 719	33 400	37 235	29 667	15 907	520 262	512 693
2006	453 536	34 190	37 148	23 869	16 649	541 523	528 244
2007	479 058	33 871	36 522	23 435	17 409	566 860	553 773
2008	475 817	30 229	37 580	25 280	18 170	561 797	549 497
2009	476 346	27 456	36 658	21 688	18 989	559 450	544 480
2010	495 432	29 634	37 577	18 248	19 806	582 449	563 120

Source: DEA (2013)

The Energy sector contributed 82.3% to the total GHG inventory (excl. Land) in 2000 and this increased to 85.1% in 2010 (Table 3-10). The second biggest contributor (6.4% - 8.5%) is the Agriculture, Forestry and Other Land Use (AFOLU) sector (excl. Land). The emissions from this sector declined by 5% over the 10 year period; while the IPPU sector emissions declined by 1.1% over the same period. Including the biomass carbon component of the Land into the AFOLU sector decreased the total GHG emissions to 563 120Gg CO 2 eq in 2010. The total emissions including Land increased by 22% between 2000 and 2007, but then declined by 2% between 2007 and 2009. Emissions increased again in 2010 (Table 3-10).

South Africa's GDP is the 26th highest in the world, but in primary energy consumption South Africa is ranked 16th in the world. South Africa's energy intensity is high mainly because the economy is dominated by large scale, energy-intensive primary minerals beneficiation industries and mining industries. Furthermore, there is a heavy reliance on fossil fuels for the generation of electricity and significant proportion of the liquid fuels consumed in the country. The energy sector is critical to the South African economy because it accounts for a total of 15% in the GDP (DEA, 2013).

3.5.3 Guidelines for Community Noise (WHO, 1999)

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

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

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

The document uses the L_{Aeq} and $L_{A,max}$ noise descriptors to define noise levels. It should be noted that a follow-up document focusing on Night-time Noise Guidelines for Europe (WHO, 2009).

3.5.4 Night Noise Guidelines for Europe (WHO, 2009)

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

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

3.5.5 WHO Air Quality Guidelines For Particulate Matter, Ozone, Nitrogen Dioxide and Sulfur Dioxide (Global Update 2005)

The WHO air quality guidelines are designed to offer guidance in reducing the health impacts of air pollution. First produced in 1987 and updated in 1997, these guidelines are based on expert evaluation of current scientific evidence. The new information included in the latest (2005) update of the Air quality guidelines relate to four common air pollutants: particulate matter (PM), ozone (O_3), nitrogen dioxide (NO_2) and sulfur dioxide (SO_2).

Table 3-11: World Health Organisation (WHO) Air Quality Guidelines

Pollutant	Averaging Period	WHO Guideline (µg/M^3) (2)
Sulphur dioxide (SO_2)	24hr	20
	10 min	500
Nitrogen dioxide (NO_2)	Annual	40
	1 hr	200
Particulate Matter (PM_{10})	Annual	20
	24 hr (1)	50
Particulate Matter ($PM_{2.5}$)	Annual	10
	24 hr (1)	25
Ozone (O_3)	8 hr (daily maximum)	100

Notes:
PM 24 hour value is the 99th percentile
WHO Interim target guidelines have been excluded.

3.5.6 Equator Principles

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

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

3.5.7 IFC: General EHS Guidelines

Environmental Noise Management

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

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

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

- Selecting equipment with lower sound power levels;
- Installing silencers for fans;
- Installing suitable mufflers on engine exhausts and compressor components;
- Installing acoustic enclosures for equipment casing radiating noise;
- Improving the acoustic performance of constructed buildings, apply sound insulation;
- Installing acoustic barriers without gaps and with a continuous minimum surface density of 10 kg/m^2 in order to minimize the transmission of sound through the barrier. Barriers should be located as close to the source or to the receptor location to be effective;
- Installing vibration isolation for mechanical equipment;
- Limiting the hours of operation for specific pieces of equipment or operations, especially mobile sources operating through community areas ;
- Re-locating noise sources to less sensitive areas to take advantage of distance and shielding;
- Placement of permanent facilities away from community areas if possible;
- Taking advantage of the natural topography as a noise buffer during facility design;
- Reducing project traffic routing through community areas wherever possible;
- Planning flight routes, timing and altitude for aircraft (airplane and helicopter) flying over community areas; and
- Developing a mechanism to record and respond to complaints.

It sets noise level guidelines (see Table 3-12) as well as highlighting the certain monitoring requirements pre- and post-development.

Table 3-12: IFC Table .7.1-Noise Level Guidelines

Receptor type	One hour LAeq (dBA)	
	Daytime 07:00 - 22:00	Night-time 22:00 – 07:00
Residential; institutional; educational	55	45
Industrial; commercial	70	70

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

Thermal Power Plants

The IFC EHS Guidelines for Thermal Power Plants is a technical reference document that can be used by new or existing facilities that are designed to produce electrical, steam, heat or a combination of these with a total heat input capacity above 50 MWth. The document is relevant for combustion processes involving boilers, reciprocating engines and combustion turbines which are fuelled by either gaseous, liquid, solid fossil fuels or biomass (except for solid waste) (IFC, 2008).

In terms of air emissions the IFC EHS Guidelines for Thermal Power Plants recommends that an existing or new thermal power plant should investigate and implement emission reduction measures that are suitable to the site and facility. These measures should ensure that there is no net increase in emissions of sulphur dioxide, nitrogen dioxide and particulate matter which are identified as the main pollutants of concern released during Thermal Power Plant combustion processes (IFC, 2008).

The IFC EHS Guidelines for Thermal Power Plants makes provision for emission guidelines for boilers (Table 3-13). It is recommended that the facility does not result in stack emissions that exceed the IFC emission guidelines (IFC, 2008).

Table 3-13: IFC EHS Emission Guidelines for boilers

Fuel Input	Particulate Matter (mg/Nm3)		Sulphur Dioxide (mg/Nm3)		Nitrogen Oxides (		Dry Gas, Excess O_2 Content (%)
Combustion Turbine							
Solid Fuels (1)	50 (3)	30 (4)	900 -1500 (3)	400 (4)	510 (3)	200 (4)	6
Solid Fuels (2)			200 - 850 (3)	200 (4)			6

Notes:
1) Plant > 50 MWth to < 600 MWth
2) Plant >/= 600 MWth
3) Non-degraded airshed
4) Degraded airshed

Source: IFC, Guidelines (2008)

3.5.8 Future Noise Policy European Commission Green Paper (1996)

The 1996 Green Paper highlighted the need for better mitigation measures to be implemented in the European Union regarding transport air-borne vibration and recognises the need for a harmonization methodology of assessment of noise exposures[1]. It is stressed that noise relating to road, rail and other transport modes in the European Union needed to be addressed.

3.5.9 Appropriate noise limits for game parks and wilderness

The United States National Park Services identifies that “intrusive” un-natural sounds are concern for the National Park Services (United States[2]) as many visitors go to parks to

[1] European Commission Green Paper (Com (96) 540).1996.

[2] National Park Services, “Soundscape Preservation and Noise Management”, 2000, p. 1.

enjoy the soundscape (interpreted as natural soundscape). Naturally quiet places will not mean (as per interpretation of the author and available information) that the noise levels in the area will be low but rather that the soundscape contributors are of a natural origin (faunal communication, wind shear, water etc.).

These natural events could include the dawn chorus when songbirds start to sing at the start of a new day or frogs croaking after a rainfall event. Although game park visitors, receptors in "natural" areas and hospitality industries may not seek intrusive un-natural sounds, the operation of the game park/hospitality industry or receptors dwelling itself is source of anthropogenic noise (vehicles, game park electrical and mechanical infrastructure etc.). National Parks do though implement their own guidelines/rules regarding noise created by park visitors.

Natural sounds can contribute a meaningful magnitude[3] to the ambient soundscape depending on season, time, faunal species, habitat and habitat fragmentation etc. Although the magnitude may be loud, natural sounds may contain harmonics[4] and other pleasant sounds that visitors seek when going to parks or wilderness areas.

Certain International states have tried implementing laws regarding external environmental "un-natural" noise sources into areas with natural sounds. In USA there exists numerous state and local laws to encourage industries near parks to keep within limits set out by the local authorities[5]. The United States National Park Service's efforts include attempts to reduce the flights over the Grand Canyon due to the introduction of non-natural impulsive noise events at the park.

3.5.10 Environmental Management Systems

Many organisations implement their own Environmental Management Systems tools to for planning, implementing and maintaining policy for environmental protection. The more popular International system is highlighted below.

3.5.10.1 ISO 14000

ISO 14000 is a family of standards related to environmental management that exists to help organizations:

- minimize how their operations (processes etc.) negatively affect the environment (i.e. cause adverse changes to air, water, or land);
- comply with applicable laws, regulations, and other environmentally oriented requirements, and
- continually improve in the above.

The term continual improvement refers to an on-going process of performance enhancement. In the context of this environmental standard, it means that you need to enhance your organization's overall environmental performance by enhancing its environmental management system and by improving its ability to manage the

[3] Environ. We Int. Sci. Tech, "Ambient noise levels due to dawn chorus at different habitats in Delhi", 2001, p. 134.

[4] Panatcha Anusasananan, Suksan Suwanarat, Nipon Thangprasert, "Acoustic Characteristics of Zebra Dove in Thailand", p. 4.

[5] E.g. State of Oregon's Environmental Standards for Wilderness Areas

environmental aspects of its activities, products, and services. Continual improvements can be achieved by carrying out internal audits, performing management reviews, analyzing data, and implementing corrective and preventive actions.

3.5.10.2 European Parliament Directive 200/14/EC

Directive 2000/14/EC relating to the noise emission in the environment by equipment for use outdoors was adopted by the European Parliament and the Council and first published in May 2000. The Directive was applied from January 3rd, 2002. The directive placed sound power limits on equipment to be used outdoors in a suburban or urban setting. Failure to comply with these regulations may result in products being prohibited from being placed on the EU market. Equipment list is vast and includes machinery such as compaction machineries, dozers, dumpers excavators etc. Manufacturers as a result started to consider noise emission levels from their products to ensure that their equipment will continue to have a market in most countries.

4 NEED & DESIRABILITY

4.1 THE NEED IN SOUTH AFRICA

South African President Jacob Zuma, said on 9 January 2012 that the country, had to face up to the "triple challenge" of unemployment, poverty and inequality. (www.southafricainfo. co.za). This project addresses the triple challenge through various mechanisms:

Unemployment – Direct employment is created and indirect employment through the generation of small businesses. (See paragraph 4.3 and 4.4)

Poverty – Economic growth has been shown as the most effective way to reduce poverty. This project will allow the stabilisation of a critical energy shortfall. Many economists attribute the lack of growth and in the last quarter the shrinking of the economy to the energy uncertainty. (See paragraph 4.2 and 4.6)

Inequality – Through many policy and legal mechanism this project seeks to uplift a significant number of previously disadvantaged individuals.

4.2 ECONOMIC GROWTH AND DEVELOPMENT

There is a critical shortage of electricity nationally, the need for more power plants in South Africa is widely published as demand currently exceeds supply and growth in demand exceeds growth in supply. This shortfall is currently dealt with in the short term in a variety of ways including: load shedding, price increases (to reduce demand), alternative energy sources, and lower manufacturing rates. Electricity is one of the critical inputs for further development and stabilisation of the economy. The additional power supply will likely result in a more reliable power supply towards the national grid, to the wider region which includes the eThekwini Metro and specifically to the local area and consequent opportunities for business expansion will follow. The current drivers for the regional economy will be altered by the proposed project. This projects is grouped under the IPP Procurement Programme, and is therefore considered as Strategically Important Developments ("SIDs"), due to their potentially significant contribution to the national economy

4.3 SMALL BUSINESS OPPORTUNITIES

Several opportunities will arise from services required by the proposed power station directly as well as opportunities relying on the needs of employees working for the proposed power station. Opportunities will start during the construction process already and will persist throughout the life of the power plant. The socio-economic impact of these opportunities through the demand for products and services were assessed and is presented in Section 9.12 of this report. The number of respondent to the survey that indicated that they own small businesses in the area was 18%. According to the Global Entrepreneur Monitor (GEM) the average early-stage entrepreneurial activity (Total Entrepreneurial Activity - TEA) rate is 7%, while that of established businesses is 2.7%. (http://www.gemconsortium.org/country-profile/108). This seems to indicate that the likelihood of people in the area taking up the opportunity to run their own business, is at least double the opportunity compared to the average.

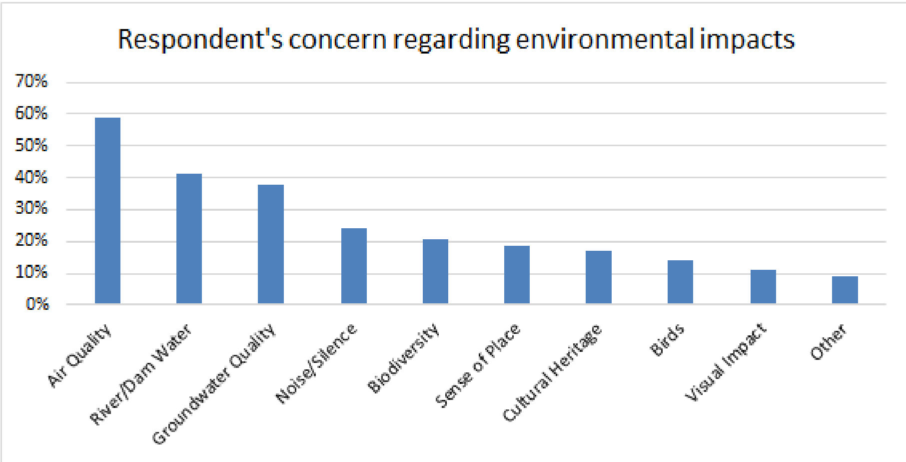
4.4 EMPLOYMENT

The proposed Coal Fired Power Station project will lead to short term jobs for skilled and unskilled workers related to the construction phase. These jobs will ultimately be replaced by longer term jobs for skilled workers working at and for the proposed power plant. The employment profile of the Local Municipality is expected to change dramatically and for a long time. The impact associated with the provision of employment was assessed and is presented in Section 9.12 of this report.

4.5 ENVIRONMENTAL IMPACT

The impacts on the environment were be evaluated as part of the assessment phase of the project. Although significant impacts were expected in terms of air quality and groundwater, the assessment indicated that these impacts is expected to be moderate to low. Significant impacts are more associated with the noise generated by construction and operational activates affecting sensitive receptors located closer than 300m to the impact, (this can be mitigated by ensuring noise activities are further then 300m, most of the site development will have a buffer of more than 300m to the closest sensitive receptor). Other significant impacts include the visual impact of the facility, and impacts on bats. All of these impacts can successfully be mitigated to reduce the significance thereof. Considering the concerns of respondents, the most significant concerns were Air quality, Surface water quality and Groundwater quality, the assessments clearly indicate that these impacts, can be effectively mitigated to fall below the World Health Organisation requirements.

Figure 4-1: Survey Respondents concern regarding environmental impacts.



Source: EcoPartners (2015)

4.6 POVERTY ABATEMENT

The local communities will benefit from the dividend flow arising from the anticipated direct ownership in the power project as well as from the revenue allocations that will be made directly into development projects to be conducted in partnership with the district and local municipalities. This will be a real opportunity to reduce poverty. The provision of more than 300 direct and sustained new employment opportunities which will increase the disposable income available in the area. When there is more money available, it will allow more entrepreneurs to generate opportunities creating indirect jobs. This was confirmed during the socio-economic impact assessment (Refer Section 9.12).

4.7 Cost of Energy

Electricity tariffs are amongst other things determined by the cost of generation of electricity, according to the Tariff Design Methodology published by Eskom (www. Eskom.co.za.) Calculation of the tariffs include a variety of factors and it considers the cost of capital, maintenance, generation, rehabilitation and mitigation. Currently the cost benefit analysis indicate that the coal-fired power station result in the lowest cost, with the greatest benefit. The generation of electricity using coal can contribute to the base load. South Africa is trying to diversify its electricity generation in order to meet the climate change requirements. It is important to remember that the contributors to climate change is dependent on human behaviour, in this sense if one cannot afford electricity, another fuel will be burned for lighting, cooking food, sterilizing water, charging cell phones and many more. The fuels used might be coal, wood, cow dung, paraffin and wax. Each with its own impacts on climate change, health and the environment. The alternative to base load electricity is therefore not alternative energy (in terms of wind and solar energy), but it is rather fossil fuels, biomass and carbon containing substances.

4.8 Rehabilitation Capacity

The project applicant has indicated and demonstrated a willingness and ability to make financial provision for rehabilitation of the project area. In the assessment phase of the project the mitigation measures and the conditions under which the proposed project might be viable are specified. The assessment resulted in the identification of a new prefered site, smaller buffer areas along the D488 route and the re-use of the ash generated thereby effectively reducing the footprint of the development by 64.2 %

4.9 Waste Recycling

The largest local impact will be on the generation of coal waste (in this case fly ash). The technical ability and financial sustainability of recycling programmes were considered during the assessment phase. The re-use of the fly ash for brick making or other alternatives is proposed. This will effectively reduce the source term, that could lead to pollution associated with the ash dump, from 70 ha to a stockpile of only 9 ha (refer Section 6). It is important to note that even the 70 ha ash dump will not result in pollution of the Thukela River

4.10 Employee Health and Safety

The most likely receptors of potential impacts will be the people or environment associated with the site. There are very strict regulation that ensure employee health and significant oversight to ensure compliance. Mitigation measures will need to be implemented to ensure that there are adequate safeguards considering workers health. Based on the assessments the exposure to employee health is currently below the World Health Organization exposure limits. The ability of workers to actively manage their own exposure to dangerous workplaces will be encouraged as part of the proposed project.

4.11 COMMUNITY STANCE ON THE PROJECT

In a survey conducted by EcoPartners, 96% of the respondents indicated that the proposed development was required in the area when asked to comment on the perceived need for the proposed coal-fired power station near Colenso. The main reasons for the need of the proposed project by the respondents was the perceived creation of business for local enterprises and job creation that would ensue as a result of the project.

Improved infrastructure, increase in local tourism activity and migration are other benefits that are expected by the local community from the proposed project.

5 DESCRIPTION OF THE ENVIRONMENT

5.1 GEOLOGY

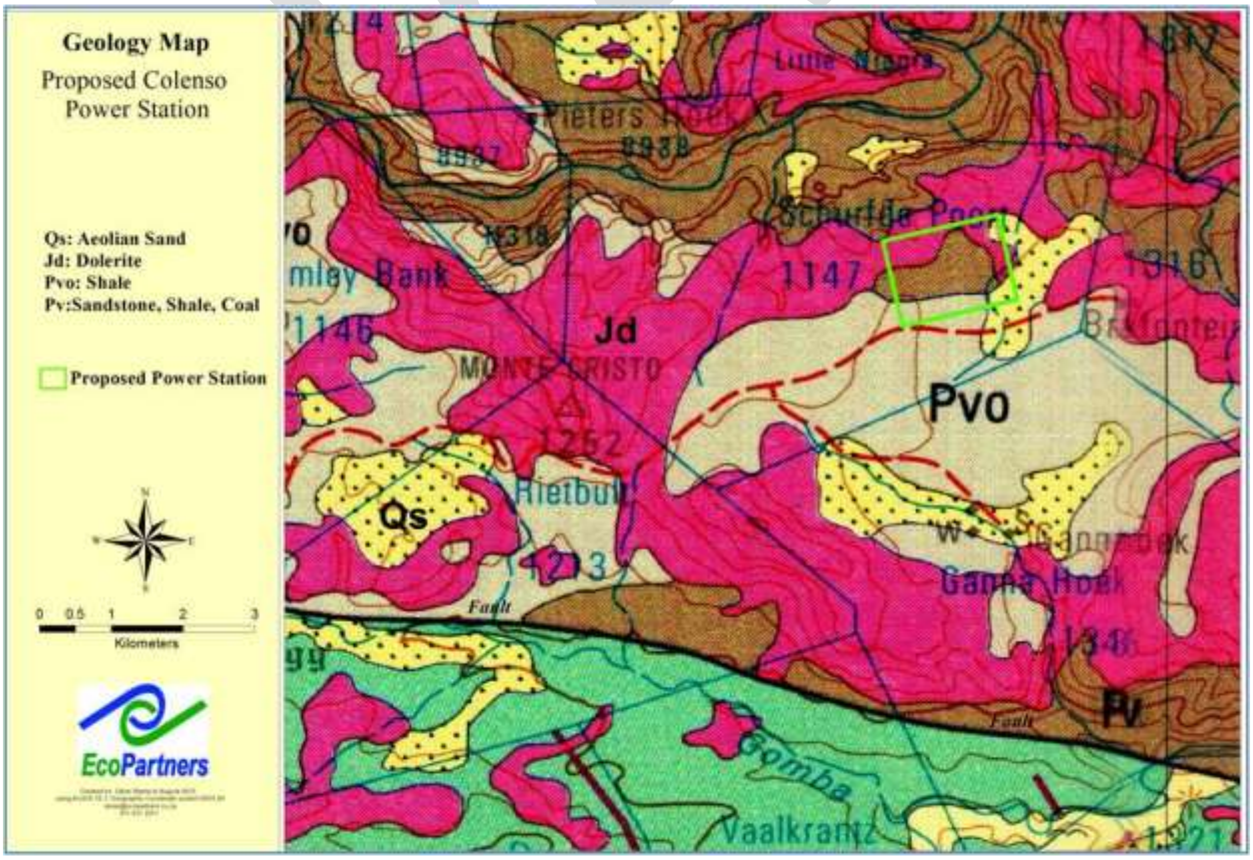
The site is located on the uppermost Permian-age Volkrust and Vryheid Formations belonging to the Ecca Group. The Volksrust Formation (Pvo) comprises blue-grey to black mudrocks and siltstone; dark-grey shales (carbonaceous in places) and sandstones. The Vryheid Formation (Pv) is exposed in places along the Thukela River valley east of Colenso. This Formation comprises thick coarse-grained sandstone beds and carbonaceous shale with thin coal seams (King G, 1997).

Numerous Jurrasic age dolerite sills intrude these rock formations and are exposed at the site. Covering these rocks is the Masotcheni Formation colluvium that is highly erodible.

Three dolerite sills exist below the power plant site as well as layered Karoo sedimentary rocks consisting mostly of sandstone, with minor layers of grit, shale and mudstone. There is a small area of alluvium of varying thickness that is present in the area between the proposed power plant and ash dump sites, adjacent to a small artificial wetland (Ages, 2015).

South of the proposed power station is an east-west striking thrust fault that forms the contact between the mudstone, shale and sandstone sequence of the Adelaide Subgroup and the coal-bearing Vryheid Group. The fault lies 5km south of the site and has a length in excess of 60km.

Figure 5-1: Geology Map



Source: Council for Geoscience,

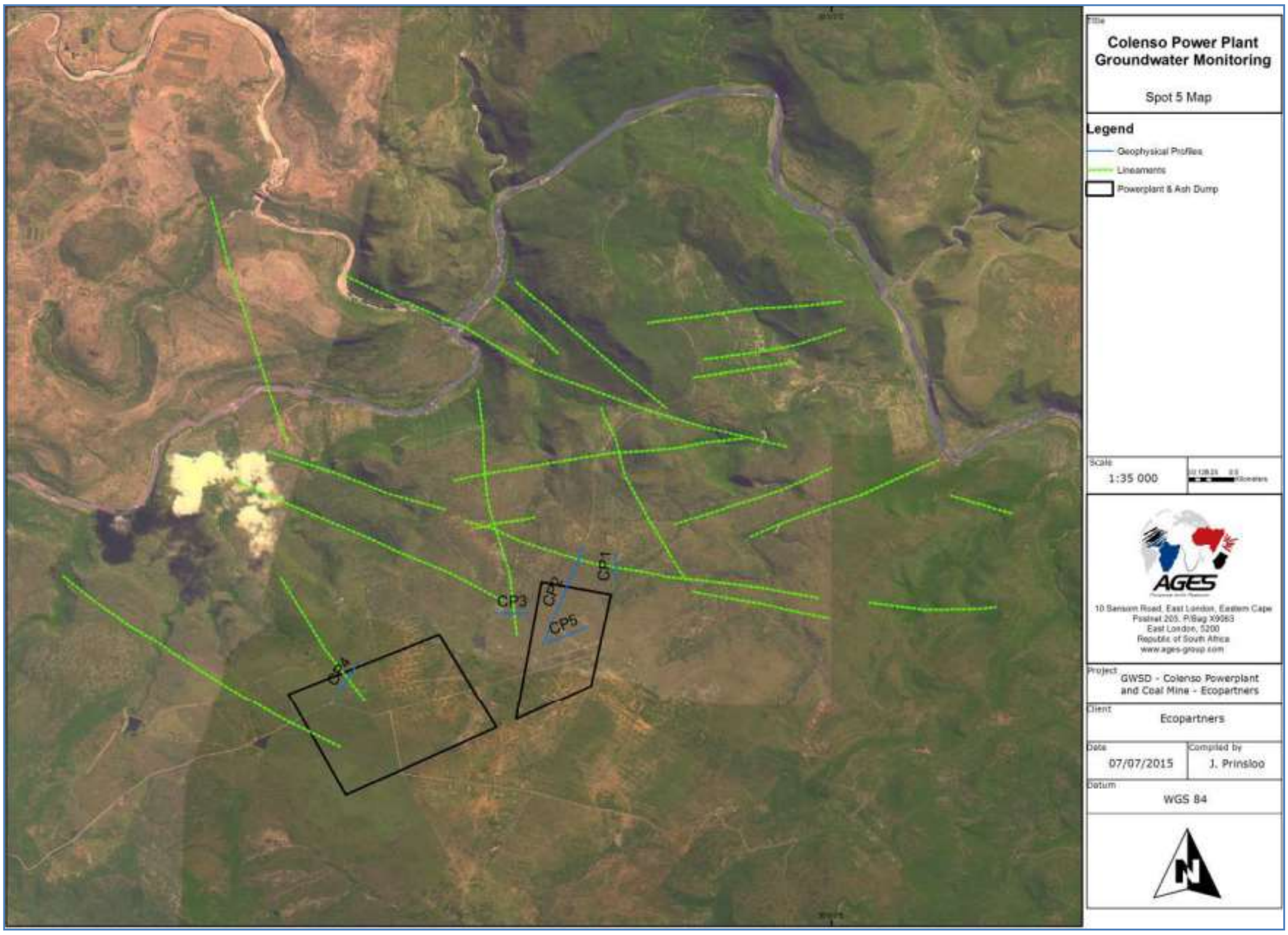
5.1.1 Lineaments and Structures

The Colenso area is situated on the division between the Kaapvaal Craton to the north and the Namaqua-Natal Belt/Crust to the south and is represented by the pervasive east-west trending Tugela Thrust Fault system (Figure 5-1). This major fault is indicated in the map as a WNW trending dotted red line and is located approximately 6km south of the power station site.

Several localised lineaments have been identified from satellite imagery (AGES, 2015). Some of these lineaments have the same orientation as the Tugela Fault system and could possibly be associated with the same structural geological event. These lineaments are most likely associated with secondary faults or possible dolerite dyke intrusions. Such structures could be preferential groundwater flow paths and therefore also have a higher potential for mass and pollution transportation.

It is noted from the geological and lineament map (Figure 5-2) that there are little to no major geological structures or abrupt changes in geology the area identified for the power plant and ash dump sites. There seems to be a higher concentration of notable structures further north of the sites. This could also be ascribed to the flat topography as well as alluvial cover that occur in some parts of the power plant and ash dump area (AGES, 2015).

Figure 5-2: Apparent lineaments in the vicinity of the power station site

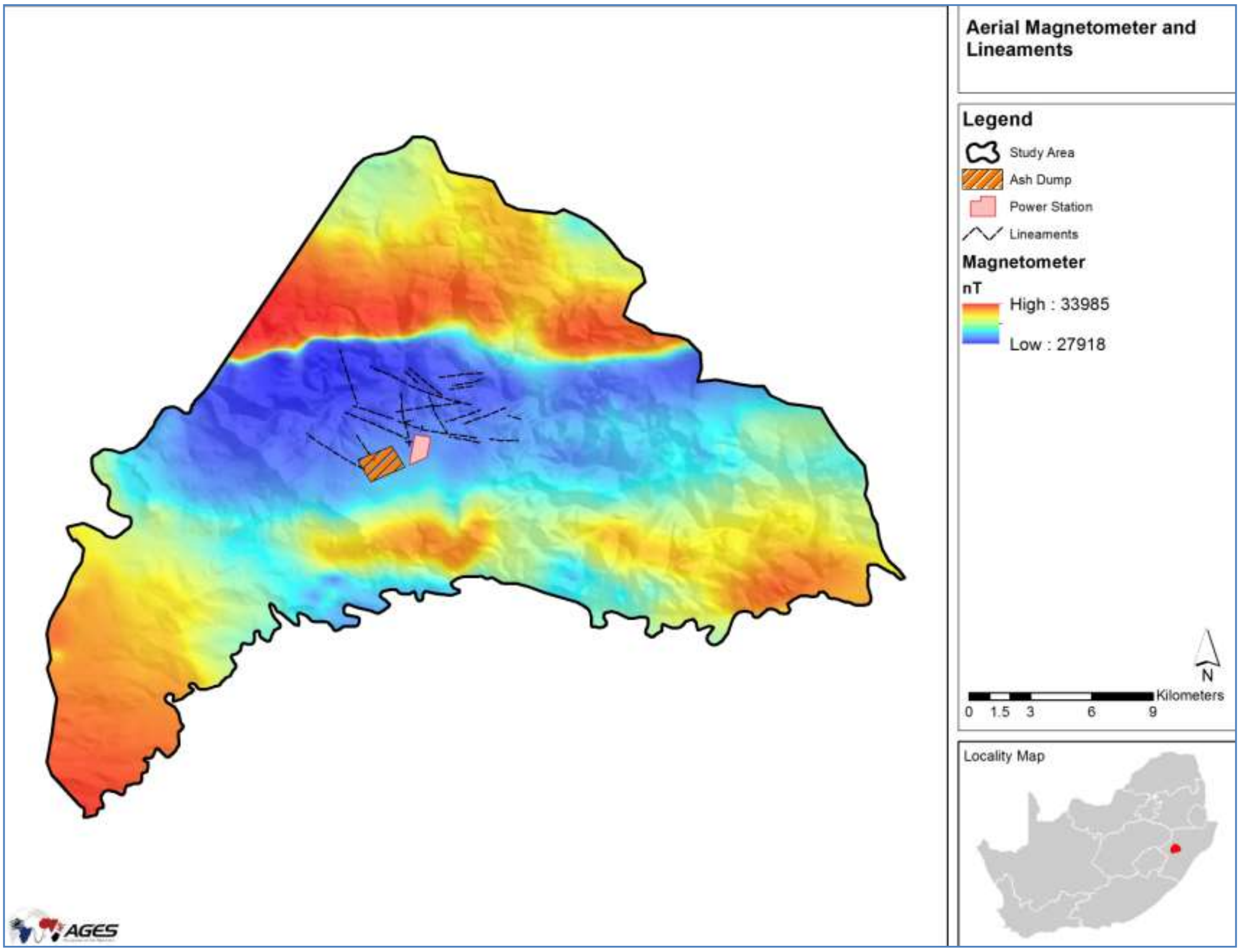


Source: AGES, Geohydrological Report, 2015

5.1.2 Regional Geophysical Characteristics

Figure 5-3 gives indication of the regional geo-magnetic character of the study area. It can be seen that the proposed power plant and ash dump sites are located in an area of lower magnetic flux density where no major regional geo-magnetic anomalies are present. This is indicative of a relatively homogeneous geological terrain (AGES, 2015).

Figure 5-3: Regional aerial magnetics and lineaments

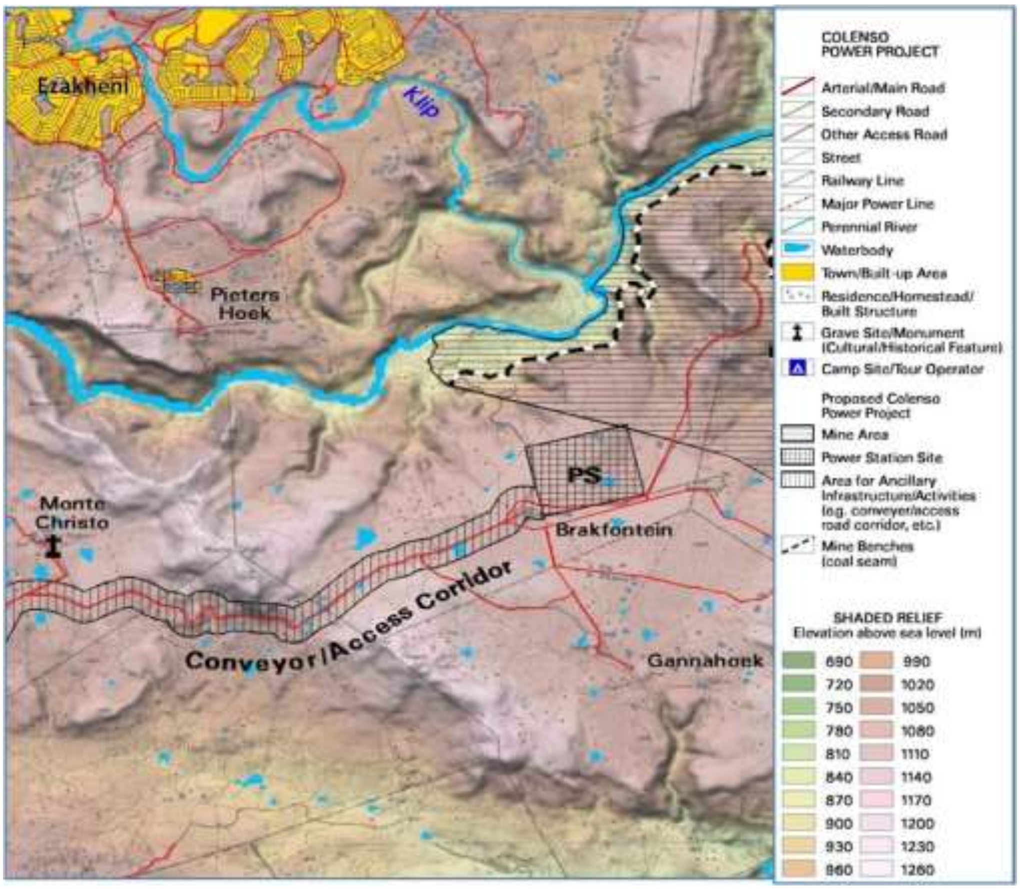


Source: AGES, Geohydrological Report, 2015

5.2 TOPOGRAPHY

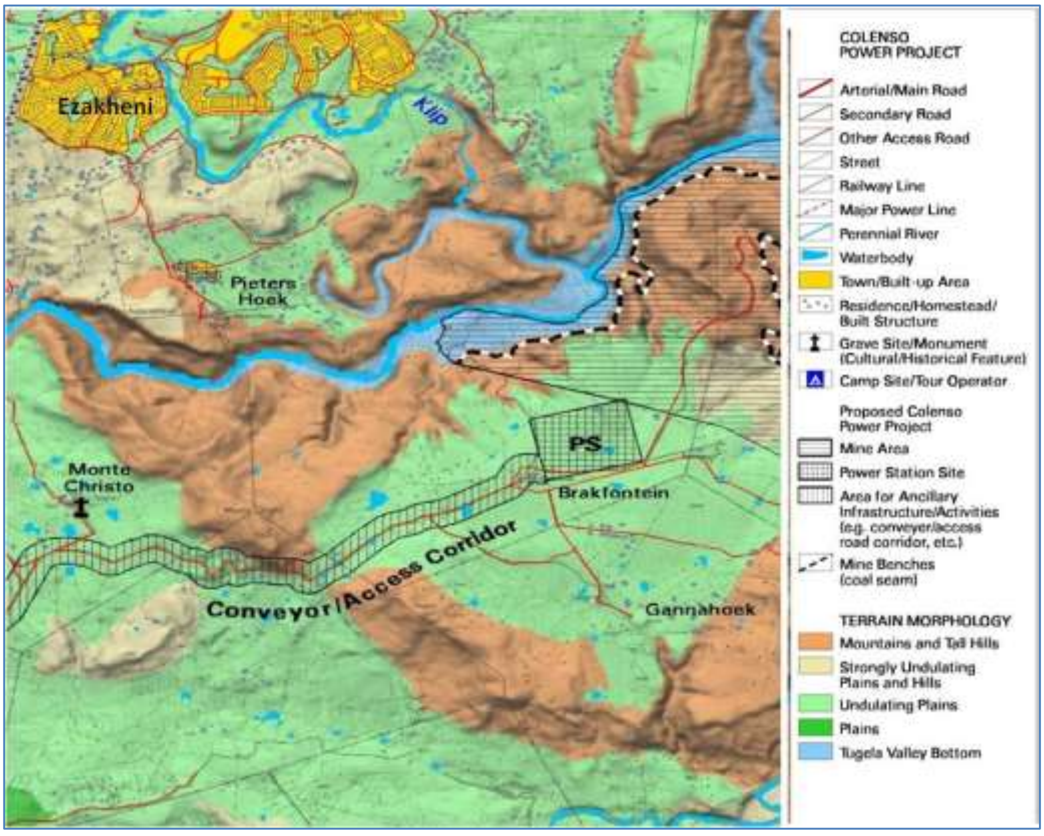
The topography or terrain morphology of the study area includes large sections of predominantly flat terrain, identified as *Plains*, *Undulating Plains* or *Strongly Undulating Plains*. These areas are generally better suited for agriculture and human settlement due to its accessibility by road. The Thukela River carves its way across the landscape in a westerly to easterly direction, forming an incised and secluded valley with steep slopes, mountains and tall hills on either side. These mountains, hills and ridges extend southwards towards the Bloukrans River which marks the lowest point where it leaves the study area at approximately 690m above sea level. The mountainous terrain evens out on top, at the site identified for the power station. This high-ground forms a plateau bounded by hills (escarpments) on all sides, bar a small section where the access road traverses. Please refer to Figure 5-4.

Figure 5-4: Shaded relief map (indicating elevation above sea level) of the area



Source: MetroGIS, Visual Assessment (2015)

Figure 5-5: Terrain morphology



Source: MetroGIS, Visual Assessment (2015)Climate

5.3 Climate

5.3.1 Temperature

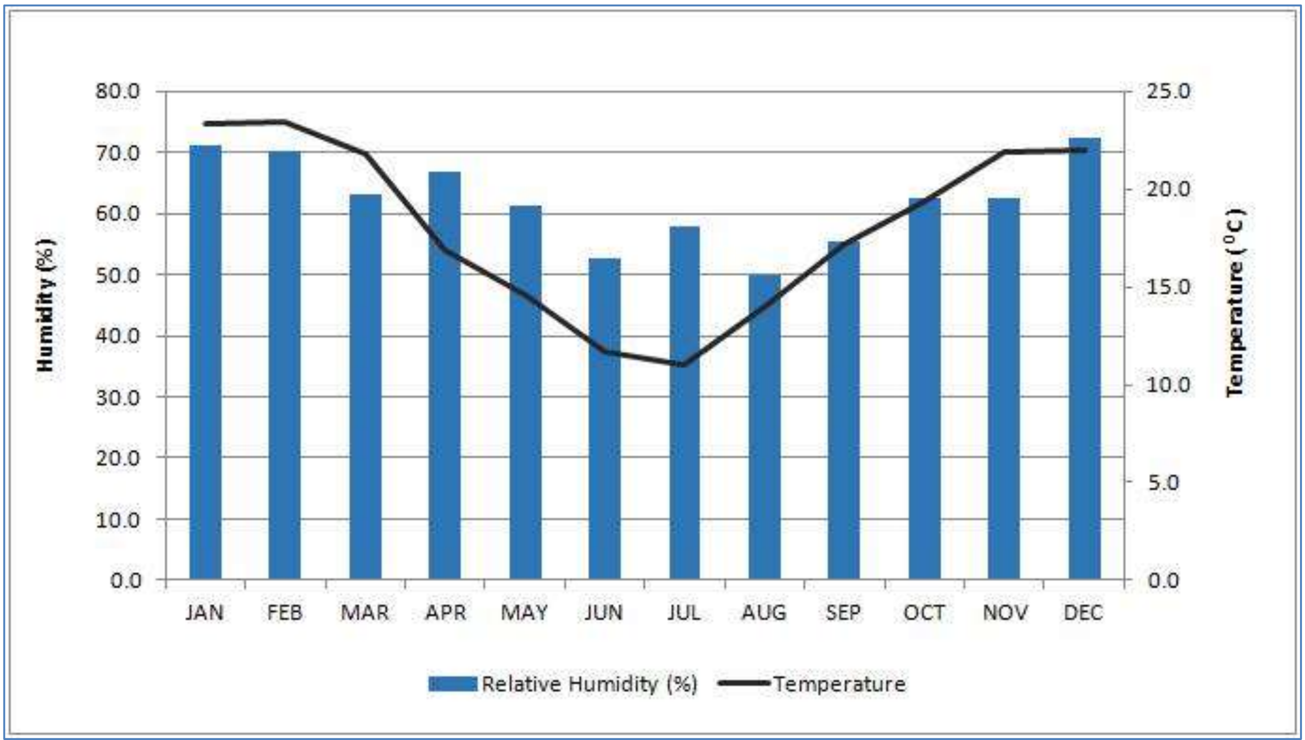
The KwaZulu-Natal Province generally experiences warm to very hot summers and mild winters. Monthly average temperatures for the Ladysmith station for the period January 2011 – April 2014 are given in Table 5-1. Average temperatures for the Ladysmith station range from approximately 22 to 23.5 °C in summer to 11 to 14 °C in winter (Table 5-1). Relative humidity is lowest during autumn and winter and highest during spring and summer (Figure 5-6).

Table 5-1: Hourly Minimum, Maximum and Monthly Average Temperatures (°C) for Ladysmith

HOURLY, MINIMUM, MAXIMUM AND MONTHLY AVERAGE TEMPERATURES (C ^{O})												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Minimum	13.8	13.9	10.7	0.2	- 3	- 4.6	- 5.8	- 2.2	- 0.4	2.7	9.8	12.8
Maximum	37.8	35.6	35.6	33.2	32.9	28.9	28.4	38.8	35.3	37.3	38.8	35.3
Average	23.4	23.5	21.9	16.9	14.6	11.7	11.0	14.0	17.1	19.4	21.9	22.0

Source: Rayten, Air Quality Report (2015)

Figure 5-6: Monthly Average Temp (°C) and Humidity (%) for Ladysmith



Source: Rayten, Air Quality Report (2015)

5.3.2 Precipitation

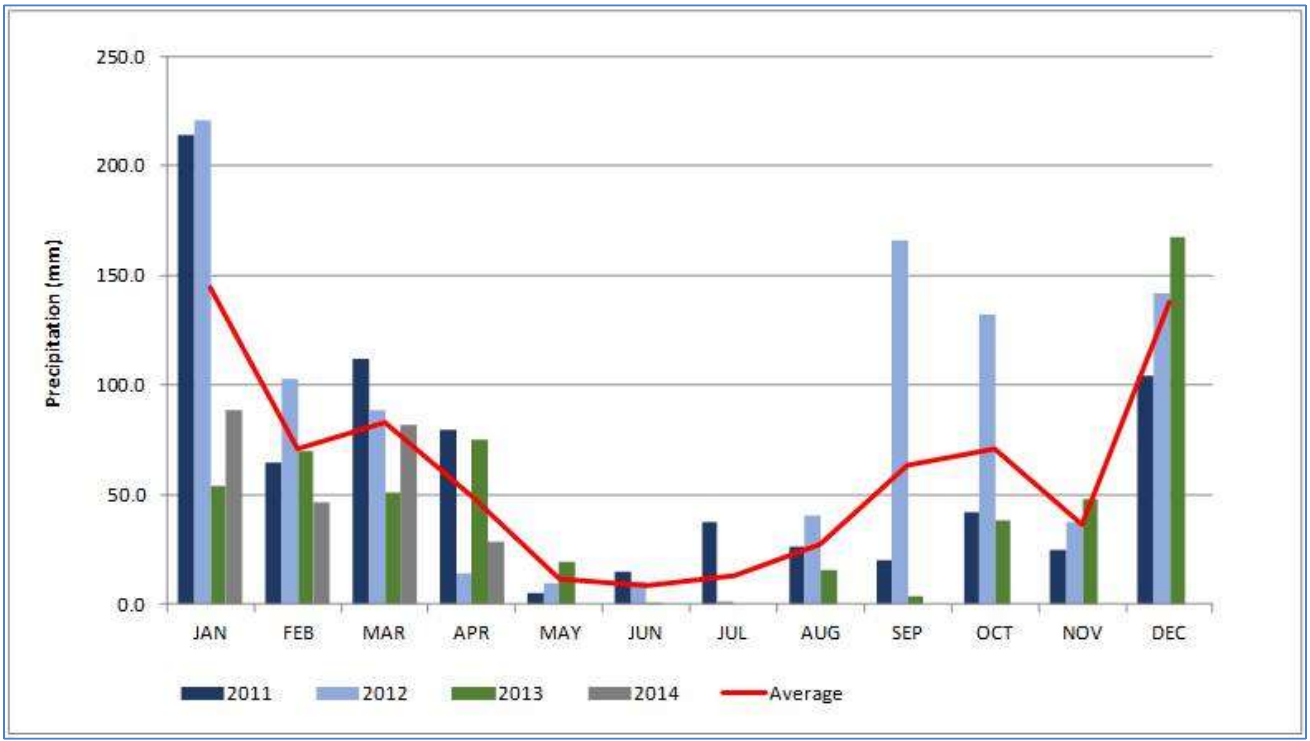
Monthly total precipitation for the Colenso project area is given in Table 5-2 and Figure 5-7 for the period January 2011 – April 2014. The area experiences spring and summer rainfall, receiving most of its rainfall for months September to March. Removal of particulates via wet depositional processes would be evident during the spring and summer seasons thus lower ambient concentrations of particulates could be expected during these seasons.

Table 5-2: Monthly Total Rainfall (Mm) for the Ladysmith Station for the Period January 2011 – April 2014

TOTAL MONTHLY RAINFALL (MM)												
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2011	214.4	64.8	112.0	79.6	5	15	37.4	26	20.2	42.4	24.4	104.4
2012	220.8	103.0	88.4	14.0	10	10.6	1.4	40.8	166	132.4	37.8	142.2
2013	53.8	70.0	50.8	75.0	19.6	0.2	0.0	16.0	4.0	38.6	48.0	167.6
2014	88.4	46.2	82.2	28.6								

Source: Rayten, Air Quality Report (2015)

Figure 5-7: Monthly Total Rainfall (Mm) for the Ladysmith Station for the Period January 2011 - April 2014



Source: Rayten, Air Quality Report (2015)

5.3.3 Local Wind Field

The Ladysmith weather station is the closest weather station to Colenso and is located approximately 20 km north-north-west (28.567 °S; 29.750 °E) of the Colenso project area. Meteorological data for parameters including wind speed, wind direction, temperature, relative humidity and precipitation were obtained for the period January 2011 - April 2014.

Percentage data capture for all meteorological parameters recorded at the Ladysmith weather station is given in Table 5-3. Data capture for the period January 2011 - April 2014 ranged from 74 – 100%. In 2012, there was 74% data recovery for wind speed and wind direction which falls below the SANAS requirements of 90% data capture per parameter. Therefore, the data captured in 2012 for wind speed and wind direction should be viewed with caution.

Table 5-3: Data Capture (%) for the Period January 2011 – April 2014

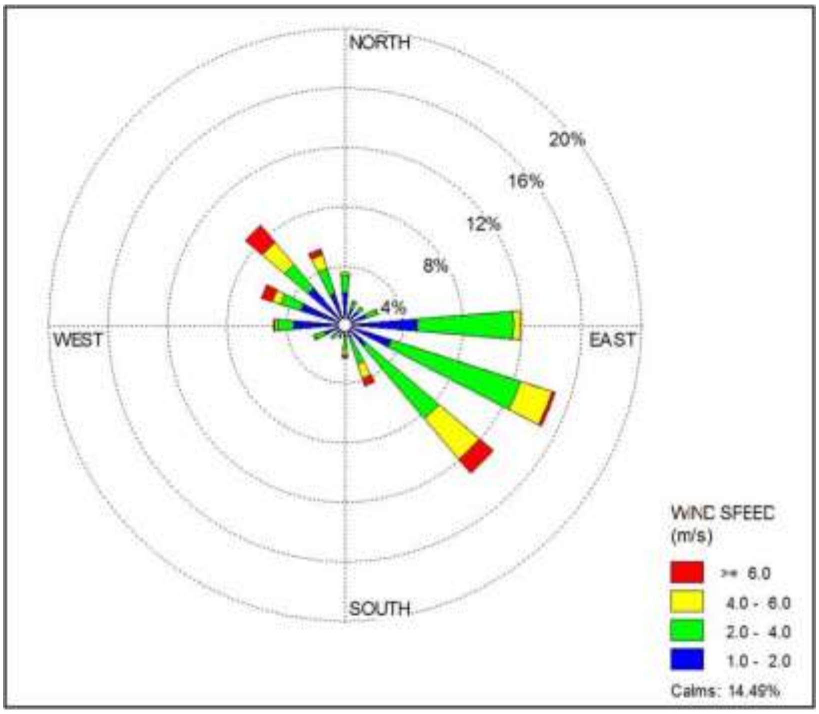
<table>
<tr><th rowspan="2">PARAMETER</th><th colspan="4">DATA CAPTURE (%)</th></tr>
<tr><th>2011</th><th>2012</th><th>2013</th><th>2014 (1)</th></tr>
<tr><td>Wind Speed</td><td rowspan="5">100%</td><td rowspan="2">74%</td><td rowspan="5">97%</td><td rowspan="5">100%</td></tr>
<tr><td>Wind Direction</td></tr>
<tr><td>Temperature</td><td rowspan="3">90%</td></tr>
<tr><td>Relative Humidity</td></tr>
<tr><td>Precipitation</td></tr>
</table>

Notes: (1) Representative of months January to April 2014

Source: Rayten, Air Quality Report (2015)

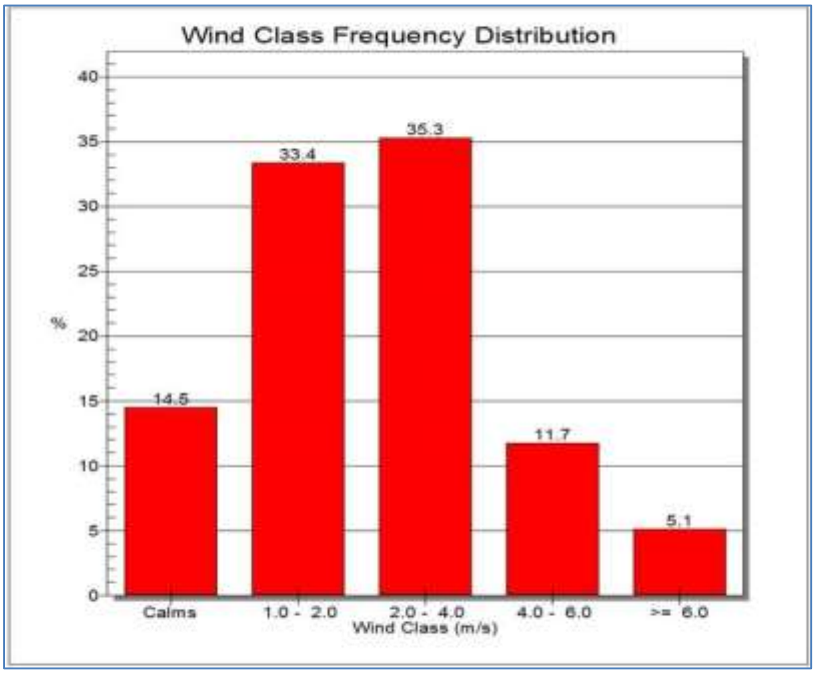
The prevailing wind field recorded at the Ladysmith weather station are represented as wind rose plots indicating the predominant wind direction and the frequency distribution of wind velocities for the Colenso project area. Wind fields observed are characterised with winds occurring predominantly from the south-easterly, east-south-easterly and easterly sectors (Figure 5-8). Wind speeds are generally slow to moderate and frequently remain within the range 1 - 4 m/s for 68.7% of the time (Figure 5-9). Calm conditions, which are defined as wind speeds less than 1 m/s, occur less frequently for 14.5% of the time.

Figure 5-8: Wind Rose for the Ladysmith Station (Period Jan 2011 – April 2014).



Source: Rayten, Air Quality Report (2015)

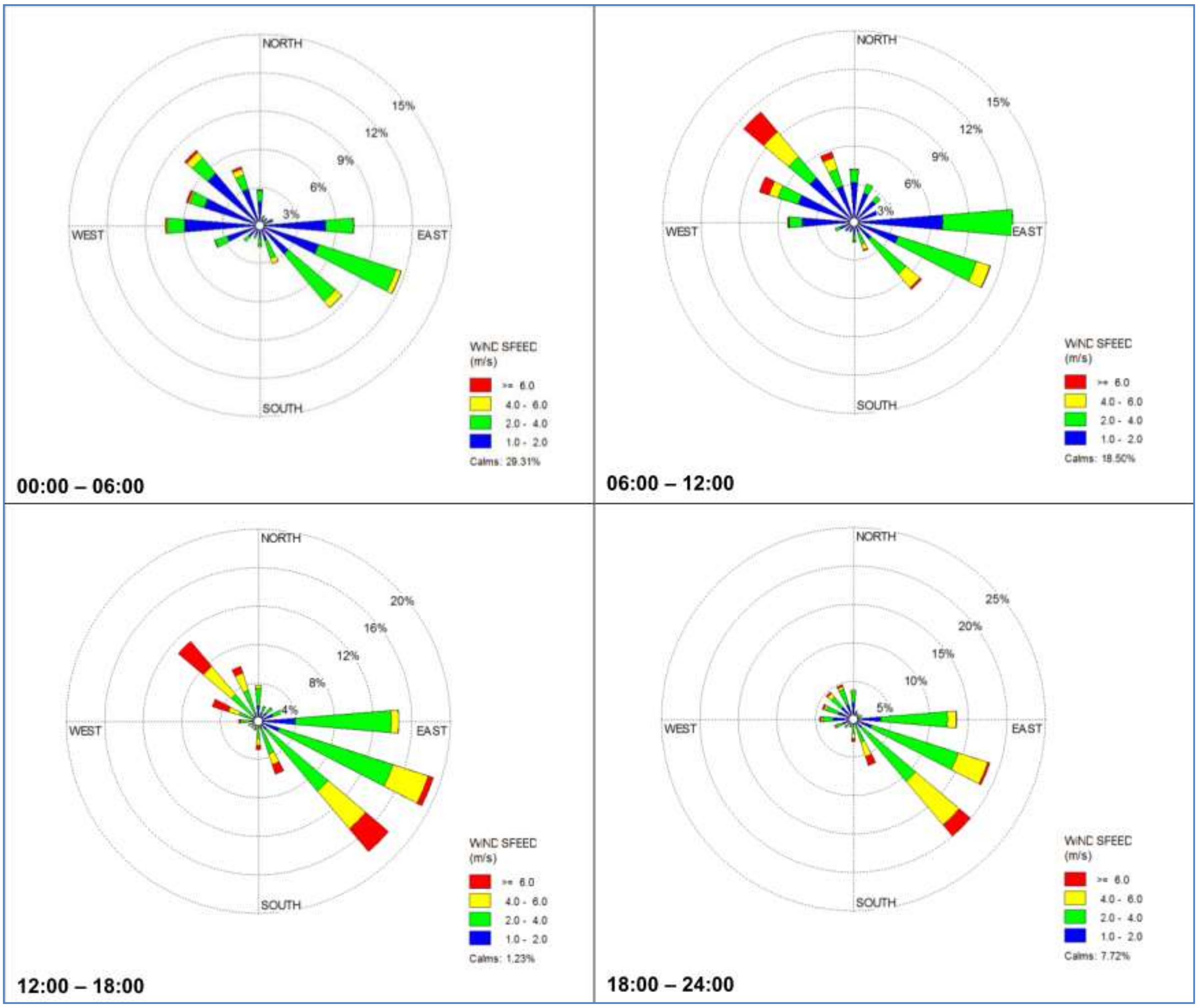
Figure 5-9: Wind Class Frequency for Ladysmith (Period Jan 2011 – April 2014).



Source: Rayten, Air Quality Report (2015)

Slight diurnal variation in winds is observed in the meteorological dataset for the period January 2011 – April 2014 (Figure 5-10). In the early morning (00:00 – 06:00), calm winds originating predominantly from the east-south-east are observed. In the late morning (06:00 – 12:00), a north-westerly component is established with slightly stronger wind speeds occurring from the same direction. During the afternoon (12:00 – 18:00), a slight shift is observed with stronger winds occurring predominantly from the east-south-east, south-east and north-west sectors. During the evening (18:00 – 24:00), the north-westerly component is less established with stronger winds occurring predominantly from the south-east, east-south-east and east.

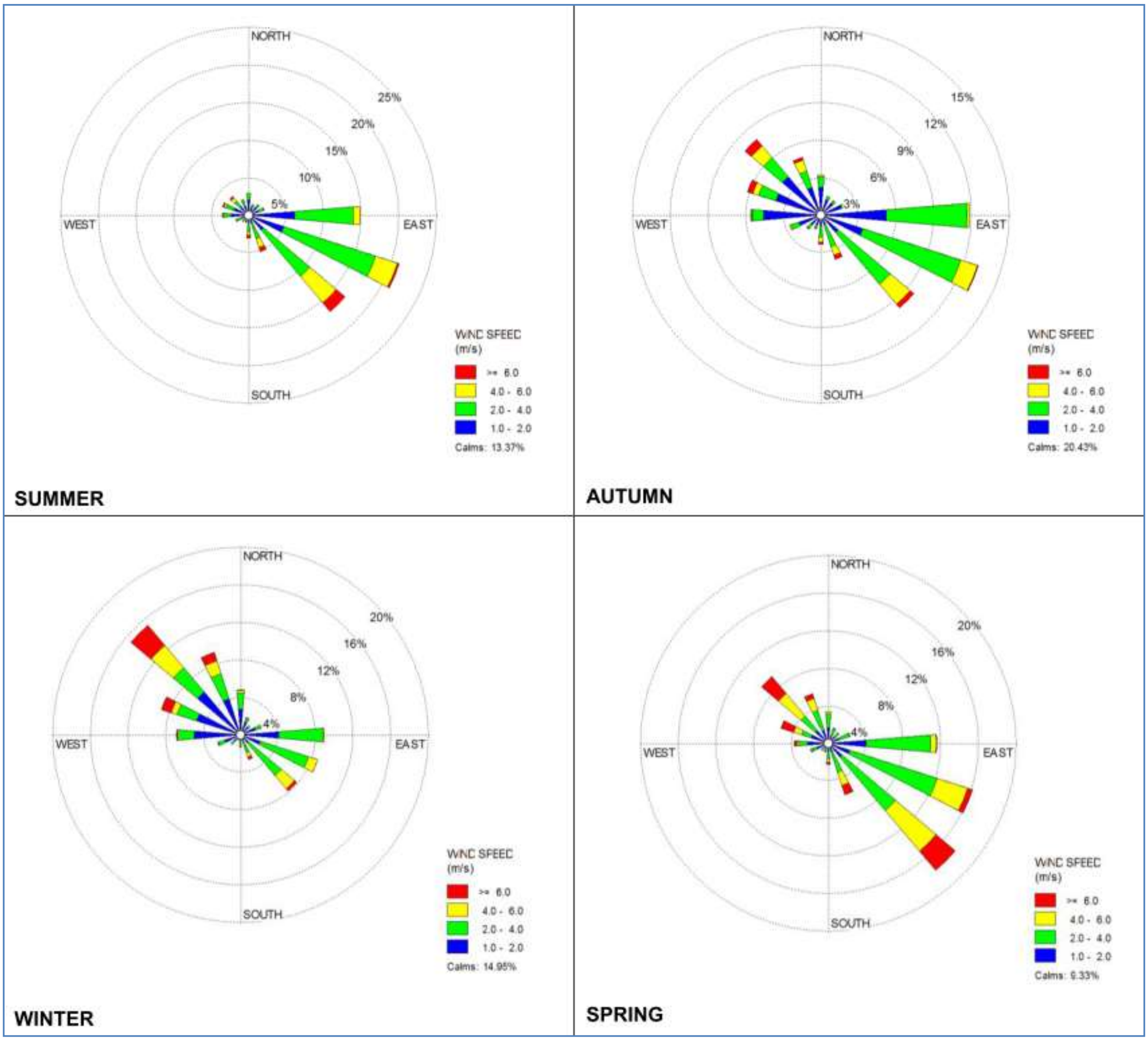
Figure 5-10: Diurnal Variation of Winds at Ladysmith (Period Jan 2011 – April 2014.



Source: Rayten, Air Quality Report (2015)

The seasonal variation in winds for the Colenso project area is shown in Figure 5-11. During the spring, summer and autumn seasons, winds originate predominantly from the east, east-south-east and south-east sectors. However, in winter, a predominant north-westerly component is established. Slightly stronger wind speeds are observed during the spring and summer seasons compared to the autumn and winter seasons where a higher percentage of calmer winds is observed.

Figure 5-11: Seasonal Variation of Winds at Ladysmith (Period Jan 2011 - April 2014)



Source: Rayten, Air Quality Report (2015)

5.4 AIR QUALITY

Rayten Engineering Solutions cc was appointed to conduct the air quality specialist study for the power station. Their report is attached as Appendix D. The baseline description for the air quality is taken from their report.

The existing air quality situation is usually evaluated using available monitoring data from ambient air quality monitoring stations operated within close proximity to the project area. The Estcourt station is the closest ambient air quality monitoring station to the Colenso project area. However this station is not operational due to technical issues with the air quality instruments thus baseline concentrations could not be defined for the Colenso project area.

5.4.1 Surrounding Sources of Air Pollution

Existing sources of air pollution surrounding the Colenso project area have been identified to be:

- Agricultural activities and Biomass burning;
- Vehicle entrainment of dust on unpaved roads;
- Wind erosion from exposed areas.

5.4.1.1 Agricultural Activities and Biomass Burning

There are mixed small scale agricultural activities occurring to the west of Colenso with an agricultural output of cattle, maize, wheat, soya beans and vegetables. Emissions from agricultural activities are difficult to control due to the seasonality of emissions and the large surface area producing emissions.

Expected emissions resulting from agricultural activities include particulates associated with wind erosion and burning of crop residue, chemicals associated with crop spraying and odiferous emissions resulting from manure, fertilizer and crop residue.

Dust associated with agricultural practices may contain seeds, pollen and plant tissue, as well as agrochemicals, such as pesticides. The application of pesticides during temperature inversions increases the drift of the spray and the area of impact. Dust entrainment from vehicles travelling on gravel roads may also cause increased particulates in an area. Dust from traffic on gravel roads increases with higher vehicle speeds, more vehicles and lower moisture conditions.

The seasonal burning of the veldt from July to September for field clearing in preparation for planting is a source of smoke. The nature of the activity has a potentially significant impact on air quality in the region.

5.4.1.2 Vehicle Dust Entrainment on Unpaved Roads

Vehicle-entrained dust emissions from the surrounding unpaved roads in the area potentially represent a source of fugitive dust. When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes the pulverisation of surface material. Particles are lifted and dropped from the rolling wheels, and the road surface is exposed to strong air currents in turbulent shear with the surface. The turbulent wake behind the vehicle continues to act on the road surface after the vehicle has passed.

5.4.1.3 Wind Erosion from Exposed Areas

Dust emissions due to the erosion of open storage piles and exposed areas occur when the threshold wind speed is exceeded. The threshold wind speed is dependent on the erosion potential of the exposed surface, which is expressed in terms of the availability of erodible material per unit area (mass/area). Any factor which binds the erodible material or otherwise reduces the availability of erodible material on the surface thus decreases the erosion potential of the surface. Studies have shown that when the threshold wind speeds are exceeded, particulate emission rates tend to decay rapidly due to the reduced availability of erodible material (Rayten, 2015).

5.5 Groundwater

Africa Geo-Environmental Services EC (Pty) Ltd (AGES) was appointed to conduct the geohydrological specialist study for the power station. Their report is attached as Appendix E. The baseline description for the groundwater is taken from their report.

The groundwater table directly below the proposed power plant and ash dump site can be expected around 20 mbgl while shallower groundwater tables are noted along small secondary drainages such as the one between the proposed ash dump and power plant site. The water table mimics surface topography with localised flow expected to be down gradient towards surface water drainages and regionally towards the Thukela River in the north and north east. Seasonal perched groundwater conditions can be expected in alluvium as well as in elevated areas closer to the Thukela River.

AGES (2015) stated that it was evident from the drilling results that dolerite sill intrusions and sedimentary rock directly below the power plant and mining site are very solid with little to no water bearing fractures and deep weathering that could form conduits for groundwater movement and major aquifers.

5.5.1 Aquifer characteristics

5.5.1.1 Geophysical survey

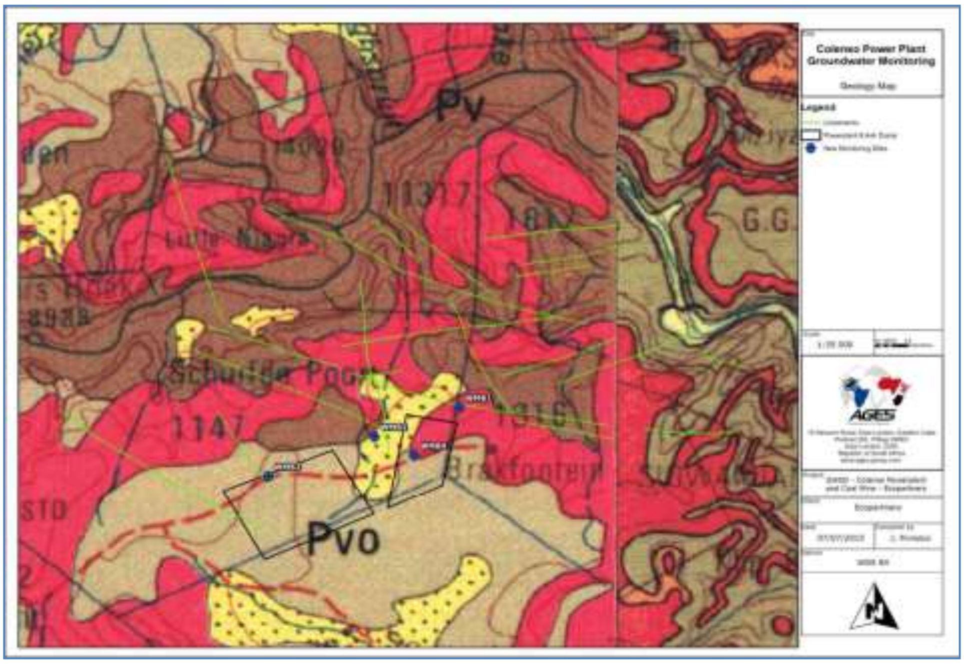
Five geophysical survey profiles were carried out across possible structures that were identified from remote sensing and site observations.

5.5.1.2 Drilling

Based on the results of the geophysical survey, AGES chose four borehole sites around the proposed power plant and ash dump sites. Three of the chosen sites (WMB2,3 and 4) each had a second shallow borehole developed adjacent to it, to ensure data could be collected from the deeper fractured aquifer as well as the shallow weathered unsaturated zone.

All boreholes that were drilled are indicated on the geological map (Figure 5-12) along with the geophysical profiles on which they were sited. Associated targeted lineaments are also indicated in the map.

Figure 5-12: Geological map indicating local lineaments as well as newly drilled site characterisation boreholes



Source: AGES, Geohydrological Report, 2015

The drilling results are presented in the table below.

Table 5-4: Drilling results

Bore hole ID	Final Depth	Water bearing structures intersected?	Depth of topsoil
WMB1	90 mbgl	No	5 m
WMB 2 S	12 mbgl	No	-
WMB 2 D	70 mgbl	Yes - 25 mbgl	-
WMB 3 S	12 mbgl	No	5 m
WMB 3 D	70 mbgl	No	3 m
WMB 4 S	12 mbgl	No	1 m
WMB 4 D	70 mbgl	No	1 m

Source: AGES, Geohydrological Report, 2015

5.5.1.3 Constant rate pumping aquifer & falling head tests

A total of three constant rate pumping aquifer tests and six falling head tests were performed on the project area in the surrounds of the proposed power plant and ash dump sites. The tests were performed to extrapolate information about the aquifer parameters of the project area within the saturated as well as unsaturated zone.

Results of the constant rate pumping & falling head tests? that were performed on the five boreholes are summarised in Table 5-5. These boreholes were selected for testing as they were the only known water yielding boreholes in the project area. They give a good indication of the maximum transmissivity's to be expected at the power plant site. EBH 04 and 07 are existing boreholes. EBH4 is located within the proposed ash dump site footprint, EBH 07 is located directly east of the power plant foot print and is used by a local farmer. GK 11 was one of the only exploration drilling boreholes drilled for coal exploration in the mining site that yielded water.

Table 5-5: Test Results

Borehole ID	Hydraulic conductivity (m/d)	Transmissivity (m^2 /d)	Static Water level
EBH04 (Deep Aquifer)		0.400	16.9 mbgl
EBH07 (Deep Aquifer)		3.770	30.68 mbgl
GK11 (Deep Aquifer)		1.750	18.4 mbgl
WMB3 Deep	0.076 m/d	0.073	
WMB4 Deep	0.001 m/d	0.041	
WMB3 Shallow	0.01 m/d	0.229	
WMB4 Shallow	0.003 m/d	0.037	

Source: AGES, Geohydrological Report, 2015

Borehole WMB3 (shallow) intersected 5m of alluvium and topsoil before entering weathered sandstone. This explains the higher transmissivity than WMB4 (shallow) where dolerite was penetrated after only 1m of topsoil and alluvium.

Higher transmissivities are noted in general in the deeper fractured aquifer than in the shallow unsaturated zone. Increased permeabilities can be expected in place where alluvium covers the underlying bedrock. The extent of this topsoil and alluvium is however not accurately defined and should be delineated and monitored during geotechnical studies and construction and treated as zones of possible increased infiltration that could link with the deeper fractured aquifer where higher transmissivities were noted. Temporary localised perched groundwater conditions are expected within the alluvium and shallow weathered zones during the rainy season.

The tests indicated that static groundwater level is expected to be between 15m and 30m below ground level at the ash dump and power plant sites.

5.5.1.4 Hydrocensus

A 5km radius hydrocensus was done by AGES to obtain a baseline data set for the groundwater evaluation. The following data was recorded:

- GPS co-ordinates and elevation of the borehole or spring;
- Water levels of the boreholes, where accessible;
- The condition of the boreholes; and
- Any other information regarding the water-use, reliability and quality.

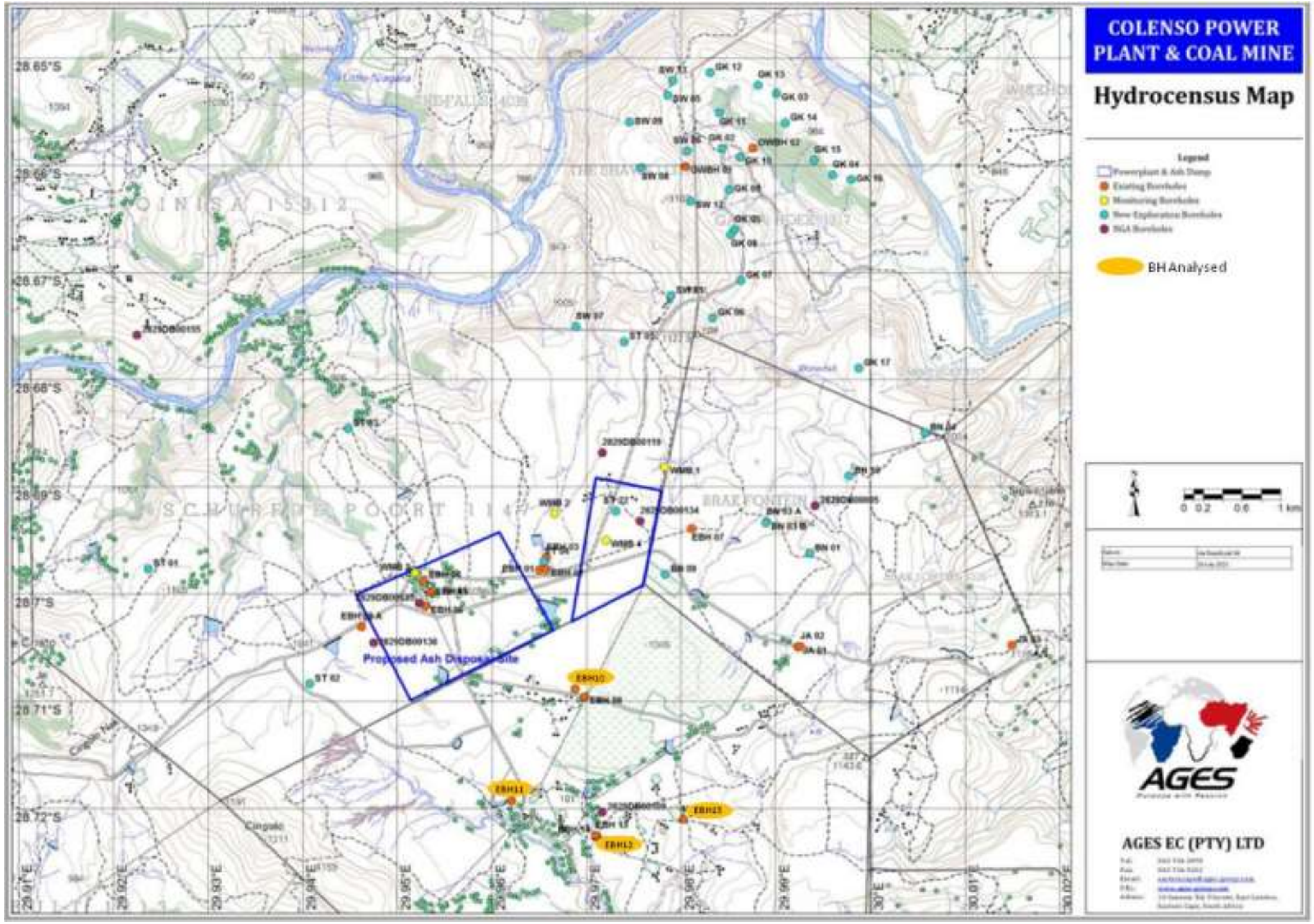
The hydrocensus was performed with the available NGA (national Groundwater Archive) data as its basis, which consists of historically registered groundwater related geosites, such as boreholes and springs. Only one of the reported eight NGA sites within a 5km radius could be verified on site namely EBH06.

The majority of boreholes found in the 5 km radius during the hydrocensus investigation are newly drilled coal exploration boreholes, of which there are 43 at the time that the report by was compiled by AGES (date??). There are 22 existing water boreholes in the 5 km radius EBH07 is currently the only borehole in use as a production borehole for human consumption on Emaweni Game Farm (approximately 1.2 km from the boundary of the proposed power station site). Also included in the hydrocensus are the seven newly drilled monitoring boreholes. In total, with the monitoring boreholes included, 65 boreholes were verified on site.

The location of boreholes of these boreholes are shown in Figure 5-13.

From the above-mentioned data sets groundwater levels in the study area vary between 1.0 to 78.6 mbgl. The average groundwater level is approximately 23.2 mbgl.

Figure 5-13: Hydrocensus Map

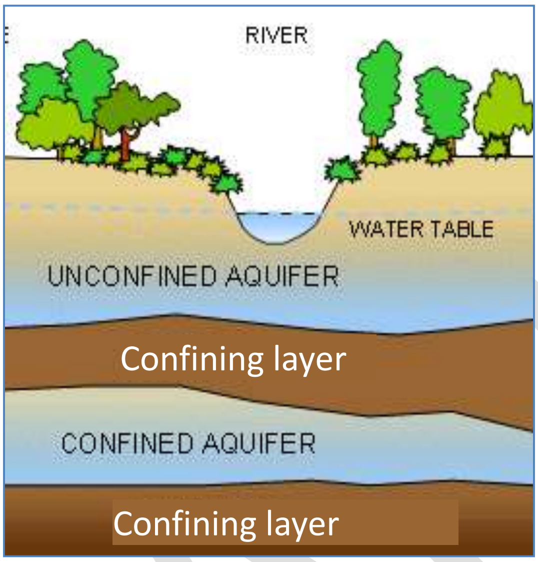


Source: AGES, Geohydrological Report, 2015

5.5.2 Groundwater flow

An interpolation technique, using the available data, was used to simulate water levels over the entire model area. The results show that groundwater levels follow topography and it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions. See figure below for schematic illustration of confined and unconfined aquifers.

Figure 5-14: Schematic illustration - Confined and Unconfined Aquifers



Source: Adapted from www.UNSW, 2015

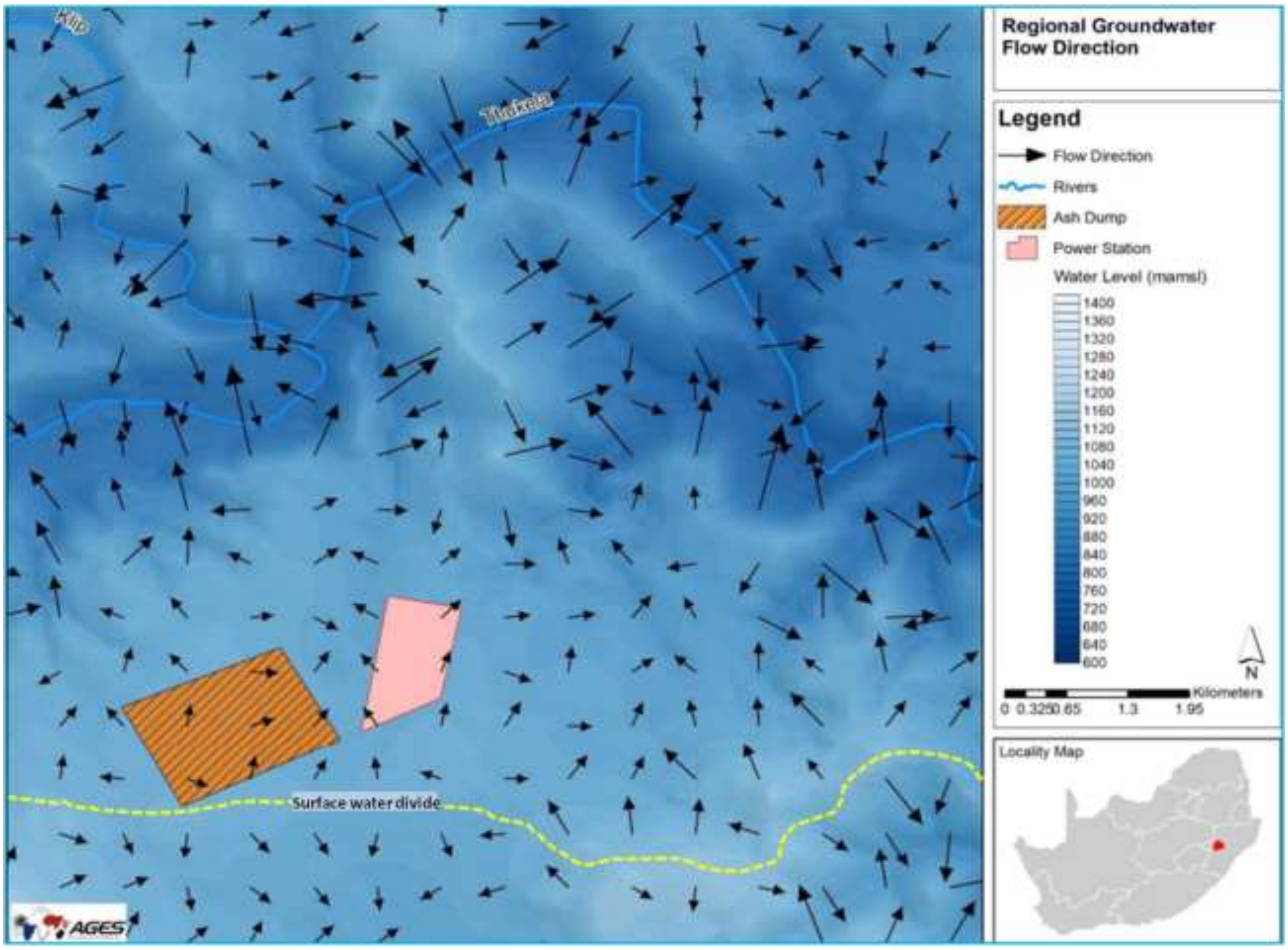
Localised groundwater flow in the direct vicinity of the power plant site is shown in Figure 5-15. From the figure it can be seen that the power plant and ash dump site is located very close to a surface and groundwater divide.

Note that the length of the arrows in the figure indicates the flow velocity (how fast the water flows). This is related to the magnitude of the hydraulic gradient or the size of the hydraulic slope that the groundwater have to follow.

From the figure it can be seen that hydraulic gradient (length of the arrow) at the proposed power plant site is relatively constant and small. As groundwater flow mimics the topography this is also an indication that the proposed power station site is located on a relatively flat area.

The direction of the arrows indicate the direction of the groundwater flow. Localised groundwater flow at the proposed power plant and ash dump site is towards the north-west and north-east. Groundwater flow at the extreme southern point of the proposed ash dump site is expected to be towards the east and possibly the south as the surface water divide is located in this area.

Figure 5-15: Regional groundwater flow direction



Source: AGES, Geohydrological Report, 2015

5.5.3 Groundwater use

Historical and existing groundwater use is related to the community that is located directly south of the proposed power plant site as well as commercial farmers in the region. Six boreholes are equipped with hand pumps for community usage of which only four are operational. The closest of these hand-pump equipped boreholes is EBH10 which is 1.15 km south of the proposed power plant site. Only one borehole (EBH07) is equipped for drinking water supply by a commercial farmer 1.2 km east of the power plant site. All other boreholes that were historically used for farming purposes are destroyed.

It should be noted that no groundwater use registrations exist on the WARMS (Water Resource Management System) database for V14E.

The community located directly south of the power plant site is supplied with potable water by the municipality through carting of water from Colenso Town. This shows that groundwater is not the sole water source for the community. Verbal reports from community members say that groundwater quality is not acceptable due to taste as well as staining of clothes which predict elevated Iron concentrations.

5.5.4 Groundwater quality

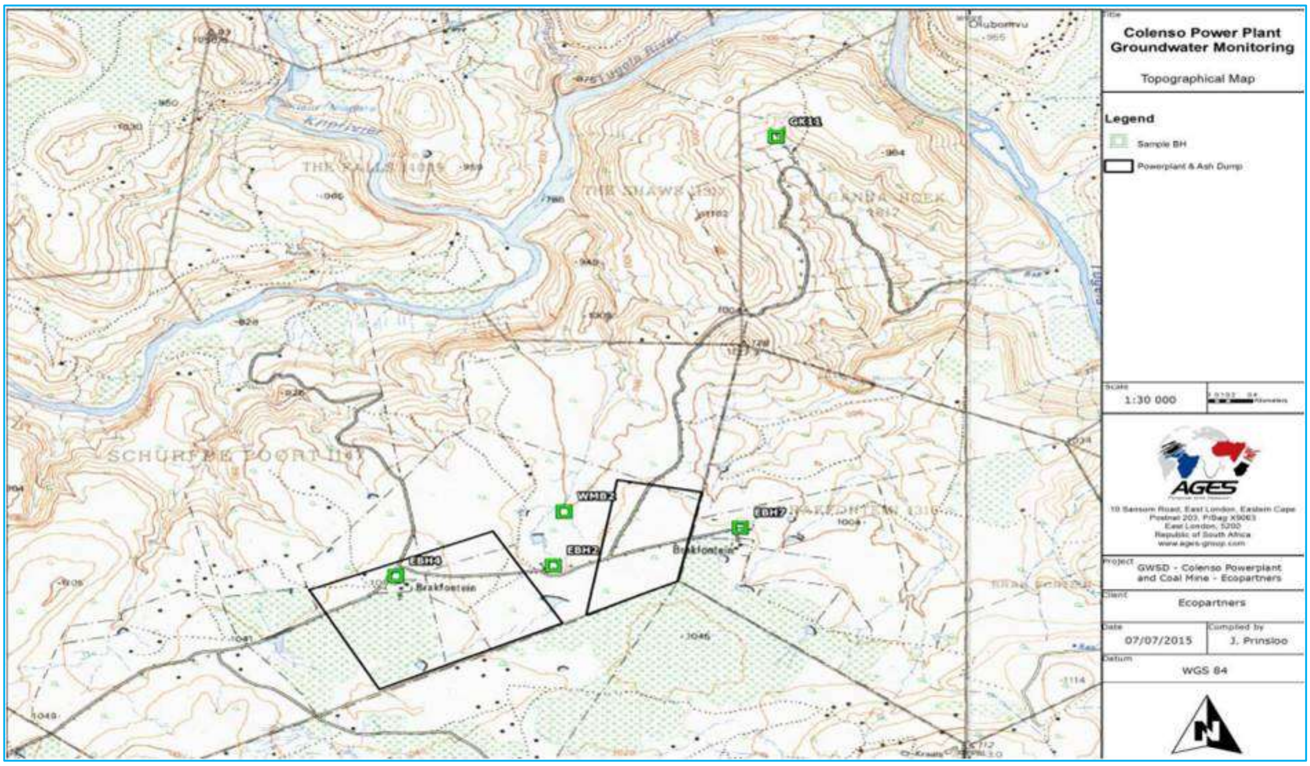
pH And EC readings were taken at the four hand pump equipped community boreholes (EBH 10, 11, 12 and 15). The location of the boreholes in relation to the proposed power station site is indicated in Figure 5-16. Results indicate that the pH values range from 7.15 to 7.55 and the EC values range from 703 to 1007 mS/m.

The high EC reading range is indicative of water that has a high salinity and in accordance DWS classifies as Class 4 (Dangerous water quality). This explains the reason why the community complains about groundwater quality in the area.

Groundwater from five additional boreholes were sampled and screened against the DWAF Water Quality Guidelines for Domestic Water Use (1996) and the South African National Standard for drinking water (SANS 241:2006).

The location of the boreholes in relation to the proposed power station site is indicated in Figure 5-16. Monitoring borehole (WMB2D) is also the only sampled monitoring borehole, as it is the only monitoring borehole in which a water strike was found. The remaining 3 boreholes that were sampled (EBH02, EBH07 and EBH04) are all existing boreholes of which only EBH07 is in use.

Figure 5-16: Groundwater monitoring boreholes



Source: AGES, Geohydrological Report, 2015

The chemical results of the groundwater are presented in the table below.

Table 5-6: Water Quality Results

Borehole ID	DWAF Classification	SANS 241 Limits	
		Suitability	**Exceedances**
EBH02	Drinking Class 2 (Marginal water quality).	Conditionally suitable for human consumption without prior treatment	The sample has a Total Hardness ($CaCO_3$) content that classifies as DWAF Class 2 at 317 mg/l.
EBH07	Drinking Class 1 (Good water quality)	Suitable for human consumption	Slightly elevated Total hardness and Total Dissolved Solids values
WMB2D	Drinking Class 3 (Poor water quality)	Not suitable for human consumption without prior treatment	pH > 9.7 F >1.5 mg/l
EBH4	Drinking Class 3 (Poor water quality)	Not suitable for human consumption without prior treatment	Mg > 100mg/l $CaCO_3$ > 300mg/l EC > 170 mS/m NO_3 > 11 mg/l NO_2 > 0.9 mg/l
GK11	Drinking Class 3 (Poor water quality)	Not suitable for human consumption without prior treatment	F > 1.5 mg/

Source: AGES, Geohydrological Report, 2015

It is evident from hydro chemical results that groundwater in the direct vicinity of the proposed power plant site is of marginal to poor quality for drinking water purposes. Only one borehole 1.2 km east of the site has good water quality.

5.5.5 Groundwater quantity

Borehole yields in the study area are relatively low and pump test data analyses of the two highest yielding boreholes (EBH7 and GK11) indicated that both could only be pumped sustainably at 0.2 l/s for 24 hours. Groundwater occurrence is indicated in Figure 5-17.

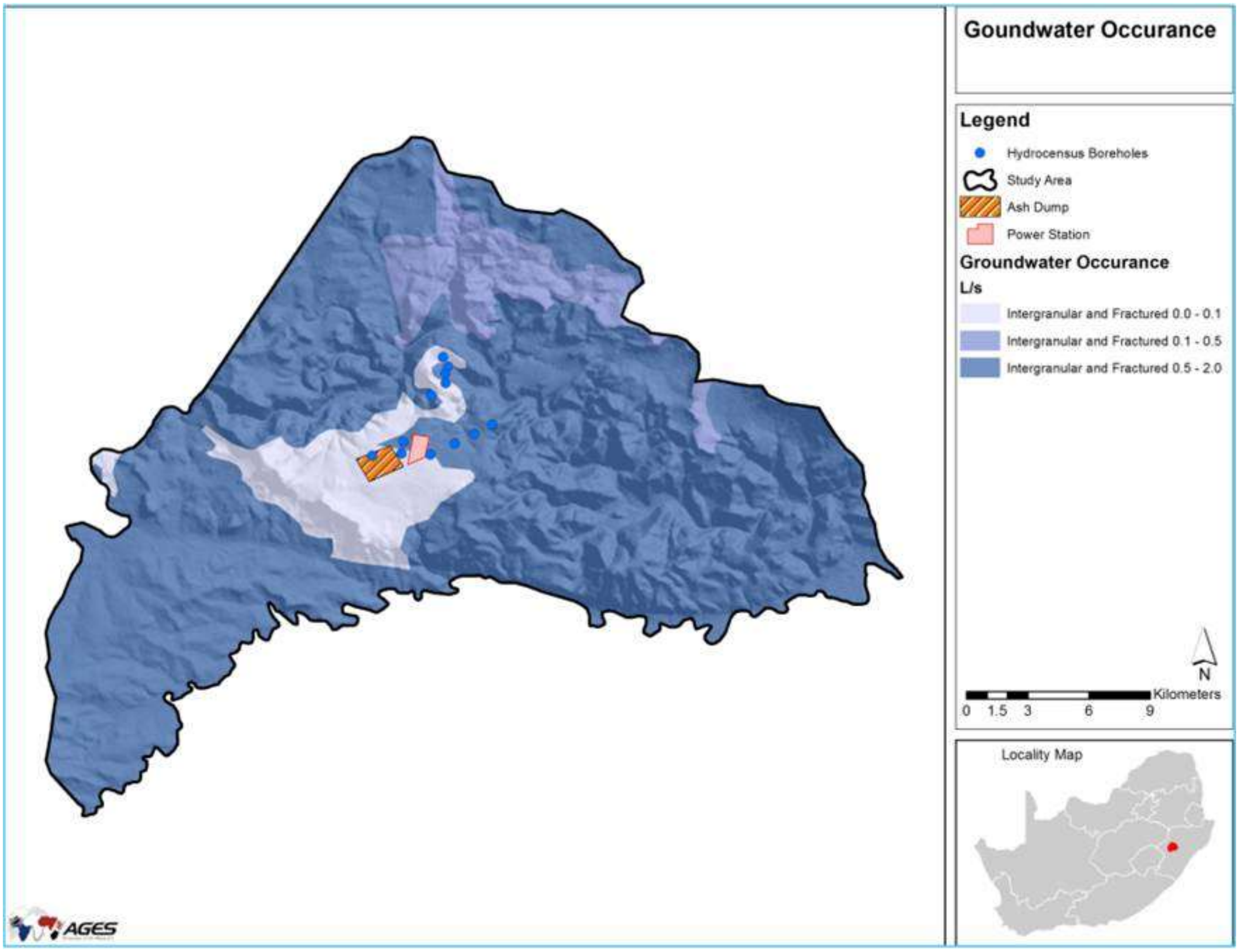
According to the 1: 500 000 Hydrogeological Map Series of the Republic of South Africa (King, 1997) the groundwater in the regional area of Colenso is confined to intergranular spaces and fractures within the Karoo Formations and intergranular spaces within alluvium aquifers. The borehole yields range 7 from 0.5 – 2.0 l/s (21).

The implication is that water supply from local groundwater sources for the proposed power plant operation is highly unlikely due to the low yields that are expected at production boreholes.

5.5.5.1 Groundwater recharge

Recharge is defined as the process by which water is added from outside to the zone of saturation of an aquifer, either directly into a formation, or indirectly by way of another formation. The recharge values for the respective Quaternary catchments in associated with the proposed power station site, according to the Groundwater Resource Assessment Phase II (GRAII) database, is presented in Table 5-7.

Figure 5-17: Groundwater Occurrence



Source: AGES, Geohydrological Report, 2015

Table 5-7: GRAII Recharge values as a percentage of MAP

Catchment	Recharge (% of MAP)
V12G	6.2
V14B	5.8
V14D	4.8
V14E	5.9

Source: AGES, Geohydrological Report, 2015

5.5.5.2 Groundwater Reserve

According to the National Water Act (1998) the Basic Human Needs and Ecological Reserve are required to be protected by law.

Approximately 95% of the proposed project footprint resides in the quaternary catchment V14E. Quaternary catchments serve as convenient boundaries for reserve determinations as national datasets (DWAF, 2003 and WRC, 2005) already exit to support the calculations on this level although it should be noted that the quaternary catchments does not necessarily align with the groundwater units as they represent surface water catchments.

As mentioned previously no groundwater use registrations exist on the WARMS (Water Resource Management System) database for V14E quaternary catchment. The general authorization for V14E is given as 45 m^3/ha/a, which is the groundwater use figure, which is not subject to a water license.

The total population for the V14E quaternary catchment was calculated to be approximately ~17 983 persons. This was based on data obtained from Census 2011 with the assumption that the population for the quaternary catchment increased annually with 0.71%. The basic human need for the catchment based on the 25 l/p/p is calculated as 0.04 Mm^3/a.

Various figures are available for groundwater contribution to baseflow. Baseflow is defined as the normal flow of the stream without the influence of groundwater or storm water contribution. For the purpose of the reserve determination AGES used 11.4 Mm^3/a as the volume of water that groundwater contributes to surface water.

The groundwater reserve determination results indicated allocable groundwater volumes between 1.04 and 4.56 Mm^3/a and the reserve as percentage of recharged was calculated at 92%. This implicates that groundwater is in a healthy state within this catchment with high allocable volumes (AGES, 2015).

5.5.6 Aquifer Classification

The classification scheme (Parsons, 1995) was created for strategic purposes as it allows the grouping of aquifer areas into types according to their associated supply potential, water quality and local importance as a resource.

Parson's classification system together with the revised version produced by DWAF (now knows as DWS) in 1998 is shown in Table 5-8. The geology underlying the site was classified according to the Parsons (and DWAF/DWS) system using current information as a minor aquifer system (AGES, 2015).

Table 5-8: Aquifer Classification scheme

Aquifer System	Defined by Parsons (1995)	Defined by DWAF Minimum Requirements (1998)
Minor Aquifer	These can be fractured or potentially fractured rocks, which do not have a high primary permeability or other formations of variable permeability. Aquifer extent may be limited and water quality variable. Although these aquifers seldom produce large quantities of water, they are important both for local supplies and in supplying baseflow for rivers.	Moderately yielding aquifer (1-5 L/s) of acceptable quality or high yielding aquifer (5-20 L/s) of poor quality water.

5.5.6.1 Aquifer vulnerability

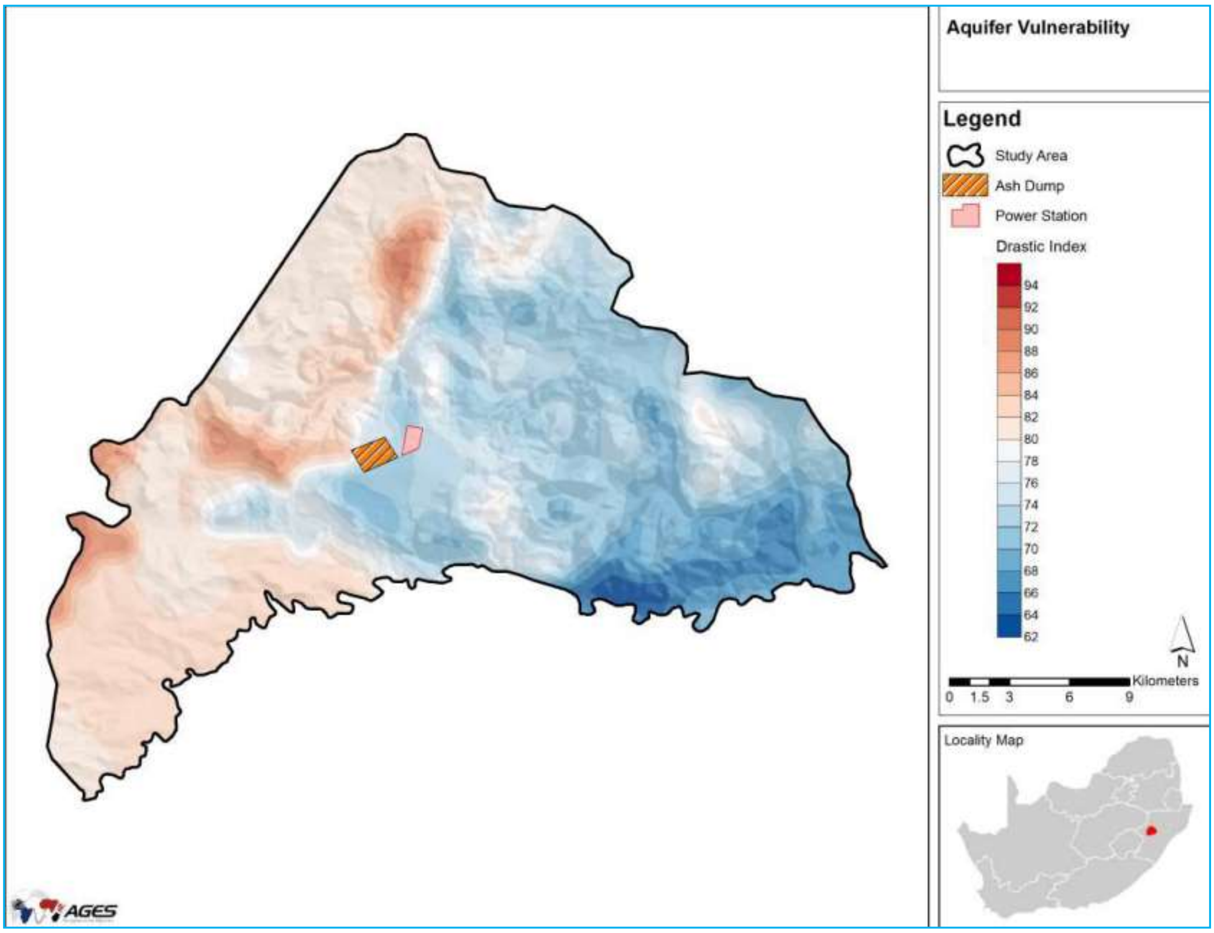
The geological and hydrogeological settings form the basis of understanding the aquifer system and identifying which major factors can control and contribute to possible contamination.

AGES made use of the DRASTIC method to quantify potential contamination in of the hydrogeological setting associated with the proposed power station site location. The method makes use of the following seven factors to calculate the vulnerability index value:

- Depth to groundwater – determines the maximum distance contaminants travel before reaching the aquifer;
- Net recharge – the amount of water that is able to travel from ground surface to the water table;
- Aquifer – the composition of the aquifer material;
- Soil media – the uppermost portion of the unsaturated zone;
- Topography – the slope of the ground surface;
- Impact of vadose zone – the type of material present between the bottom of the soil zone and water table; and
- Hydraulic conductivity of the aquifer – indicates the aquifer's ability to allow for the flow of water to occur.

The produced aquifer vulnerability can be seen in Figure 5-18. It is important to note that the vulnerability index is used to look at the relative vulnerability between different zones or areas. In this case it can be seen that the proposed power plant and ash dump sites are located in an area of lower aquifer vulnerability which increases to the west of the sites.

Figure 5-18: Aquifer Vulnerability



Source: AGES, Geohydrological Report, 2015

5.6 Surface Water

Storm Water Solutions (Pty) Ltd was appointed to conduct the surface water assessment. Their report is attached as Appendix F. The baseline description for surface water is taken from their report.

5.6.1 Catchments

Catchments are delineated in a holistic manner from a large to a small scale. The Project Area is characterized by the following catchments:

- Water Management Areas;
- Quaternary Catchment Area; and
- Site specific delineated Natural Catchments.

5.6.1.1 Water Management Area (WMA):

The Project Area falls within WMA 7 – Thukela. The Thukela WMA lies predominantly in the KwaZulu-Natal province. It is a funnel-shaped catchment, with several tributaries draining from the Drakensberg escarpment towards the Indian Ocean. It is characterized by mountain streams in the upper reaches, where several parks and conservation areas are located.

The Thukela Water Management Area covers a surface area of 29 158 km^2 and yields a Mean Annual Runoff (MAR) of 3 799 m^3 (million cubic meters per annum).

5.6.1.2 Quaternary Catchment Areas:

The natural catchment covers a huge area which comprises of a number of quaternary catchment areas. The proposed infrastructures however are only found in the following Quaternary Catchments;

- V14B;
- V14D; and
- V14E.

The peak flows for the 1 in 50 and 1 in 100 year 24 hour storm event, for Quaternary Catchment V14E are 921.62 m^3/s and 1 159.48 m^3/s respectively.

5.6.1.3 Site specific Catchment:

Significant Discharge Points (DPs) are identified on significant rivers from which upstream catchments are then delineated. Only one significant DP was identified for the Colenso Coal Power Plant Project area.

The significant stream for this study area is the Thukela River with the Klip River being the most significant tributary. The Thukela has a number of tributaries coming off the Drakensberg. The following tributaries (Named from upstream to downstream) also have a direct impact on the flow of water at the discharge point of the site specific Catchment1:

Tributaries (Named from upstream to downstream)

- Thukela
- Sithene;
- Ifidi;
- Mlambonja;
- Sandspruit;
- Ventерspruit
- Lindespruit;
- Lindequeenspruit
- Sterkspruit;
- Njesuthi;
- Kaalspruit; and
- Klip
- Sandspruit.

Only 1 natural catchment was delineated for the Project area which has its Discharge Point (DP) at the most downstream location of the boundary of the Project site area.

Table 5-9 summarizes the surface area sizes of the three main significant catchments for the project area.

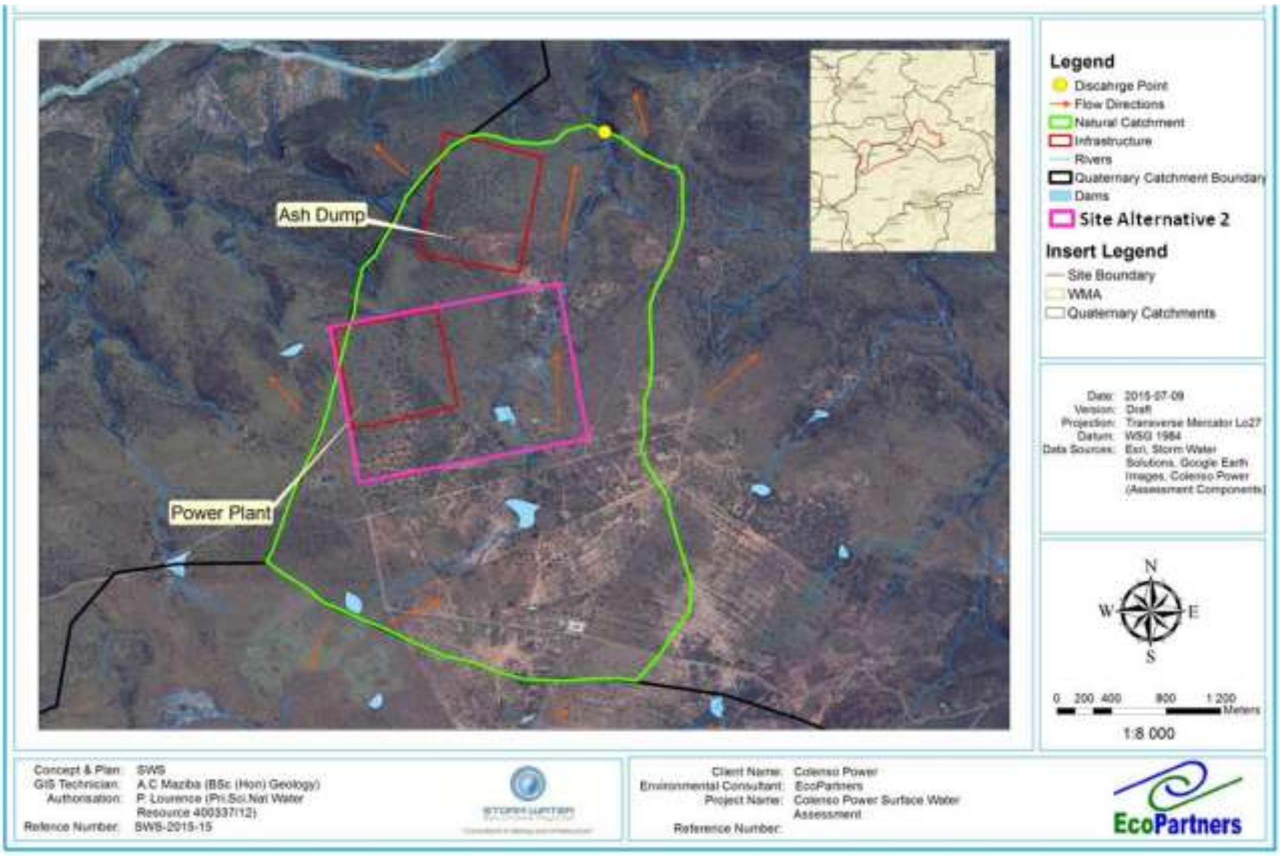
Table 5-9: Catchment Surface Area Sizes

Catchment	Surface Area Size (km2)	Discharge points (DPS)
WMA 7: Thukela	29 046	N/A
Quaternary Catchment V14E	287	N/A
Site Specific Catchment	6 792	DP1

Source: Storm Water Solutions, Surface Water Assessment (2015)

The catchments of the project area are illustrated in the figure below.

Figure 5-19: Catchments of the project area



Source: Storm Water Solutions, Surface Water Assessment (2015)

The hydrological characteristics of the Natural Catchment 1 are summarized as follows:

Mean Annual Precipitation	= 851 mm
Area of catchment	= 7359.0 km²
Length of longest watercourse	= 152.0 km
Flow of water	= Defined water course
Height difference along 10-85 slope	= 2340.0 m
Average slope	= 0.02053 m/m
Time of concentration	= 14.17 h
Run-off factor - Combined - C	= 0.458
Days on which thunder was heard	= 17 days
Basin mean annual evaporation	= 1 500 mm
Basin evaporation index MAE/MAP	= 1.97

The peak flows for the 1 in 50 and 1 in 100 year 24 hour storm event, for Catchment 1 are 6 271.19 m^3/s and 7 889.67 m^3/s respectively.

5.6.2 Mean Annual Runoff

The site specific Catchment falls within the Upper Thukela Sub-area. This sub area has a discharge point at Quaternary Catchment V14E and contributes approximately 39.5% of the MAR for the Thukela Water Management Area.

A summary of the catchment MAR is given in the table below.

Table 5-10: Mean Annual Run-off Summary

Catchment	Type of Runoff			
	MAR	Average Normal Annual	Average Wet Monthly	Average Dry Monthly
	(m^3)			
WMA 7: Thukela	3 881 000 000	n/a	n/a	n/a
Quaternary Catchment V14E	25 980 000	15 739 583	2 652 238	762 240
Site Specific Catchment	822 334 230	372 485 175	62 766 547	18 038 789

Source: Storm Water Solutions, Surface Water Assessment (2015)

5.6.3 Flood lines

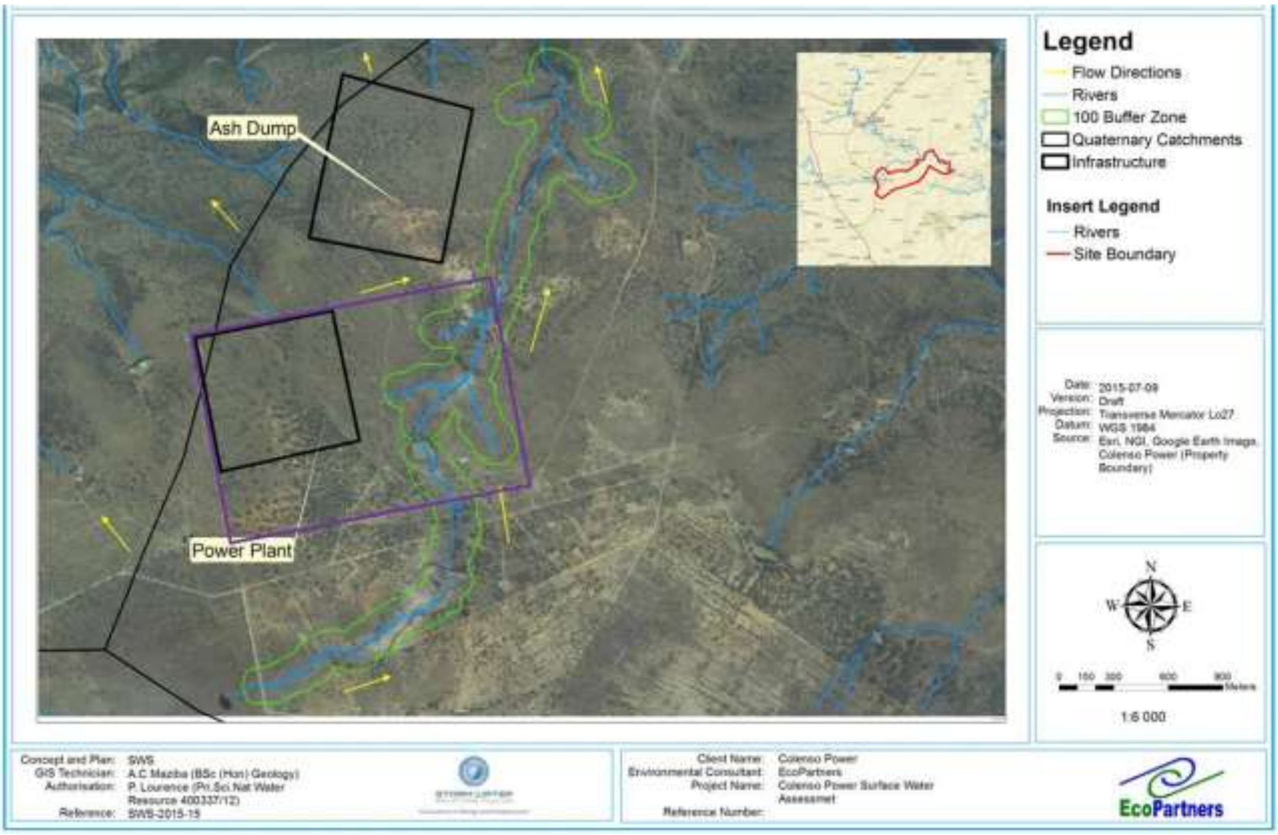
Storm Water Solutions did a flood line determination and concluded that from the assessed peak flows and water levels on the Thukela River in close proximity to the project area, the potential flood lines from the required design periods as well as worse case scenarios will not exceed beyond the 100 m buffer zone. Thus, the 100 m buffer zone is accepted as the exclusion zone according to GN704 for the Project Area.

Smaller rivers and tributaries were only assessed for 100m buffer zones and these are consequently accepted as worst case scenario as well. It is assumed that the 100 m buffer (as in the case of the Thukela River) will always exceed the 1:100 year 24 hour flood line (Storm Water Solutions, 2015).

The 100m buffer zones are also the only no-go areas and/or sensitive areas for the project which should be considered during Authorisation.

The figure below indicates the 100m buffer zones for the river closest to the Power Plant proposed development.

Figure 5-20: Buffer zone -- Thukela River (100m)



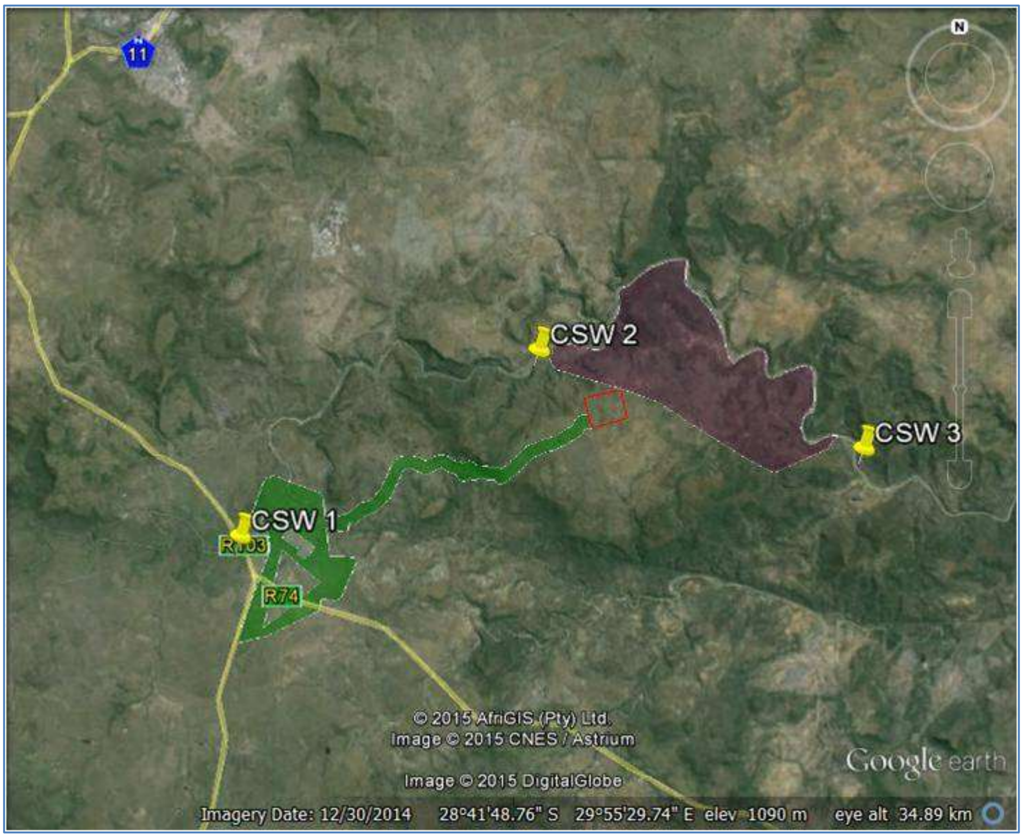
Source: Storm Water Solutions, Surface Water Assessment (2015)

5.6.4 Surface water quality

Water quality samples were collected along the Thukela River and the sampling points were named as follows (refer Figure 5-21: Surface water sampling points):

- CSW1 – Colenso Surface Water 1 located upstream of the Project Boundary area near the R103 bridge crossing;
- CSW2 – Colenso Surface Water 2 located in the middle of the Project Boundary area; and
- CSW3 – Colenso Surface Water 3 located downstream of the Project Boundary area.

Figure 5-21: Surface water sampling points



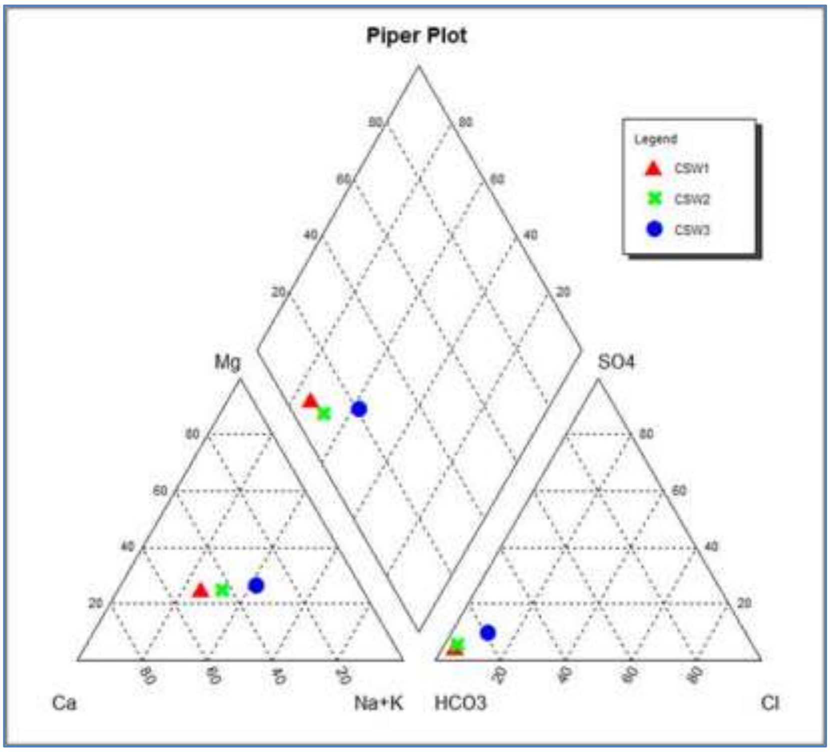
Source: Storm Water Solutions, Surface Water Assessment (2015)

Analysis of the major ionic constituents was undertaken using a Piper diagram to assess the proportions of these constituents and broadly characterize the water type/s. The piper diagram in Figure 5-22 presents the ionic constituents of the water along the Thukela River section traversing along the perimeter of the Project site.

The prevailing water quality of the Thukela River along the perimeter of the proposed Project site is dominantly of calcium-bicarbonate water. The slight change in water quality at sample point CSW3, is likely due to the mixing of water down-stream of confluence with perennial Klip River flow system

The samples were analysed and compared against the water quality standards / guideline for drinking / domestic use although no surface water users were identified in the immediacy of the project area.

Figure 5-22: Piper Diagramme



Source: Storm Water Solutions, Surface Water Assessment (2015)

The following main interpretations are made from the study:

- In general, the water quality of the Thukela River flow system is suitable for human consumption with no adverse effects on selective crops if used for irrigation purposes. The elevated aluminum and iron concentrations are most likely naturally occurring effect from the stream bed sediments.
- Some degree of acute adverse effects on aquatic ecosystem is expected due to the elevated aluminum and ammonium concentrations.
- The slightly acidic conditions and elevated concentrations of nitrogen-species (e.g. ammonium) is most likely a result of the large-scale agricultural activities (i.e. irrigation-schemes) being conducted up-stream of the proposed Project site, adjacent to the perennial Thukela River flow system.
- The general higher constituent concentrations measured at CSW3 is most likely a result of mixing of water down-stream of the confluence of the perennial Thukela River and Klip River flow systems.

Figure 5-23: Man-made farm dam present on the proposed site

Source: David Allan, Avifaunal Assessment (2015)

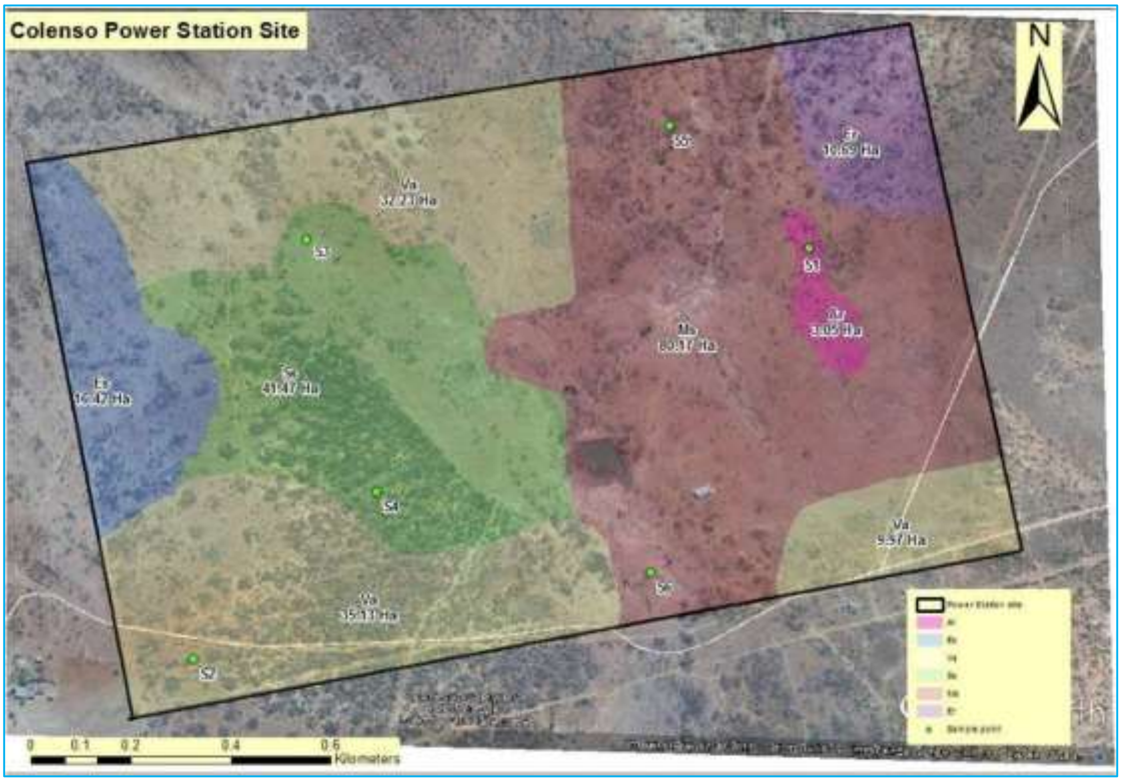
5.7 Soils and Agricultural Potential

ARC-Institute for Soil, Climate and Water was appointed to conduct the soil and agricultural potential study. Their report is attached as Appendix G. The baseline description for the soil is taken from their report.

Several soil map units were identified on site. A description of the most important soil characteristics of each unit, such as the dominant soil form and family, soil depth, topsoil texture and underlying material, is given in the soil legend shown in Table 5-11.

In general, the soils in the western half are mostly duplex soils (sandy topsoil abruptly overlying a structured clayey subsoil) with dark brown to reddish brown colours and a small patch of greyish brown subsoils, with smaller areas of swelling clays. In the east, there is also large area of shallow rocky soils, as well as eroded area with underlying rock exposed.

Figure 5-24: Soil Map



Source: ARC, Soil Report (2015)

The map units are shown on the map in Figure 5-24 as in the following example:

Va

32.23 ha

Where **Va** represents the map unit (in this case moderately deep to deep Valsrivier soils) and **32.23 ha** is the area of the unit.

5.7.1 Analysis results

For the soil sampling sites (S1 to S6), the results of the soil analyses are given in Table 5-12. The results show the difference between the high clay content, black, swelling clay soils (S1) and the duplex soils (S2-S4), which generally have a clear increase in clay from a more sandy topsoil to the clay subsoil. The swelling clay soils are alkaline, with higher CEC values, due mainly to the higher levels of Ca and Mg in the soils.

The duplex soils are moderately to slightly acidic, while the shallower soils (S5 and S6) are close to neutral. The P levels are low, showing no evidence of any recent cultivation, while the organic carbon values are moderately high.

Table 5-11: Soil map legend

Map Unit	Depth (mm)	Dominant Soil Form(s)	Sub-dominant Soil Form(s)	General description of soils occurring	Area (ha)
Duplex soils					
Va	300-900	Valsrivier	Sterkspruit,	Brown, loamy, weakly structured topsoil on red-brown to reddish, blocky, structured clay subsoil, with clearly visible cutans, over unconsolidated material without signs of wetness.	77.3
Ss	300-900	Sterkspruit	Valsrivier	Dark reddish brown, apedal to weakly structured, sandy loam topsoil on reddish-brown, blocky, prismatic structured clay loam to clay subsoil with reddish-brown clay cutans.	41.5
Es	800-1000	Escourt	Sterkspruit	Grey-brown, apedal to weakly structured, sandy loam topsoil over apedal, bleached grey, sandy loam E horizon, overlying brown, blocky, prismatic structured, mottled clay with clay coating.	16.4
Swelling clay soils					
Ar	300-700+	Arcadia		Dark brown to black, structured, swelling clay soils on rock.	3.1
Shallow lithosols					
Ms	1000-1200+	Mispah	Glenrosa	Dark brown, sandy loam to sandy clay loam, weakly structured topsoil on hard (occasionally weathering) rock.	80.2
Other areas					
Er	-	Eroded soils		Areas with highly eroded soils, with exposed subsoil and rocks	10.7
TOTAL AREA					**229.2**

Source: ARC, Soil Report (2015)

Table 5-12: Soil analysis results

Sample site		S1		S2		S3		S4		S5		S6	
Co-ordinates (Lat/Long)		28° 41' 37.8" S 29° 58' 04.4"E		28° 41' 58.3" S 29° 57' 25.0"E		28° 41' 42.7" S 29° 57' 31.3"E		28° 41' 32.9" S 29° 57' 36.8"E		28° 41' 23.2" S 29° 57' 53.3"E		28° 41' 52.4" S 29° 57' 53.3"E	
Soil Form		Arcadia		Valsrivier		Sterkspruit		Sterkspruit		Mispah		Mispah	
Horizon		A1	A2	A1	B1	A1	B1	A1	B1	A1	Rock	A1	Rock
Depth (mm)		0-300	300-600	0-300	300-600	0-300	300-600	0-300	300-600	0-300		0-300	
Sa	%	48	38	80	68	76	58	54	50	64		76	
Si	%	12	10	4	4	6	6	10	10	12		4	
Cl	%	40	52	16	28	18	36	36	40	24		20	
Na	cmol kg^{-1}	0.971	0.024	0.019	0.065	0.019	0.035	0.027	0.091	0.021		0.036	
K	cmol kg^{-1}	0.380	0.345	0.363	0.276	0.339	0.359	0.879	0.742	0.563		0.456	
Ca	cmol kg^{-1}	18.564	16.309	1.430	2.377	1.278	1.988	7.182	9.685	20.181		5.992	
Mg	cmol kg^{-1}	11.154	14.177	0.717	1.426	0.627	1.713	1.947	2.490	1.387		3.579	
CEC	cmol kg^{-1}	30.290	36.984	4.140	8.903	4.916	9.951	15.026	16.509	22.082		11.661	
P (ppm)		3.52	2.11	6.82	1.84	6.13	3.21	1.72	1.41	4.16		7.01	
pH (H_2O)		8.36	9.03	5.99	5.59	5.51	5.07	6.24	6.37	7.67		7.00	
Org C (%)		1.55	0.89	0.61	0.73	1.62	0.57	1.48	0.79	1.91		1.03	

Source: ARC, Soil Report (2015)

No abnormal or unexpected values were obtained.

5.7.2 Agricultural Potential

The general agricultural potential class of each map unit for the Power Station site, and their main limiting factors, are given in Table 5-13 below.

Table 5-13: Agricultural Potential, Power Station site

Agricultural Potential	Map unit	Limitations	Area (ha)
Low to moderate	Va, Ar	High subsoil clay content, usually structured, restricted permeability and impeded drainage	80.5 *(35.1%)*
Low	Es, Ss	As for Va and Ar units, with abrupt transition to subsoil and limited depth	57.9 *(25.3%)*
Very low	Ms	Very restricted soil depth and rockiness	90.8 *(39.6%)*
	Er	Exposed subsoil and underlying rocks	
Total			**229.2** ***(100%)***

Source: ARC, Soil Report (2015)

The study area is dominated by low to very low potential soils. The low to moderate potential soils (Va and Ar map units) may be cultivated, but their internal drainage will still be poor due to the soil structure and clay texture. These soils will be difficult to work and will be more susceptible to waterlogging.

5.8 BIODIVERSITY

Zone Land Solutions was appointed to conduct the Biodiversity Assessment. Their reports were used to describe the baseline biodiversity status of the site presented below.

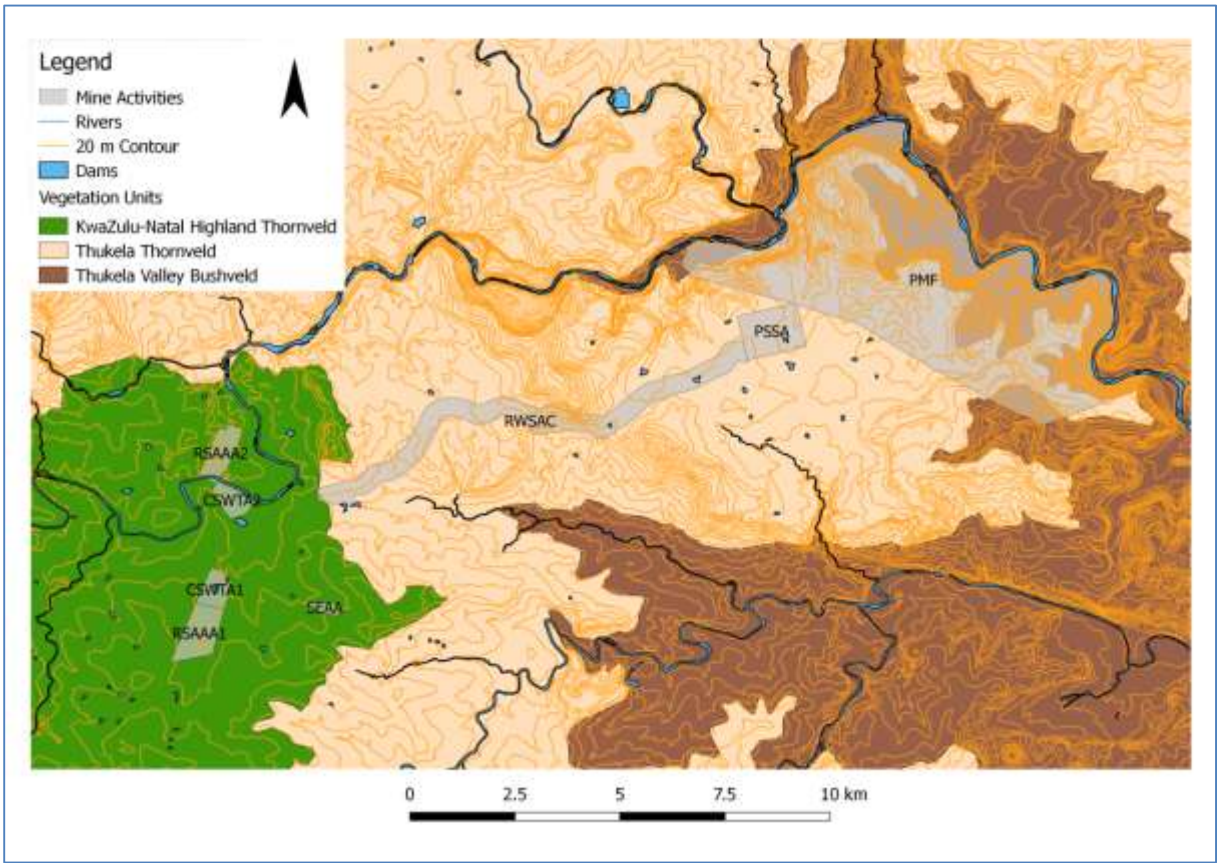
5.8.1 Flora

Dr Johannes J. Le Roux and Mr Jan-Hendrik Keet conducted the vegetation assessment. Their Report is attached as Appendix H.

5.8.1.1 Broad-scale vegetation description

According to the Vegetation Map of South Africa (Mucina and Rutherford 2006) the proposed area for development of the proposed power station falls within the Thukela Thornveld vegetation type. By definition, major vegetation types are distinguished by having distinct compositional (dominant, common and rare species), structural (growth forms), climate, soil, geological and topographical features. The boundaries between different vegetation types are not sharp or discreet, and often harbour unique biodiversity. It is therefore noteworthy that the proposed site is situated nearby transition zones with two other vegetation types: KwaZulu-Natal Highland Thronveld (approximately 12 km away) and Thukela Valley Bushveld (approximately 2.5 km away).

Figure 5-25: Vegetation Map

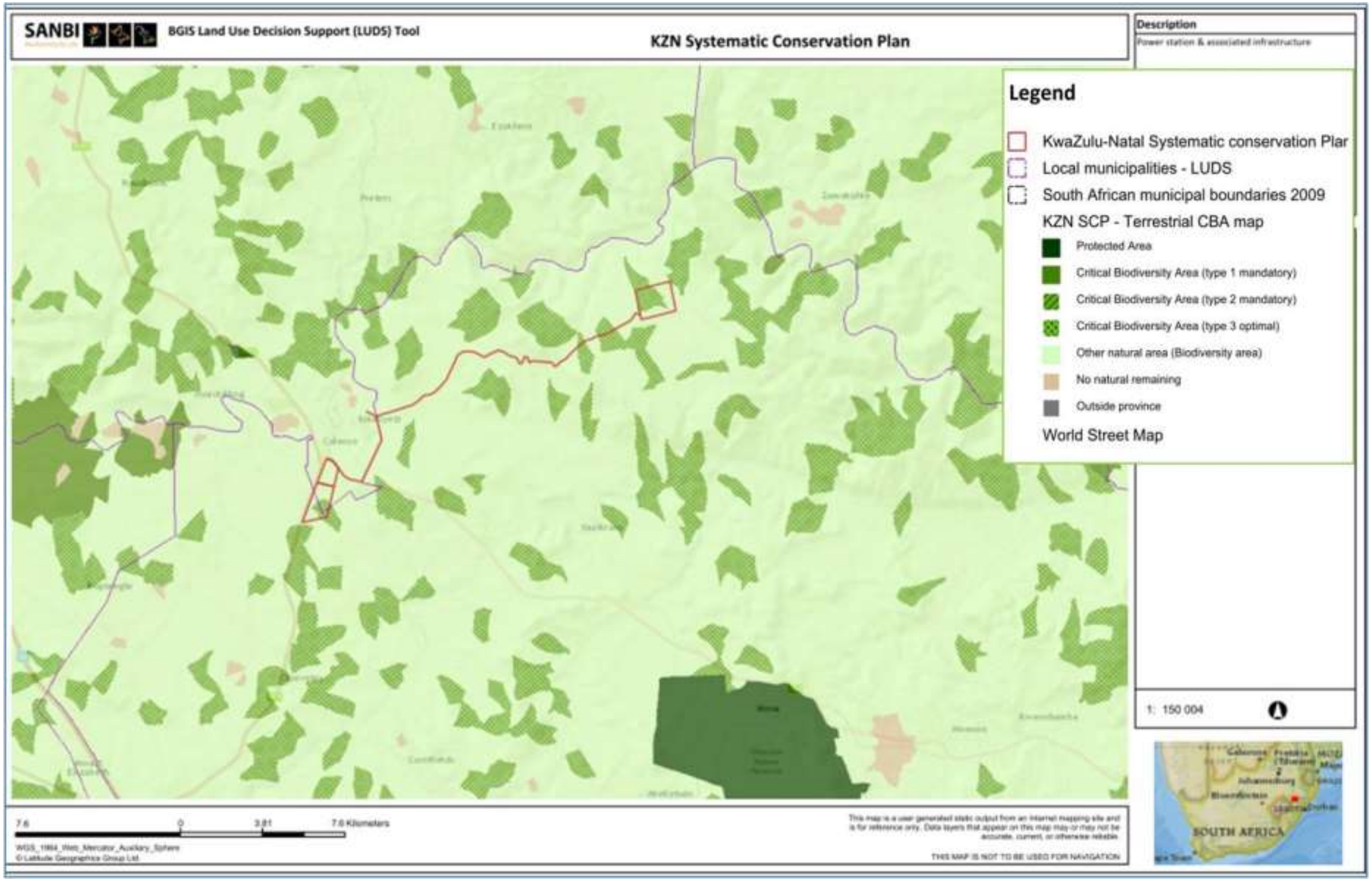


Source: Le Roux & Keet, Vegetation Assessment (2015)

The Thukela Thornveld is not a threatened vegetation type and the conservation status of this vegetation type is classified as 'Least Threatened', probably as most of it falls outside areas of intensive agriculture. To date, about 5% of this vegetation type has been transformed through agricultural activities (Mucina & Rutherford 2006). This vegetation type is however poorly protected with only about 1500 ha falling within protected areas (Weenen Game Reserve and Isandlwana Nature Reserve). Endemic species listed for Thukela Thornveld vegetation include the small trees, the critically endangered *Encephalartos msinganus* (Msinga cycad, Donaldson, 2010) and *Vitellariopsis dispar* (Tugela Bush-milkwood, Hilton-Taylor *et al.* 1998) and the succulent herbs, *Aloe prinslooi* and *Orbea woodii* (Mucina and Rutherford 2006).

Certain components of the project falls within Critical Biodiversity Areas identified in the KwaZulu Natal Systematic Conservation Plan (Refer Figure 5-26). All the affected areas are classified as CBA 3 Optimal. According to the Draft Document describing the Conservation Planning Terms for the EKZNW Spatial Planning Products (2012) it is preferred that development be focused within these areas, although this still has to be conducted in an informed and sustainable manner.

Figure 5-26: Location of project in relation to KZN C-Plan Critical Biodiversity Areas



5.8.1.2 Site-specific vegetation description

High levels of vegetation transformation by domestic livestock is prevalent in some areas of the study site, supported by a high grazing pressure resulting in low species ground cover (i.e. patches of bare soil) underneath mostly tree vegetation (such as Acacia spp.), a feature often associated landscapes characterised by intensive transformation by livestock (Van Oudsthoorn, 2012).

During the site visit, the specialist identified 60 plant species in the area, of which four are non-native to South Africa. The rest are all native to South Africa. A complete list of all species identified at the site (including various attributes, e.g. Red List status) can be found in the vegetation assessment report attached as Appendix H. Note that some species identifications were not possible, due to the absence of e.g. fresh flowers, e.g. 1 *Asparagus* sp., 1 *Berkheya* sp., 1 *Cucumis* sp., 1 *Eragrostis* sp., 1 *Hypoxis* sp. and 1 *Ledebouria* sp. All *Ledebouria* species are provincially protected in KwaZulu Natal.

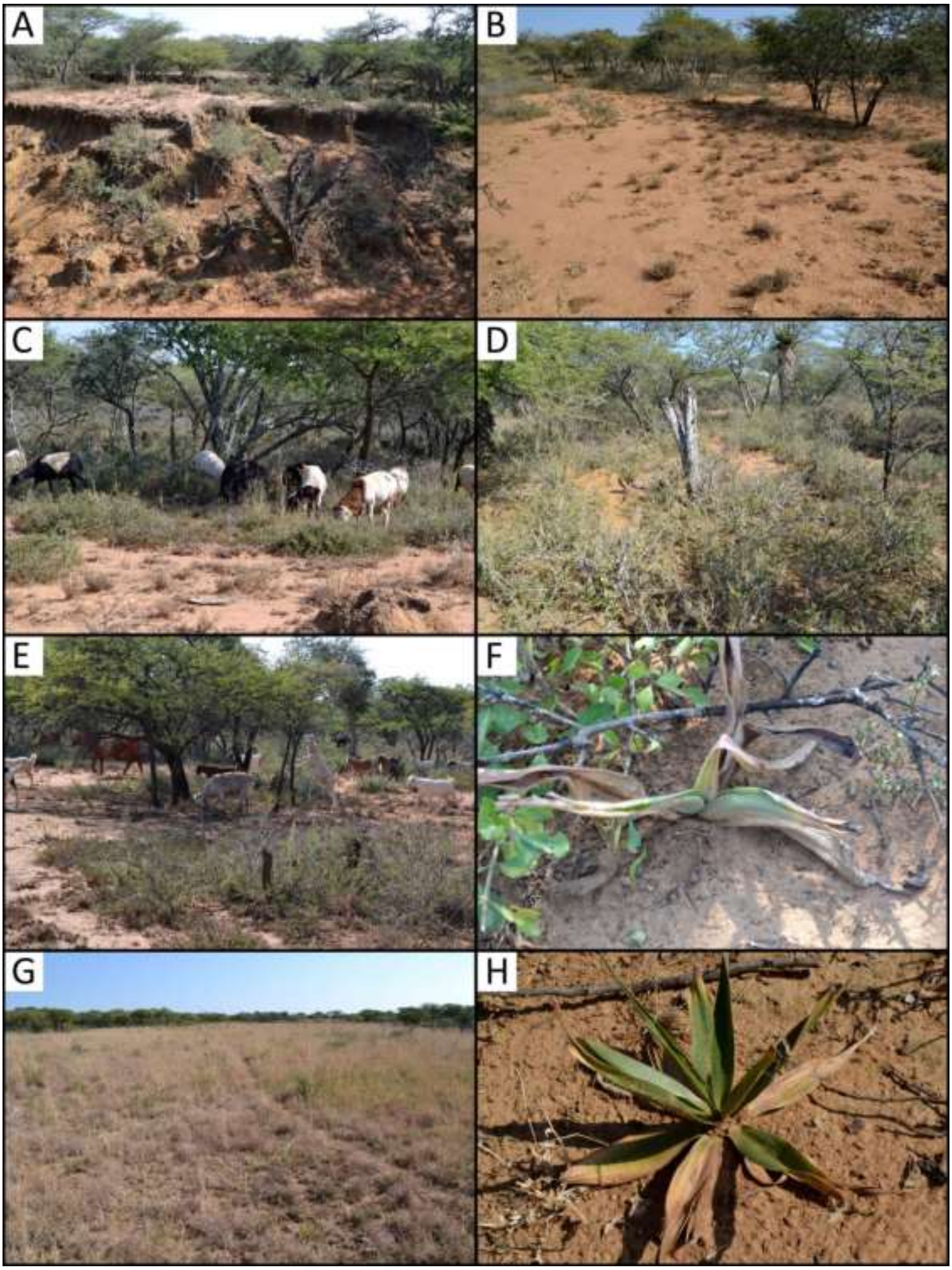
Cattle, sheep and goats were observed grazing in the area and appeared to have unrestricted access to the site, especially the lower lying areas. Evidence of a long history of grazing and disturbance is provided by characteristics of the grass community present at the site, such as the abundance of the grasses *Aristida adscensionis* (Annual Three-awn), *Aristida congesta* subsp. *barbicollis* (Spreading Three-awn) and *Heteropogon contortus* (Spear Grass) (Van Oudtshoorn 2012). Index plants for this area are *Acacia karroo* (Sweet-thorn), *Acacia nilotica* (Scented-pod Thorn), *Hyparrhenia hirta* (Common Thatching Grass) and *Eragrostis superba* (Saw-tooth Love Grass) (Edwards 1967).

Of the 60 plant species found and identified at the site, 45 are classified as being of Least Concern according to the ICUN Red List data. One species, *Hypoxis hemerocallidea* (Star-flower), found at the proposed site of development (Figure 5-27F), is currently listed 'Declining'. A taxon is classified as 'declining' when it does not yet meet the necessary criteria to qualify for the categories 'threatened' or 'near-threatened' but where there are threatening processes which are causing a continuing decline in population sizes.

A single *Ledebouria* sp species within the Hyacinthaceae family was also identified at the proposed site of development (refer Figure 5-27H). All members in the genus *Ledebouria* (commonly referred to as squils) are recognized as Schedule 12 species (KwaZulu-Natal Ordinance 15 of 1974), for which protection of the genus as a whole is provided. Such protected species represent an important aspect of biodiversity conservation, necessitating adequate measures to minimize negative impacts on individuals or populations.

The vegetation cover over most of the development site appeared to be heavily overgrazed as evidenced by large patches of bare ground, deep erosion dongas and an abundant element of short woody shrubs, most notably *Coddia rudis* (Small Bone-apple) (refer Figure 5-28). The abundance of woody shrubs is the result of bush encroachment. The continuous problem of soil erosion as a result of overgrazing throughout the Thukela Basin, together with the problem of secondary bush encroachment into the grasslands, has been thoroughly documented almost 50 years ago (Edwards 1967). Thus, ecologically damaging land use within the Thukela Basin has a long history. High densities of alien plants, *Solanum* (Nightshade) and *Opuntia* (Prickly pear) species were also observed at the site. observed).

Figure 5-27: Representative photos of the development site for the Colenso power station.



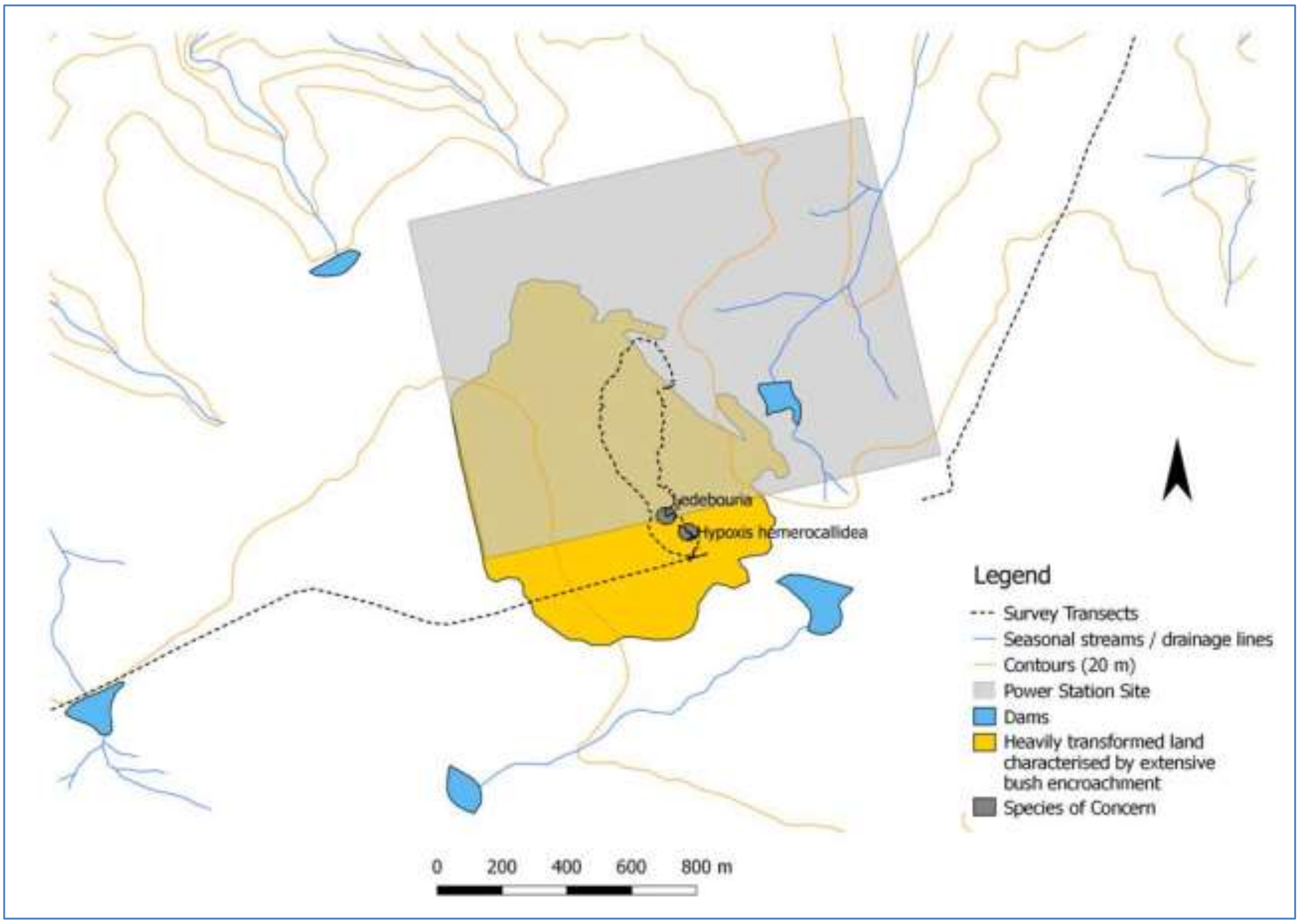
A) Large erosion gulleys, B) areas with very little vegetation cover and interdispersed are of bare soil, C) herd of sheep grazing on site, D) dense bush encroachment primarily by the low shrub *Coddia rudis* (Small Bone-apple), E) herd of goats grazing on site, F) specimen of *Hypoxis hemerocallidea* (Star-flower) found at the development site, G) section of grassland with signs of bush encroachment by shrubby vegetation, H) specimen of *Ledebouria* sp. (squil) found on site.

Source: Le Roux & Keet, Vegetation Assessment (2015)

Furthermore, herds of cattle, sheep and goats passed through the site during the inspection. Overall most of the area is considered as being highly impacted by anthropogenic disturbance (refer Figure 5-28).

Figure 5-31 indicates the site's proximity to various dams, drainage lines, existing infrastructure, and certain landscape features. A large proportion of the site represents an area that is heavily transformed and characterised by extensive bush encroachment and is indicated in yellow. The remainder of the site is less transformed (more open grassland with limited bush encroachment, although signs of early-stage bush encroachment was

Figure 5-28: Transformed vegetation areas on proposed power station site



Source: Le Roux & Keet, Vegetation Assessment (2015)

5.8.2 Fauna

SW van der Merwe conducted the faunal assessment. The report is attached as Appendix H.

5.8.2.1 Mammals predicted to occur

Table 5-14: Red Data mammals predicted to occur in the study area

Scientific Name	Common Name	Status
Chrysospalyx villosus	Rough-haired Golden Mole	Critically Endangered
Myosorex varius	Forest Shrew	Endangered
Crocidura flavescens	Greater Red Musk Shrew	Endangered
Poecilogale albinucha	Striped Weasel	Rare
Ourebia ourebi	Oribi Antelope	Vulnerable
Orycteropus afer	Aardvark	Vulnerable
Mystromys albicaudatus	White- Tailed Mouse	Vulnerable
Amblysomus hottentotus	Hottentot Golden Mole	Data Deficient

Source: SW vd Merwe Faunal Assessment (2015)

Data on mammal species listed in Table 5-14 was obtained from the Red Data Book of Mammals of South Africa, the Emnambithi Ladysmith Local Municipality: Strategic Environmental Planning Tool, and Smither's Mammals of Southern Africa (2000).

5.8.2.2 Birds predicted to occur

The birdlife of the study area has been addressed in a separate study (refer Appendix O).

The list of important bird species potentially present or affected by activities on the site, listed in Table 5-15, was obtained from the Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Barnes, 2000), Roberts Online- Birds of Southern Africa (http://www.robertsonline.co.za) as well as the SANBI Bird in Reserves Project website (http://www.birds.sandi.org).

Table 5-15: Red Data bird species predicted to occur in the study area

Scientific Name	Common Name	Status
Bugeranus carunculatus	Wattled Crane	Critically Endangered
Hirundo atrocaerulea	Blue Swallow	Critically Endangered
Bucorvus leadbeateri	Southern Ground Hornbill	Endangered
Lioptilus nigricapillus	Bush Blackcap	Near Threatened
Zoothera gurneyi	Orange Ground Thrust	Near Threatened
Stephanoaetus coronatus	Crowned Eagle	Near Threatened
Anthropoides Paradisea	Blue Crane	Vulnerable
Balearica regulorum	Grey Crowned Crane	Vulnerable
Hemimacronyx chloris	Yellow Breasted Pipit	Vulnerable
Neotis denhami	Denham's Bustard	Vulnerable
Typo capensis	Grass Owl	Vulnerable
Eupodotis cafra	Whitebellied Korhaan	Vulnerable
Neotis denhami	Stanley's Bustard	Vulnerable
Falco Naumanni	Lesser Kestrel	Vulnerable
Circus ranivorus	African Marsh Harrier	Vulnerable

Source: SW vd Merwe Faunal Assessment (2015)

5.8.2.3 Reptiles predicted to occur

Data on reptile species of conservation importance was based on information obtained from the Emnambithi Ladysmith Local Municipality: Strategic Environmental Management Tool, the EKZNW Strategic Environmental Assessment Report, and the EKZNW Minset Database for the area. The species predicted to occur on the site are summarised in the table below.

Table 5-16: Red Data reptile species predicted to occur in the study area

Scientific Name	Common Name	Status
Bradypodion thamnobates	Natal Midlands Dwarf Chameleon	Near threatened
Bradypodion melanocephalum	Black-Headed Dwarf Chameleon	No entries found
Scelotes bourquini	Bourquin's Dwarf Burrowing Skink	No entries found

Source: SW vd Merwe Faunal Assessment (2015)

5.8.2.4 Amphibians predicted to occur

The Strategic Environmental Management Tool for the municipality indicates that the Long-Toed Tree Frog (*Leptopelis xenodactylus*) and Natal Spiny Reed Frog (*Afrixalus spinifrons*) may occur in the study area.

Table 5-17: Red Data amphibian species predicted to occur in the study area.

Scientific Name	Common Name	Status
Leptopelis xenodactylus	Long-Toed Tree Frog	Endangered
Afrixalus spinifrons	Natal Spiny Reed Frog	Vulnerable

Source: SW vd Merwe Faunal Assessment (2015)

5.8.2.5 Transact Survey

The transect survey revealed the following:

None of the Red Data Species or any sign that indicates the occurrence of such species has been observed.

- The study area and the comparison transects were found to be almost completely devoid of faunal species or indications of the occurrence of such species. (By nature, Red Data species are difficult to observe. The fact that none of the Red Data species predicted to occur in the area has been observed does not necessarily mean that they do not occur.
- However, the almost total lack of species that are generally readily observed may be construed as a conclusive indicator that the integrity of the faunal life in the area is low).
- The spoor and faecal material of a mongoose were noted at the dam.
- Bronze Manikins (*Spermestes cuullatus*) and Redwing Starlings (*Onychognathus morio*) were seen foraging at two locations.
- The spoor of people and domestic dogs were observed throughout the site.
- The spoor of cattle, donkeys and goats were observed throughout the site.
- Most of the watercourse has been extensively grazed and trampled by livestock.
- There is a high level of human disturbance on the site, including littering and the harvesting of firewood and thatch.
- High levels of vegetation transformation by domestic livestock are prevalent throughout the study site. The evident high grazing pressure has resulted in patches of bare soil and areas of extensive erosion.

The existing drainage and seepage area together with the human-made dam is the most important faunal habitat remnants in the study area. This area has been the subject of a separate study.

However, observations undertaken under the fauna study presented in this report confirmed the occurrence of a number of aquatic species, including the common African helmeted turtle species *Pelomedusa negra*, the common Natal freshwater crab species *Potamonautes sidneyi*, three amphibian species were observed, these included the common toad *Amietophynus rangeri*, the painted or marble reed frog *Hyperolius marmoratus* and the common river frog, *Amietia angolensis*. All of the species listed above are common, have large population sizes and have wide geographic distribution ranges throughout Southern Africa. None of the species are of conservation concern.

5.8.3 Freshwater

Savel Daniels conducted the freshwater assessment. The report is attached as Appendix H

The sole and dominant surface freshwater body on site is an artificial man-made dam that is approximately 1.14 ha.

Figure 5-29: Western boundary of power station site showing man-made dam

Source: Savel Daniels, Freshwater Report (2015)

The man-made freshwater dam was formed as a result of a natural depression in the soil that has been reinforced by a support wall made from compacted top soil. To the west of the dam is a small seepage area. The seepage is a non-perennial drainage line which is defined as one that does not flow or hold water continuously throughout the year. Note that water was observed in the seepage during the site visit in the dry season under drought conditions.

The drainage line that feed into the dam flows down two areas on the eastern border of the dam and are both seasonal and non-perennial and flows during the rainy summer months, the main period of precipitation in the KwaZulu-Natal province. During drought periods however, the streams that feed into the dam run dry.

The second hydromorphic unit identified on the site is the seepage area connected to the dam and spanning across the western border of the proposed site (Refer Figure 5-29).The seepage can be defined as: “a concave wetland area located on a valley floor at the head of a drainage line, with water inputs mainly from subsurface flow (although there is usually also a convergence of diffuse overland water flow in these areas during and after rainfall events). Horizontal, unidirectional (down-slope) movement of water in the form of interflow and diffuse surface flow dominates within a seep, while water exits at the downstream end as concentrated surface flow where the seep becomes a channel (Ollis et at. 2009:34).

Figure 5-30: Seepage area / wetland present at the edges of the man-made dam

Source: Savel Daniels, Freshwater Report (2015)

5.8.3.1 Wetland vegetation

The vegetation consists of areas of facultative dry-land wetland plant species, which is an indicator that permanent/seasonal wetland conditions are unlikely across the entire site as well as facultative and obligate wetland vegetation which are synonymous with seasonal and temporary wetland areas. Smaller areas within the drainage line areas contain more abundant obligate facultative vegetation, which is an indication that these areas remain saturated for more permanent periods.

5.8.3.2 Geomorphological Integrity

The intensity of the impact score for the studied area is rated as low, because the area has low biodiversity and is not linked to other freshwater systems and appears rather isolated (Table 5-18).

5.8.3.3 Ecological Importance and Sensitivity

The area is of low ecological importance (Table 5-18) considering that it is a recent manmade structure that harbours limited biological diversity.

5.8.3.4 Present Ecological Status (PES)

The area is seriously modified (Table 5-18). The PES score associated with this rating is 20-40%. This category is assigned to systems where a large change in biota and habitat loss has taken place, resulting in the loss of ecosystem function and structure and a complete change in biota.

Table 5-18: Description on the condition of surface water on site

Criteria	Hydrological assessment criteria	Geomorphological Integrity	Ecological importance and sensitivity	Present Ecological Status
Score	Very large (>-9) Very large reduction in flows, usually >75% reduction (e.g. entire catchment completely planted with eucalyptus trees or a very high level of abstraction of water from the catchment for irrigation)	Small (1.5) - Although identifiable, the impact of drainage channels or gullies on water distribution and retention is small (e.g. because the drains are poorly intercepting flow and are very shallow.	Quaternaries / delineations that are considered not unique at any scale. These rivers (in terms of biota and habitat are generally not very sensitive to flow modifications and usually have a substantial capacity for use.	Category E; PES Score 20-40% - Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive
Source	WET-Health (2008:50)	WET-Health (2008:123)	Ollis (2011:4) *cf* DWAF (1999a).	Ollis (2011:4) *cf* DWAF (1999a)

Source: Savel Daniels, Freshwater Report (2015)

5.8.3.5 Faunal composition around the dam

Visual examination of the man-made dam at the proposed site revealed the presence of the African helmeted turtle. Historically the African helmeted turtle also commonly referred to as the marsh terrapin, or the side neck turtle was known as a single species *Pelomedusa subrufa* and occurred in the entire Afrotropical region. However, recent DNA molecular systematic research has indicated that the species is comprised of several distinct lineages (Petzold *et al*., 2014). Hence the South African specimens of the species were transferred to the new species *Pelomedusa negra*. The species prefers ephemerals pans where they consume crabs and other crustaceans and is common throughout Southern Africa. Based on the current IUCN red listing there are no conservation concerns for the species since it is widespread and common (Reptile Red Data Book, 2014). Its formal status is LC (least concerned).

5.8.3.6 Freshwater Decapoda

The banks of the dam as well as the adjoining seepage area adjacent to the dam were characterised by the presence of deep burrows made by the common Natal freshwater crab *Potamonautes sidneyi*. The species is widespread in freshwater systems, including rivers, lakes, streams and dams and is distributed from the Eastern Cape along the KwaZulu-Natal coast and adjacent interior of the Great Escarpment into Gauteng Mpumalanga and the Limpopo provinces with an extent of occurrence of 180, 000 km^2. The species is common and of no conservation concern (Cumberlidge and Daniels, 2007) and is hence listed as least concern by the IUCN.

5.8.3.7 Amphibians

The three frog species were identified and included the common toad *Amietophrynus rangeri* the painted or marble reed frog *Hyperolius marmoratus* and the common river frog, *Amietia angolensis* were collected from underneath rocks in the seepage area. *Amietophynus rangeri*, or Rangeri's frog is distributed throughout most of South Africa, Swaziland and Lesotho, and almost certainly into extreme southern Namibia. It is a low-altitude species, ranging up into the Drakensberg Mountains to over 1,000 masl. Although the species is in decline in some parts of its distribution its current IUCN status is least concern (LC). *Hyperolius marmoatus*, commonly known as the marble frog ranges from northern Mozambique, through eastern Malawi and eastern Zimbabwe to Swaziland and eastern and southern South Africa. The western parts of the range in the Limpopo and Mpumalanga Provinces of South Africa probably represent a recent range expansion at higher altitudes. It has also extended its range along the south coast of South Africa. The species is extremely abundant and is listed as Least Concern. *Hyperolius marmoratus* is often locally abundant, and populations often consist of hundreds or even thousands of individuals. The species occurs in several national parks and numerous provincial nature reserves and therefore does not require additional conservation attention. *Amieta angolensis* also known as the common river frog, has a wide distribution range in eastern and southern Africa where it occurs in rivers, streams and agricultural lands and dams. It is listed also as Least Concern. None of the species are of conservation concern and the reed frog is widely considered an invasive since it prefers man made habitats such as dams (Pynton *et al*., 2015).

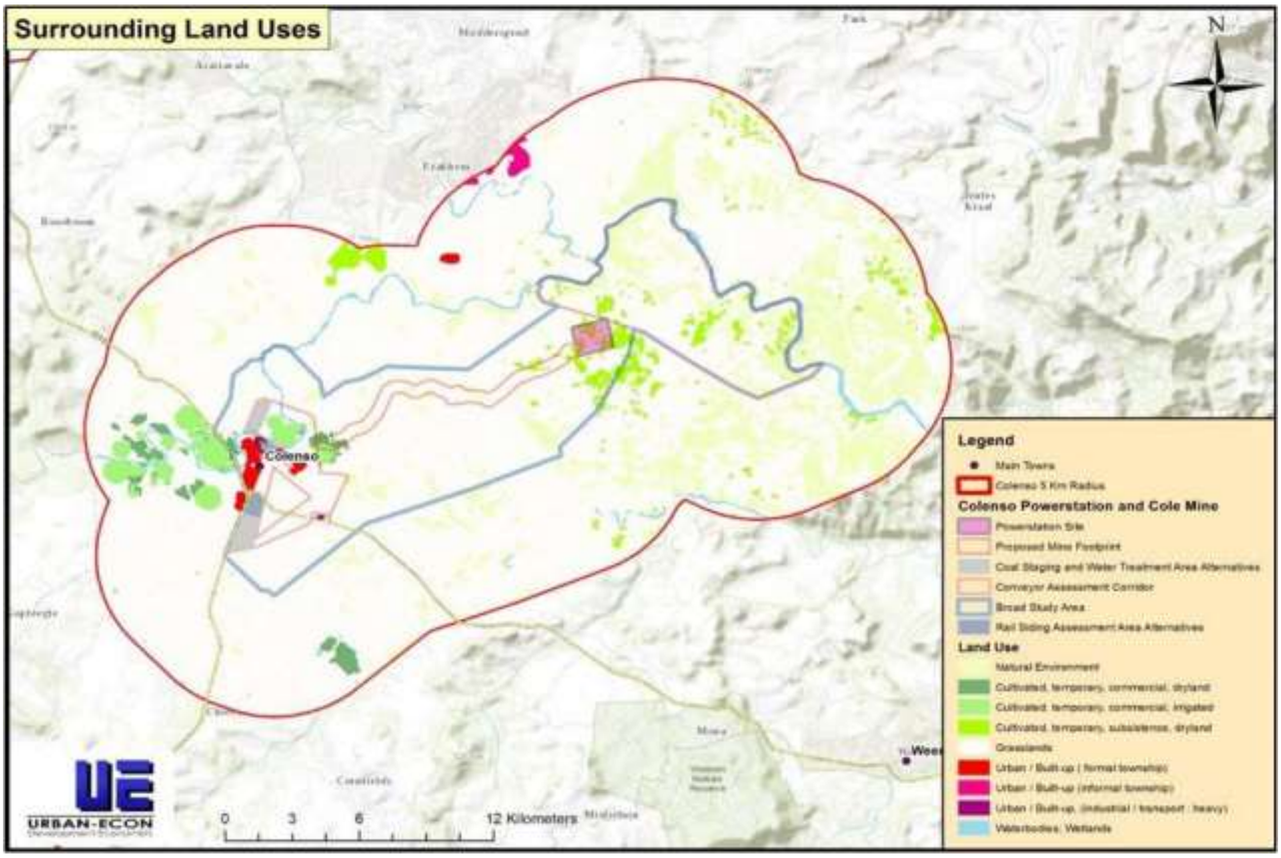
5.9 LAND USE

Figure 5-31 illustrates the primary land uses in the area. It should be noted that it includes only the surface land uses and does not illustrate the area of mineral resources. It also does not contain information on the protected areas or tourism facilities. Lastly, the data presented reflects 2007 data, which means that it may be outdated. Nonetheless, it provides valuable information on the surrounding land uses particularly as far as the proposed components of the project are concerned.

The larger part of the study area has a relatively low population density (less than 30 people per km^2), located within settlements and villages predominantly north of the Thukela River. The dominant land use in these rural areas is subsistence agriculture (dryland agriculture) and cattle farming, practised by the majority of isiZulu speaking local people. Higher population densities occur to the north-west (towards Ladysmith) where the formal urban settlement of Ezakheni is found. The other population concentration point in the region is the town of Colenso with roughly 650 people per km^2 (MetroGIS, 2015).

The uThukela District Municipality Spatial Development Framework June 2008 states that the key development issues that face uThukela include environmental degradation and the over-utilisation of natural and physical resources. This is due to the growth of dispersed settlements with limited infrastructural services. The result is that individuals depend on the environment for energy and water which places the environment at risk and result in human energy being utilised toward nonproductive ends.

Figure 5-31: Land-uses within the proposed project site (exclude protected areas and mineral resources)



Source: CSIR land data 2007)

The area west of Colenso is primarily characterised by commercial crop farming (irrigated maize farming) that extends westward along the Thukela River all the way to the foothills of the Drakensberg.

Figure 5-32: Irrigated agriculture west of Colenso

Source: MetroGis, Visual Assessment (2015)

The land located east of Colenso and south of the Thukela River is predominantly in a natural state with some farming activity (dryland agriculture) and farmsteads interspersed.

The steeper slopes and general inaccessibility of this area has led to the low occurrence of farming activity and human settlements.

Land parcels where the power plant is proposed to be located are used for subsistence farming.

There are a number of tourism facilities located in the area (refer to Figure 5-33):

- Emaweni Game Ranch and Hunting Lodge, operated by Thukela Wildlife CC, is located on land that is anticipated to be impacted by the coal mine. Furthermore, the lodge will be bordered by the power station, rendering hunting activities unsafe.
- Zingela Safaris and River Camp is another eco-tourism facility that is situated in the area about 23 km from Colenso. It is located on the bank of the Thukela River and is situated about 9.3 km east south-east from the proposed power station site. The closest point of the delineated mining footprint is about 1.6 km from the Zingela lodge.
- The Tugela Drift Nature Reserve is located outside the town of Colenso.
- The Stoney Ridge Offroad Academy is located about 13 km from Colenso south-east and accessed from the R74. It is situated about 7.3 km north of the R74, which means that it will be in some proximity to the project site. The tourism facility is situated about 7.3 km south of the proposed power station site. In relation to the mining site area, it is situated about 8.5 km to the southernmost point of that zoned area.
- The Weenen Nature Reserve found to the West of the town of Weenen is far away from the proposed project area thus no spatial conflicts are envisaged in this particular regard.

Figure 5-33: Location of commercial game reserves and nature reserves

Source: Urban-Econ Development Economists (2015)

5.10 Socio-Economic

Urban-Econ Development Economists (U-EDE) was appointed to conduct the Socio-economic impact study. Their report is attached as Appendix I. The socio-economic baseline description is taken from their report.

5.10.1 Spatial context

The project is located in the **UThukela District Municipality**. The UThukela DM is one of ten district municipalities in the KwaZulu-Natal province. It is located in the western boundary of the province and abuts on the Kingdom of Lesotho and the Free State province. The district is approximately 11 500km² in size. The UThukela DM has three district municipalities bordering onto it within the KwaZulu-Natal province, namely Amajuba, Umzinyathi and Umgungundlovu. It consists of five local municipalities and one District Management Area (DMA), namely, the Indaka LM, the Emnambithi/Ladysmith LM, the Umtshezi LM, the Okhahlamba LM, the Imbabazane LM, and the DMA 23.The district is predominately rural with three of the five local municipalities being rural-based.

Due to the project's components being located in the Emnambithi and Umtshezi LM, as well as the fact that the area is situated on the boundary with the Indaka LMs, all three municipalities were considered.

The Emnambithi/Ladysmith LM is located along the northern boundary of the Uthukela District and is bordered by the Free State Province to the west. It covers an area of approximately 3 020km². Ezakheni, Steadville and Colenso/Nkanyezi are the main urban areas within the municipality. The municipality is highly accessible at both regional and national levels since it is strategically located at the intersection of two major national development corridors and trade routes, i.e. the N11 and the N3. The N11 runs in a north-southerly direction linking KwaZulu-Natal with Mpumalanga Provinces, while the N3 runs in an east-westerly direction linking Durban and Johannesburg. A railway line linking KwaZulu-Natal with Gauteng and Mpumalanga also runs through the area. The LM has a number of natural attractions which include the Drakensberg Mountain, archaeological sites, nature reserves, UThukela Biosphere Reserve, Thukela Catchments and Thukela River, Natural Bush and Forests. U-EDE reports that from information gathered during interviews conducted, the LM's Local Economic Development (LED) Manager revealed that the municipality tried to expand the industrial sector by developing industrial estates. Apparently, four new companies were interested in opening at these parks; however, due the lack of water and electrical infrastructure in these parks, activities did not commence. The interviews also revealed that agriculture and specifically maize farming is a prominent sector within the local economy. Much of this production is claimed to be subsistence in nature while commercial farming is perceived as a significant employment creation sector.

The **Umtshezi LM** is located in the midlands area of KwaZulu-Natal, and is bordered by the Mooi Mpofana, Msinga, Indaka, Emnambithi and Okhahlamba, Imbabazane LMs. Estcourt is the only major town in the area, while Weenen is the other small town found within the municipality. The municipality is located along the foothills of the Drakensburg Mountain and has a rich heritage and sites of historical significance. It forms part of the Thukela River catchment through Bushman's River and Umtshezi River. The LM boasts of well-established industrial, commercial and residential areas as well as rich agricultural farmlands. The N3 runs through the municipal area and the LM also lies on the Johannesburg-Durban electrified main railway line. There are no proclaimed Traditional Authority Areas in the municipality; portions of the LM's land though are under land reform and these areas are largely associated with low potential agricultural land (Isibuko se-Africa, 2008)

The **Indaka LM** is a rural municipality with very low population densities, with about half of the land being under the control of the Ingonyama Trust (The Indaka LM, 2010). It shares borders with the Emnambithi, Endumeni, Msinga and Umtshezi LMs. The Indaka LM has a very small economic base with Ekuvukeni, former R293 Township, being the only town in the municipality. The LM is located within the south-western foothills of the Biggarsberg Mountains; the east-flowing Thukela River forms the southern boundary of the municipality. The Sundays River is another major land feature within the municipality. The municipality is not traversed by any national roads, but has a network of provincial and district roads due to its proximity to the N3 and N11. Agricultural potential within the Indaka municipality is limited due to the land being largely degraded as a result of high propensity for soil erosion, land mismanagement, and overgrazing (The Indaka LM, 2010). The municipality has two land reform projects that are currently being implemented, i.e. the Klipriver/Emnambithi State Land Disposal Project made up of 84 farms extending across the municipality and the Opmerkzaamheid Project involving 22 beneficiary households.

5.10.2 Nearest towns and settlements

As mentioned, the closest towns to the proposed project site are Colenso and the Ezakheni settlement located south of the Ladysmith town.

Colenso, including Nkanyezi Township, is located in the southern tip of the Emnambithi/Ladysmith LM, on the border with the Umtshezi municipality. The town was developed on the banks of the Thukela River and is accessed from the R103 that links Colenso to Ladysmith in the north and from the N3 in the south. The area forms part of the famous Battlefields Route and has a rich history and many historic remnants (Isibuku se Africa, 2012).

The town was developed by Eskom to support the Colenso coal-fired power station previously located in the area. Eskom provided all infrastructure including water, electricity and the road network to the town. When the refurbishment of the power station became too expensive, it was decommissioned in 1985. After this, the town lost its sole employment provider. Once this happened, supporting industries also began to fail. Information gathered from the interviews conducted with the relevant local authorities revealed that unemployment is the major challenge within the town. There is a considerable reliance on social grants and those that are employed are forced to travel more than 50km to their workplace. Furthermore, many of the buildings in the town are in dilapidated state and many buildings are decaying.

Ezakheni, a township north of the proposed project site, is one of the oldest settlement in the Emnambithi/Ladysmith municipality, situated about 25 kilometres from the Ladysmith CBD. It was established, in part, as a response to the industrial decentralisation program. The program led to the establishment of Ezakheni Industrial Township as a means to meet the housing requirements of people who were coming to work in and around the Ladysmith area. According to the Emnambithi/Ladysmith LM SDF, Ezakheni represents one of the footprints of the apartheid past that will take a while to eliminate (Isibuku se Africa, 2012).

5.10.3 Demographic profile and income levels

As mentioned, the study area encompasses three LMs within the Uthukela DM, i.e. Emnambithi/Ladysmith, Indaka and Umtshezi, which encompass 63.3% of the District's population. The Uthukela District has a **population** of 668 580 that form 147 280 households. Of the three LMs being studied within the Uthukela District, Emnambithi/Ladysmith LM is the biggest with a population of 237 438 and 58 055 households or 35.5% of the District's population. The Indaka LM has a population of 103 117, while the Umtshezi LM's population is significantly smaller at 83 154.

Less than a third of the District's population stay in urban areas with the majority (51%) residing in traditional/tribal areas. This situation looks somewhat different in the three LMs with just about 45% of its total population residing in formal towns or urban areas, i.e. slightly bigger than the situation in the district on average. It should be noted, however, that the Indaka LM's population resides predominantly on tribal land.

Most of the population of Uthukela DM speaks isiZulu as a first **language** (89.9%) as is the case in all three of the LMs being studied. In the Emnambithi/Ladysmith and Umtshezi LMs, the second most prominent language is English with 7.3% and 10.6% prevalence respectively, while Ndebele with 1.2% of the population speaking the language is the second home language choice in the Indaka LM.

As indicated in Table 5-19: Age and gender profile, all of the communities shown have a slightly higher **female** population than **male**, with a typical ratio of 55:45, respectively. Working aged individuals (15 – 64 y.o.) constituting the dominant age group.

Table 5-19: Age and gender profile

Age	Male	Female	Total	Male	Female	Total	Male	Female	Total
Age group	Emnambithi/Ladysmith LM			Indaka LM			Umtshezi LM		
65+	1.4%	3.1%	4.5%	1.4%	3.9%	5.4%	1.3%	2.9%	4.2%
35 - 64	10.8%	14.3%	25.1%	6.9%	12.0%	18.9%	10.6%	14.6%	25.3%
15 - 34	17.9%	19.2%	37.1%	14.6%	18.2%	32.7%	17.2%	19.0%	36.2%
5 - 14	10.6%	10.5%	21.1%	13.9%	13.3%	27.1%	11.0%	11.2%	22.1%
0 - 4	6.1%	6.1%	12.2%	8.1%	7.7%	15.8%	6.1%	6.1%	12.2%
TOTAL	**46.8%**	**53.2%**	**100.0%**	**44.9%**	**55.1%**	**100.0%**	**46.3%**	**53.7%**	**100.0%**
Age group	Colenso			Ezakheni			Ladysmith		
65+	1.3%	3.3%	4.6%	0.9%	2.7%	3.5%	1.7%	2.8%	4.5%
35 - 64	10.3%	14.8%	25.1%	9.4%	14.5%	23.9%	13.8%	16.5%	30.2%
15 - 34	17.1%	18.9%	36.0%	17.8%	20.5%	38.3%	18.9%	19.2%	38.1%
5 - 14	10.7%	11.2%	21.9%	10.8%	10.7%	21.5%	8.5%	8.8%	17.3%
0 - 4	6.3%	6.2%	12.5%	6.4%	6.4%	12.8%	4.8%	5.0%	9.8%
TOTAL	**45.7%**	**54.3%**	**100.0%**	**45.3%**	**54.7%**	**100.0%**	**47.7%**	**52.3%**	**100.0%**

Source: U-EDE (2015) from Quantec (2014)

With respect to the **closest towns** to the project site, i.e. Colenso, Ezakheni and Ladysmith, together they comprise 59.8% of Emnambithi/Ladysmith LM's population.

Towns located slightly further away such as Estcourt and Weenen make up just about 31% of the total population of the Umsthezi LM population. Estcourt, Weenen, Colenso, and Ladysmith are urban settlements while 22.7% of the population of Ezakheni reside on farms or traditional land. As is the case on District and LM levels, the dominant home language is isiZulu in all of the towns.

Of the local municipalities studied by U-EDE, **literacy levels** are poorest in the Indaka LM, where 22% of individuals 20 years and older have no formal schooling. This is worse than the 13.6% at the District level with no schooling.

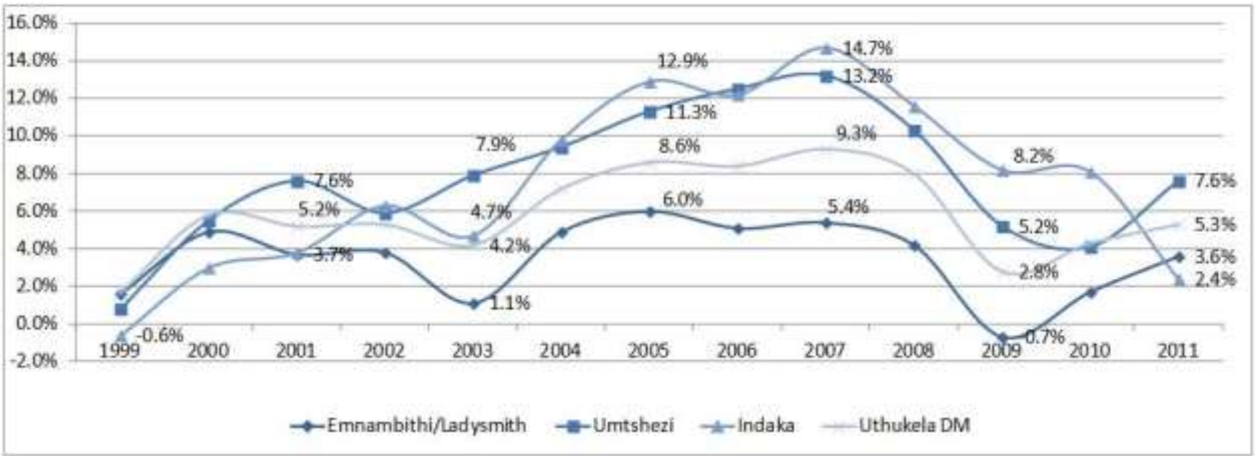
In Colenso only 8% of individuals older than 20 has no schooling with only 7.3% in Ezakheni and a much lower 4.4% with no formal schooling in Ladysmith. Overall approximately two thirds of the study community have reached secondary school level or have successfully completed Matric.

Of the local municipalities directly affected by the proposed project, the Indaka LM has the lowest **monthly income per household**, with 14.5% earning no income at all. The average household income of R2 738 per month is slightly more than half the average monthly income of the District (R4 806) and considerably less than the national average of R9 719 per month. The Emnambithi and Umtshezi LMs are somewhat closer to the national monthly average with household income levels of R6 073 and R6 262, respectively. Ladysmith's average monthly income per household is R9 998, while the biggest settlement in the study community – Ezakheni having an average monthly income of only R3 959. Colenso's average monthly income is R5 133. In Ladysmith 12.5% of households have no income while the majority earns between R 1 600 and R3 200 per month. The situation is worse in Ezakheni and Colenso where 16% and 17.8% of households have no income.

5.10.4 Economy and its dynamics

In 2011, the **economy** of the Uthukela District was valued at R20 735 million in current prices (Quantec, 2014). The Emnambithi/Ladysmith LM was contributing 40.6% to the District's economy with a local economy valued at R8 423 million in current prices. The Umtshezi LM's economy was valued at just over half of that at R4 404 million in current prices, while the Indaka LM had a significantly smaller economy valued at R958 million (i.e. 4.6% of the District's economy).

Figure 5-34: Dynamics of the local economies between 1999 and 2011



Source: U-EDE (2015) from Quantec (2014)

Over the years between 2006 and 2011, the economy of the Uthukela District grew at a compounded annual growth rate (CAGR) of 5.9%. The economy of the Emnambithi/ Ladysmith LM grew at a slower pace – 2.8%, while Umtshezi and Indaka grew at 8% and 8.9% respectively as is illustrated in Figure 5-34.

The economy of **Uthukela District** is predominantly a service economy with more than two thirds (67%) of its Gross Domestic Product per region (GDP-R) being generated by tertiary industries, such as trade (19%), government services (14.5%), business services (14%), and transportation & communication (13.2%).

The economic structure of **Emnambithi/Ladysmith** also largely comprises of the tertiary sector, which has shown a positive growth between 2006 and 2011; however, about a fifth of this economy's GDP-R is generated by the manufacturing sector, which experienced a decline between 2005 and 2011 and contributed to the lower than expected growth of that economy. The development of the local manufacturing industry goes back to the pre-1994, when government designated Ladysmith as a growth point in 1968 and later with the establishment of the Peters Industrial Estate in 1983 (Isibuku se Africa, 2012). The industrial activities at this stage are clustered in the Peters Industrial Estate, which is situated in Ezakheni township, Nambithi Industrial Area, and Danskraal (Isibuku se Africa, 2012). The majority of manufactures located in these areas form part of the textile, footwear and clothing industry, with food and beverages manufacturing being the other common industrial activity.

The **Umtshezi LM** is also largely a tertiary-based economy with only about a quarter of its GDP-R being generated by the primary and secondary industries. Most of the economic sectors in the LM have experienced above average economic growth rates with the trade, transportation, and business services growing at above 10% per annum between 2006 and 2011. Only the construction sector experienced a negative growth in the period analysed, but it was the second smallest sector in the area with a value of R46 million in current prices in 2011, which did not affect the overall performance of the municipality.

The situation is somewhat different in the **Indaka LM**, the fastest growing municipality in the study area (8.9% CAGR). Only half of the municipality's GDP-R is generated by tertiary industries in comparison with over 70% contribution made by this sector in other municipalities. Importantly, about 41% is generated by secondary industries. In fact, the utilities industry is the single biggest contributor to the area's economy – 25.5%. This is due to the presence of the two water treatment works, i.e. Tugela Estate and Olifantskop. Other sectors that make the largest contribution to the local economy include transport and communication, trade, general government services, and manufacturing. The manufacturing sector in the municipality was developed through the support offered to the sector in the past with the textiles, clothing, footwear and the leather industry being established at the time. However, limited investment in the industry has been made in the past few years.

From the land use perspective, due to the natural features found in the area that have touristic value (Ukhahlamba-Drakensburg Park, UThukela Biosphere Reserve, Thukela Catchments and Thukela River, Natural Bush, Forests, etc.) the tourism industry plays an important role in the development of these economies and decreasing the dependence on the local purchasing power. In addition to the local historical, cultural and natural resources that are used to attract tourists, game ranching activities in the area is growing creating additional touristic attraction. Furthermore, the municipalities have pockets of intensive agricultural activities that do not only contribute to the local economic development and job creation, but also provide much needed income derived from export of produce. Beef ranching is among the most common agricultural activities found in the areas analysed with occasional sheep and dairy farming being found in parts of the selected municipalities; however there is an apparent trend towards the conversion of cattle farms into game farms in the area. Crop production in the area is also notable, particularly in areas that have irrigation systems. These include growing of such produce as beetroot, carrots, maize, potatoes, cabbage, dry beans, etc.

5.10.5 Labour force and employment structure

In 2011, the Uthukela DM had 391 821 people within the working age population, 90 790 of these individuals were **employed** while 58 588 were **unemployed** in 2011. The labour force participation rate in the District was therefore 38% or 149 378 individuals, with an unemployment rate of 39.2%, which was considerably higher than the national unemployment rate of 29.7% for the same year. About 11% of the District's working age population were discouraged work seekers.

Of the local municipalities studied by U-EDE, the unemployment rate was worse in the Indaka LM (57.5%), which correlates with the lowest household income level observed in this LM compared to other analysed economies, which was referred to earlier. The Emnambithi/Ladysmith and Umtshezi LMs had slightly lower unemployment levels than the District but still higher than the national figure at 34% and 36% respectively. In the Indaka LM the labour force participation rate was only 19.5%, indicative of the fact that more than 80% of the municipality's 53 271 working aged individuals were either not economically active or discouraged job seekers (7 660).

The situation looked worse in Colenso where the working aged population comprised of 3 915 individuals. The town had a labour force of 2 045 people with 337 discouraged work seekers. Of the 2 045 strong labour force only 1 180 had employment – an unemployment rate of 42.3%. The unemployment rate in Ezakheni was on par with the District and LM figures at 39.3%, while the unemployment rate in Ladysmith was significantly lower at 24.3%. Of the other towns surrounding the project site the situation was worst in the tribal Engonyameni with an unemployment rate of 53%.

In all of the study areas save Etatane - a farming community with 50.7% of the employed working in private households - about three quarters of the employed were working in the formal sector. In the LMs being studied the number of employed working in the informal sector or for private households were just about equal with between 21% - 22% of the region's employed relying on these opportunities for a livelihood. Of the towns that are likely to be most affected by the project, the formal sector creates the most jobs in Ezakheni and Colenso with 81.9% and 79.3% of the employed respectively being formally employed.

In the Uthukela District, 24.6% of formal and informal job opportunities were provided by the wholesale, trade and accommodation sector. Other sectors making a prominent contribution in the District were the personal and government services sectors with 15.6% and 15.9% respectively. In keeping with the above, the dominant employment creator was the wholesale, trade and accommodation sector in all three of the LMs being studied. This sector made the biggest contribution in the Umtshezi LM with employment provision of 28% of jobs. Employment creation was, however, most diversified in the Indaka LM, where other noticeable employment creators were the manufacturing sector (11.7%) and transport sector (11.5%). The manufacturing sector's contribution to the local economies was the greatest in the Emnambithi/Ladysmith LM with 14.6% of job opportunities being created by this sector.

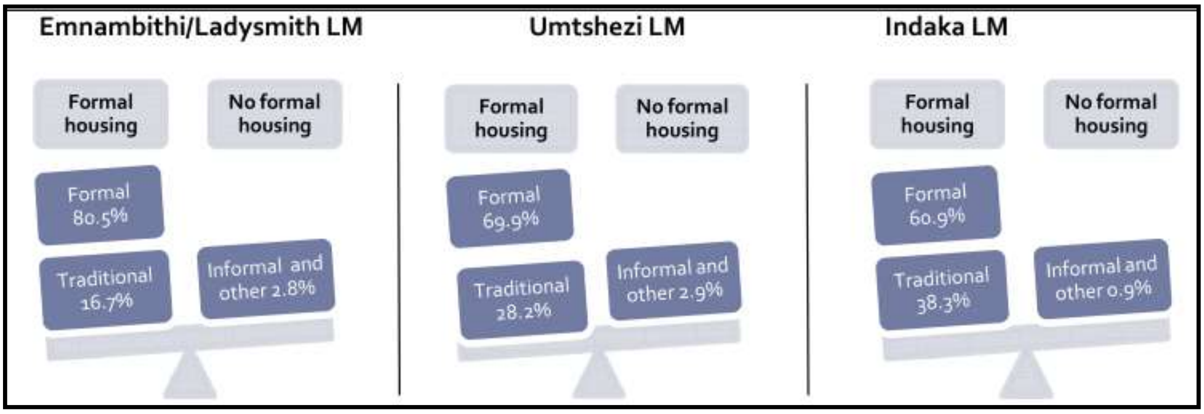
5.10.6 Access to services and state of local built environment

Access to shelter, water, electricity, sanitation, and other services are indicators that assist to determine the standard of living of the people in the area under investigation. Infrastructure and the state of local infrastructure is another indicator to contemplate when considering living standards. The availability of social and economic infrastructure including roads, educational facilities, and health facilities further indicates the nature of the study area, which is valuable in developing a complete profile of the circumstances in which communities are living. These measurements create a baseline against, which the potential impacts of the proposed project can be assessed.

5.10.6.1 Access to housing

In 2011 65.9% of households in the Uthukela District were living in some form of formal dwelling with 32.2% of individuals living in traditional structures such as a hut. Informal dwellings, comprising of shacks or caravans / tents and other provided for 1.9% of dwellings in the District, this is to say that in 2011, 2 075 of households in the Uthukela District were living in shacks, tents or caravans. In Emnambithi/Ladysmith LM 80% of households was living in a formal dwelling, predominantly a house or brick structure in a separate yard. The number of households in the LM living in traditional dwellings was significantly lower than the figure at District level (16.7%); however, more families were living in some sort of informal dwelling – 2.9%.

Figure 5-35: Access to housing



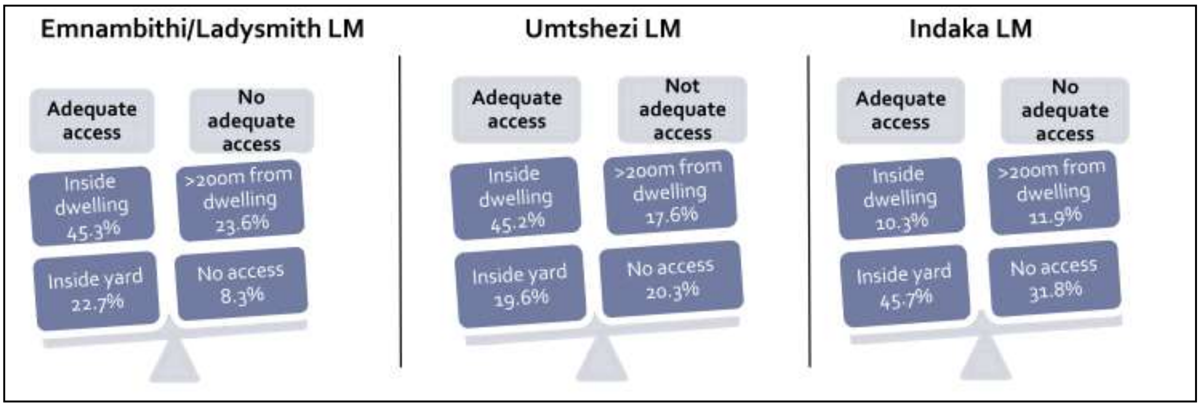
Source: U-EDE (2015) from Stats SA (2014)

When looking at the towns being studied within the Emnambithi/Ladysmith LM the situation looked worst in Ladysmith with 4.3% of households living in informal dwellings, this figure stood at 0.4% and 1.6% for Colenso and Ezakheni respectively. The other two LMs comprising the prime study area had figures that were more or less in line with that of the District, controlling for the fact that half of the Indaka LM is under the tribal authority.

5.10.6.2 Access to water

Just over half of households in the Uthukela District had access to piped water in their dwelling or inside their yard. More than one out of every five households had no access to piped water in the District (29 743 households). In the Emnambithi/Ladysmith LM, the situation looked marginally better with 68% of households having access to piped water in their home or inside their yard, while 8.3% of families had no access to water. In the Indaka LM, almost a third of households had no access to water with most of the families with access getting their water from within their yard. In the Umtshezi LM, the percentage of households with no access was relatively on par with the District average, with 20.3% of families having no access. Of the towns most likely to benefit from the project, Ladysmith had the highest number of households with no access to piped water, 2%, which is in keeping with the fact that 4.3% of families in Ladysmith reside in informal dwellings.

Figure 5-36: Access to water

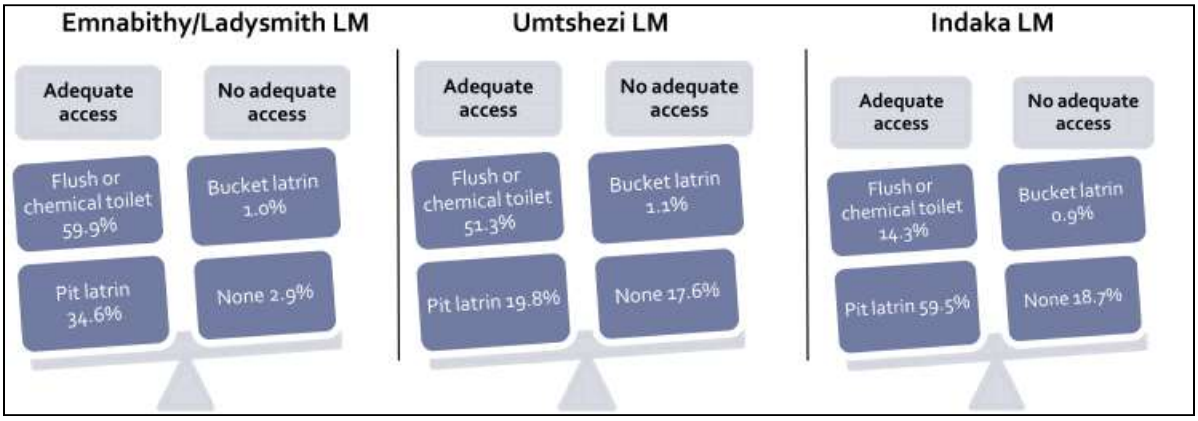


Source: U-EDE (2015) from Stats SA (2014)

5.10.6.3 Access to sanitation

In the Uthukela District 8.3% of families had no access to toilet facilities with 1% still using the bucket system. A third of households in the District had access to a flush toilet connected to either a sewerage system or a septic tank. The next most prominent toilet system in the District was a Pit Latrine without ventilation (VIP system). In the Emnambithi/Ladysmith LM, the situation looked slightly better with 57.7% of households having access to flush toilets, and 2.9% or 1 667 families with no toilet facilities. In the Indaka LM, 18.7% of households had no access to toilet facilities with the majority of households in the municipality having access to VIP systems. In the Umtshezi LM, the situation was similar with 17.6% of households with no access but the majority of families with access were using flush toilets (51%). At town level the situation was worst in Weenen, the Umtshezi LM, where 36% of households had no access to toilet facilities. Of the towns closest to the project the situation was poorest in Colenso where 3% of households had no access and 2.6% of households were still using the bucket system.

Figure 5-37: Access to sanitation



Source: U-EDE (2015) from Stats SA (2014)

5.10.6.4Access to electricity

This measurement of quality of basic services is examined through a proxy indicator "energy for lighting".

In Uthukela DM, access to electricity according to this proxy was not universal with just about three quarters (74.6%) of households using electricity for lighting. The rest of the households in the District primarily made use of candles (23.3%). The situation in Umtshezi LM was similar to that of the District, while 82% of households in Emnambithi/Ladysmith LM had access to electricity with a slightly lower 16% having to rely on candles. In Indaka, the situation was worse with 38.7% of households having to rely on candles for lighting, only slightly more than half (58%) of the households in the municipality had access to electricity. The situation in Colenso was just about on par with the municipality with 79% of households having access to electricity. In Ezakheni and Ladysmith access was better though still not universal with 91% and 92% of households with access respectively.

5.10.7 Social and recreational infrastructure

The Indaka LM faces a severe shortage of social and recreational infrastructure. There are only three health facilities, one library and one police station in the whole of the Indaka LM. U-EDE further reported that there are no institutions of higher learning within the municipality with school-leavers having to go to other municipalities or districts in order to further their education.

In Umtshezi LM the social and recreational infrastructure is mostly located in urban settlements making such facilities unreachable for the rural communities. There is one hospital in the municipality and the distribution of nursery, primary and secondary schools is still a major concern with some learners having to travel long distances in order to access education services. The shortage of teachers in some other schools is another major concern for the Umtshezi LM.

Looking at the facilities available in the town of Colenso, one can also see that the distribution of social and recreational infrastructure in some parts of the Emnambithi/ Ladysmith LM is also a challenge. Information gathered by U-EDE from interviews conducted with the responsible local authorities for the town of Colenso showed that the town has one clinic, two primary schools and one combined primary and secondary school. When faced with serious health issues, the residents of Colenso travel to Ladysmith. The town also has a single library, a sports field and a swimming pool which is currently being upgraded.

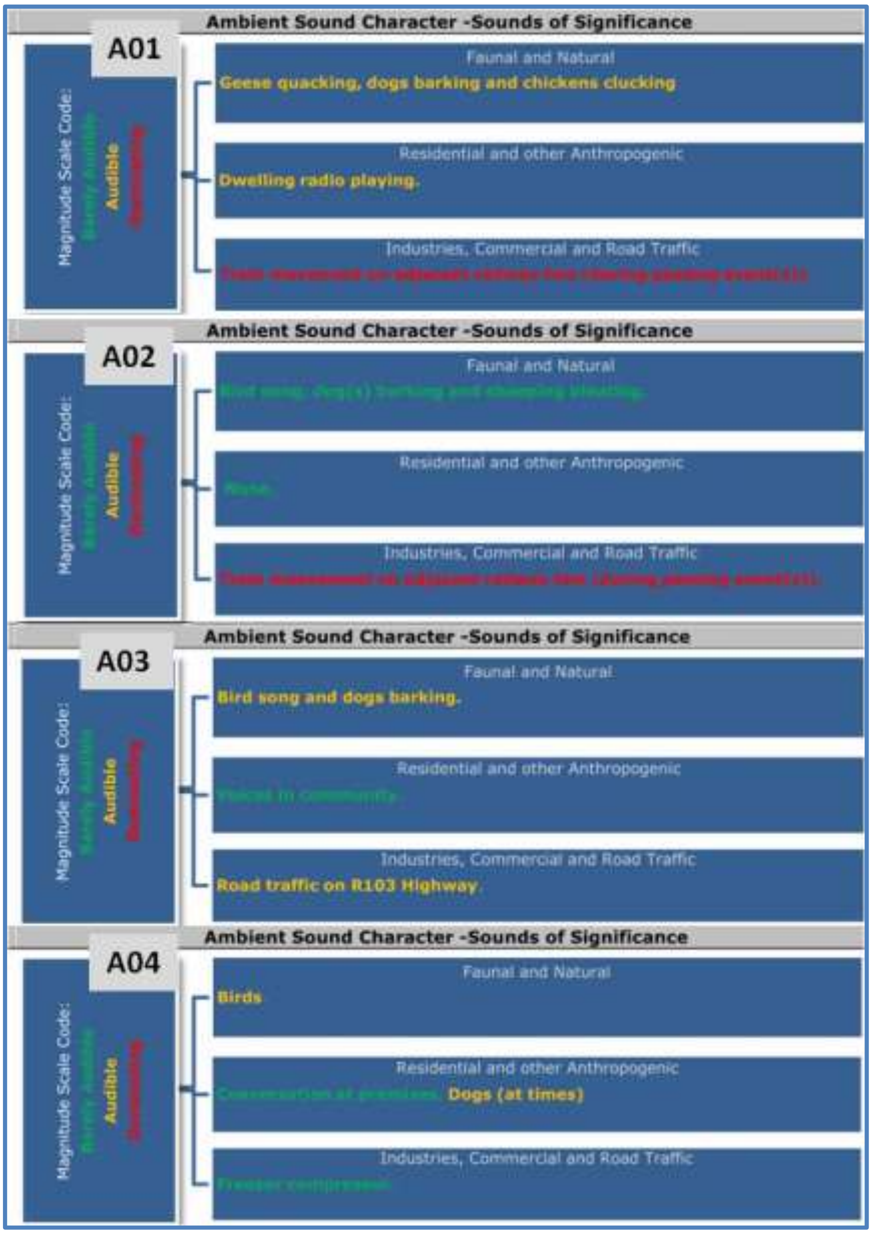
5.11 NOISE

Enviro-Acoustic Research (EAR) was appointed to conduct the Noise impact study. Their report is attached as Appendix J. The description of the existing soundscape is taken from their report.

Refer to Figure 5-38 for an indication of the sounds heard at the measurement points by the acoustical consultant during the site visit.

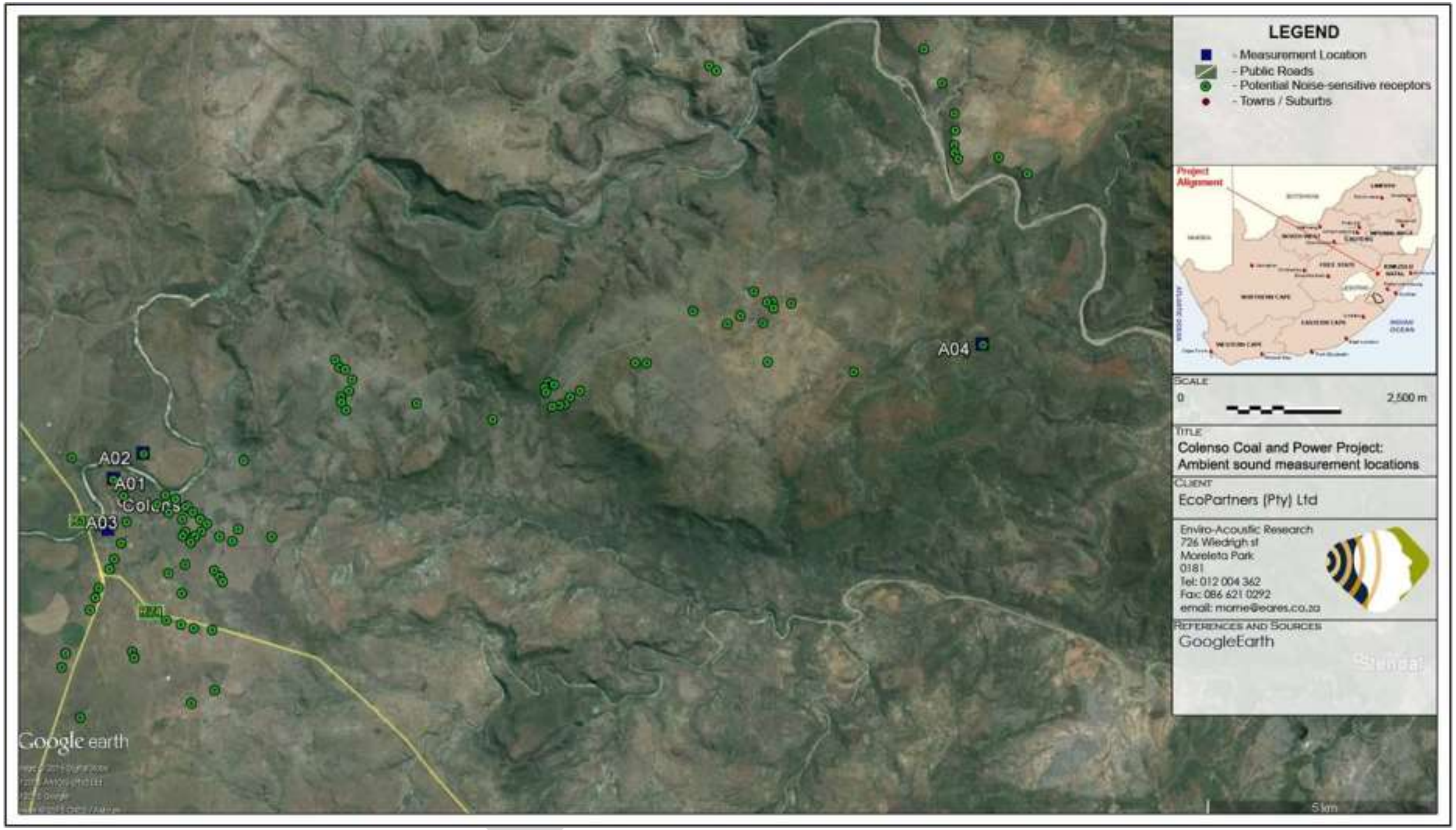
Measurements were taken at four locations, locations were numbered from A01 – A04 **.** These measurements were conducted over a period of at least 2 night-time periods. Measured localities are illustrated in Figure 5-39 as blue squares**.**

Figure 5-38: Noises/sounds heard during site visits



Source: Enviro-Acoustic Research (2015)

Figure 5-39: Localities of ambient sound measurement



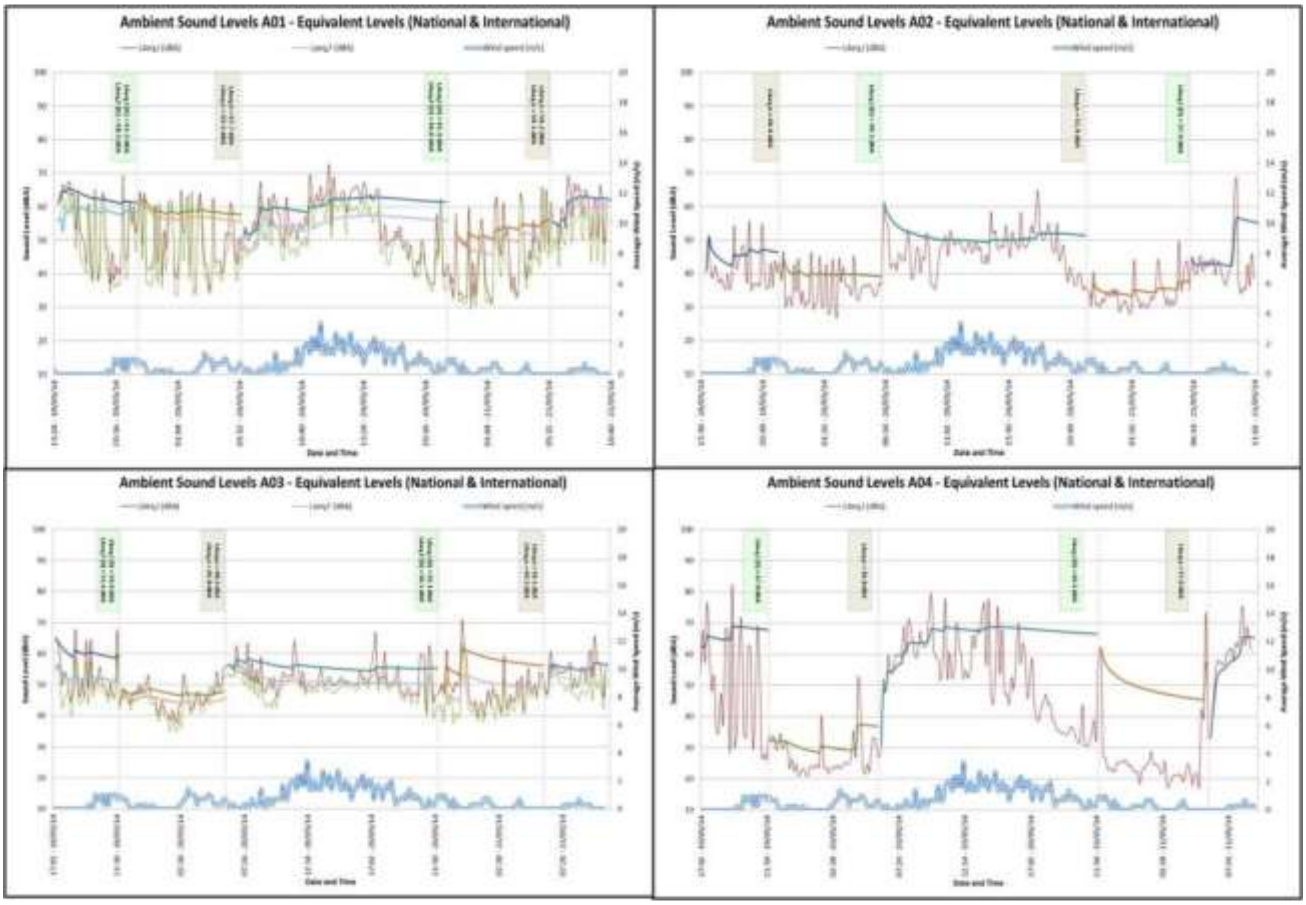
Source: Enviro-Acoustic Research (2015)

5.11.1 Impulse equivalent sound levels (South African legislation)

Impulse noise is a category of (acoustic) noise which includes unwanted, almost instantaneous (thus impulse-like) sharp sounds (like clicks and pops). Figure 5-40 illustrates the impulse 10 minute equivalent (average) sound levels for the day and night-time periods at the four measuring points.

At A01 the daytime $L_{Aeq,I}$ values ranged between 36.7 to 72.4 dBA and the night-time $L_{Aeq,I}$ values between 31.8 to 66.0 dBA. The average value of the 160 10-minute equivalent daytime sound level measurements for A01 were calculated at 55.7 dBA, while the average for the 96 night-time measurements were calculated at 47.8 dBA.

Figure 5-40: Ambient Sound Levels



Source: Enviro-Acoustic Research (2015)

At A02 the daytime $L_{Aeq,I}$ values ranged between 34.0 to 68.3 dBA and the night-time $L_{Aeq,I}$ values ranged between 27.1 to 49.7 dBA. The average value of the 161 10-minute equivalent daytime sound level measurements at A02 were calculated at 45.0 dBA, while the average for the 96 night-time measurements were calculated at 34.9 dBA.

At A03 the daytime $L_{Aeq,I}$ values ranged between 41.1 to 67.8 dBA and the night-time $L_{Aeq,I}$ values ranged between 37.9 to 70.8 dBA. The average value of the 154 10-minute equivalent daytime sound level measurements at this measuring point were calculated at 52.9 dBA, while the average for the 96 night-time measurements were calculated at 47.2 dBA.

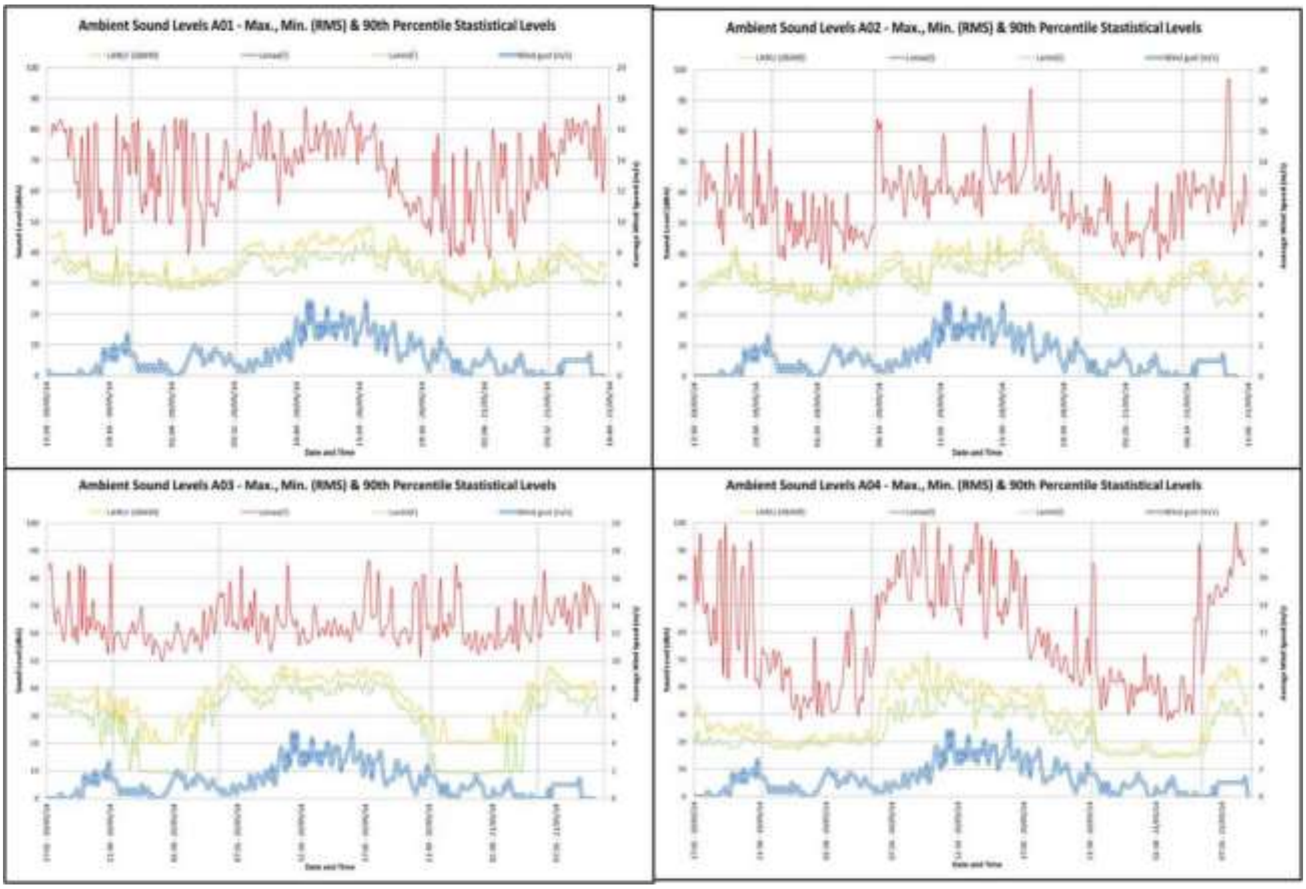
At A04 the daytime $L_{Aeq,I}$ values ranged between 26.3 to 82.3 dBA and the night-time $L_{Aeq,I}$ values ranged between 17.4 to 73.5 dBA. The average value of the 164 10-minute equivalent daytime sound level measurements at A04 were calculated at 53.4 dBA, while the average for the 96 night-time measurements were calculated at 26.8 dBA.

5.11.2 Statistical sound, Maximum noise levels, Minimum noise levels

The L_{A90} level is used to define the “background ambient sound level”, or the sound level that can be expected if there were little single events (loud transient noises) internationally.

Statistical sound levels ($L_{A90,F}$), together with Maximum noise levels ($L_{Amax,F}$) Root Mean Square (RMS) and Minimum noise levels ($L_{Amin,F}$) RMS for the four measuring stations are presented in Figure 5-41.

Figure 5-41: Maximum, minimum and statistical values



Source: Enviro-Acoustic Research (2015)

At A01 The daytime L_{A90} levels were influenced by maximum noise events, amount and magnitude. Besides maximum noise events, the subjacent L_{A90} levels indicate that there were very few times during the day and night-times when the background ambient soundscape became very silent. Generally the ambient soundscape had consistent continuous sounds in the area, pierced on occasion by higher magnitude noise events ($L_{Amax.F}$). The L_{A90} statistical value remained above the 26.0 dBA90 during all measured periods, frequently breaking above the 40 dBA90 level during the day. L_{A90} data also increased at roughly 06:30 – 07:00 on both mornings, and would most likely be attributed to the surrounding area awakening during the dawn period preparing for their daily routine (e.g. bird dawn chorus, increased traffic flow on local and regional roads etc.). During the night the quietest period was measured at roughly between 00:30 and 01:00 on the second night, when a peaceful period is likely sought in the area (sleeping etc.).

L_{Amax} levels exceeded 55 dBA on many occasions during the night-times (during the 10 minute measurements) where noise events may become an annoyance.[6] Most noise events recorded were due to noise sources such as train pass-by etc. The measurements for A01 illustrate an area that rarely becomes quiet with both the $L_{Amin,I}$ and L_{A90} values remaining for the most part above the 30 dBA plain.

The L_{A90} levels at A02 were influenced by maximum noise events, amount and magnitude during the daytime, less so during the night. Besides maximum noise events, the subjacent L_{A90} levels indicate that during the night the background levels can become relatively silent only to be pierced on occasion by higher magnitude noise events ($L_{Amax.F}$). The L_{A90} statistical value could dip as low as low 20.0 dBA90 during the night, during the day breaking above the 40 dBA90 plain. L_{A90} data also increased at roughly 06:30 – 07:00 on both mornings, and would most likely be attributed to the surrounding area awakening during the dawn period preparing for their daily routine (e.g. bird dawn chorus, increased traffic flow on local and regional roads etc.). During the night the quietest period was measured roughly between just after 23:00 up till the next morning at approximately 04:00.

The quietest sounds were measured during the day at 22.9 dBA (averaged 33.0 dBA), while night-time quietest was measured at 20.9 dBA (

At A03 the daytime L_{A90} levels were influenced by maximum noise events, amount and magnitude. During the night L_{A90} was very rarely influenced by noise events. Besides maximum noise events, the subjacent L_{A90} levels indicate that during the day the soundscape was busy that became very silent during the night. The daytime L_{A90} statistical value remained above the 44.0 dBA90, hovering around the 20 dB90 during the night. L_{A90} data also increased at roughly 04:30 – 05:30 during the mornings, and would most likely be attributed to the surrounding area awakening during the dawn period preparing for their daily routine (e.g. bird dawn chorus, increased traffic flow on R103 Road etc.). During the night the quietest period was measured roughly between 00:00 and 03:00, when a peaceful period is likely sought in the area (sleeping etc.).

At A02 the quietest sounds were measured during the day at 10.4 dBA (averaged 36.2 dBA), while night-time quietest was less than 20 dBA (average also less than 20 dBA).

As with A01 the L_{Amax} levels for A02 and A03 exceeded 55 dBA on a few occasions during the night-times (during the 10 minute measurements) where noise events may become an annoyance.

At A04 the daytime L_{A90} levels were slightly influenced by maximum noise events, amount and magnitude, with no effect during the night-times. The subjacent L_{A90} levels indicate that during the night-times the background ambient soundscape at this measuring point became very silent. Generally the ambient soundscape had consistent noisy events during the day (from the dwelling), with very silent soundscape during the night. The L_{A90} statistical value remained above the 33.0 dBA90, during the day and would subside to the low 20.0 DB90 during the night. L_{A90} data also increased approximately after 06:00 on the morning, and

[6] World Health Organization, 2009, '*Night Noise Guidelines for Europe.*

would most likely be attributed to the surrounding area dwelling awakening during the dawn period preparing for their daily routine. During the night the quietest period was measured between 22:00 and 06:00, when a peaceful period is likely sought in the area (sleeping etc.).

At A04 L_{Amax} levels exceeded 55 dBA only on very few occasions during the night-times (during the 10 minute measurements) where noise events may become an annoyance. Maximum sound events during the day were all the result of activities from the game lodge and not environmental contributors (e.g. roads, railway line etc.). Measurements at this measuring point illustrates an area that becomes very quiet with both the $L_{Amin,I}$ and L_{A90} values subsiding to the low 20 dBA.

5.11.3 Third octave spectral analysis

When more detailed information about a complex sound is needed, the frequency range of 20Hz to 20kHz can be split into sections or bands. These bands usually have a bandwidth of one octave or one third octave. An octave band is a frequency band where the highest frequency is twice the lowest frequency. For example, an octave filter with a centre frequency of 1kHz has a lower frequency of 707Hz and an upper frequency of 1.414kHz. Any frequencies below and above these limits are rejected. A third octave has a width of 1/3 of that of an octave band. By using octave band filters, the noise from the environment can be split up into its components (Tingay, 2011).

Third octave analysis was done for measuring points A01, A03 and A04. The results obtained at A03 and A04 are discussed in the following paragraphs and presented in Figure 5-42 to Figure 5-45

5.11.3.1 Lower frequencies (20 – 250 Hz)

The daytime and night-time 10 min. measurement for A03 illustrates a mishmash of peaks and troughs throughout this entire lower range, with a clear dominant 63 HZ third octave frequency resonance. This frequencies were also the most consistent peaks during the day and night periods at this measuring point.

A consistent and dominant 80 and 160 HZ third octave frequency resonance occurred in most measured data at the A04 measuring point.

5.11.3.2 Third octave surrounding 1,000 Hz

The frequency band surrounding this band had moderate to high energy in measured data, specifically at the 800 Hz range at the A03 measuring point.

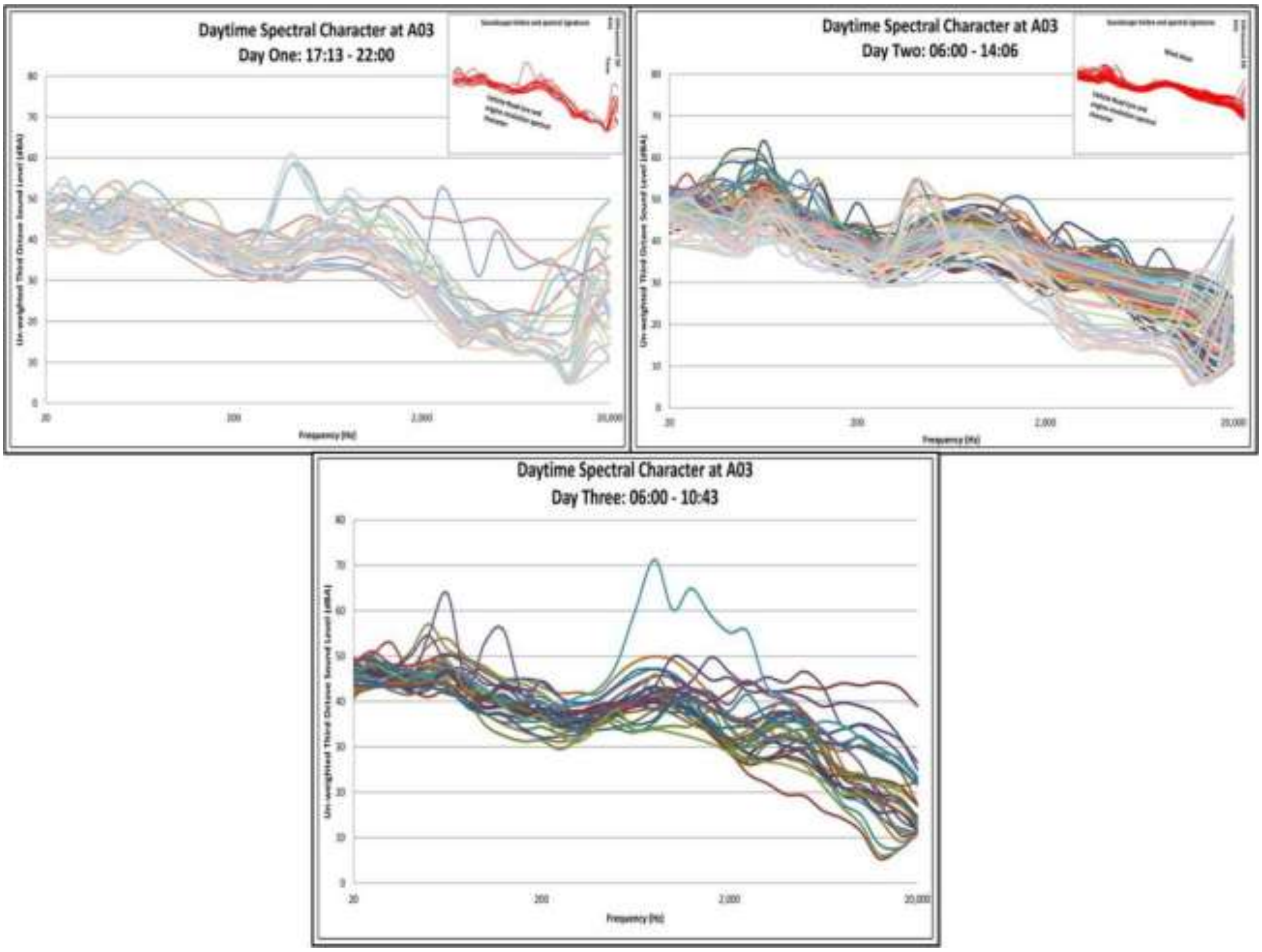
At A04 the daytime 10 min. measurement illustrates a mishmash of peaks and troughs throughout this entire mid-range, with no clear dominant third octave frequency peaks. This is likely from voices in the area.

5.11.3.3 Higher frequencies (2,000 Hz upwards until ultrasound range)

There were some predominant peaks in the 5, 000, 16,000 and 20,000 Hz range at A03. At times a tone was associated with the higher frequencies (refer to red inserts in Figure 5-42 Figure 5-43)

At A04 there was surprisingly very little energy in this range, with the odd peak measured during the day.

Figure 5-42: Daytime spectral frequency distribution at A03

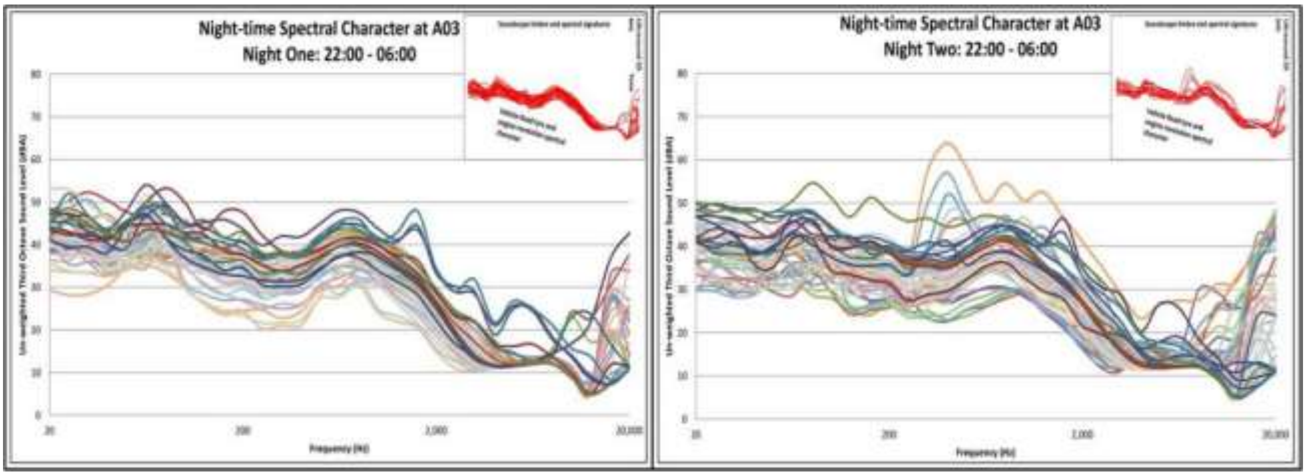


Source: Enviro-Acoustic Research (2015)

5.11.3.4Summary of Spectral Analysis results

The red inserts in the Figures illustrates a basic interpretation of data by removing certain measured data with potentially unwanted spectral signatures (e.g. a time when grass is cut at a homeowner’s property, extraneous noises sources etc.). It is for representation purpose only, and is used to represent a likely spectral character of the area (natural, suburban, industrial etc.), identify concerns or potential acoustical traits.

Figure 5-43: Night-time spectral frequency distribution at A03



Source: Enviro-Acoustic Research (2015)

<u>A03 :</u>

Refer Figure 5-42 and Figure 5-43. Measured higher frequency peaks are likely song/faunal communication (e.g. dawn chorus). Energy in the higher frequencies was more dominating during the morning and evening hours. “Natural” contributors could include your native suburban bird species calls such as Weaver Finches, doves etc. as well as other faunal communication such as cicada, frogs, crickets etc. (measurements conducted during autumn-winter). The higher frequency at 16,000 to 20,000 Hz could almost be comparable to a high pitch squeal and is relatively close to the ultrasound range. The contributors to these high frequencies were most likely due to faunal echolocation such as that can be found from bats etc. The smoother linear regression data on day two is likely due a short windy period.

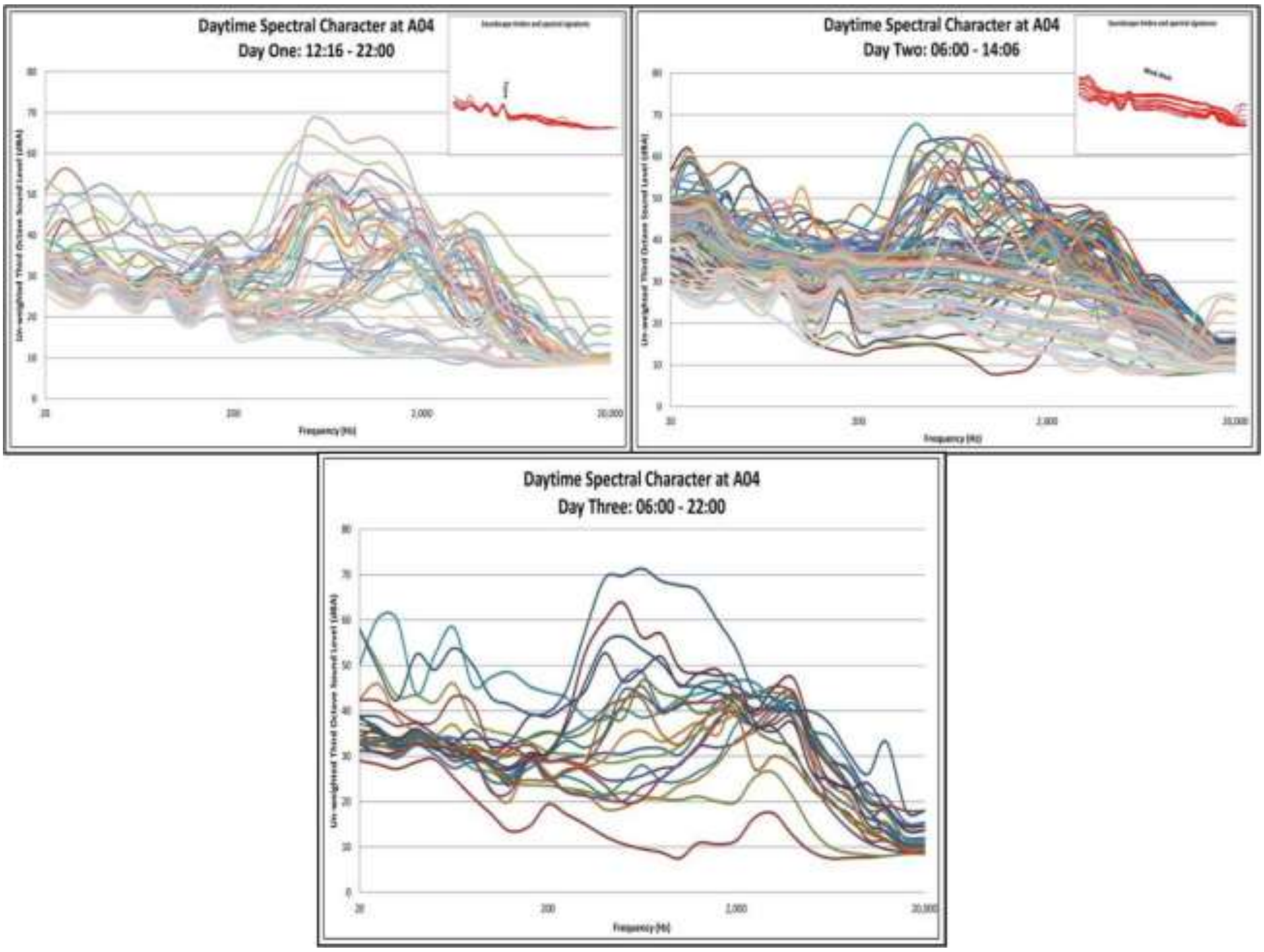
The spectral contributors to the mid and low frequencies are a cumulative contribution from various noises (such as from R103 vehicle, contribution from railway line operations, far-off voices, typical urban sounds, etc.). Excluding high frequencies, there are no specific frequencies that stand out.

The area surrounding the 1,000 Hz range did have a significant acoustic energy with a predominant peak at 800 Hz. This is likely due to the medium-high speed at which local road traffic were travelling on the Regional Roads.

At times that the trains pass along the railway line, a host of noise sources may be active depending on the surrounding environment in relation to the train.

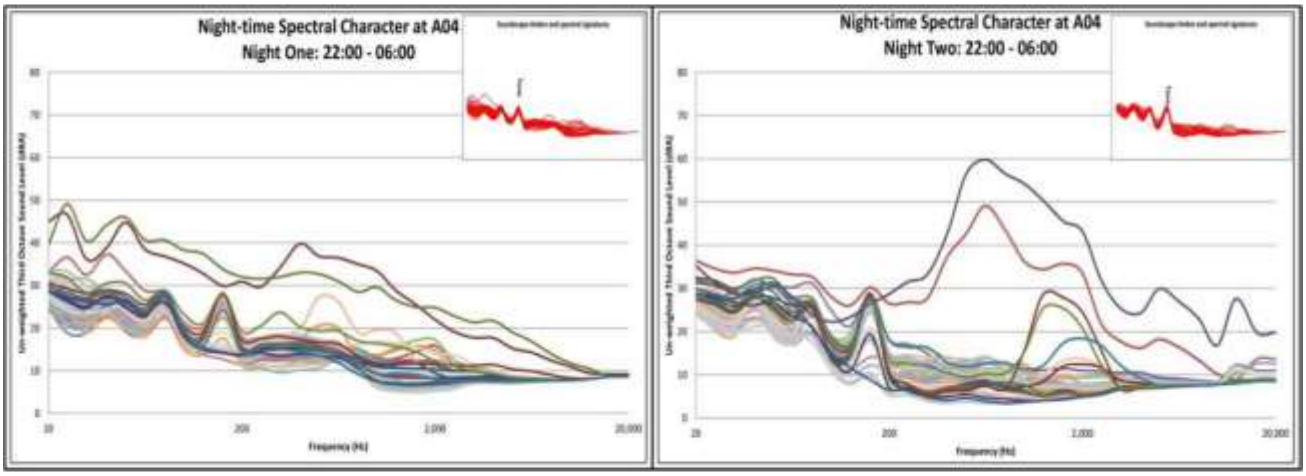
The smoother linear regression data on day two (refer to red inserts in Figure 5-42) is from the increased wind speeds as measured briefly during day 2.

Figure 5-44: Daytime spectral frequency distribution at A04



Source: Enviro-Acoustic Research (2015)

Figure 5-45: Night-time spectral frequency distribution at A04



Source: Enviro-Acoustic Research (2015)

A04

Refer to Figure 5-44 and Figure 5-45 to the inserts in the mentioned figures (in red) illustrating a basic interpretation of data by removing certain measured data with potentially unwanted spectral signatures (e.g. a time when grass is cut at a homeowner's property, extraneous noises sources etc.). The criterion used to illustrate these spectral profiles was the frequency of occurrences and repetitiveness of certain frequencies. It is for representation purpose only, and is used to represent a likely spectral character of the area (natural, suburban, industrial etc.), identify concerns or potential acoustical traits.

The spectral contributors to the mid frequencies are extraneous data collect from the lodge, such as conversation or when someone approached the microphone (e.g. people walking past microphone).

The consistent noise contributor to the 80 and 160 HZ peaks measured during the day/night period was likely from the lodge's fridge/freezer compressor unit. Other mechanical buzz or hum may have been monitored (e.g. air conditioner unit etc.). The smoother linear regression data on day two (refer to red inserts in Figure 5-44**)** is from the increased wind speeds as measured briefly during day 2.

5.11.4 SANS 10103:2008 Rating Level

Refer to Table 5-20: Summary of Noise district Rating Levels comparing each measured $L_{Req,T}$ based on $L_{Aeq,I}$ measurements.

A01: Considering the $L_{Aeq,I}$ measured daytime data, ambient sound indicated many sound levels slightly higher than a urban district, yet lower than a central business district. Night-time data reflected a slightly higher than a busy central business district, yet lower than an industrial district. Many 10 minute night-time $L_{Aeq.F}$ levels measured did not conformed to the recommendation of 55 and 45 dBA respectively set out by the World Health Organization, World Bank and International Finance Corporation for a residential area.

A02: Considering the $L_{Aeq,I}$ measured daytime data ambient sound indicated many sound levels slightly higher than a rural district, yet lower than an urban district. Night-time data reflected a slightly higher than a rural, yet lower than a suburban district. Most 10 minute day and night-time $L_{Aeq.F}$ levels measured conformed to the recommendation of 55 and 45 dBA respectively set out by the World Health Organization, World Bank and International Finance Corporation for a residential area.

A03: The $L_{Aeq,I}$ daytime data indicate many sound levels slightly higher than a suburban area, yet lower than a urban district. Night-time data reflected a slightly higher busy urban district, yet lower than a central business district. Many 10 minute $L_{Aeq.F}$ levels measured during the day and night conformed to the recommendation of 55 and 45 dBA respectively set out by the World Health Organization, World Bank and International Finance Corporation for a residential area.

A04: Considering the $L_{Aeq,I}$ measured daytime data ambient sound indicated many sound levels slightly higher busy urban district, yet lower than a central business district. Night-time data reflected a slightly higher rural area, yet lower than a central business district.

Table 5-20: Summary of Noise district Rating Levels

Point name	Noise district rating based on $L_{Aeq,I}$ measurement data (Day / Night)	Noise district rating based on all data and character of area	Existing ambient sound levels conforming to international recommended levels? (day / night)
A01	urban – central business district/central business district - industrial	Industrial	Yes at times/no
A02	rural – urban district/rural – suburban district	Suburban-urban	N/a
A03	suburban – urban district/urban – central business district	Suburban-urban	Yes at times
A04	urban – central business district/rural – central business district	Rural	N/a

Source: Enviro-Acoustic Research (2015)

A summary of the SANS 10103:2008 Rating Levels for noise in districts is provided in Table 5-20 above.

Houses near the R103 Road, railway route or town of Colenso measured data (in accordance with South African legislation) indicated many sound levels slightly higher than a typical suburban area, yet lower than a business urban district. This is evident at monitoring localities A01 to A03. Although the town of Colenso is not a makro community, the R103 and railway line plays significant contributors as an environmental noise sources.

Singular dwellings further from environmental noise contributors indicated many sound levels slightly higher than a typical rural area, yet lower than a business urban district. This is evident at monitoring locality A04. Although it is always likely that a degree of over-engineering or precautionary principals are adhered to in environmental assessments, this case would see the opposite with an overestimation of the daytime Rating Level as monitored in this rural location. This is due to the fact that during the day extraneous noises from the lodge where monitoring equipment was implemented played a factor to the high than expected measured data. L_{A90} statistical and L_{Amin} during the night-time indicated rural dwellings to become very silent during the night-time periods.

5.12 Visual

The topography within the area zone slopes down gradually in a southern direction, with the residential community of Ezakheni in the northern parts of the proposed power staion site being located on higher ground. As such, lower lying terrain with incised valleys occur in the vicinity of the Bloukrans River dominates in the southern part of the study area.

Most visual degradation is concentrated in areas surrounding these built-up nodes. In areas surrounding the town of Colenso, commercial agriculture occurs along the banks of the Thukela River and subsistence agriculture is taking place to the south of Colenso in close proximity to the informal settlement. In the north and north-eastern parts of broad study area large areas have been transformed by informal settlement and subsistence agriculture (SiVest, 2014).

Figure 5-46: View east from the R103 toward proposed site showing the typical topography within the area (Google earth street view photograph)

Source: SiVest, Visual Assessment, 2014

The land use in the area is characterised by natural or undeveloped areas which have been partially transformed and degraded as a result of urban transformation, rural settlement, and agricultural activities in the form of livestock grazing, subsistence and commercial farming. Other built form in the study area includes, high voltage power lines and a railway line that runs in a north south alignment parallel to the R74 and P544. The cooling towers from the Colenso power station that was decommissioned, are located just east of Colenso and can be seen from vast areas throughout the broad study area (SiVest, 2014).

Figure 5-47: View north of Colenso showing the high voltage power lines, railway line and decommissioned cooling towers

Source: SiVest, Visual Assessment, 2014

5.13 Traffic

A traffic impact study was undertaken by Sturgeon Consulting. The description of the existing traffic conditions was taken from their report.

5.13.1 Existing road infrastructure

The existing road network in the vicinity of the site can be seen on the Locality in Appendix P. Existing road infrastructure is well developed in the area and consists of the following provincial and district roads:

- The R74 (P12-3) is a provincial route that runs in an east- west direction and links Colenso with Weenen to the east. It is a two lane undivided road approximately 3.4m lanes in each direction with 0.9m shoulders
- The R103 (P1-10), a provincial regional route and runs in a north-south direction to the west of Colenso and links with Ladysmith to the north. It is a secondary corridor of the municipal area and it is also an alternative route for traffic that passes through Ladysmith to other towns which choose not to use the N3. The section between Ladysmith and Colenso is primarily a movement corridor and is used by residents as an alternative route to avoid tolls on the N11 and N3. It is a two lane undivided road approximately 3.4m lanes in each direction with 0.9m shoulders.
- The District Route D488 is a provincial class D gravel access road and connects with Inkanyezi in Colenso to the west. It is approximately 7.0m wide with two road over river bridge structures.

Important to note is that a maximum weight limit of 3 t is allowed on the railway bridge in Colenso, as shown in Figure 5-48.

Figure 5-48: Weight Restriction on railway bridge in Colenso

Source: Sturgeon Consulting, Traffic Assessment (2015)

The road network affected by the power station is under the jurisdiction of various road authorities, such as SANRAL, KZNDT, N3TC, uThukela DM and Umtshezi Local Municipality. Any impact or proposed road upgrades on these roads will require consultation with the different authorities.

5.13.2 Existing traffic conditions

A permanent traffic counting station is located on the R103 (P1-10) at KM2.6 between Colenso and the Esakheni turn-off. Table 5-21 summarises the existing traffic highlights along the R103.

Table 5-21: Existing Traffic Highlights – R103

	To Ladysmith	To Colenso	Total: Two Way
Average Daily Traffic (ADT)	3 006	3 076	6 083
Average Daily Truck Traffic (ADTT)	495	572	1 067
Percentage heavies	16.5%	18.6%	17.5%
Percentage of night traffic (20:00 to 06:00)	12.9%	11.0%	12.0%
Average speed – heavy vehicles	65 km/h	59.6 km/h	62.1 km/h
Highest volume on the road (veh/h)	376	395	704

Source: Sturgeon Consulting, Traffic Assessment (2015)

The Average Daily Traffic (ADT) along the R103 in the vicinity of Colenso is 6 083 vehicles with a 50/50 directional split. The Average Daily Truck Traffic (ADTT) is 1 067 vehicles. The highest two- way traffic volume is 704 vehicles per hour (approximately 50/50 directional split). The posted speed limit for the R103 is 100km/h.

There are no permanent counting stations on the R74 in the vicinity of Colenso however it is assumed that the traffic volumes along this road will be lower than on the R103. Both of these roads carry low volumes of traffic, however, the percentage heavies indicated on the R103 is high.

The existing traffic volumes along the R103 and the R74 will not be any reason for concern in terms of network and intersection capacity.

5.14 Heritage

A Heritage Scoping Report for the Colenso Project was conducted in 2014 by PGS Heritage. The description of the cultural heritage history of the area was taken from this report.

5.14.1 Colonial/Historical Period

The Great Trek that started in 1838 resulted in the conflict between the Zulu, under Dingane, and the Voortrekkers under their leader Piet Retief. The resultant massacre of Retief and his party by Dingane on 6 February 1838 lead to numerous battles and skirmishes over the next year. These include, Ithaleni, Blood River, Saailager, Rensburg Koppie, Veglaer and Bloukrans. After the massacre of Retief, Dingane dispatched his impi to kill all remaining Boer parties. On the night of 16 February 1838, the laager at Bloukrans was surrounded and attacked on the morning of 17 February 1838, with approximately 282 Voortrekkers and 250 servants were killed during the Battle of Bloukrans. Colenso was established as a wagon stop in 1855 at Commando Drift, a crossing on the Thukela River.

This crossing was on the main road between the then Colony of Natal and the Republic of the Orange Free State and the South African Republic. The Bulwer Bridge was constructed in 1879 along with a toll house to cross the Thukela and in 1886 the railway bridge was opened to the east of the Bulwer bridge. Colenso and the crossings of the Thukela River played a major part in the first part of the South African War (1899-1902). Between December 1899 and February 1900 a number of battles and skirmishes took place on the Natal front around Colenso (PGS, 2014).

The known historical heritage resources (PGS, 2014) include the site of the Battle of Bloukrans (1838) 6.5km to the south of the study area, to sites in and straddling the study area with their associated monuments, graves and cemeteries:

- Battle of Colenso (16 December 1899),
- Battle of Thukela Heights that comprised of the battles and skirmishes at:
- Hlangwane Hill – 19 February 1900
- Monte Cristo – 18 February 1900
- Cingolo Hill – 17 February 1900
- Horshoe Hill – 21 February 1900
- Wynne’s Hill – 21 February 1900
- 8 Hart’s Hill – 23 February 1900
- Pieters Hill – 27 February 1900

Another recent historical site is the Colenso Power Station that was constructed by the South African Railway Administration for the electrification of the Natal main line between the Glencoe Junction and Pietermaritzburg. The implementation of the line and power station took place in June 1926. The construction commenced in November 1922 and by 1925 construction was completed. During the same time the barrage in the Thukela River was completed by 1926. In January 1927 the power station was taken over by Escom, with a number of buildings and other additions done over the years up to its decommissioning in 1985 (PGS, 2014). The 2014 field work by PGS identified a Muslim cemetery situated inside one of the coal staging and water treatment alternatives, this alternative also contained the remains of the historical Colenso Power Station of which some of the buildings were still in use.

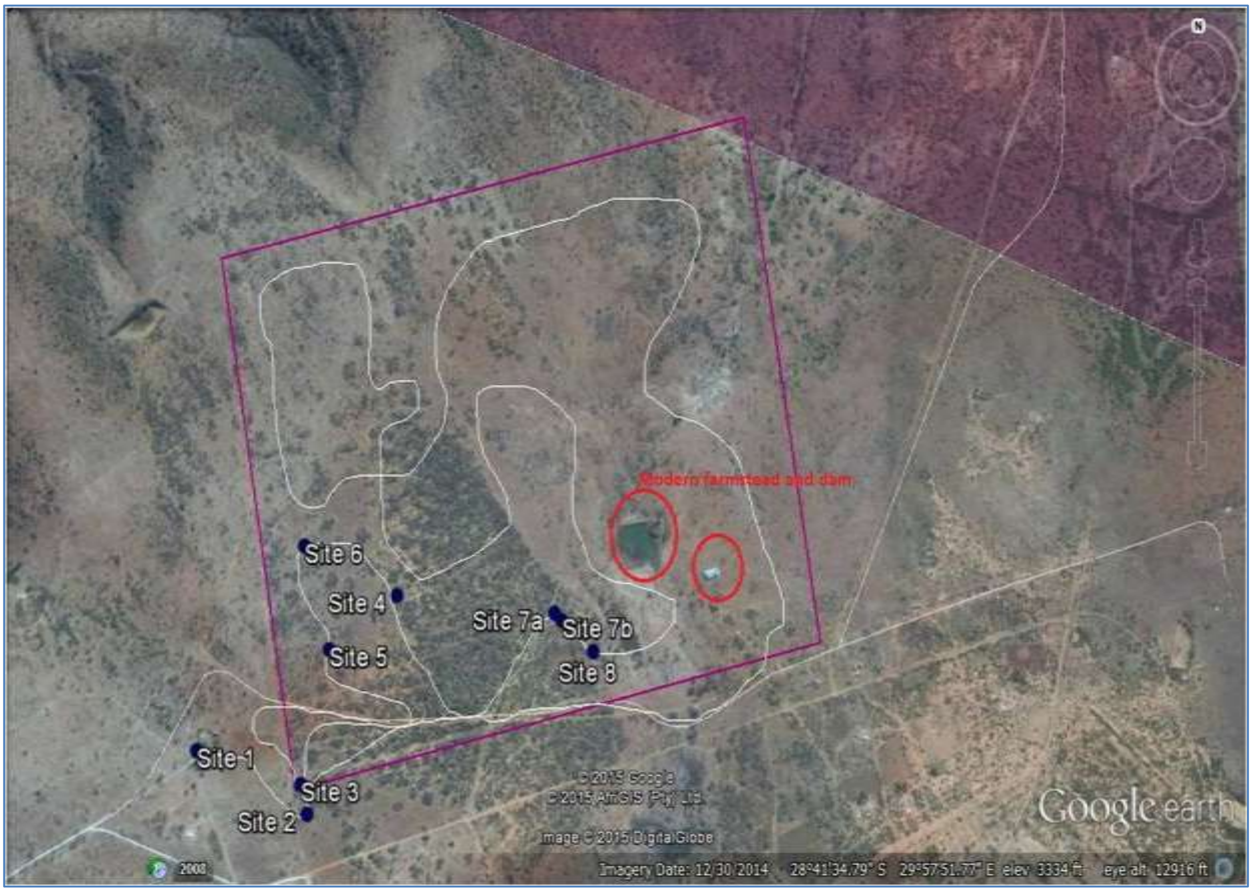
5.14.2 Site specific heritage description

The 2014 PGS Heritage report recommended that a detailed HIA of the area had to be undertaken once the final footprint for the development actions had been determined. APelser Archaeological Consulting (APAC) was appointed to conduct the Phase 1 HIA. The findings of APAC was used to describe the current heritage environment of the proposed power station site. The Phase 1 Heritage Report is attached as Appendix M.

The area is relatively flat and open, and sections have been impacted by agricultural activities such as ploughing, while cattle and other livestock are kept in the area as well. Grazing has also impacted on the vegetation of the area. As a result the trees are fairly small throughout. Another characteristic of the area is the red sandy soils and erosion dongas caused by overgrazing.

Figure 5-49 provides an indication of the location of the heritage sites identified on the proposed power station site.

Figure 5-49: Aerial view of Power Plant preferred location showing sites recorded & tracks followed during assessment.



Source: APAC Phase 1 HIA (2015)

Site 1 - Farmstead

This site contains a farmstead and related outbuildings, of which some were built of sandstone. The age of the buildings is not known but is likely less than 60 years of age and not of any heritage significance. Some rondavels are present, and the farmstead and related structures probably formed part of the Tugela Game Ranch located here (Figure 5-50).

<u>GPS Location</u>: S28.69939 E29.95283

Sites 2 & 3 – Possible Graves

Both these features are stone packed, without any headstones though, and are the size and shape typical of graves (Figure 5-51: Sites 2 & 3 - Possible Graves

Source: APAC Phase 1 HIA (2015)

Sites 4; 5 & 8 – Single piece of pottery (4), broken lower grinding stone (5) & broken upper grinder (8)

All three finds are out of context (not associated with an identified settlement in the area), but probably related to Later Iron Age habitation and activities. The pottery piece is very small and undecorated and cannot be used to determine the relative age of the material finds and the cultural identity of the occupants of the area (Figure 5-52). Because these objects are out of context their archaeological significance is low.

<u>GPS Location</u>: S28.69622 E29.95812 (Site 4); S28.69732 E29.95633 (Site 5) & S28.69723 E29.96360 (8)

). One of the stone cairns (Site No.3) has a ploughshare on it, another object sometimes associated with graves. Social consultation should be undertaken to determine if these are indeed graves and if there are any further low, stone-packed or unmarked graves in the study area.

<u>GPS Location</u>: S28.70072 E29.95582 (Site 2) & S28.70007 E29.95563 (Site 3)

Figure 5-50: Site 1 - Farmstead

Source: APAC Phase 1 HIA (2015)

Figure 5-51: Sites 2 & 3 - Possible Graves

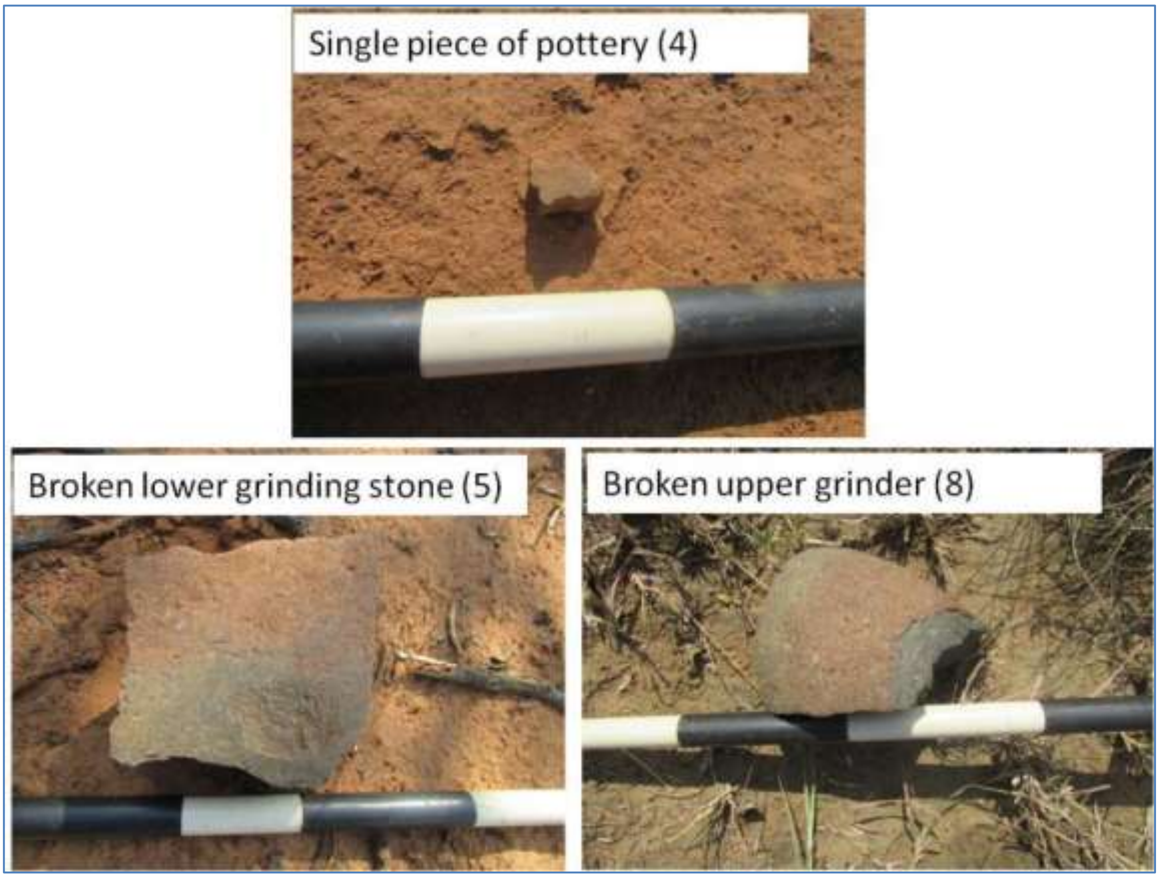
Source: APAC Phase 1 HIA (2015)

Sites 4; 5 & 8 – Single piece of pottery (4), broken lower grinding stone (5) & broken upper grinder (8)

All three finds are out of context (not associated with an identified settlement in the area), but probably related to Later Iron Age habitation and activities. The pottery piece is very small and undecorated and cannot be used to determine the relative age of the material finds and the cultural identity of the occupants of the area (Figure 5-52). Because these objects are out of context their archaeological significance is low.

GPS Location: S28.69622 E29.95812 (Site 4); S28.69732 E29.95633 (Site 5) & S28.69723 E29.96360 (8)

Figure 5-52: Sites 4, 5 & 8 - Later Iron age



Source: APAC Phase 1 HIA (2015)

Site 6 – Stone platform

This could be a granary stand or a small enclosure of which the wall had collapsed (Figure 5-53). An upper grinding stone (site 8) was found in close proximity of this feature. No other stone walling were recorded in the immediate area.

GPS Location: S28.69529 E29.95559

Site 7 – Stone Age tool scatter

This site consists of a low density scatter of individual MSA/LSA stone tools and flakes located in and around an erosion donga in the area (Figure 5-54). These dongas are caused by overgrazing and by livestock tracks cutting through the area.

GPS Location: S28.69648 E29.96249 & S28.69659 E29.96265

Figure 5-53: Site 6 – Stone platform

Source: APAC Phase 1 HIA (2015)

Figure 5-54: Site 7 – Stone Age tool scatter

Source: APAC Phase 1 HIA (2015)

6 ALTERNATIVES

6.1 ALTERNATIVES CONSIDERED

6.2 TECHNOLOGY ALTERNATIVES

6.2.1 Coal combustion technology

Coal combustion (boiler) alternatives considered were described in the Scoping Report. The table below provides a list of the technology alternatives considered and a summary of the key characteristics of the different coal combustion processes in terms of performance and operating experience.

Table 6-1: Commercial experience

Boiler Technology	Operating Plants
Pulverised Coal (PF)	▪ Mature technology; 1000s of units worldwide, >90% of coal fired capacity ▪ Supercritical has been applied for decades in the developed world technology of choice in the US, Europe and Japan for new coal plants due to environmental constraints. Now being applied to the developing world – e.g. China
Circulating Fluidised Bed (CFB)	▪ Mature technology; 100s of units <100 MW worldwide; small fraction of coal fired capacity ▪ Limited number of supercritical CFB boilers in operation in the world ▪ Major markets are China, Central Europe, USA, Eastern Europe and Asia.
Integrated Gasification Combined Cycle (IGCC)	▪ 9 operational plants with a combined output of 4100 MW several are demo Projects (heavily subsidised) ▪ Other plants are developed (US, South Korea, China) but some have been shelved

Source: Mott MacDonald, 2015

Preferred Alternative - Pulverised Fuel Boiler: Generally PF systems can be used to fire a narrow range of coals within the envelope of design conditions, the key parameters are volatile content, fixed carbon, Hargrove index, ash softening temperature and ash content. Anthracitic coals is proposed for this project and this make the Pulverised Fuel Boiler the ideal technology to use. Note that there is no other power station in South Africa that burn anthracite coal and all the coal mined in KwaZulu Natal is anthracite (including from the future coal mine proposed next to the power station).

6.2.2 Cooling option alternatives

The following cooling alternatives were discussed in the Scoping Report:

- Once-through cooling
- Evaporative cooling towers
- Dry cooling

Preferred Alternative- Dry Cooling: Water is a scarce resource in South Africa and the use of dry cooling will reduce the volume of water required for the power plant. .

6.2.3 Make-up Water for Steam Cycle

Demineralised water supplied to the boiler must be of sufficiently high quality to avoid steam contamination which can result in steam turbine blade deposition problems.

There are a number of options available for the demineralisation process which have no major advantages and disadvantages. Certain boiler manufacturers have preferences based on their water quality requirements and the chemical dosing require they recommend. The processes are either:

- an anionic and cationic ion exchange bed system
- a reverse osmosis (RO) system followed by anionic and cationic ion exchange beds.
- electrodeionization (EDI) technology

Preferred Alternative - Reverse Osmosis: RO combined with an anionic and cationic ion exchange bed system is the most widely used system.

6.2.4 Ash Handling Alternatives

Ash handling and disposal alternatives either by wet or dry methods were described in the Scoping report.

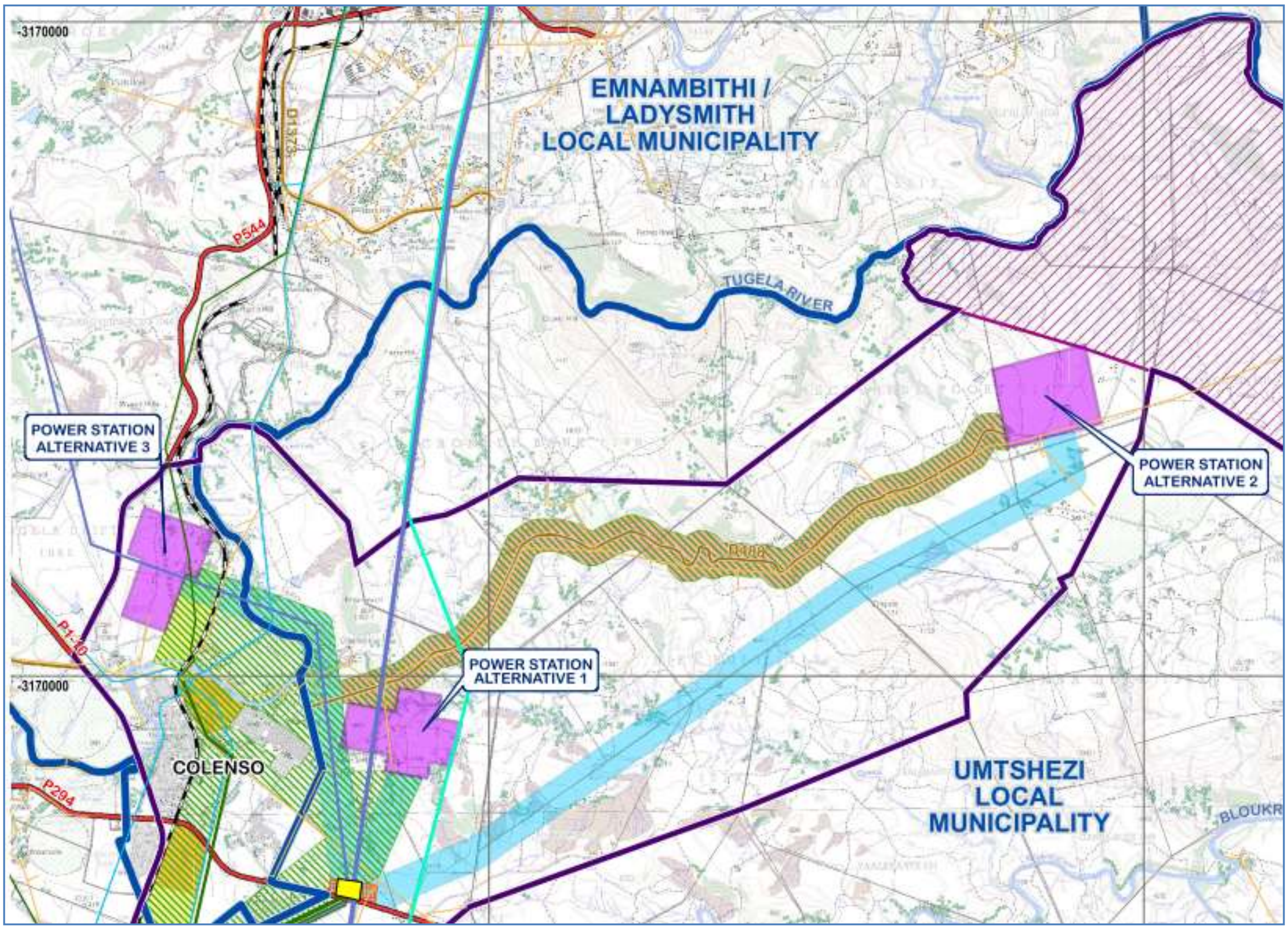
Preferred Alternative- Dry Ash Handling and Disposal: Slurry paste with a water content of 15% or less will be taken out by conveyors / rail-veyors to stacker. Dry ash disposal was chosen as the preferred alternative because less water will be required.

6.3 Location Alternatives

Three location alternatives for the powers station has been evaluated (refer Figure 6-1):

- Alternative 1 - This site is located at the location of the old decommissioned Colenso power station site east of Colenso and lies south of the Thukela River.
- Alternative 2 - This site is located approximately 13 km north east of Colenso close to the proposed mining area (separate DMR application will be lodged for the mining operations) and also lies north of the Thukela River.
- Alternative 3 - This site is located just north of Colenso, close to the railway line and lies north of the Thukela River.

Figure 6-1: Location of Alternative Sites



Source: SiVest (2014)

6.3.1 Site Alternative 1

As mentioned the site is located at the location of the old decommissioned Colenso power station. The infrastructure options considered for this site is were as follows (refer Figure 6-3):

6.3.1.1 Water supply

Three options were considered for water supply:

- Existing Ezakheni Abstraction - This abstraction works is considered because there is a weir in place. A new abstraction system would need to be constructed on the south bank of the Thukela River along with new primary treatment system, new pumping station and a new 250mm diameter pumping main to this site. This preference is made such that a river crossing is avoided, if the use of the existing abstraction Works is used. Raw water, after primary treatment, will be pumped to a suitably located reservoir on the site.
- Old Power station abstraction works - The augmentation and upgrade of the old Power Station Abstraction Works on the Thukela River, located close to Colenso town, is considered as a water supply source for this site. The weir at this structure will be upgraded, a new abstraction system will be constructed along with a new primary treatment system, a new pumping station and a new 250mm diameter

pumping main, to cater for the water demand for this site. A suitable alignment for a pumping main will assessed accordingly. Raw water will be pumped to a suitably located reservoir on the site.

- Ezikenbeni Abstraction works - The Colenso Esikhenbeni Water Works can be considered as an option to supply water to this site. The upgrade of the weir, the abstraction system and the primary treatment system at this structure will be required. A new pumping station and a new 250mm diameter pumping main will be required, to supply the water demand for this site. The raw water will be pumped to a suitably located reservoir at the site.

6.3.1.2 Sewage

A package Waste Water Treatment Plant is to be provided, to treat and discharge treated water.

6.3.1.3 Coal transportation routes to power station site

Two options were considered for the coal transportation routes.

OPTION 1

Road

Transportation of coal via road from Newcastle to this site, will travel from Newcastle via Ezakheni on the P544. The trucks will be able to access the site via the R74/D488 intersection.

Upgrades of the P544/R103, R103/R74 and R74/D488 intersections would be required, to cater for the turning movements, traffic control, safety and the load of the trucks and its cargo.

Transportation of coal from the mine, will be done using the District Road, the D488. The D488 will require upgrading for a length of 22km.

Rail

Staging Areas

One of the options for transporting via rail is that the coal will be offloaded and stockpiled at a newly constructed Coal Staging Area. There are two locations available for Coal Staging areas to be constructed.

From Coal Staging Area 1 The first option for a Staging area is located at the South – West of Colenso. Coal will then be transported to the Power Station from here. The transportation from the Coal Staging Area 1 are as follows:

By Road:

A new road will be constructed from the Coal Staging area, for a length of 2.2km, which will lead to the R74. A new road intersection will need to be constructed to allow access to this Power Station site. This new road can be aligned to meet the existing D488, which will be upgraded for a length of 2.2km. The alternate option is that the new road from the staging area can be aligned, for a length of 2.6km to meet the new road to Power Station site 1.

The upgrading will be required to cater for the large volume of trucks that will be using the route on a daily basis. The intersection off the R74 will need to be upgraded and extended to cater for the turning movement of the trucks, traffic control and safety.

By Conveyor / Rail-veyor:

Please refer Figure 6-2 for image of a rail-veyor system. The coal will be stockpiled at the staging area and will be transported by a newly constructed conveyor / rail-veyor system along a suitable route to the site for a length of 5.6km.

Figure 6-2: Rail-veyor system

Source: Rail-Veyor Technologies Global, promotional video

From Coal Staging Area 2 - A second option for a new Coal Staging area, located at the North – West of Colenso, is considered for stockpiling the coal. Coal will then be transported to the Power Station from here. The options for transportation from the Coal Staging Area 2 are as follows:

By Road:

The road that will be used to transport the coal with the trucks will need to be upgraded to cater for the large volume of trucks that will be using the route on a daily basis. A new road from Coal Staging area 2 to the P544 will need to be constructed for a length of 1.2km, a new intersection at the P544 and the D488 will be need upgrading. The intersections that will require augmentation are the P544/R103, R103/R74 and the R74/D488 to cater for the turning movement of the trucks, traffic control and safety.

By Conveyor / Rail-veyor:

The coal will be stockpiled at the staging area and will be transported by a newly constructed conveyor/rail-veyor system along a suitable route to the site for a length of 5.1km.

OPTION 2

New Rail

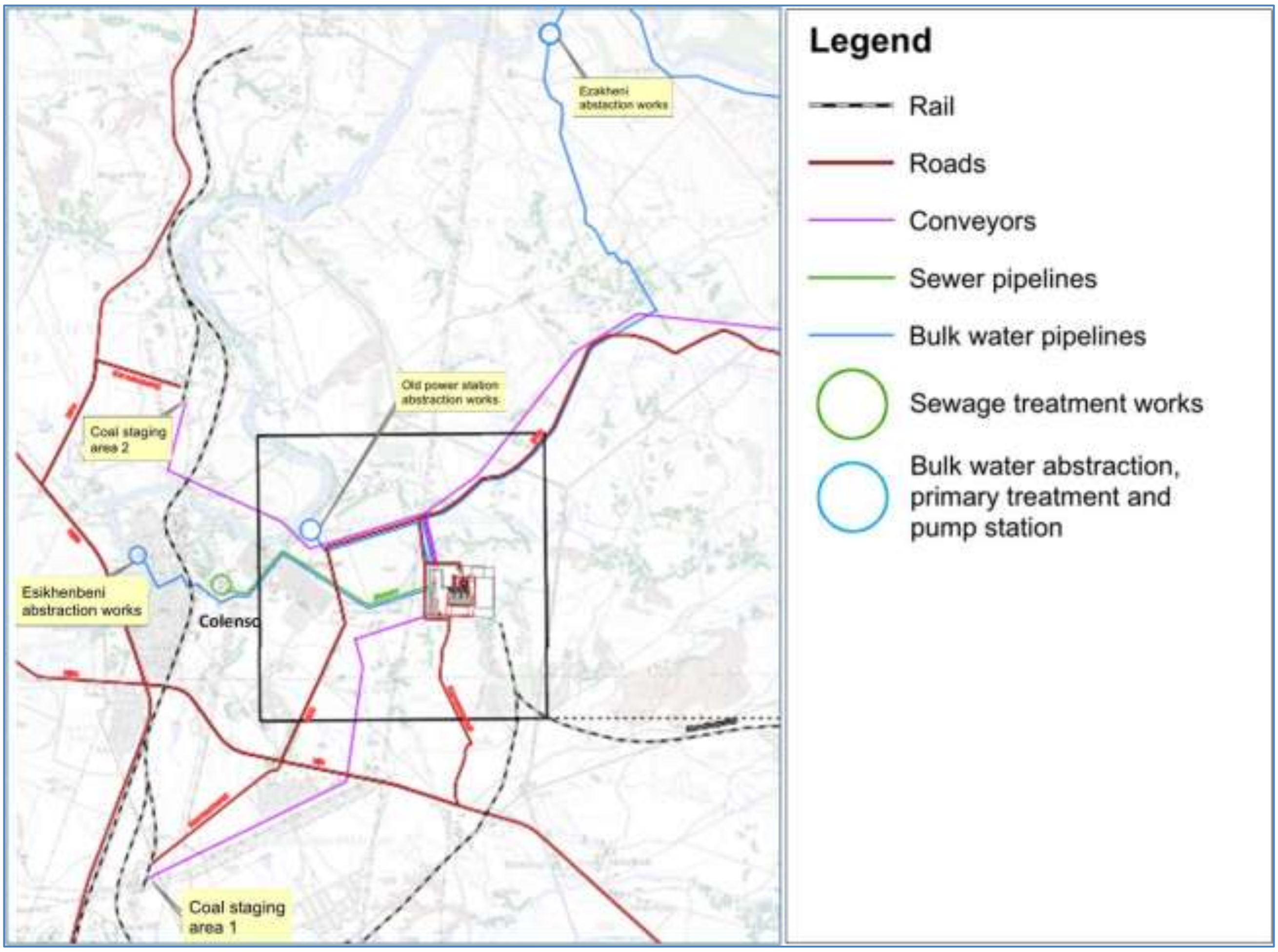
New Rail off Main link: - The coal being transported from Newcastle can be delivered to the site via a new rail line, which will branch off the existing Newcastle to Colenso rail line. The new rail line will be constructed for a length of 11.1km.

New Rail line from proposed mine: - Coal can be transported to this site via a new rail line from the proposed mine (subject to a different application). The coal will be loaded into the wagons via a conveyor system from the mining area, for a length of 3.1km. The rail line from the proposed mine (to be established) to the power station is to be constructed for a length of 20.2m to the power station site.

Conveyor / Rail-veyor

The coal will be transported via the conveyor / rail-veyor system from the new mine along a route from the proposed mine to the power station. The conveyor / rail-veyor system will run along an alignment for approximately 17.8km.

Figure 6-3: Infrastructure Options - Site 1 Alternative



Source: Mott MacDonald (2015)

6.3.2 Site Alternative 2

This site is located approximately 13 km north east of Colenso. The infrastructure options considered for this site is were as follows (refer Figure 6-4):

6.3.2.1 Water supply

Two options were considered for water supply to the site:

- Construction of a new weir: - A new weir, abstraction system, primary treatment, pumping station and a 250mm diameter pumping main is required on the Thukela River, close to the site. The raw water, after undergoing primary treatment, will be pumped into a suitably located storage reservoir on the site.
- Existing Ezakheni Abstraction Works: - It is the intention to supply water to this site using the existing Ezakheni Abstraction Works located further upstream from the site. This abstraction works is considered because there is a weir in place. A new abstraction system would need to be constructed on the south bank of the Thukela River. This preference is made such that a river crossing is avoided, if the use of the existing abstraction Works is used. The upgrading of the weir, abstraction works and Primary treatment will be required and construction of a new pump station and a new 250mm diameter pumping main will be required to pump the raw water after primary treatment, to a storage reservoir on site.

6.3.2.2 Sewage

- Option 1: - A package Waste Water Treatment Plant is to be provided, to treat and discharge treated water.
- Option 2: - A conservancy tank is to be provided for municipal services to empty regularly.

6.3.2.3 Coal transportation routes to power station site

Road

Transportation of coal via road from Newcastle to this site, will travel from Newcastle via Ezakheni on the P544. The trucks will be able to access the site via the R74/D488 intersection. Upgrades of the P544/R103, R103/R74 and R74/D488 intersections would be required, to cater for the turning movements, traffic control, safety and the load of the trucks and its cargo.

Transportation of coal from the mine proposed to be established to the west of the site will be delivered via a direct road link from the mine, for a length of 7.8km. This road will be designed and constructed for large industrial vehicle usage.

Rail

<u>Staging Areas</u>

One of the options for transporting via rail is that the coal will be offloaded and stockpiled at a Coal Staging Area. There are two locations available for Coal Staging areas to be constructed.

From Coal Staging Area 1 - The first option for a staging area is located at the south – west of Colenso. Coal will then be transported to the Power Station from here. The transportation from the Coal Staging Area 1 are as follows:

By Road:

A new road will be constructed from the Coal Staging area, for a length of 2.2km, which will lead to the R74. A new road intersection will need to be constructed to allow access to this Power Station site. This new road can be aligned to meet the existing D488. The D488 will be upgraded for a length of 17.7km to access the Power Station Site – Alternative 2.

The upgrading will be required to cater for the large volume of trucks that will be using the route on a daily basis. The intersection at the R74/D488 will need to be upgraded and extended to cater for the turning movement of the trucks, traffic control and safety.

By Conveyor / Rail-veyor:

The coal will be stockpiled at the Staging area and will be transported by a newly constructed conveyor / rail-veyor system along a suitable route to the site, for a length of 20.7km.

From Coal Staging Area 2 - A second option for a Coal Staging area, located at the North – West of Colenso, is considered for stockpiling the coal. Coal will then be transported to the Power Station from here. The options for transportation from the Coal Staging Area 2 are as follows:

By Road:

The road that will be used to transport the coal with the trucks will need to be upgraded to cater for the large volume of trucks that will be using the route on a daily basis. A new road from Coal Staging area 2 to the P544 will need to be constructed for a length of 1.2km, a new intersection at the P544 and the D488 will be need upgrading for a length of 7.8km. The intersections that will require augmentation are the P544/R103, R103/R74 and the R74/D488 to cater for the turning movement of the trucks, traffic control and safety.

By Conveyor / Rail-veyor:

The coal will be stockpiled at the staging area and will be transported by a conveyor / rail-veyor system along a suitable route to the site for a length of 18km.

OPTION 2

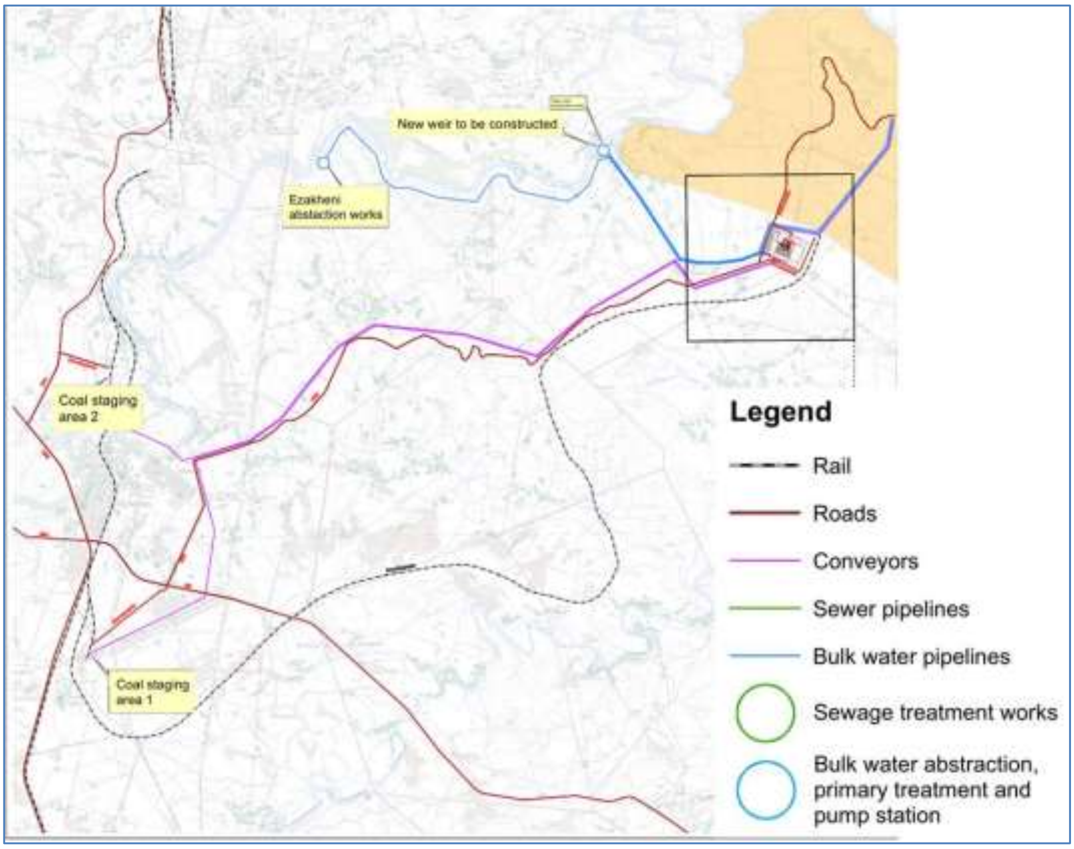
New Rail

The coal being transported from Newcastle can be delivered to the site via a new rail line, which will branch off the existing Newcastle to Colenso rail line. The new rail line will be constructed for a length of 28.2km.

Conveyor / Rail-veyor

The coal will be transported via the conveyor / rail-veyor system from the new mine along a route from the mine to the Power Station. The conveyor / rail-veyor system will run along an alignment for approximately 4.0km.

Figure 6-4: Infrastructure Options - Site 2 Alternative



Source: Mott MacDonald (2015)

6.3.3 Site Alternative 3

This site is located just north of Colenso, close to the railway line. The infrastructure options considered for this site is were as follows (refer Figure 6-5):

6.3.3.1 Water Supply

Three options were considered for the water supply:

- Existing Ezakheni Abstraction Works: - It is the intention to supply water to this site using the existing Ezakheni Abstraction Works located on the Thukela River, further downstream from this site. The existing weir, abstraction system and primary treatment would need augmentation and the construction of a new pumping station and a 250mm diameter pumping main would be required so that the water demands of this site are met. The raw water, after primary treatment, will be pumped to a suitably located reservoir.
- The old Power Station Abstraction System is an option to supply raw water to this site. The upgrading of the weir and the construction of a new abstraction system, primary treatment, pump station and a 250mm diameter pumping main will be required to pump the raw water after primary treatment, to a storage reservoir on site. This option was considered because of the weir in place.
- The Colenso Esikhenbeni Water Works can be considered as an option to supply water to this site. The upgrade of the weir at this structure, the abstraction system and Primary treatment will be required. The construction of a new pumping station

and a new 250mm diameter pumping main will be required, to supply the water demand for this site. A suitable pipeline route to a new storage reservoir on site will be hydraulically assessed.

6.3.3.2 Sewage

- Option 1:- A package Waste treatment Plant is to be provided, to treat and discharge treated water.
- Option 2: - Provide a new pumping station and a new pumping main to the existing Colenso Sewage Works. Colenso Sewage works would need to be upgraded to cater for the additional sewage waste, to be disposed from this site.

6.3.3.3 Coal transportation routes to power station site

Road

Transportation of coal via road from Newcastle to this site, will travel from Newcastle via Ezakheni on the P544. The trucks will have a direct link off the P544 to access the site via a newly constructed intersection on the P544. Upgrades on the P544 would be required, to cater for the turning movements, traffic control, safety and the load of the trucks and its cargo.

Transportation of coal from the mine, will be done using the District Road, the D488. The D488 will require upgrading for a length of 25.8km. The intersections requiring upgrading is the R74/D488, R74/R103 and the R103/P544. These intersections will be travelled by the trucks to access this site. Furthermore, a newly constructed intersection off the P544 would be required to access the Power Station. A new road for a length of 0.56km is to be constructed as the Power Station access road.

Rail

Staging Areas

One of the options for transporting via rail is that the coal will be offloaded and stockpiled at a Coal Staging Area. There are two locations available for Coal Staging areas to be constructed:

From Coal Staging Area 1 - The first option for a staging area is located at the South – West of Colenso. Coal will then be transported to the Power Station from here. The transportation from the Coal Staging Area 1 are as follows:

By Road:

Access from the Coal Staging area 1, will be provided via a new road for a length of 2.2km, intersecting at the R74. The intersection at the R74 would require augmentation, to allow for turning movements of trucks, traffic control and safety. The further intersections that would require augmentation is the R74/R103 and the R103/P544. A new intersection on the P544 would be required to access the Power Station Site 2. A new road link from the P544, is required to access this site.

The upgrading will be required to cater for the large volume of trucks, the turning movement of the trucks, traffic control and safety that will be using the route on a daily basis.

By Conveyor / Rail-veyor:

The coal will be stockpiled at the staging area and will be transported by a newly constructed conveyor / rail-veyor system along a suitable route to the site, for a length of 102.km.

From Coal Staging Area 2 - A second option for a Coal Staging area, located at the North – West of Colenso, is considered for stockpiling the coal. Coal will then be transported to the Power Station from here. The options for transportation from the Coal Staging Area 2 are as follows:

By Road:

The Power Station site 3, would have a direct access road for a length of 0.8km from Coal Staging Area 2.

By Conveyor / Rail-veyor:

The coal will be stockpiled at the staging area and will be transported by a newly constructed conveyor / rail-veyor system along a suitable route to the site, for a length of 0.7km.

OPTION 2

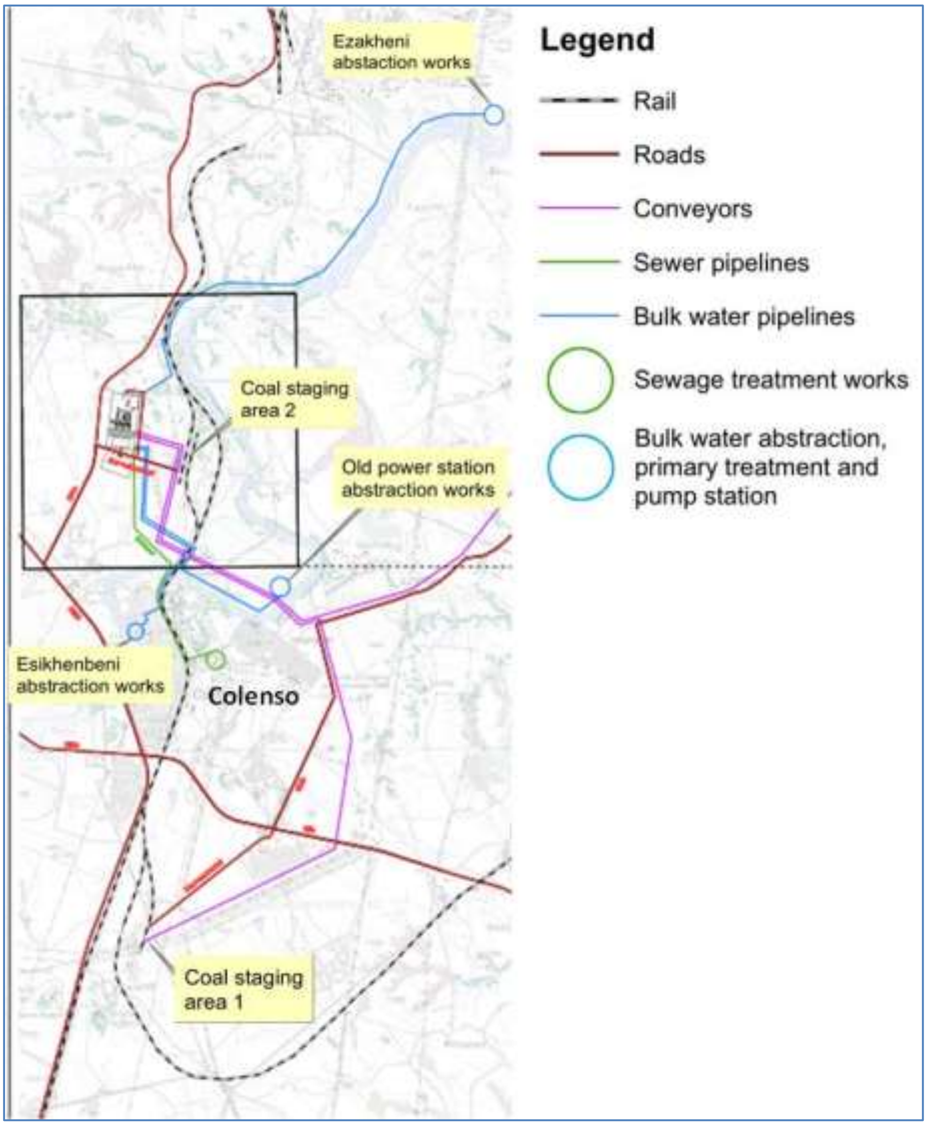
New Rail

The mined coal, will be transported via a new conveyor / rail-veyor system, for a length of 3.1km, to the wagons and transported to this site via the new railway line. The new rail line is to be constructed for a length of 28.2km. A new rail siding close to the Power station site 3 will be required to be constructed.

Conveyor / Rail-veyor

The coal is transported via the conveyor / rail-veyor system from the new proposed mine to the Power Station for a length of approximately 22.7km.

Figure 6-5: Infrastructure Options - Site 2 Alternative



Source: Mott MacDonald (2015)

6.4 ENVIRONMENTAL SCREENING OF SITE ALTERNATIVES

Specialist studies were undertaken to compare the devised alternatives for the project's components and to advise on the most beneficial option considering available information.

The following specialists were appointed to provide information on the site alternatives (The Reports were attached as appendices to the Final Scoping Report):

- Geotechnical Assessment - SiVest
- Air Quality Scoping Assessment - Rayten Engineering
- Surface Water Scoping Assessment - Sivest
- Soil & Agricultural Potential Desktop Assessment -ARC (Agricultural Research Council)
- Biodiversity negative Mapping - SiVest
- Avifaunal Assessment - Chris van Rooyen & Albert Froneman
- Socio-Economic Scoping Assessment - Urban-Econ Development Economists

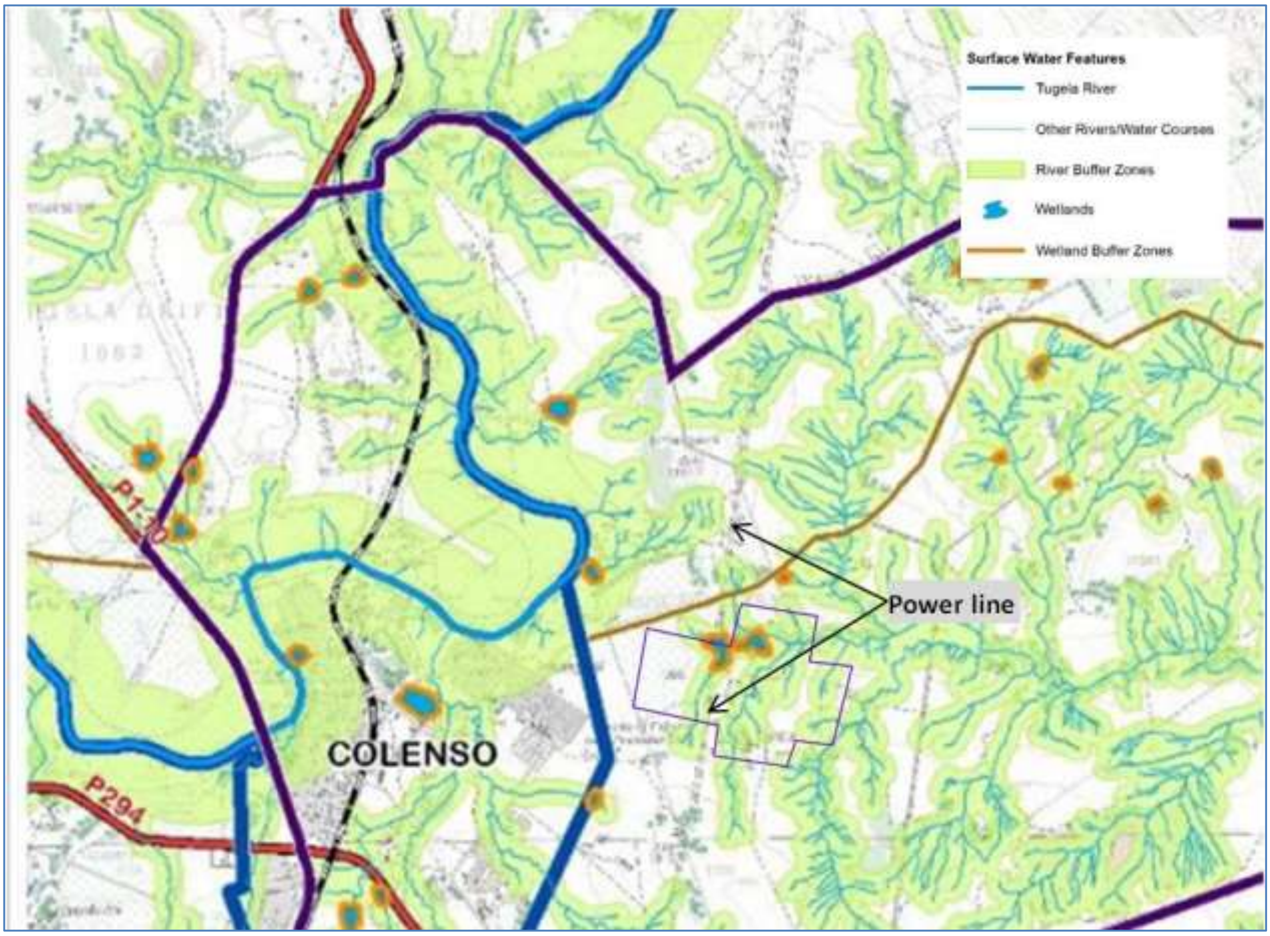
- Noise Scoping Level Study - EAR (Enviro Acoustic Research)
- Visual Scoping Assessment - SiVest
- Heritage Scoping Level Assessment - PGS Heritage

During this process fatal flaws were identified for two of the sites.

6.4.1 Site Alternative 1

A wetland is located on site as well as numerous streams/rivers. The buffers associated with these water bodies effectively ruled out the eastern side of the site. A power line crossing over the site also added to the fact that the site was found to be unsuitable for the construction of the power station.

Figure 6-6: Wetlands and power line found on Site Alternative 1

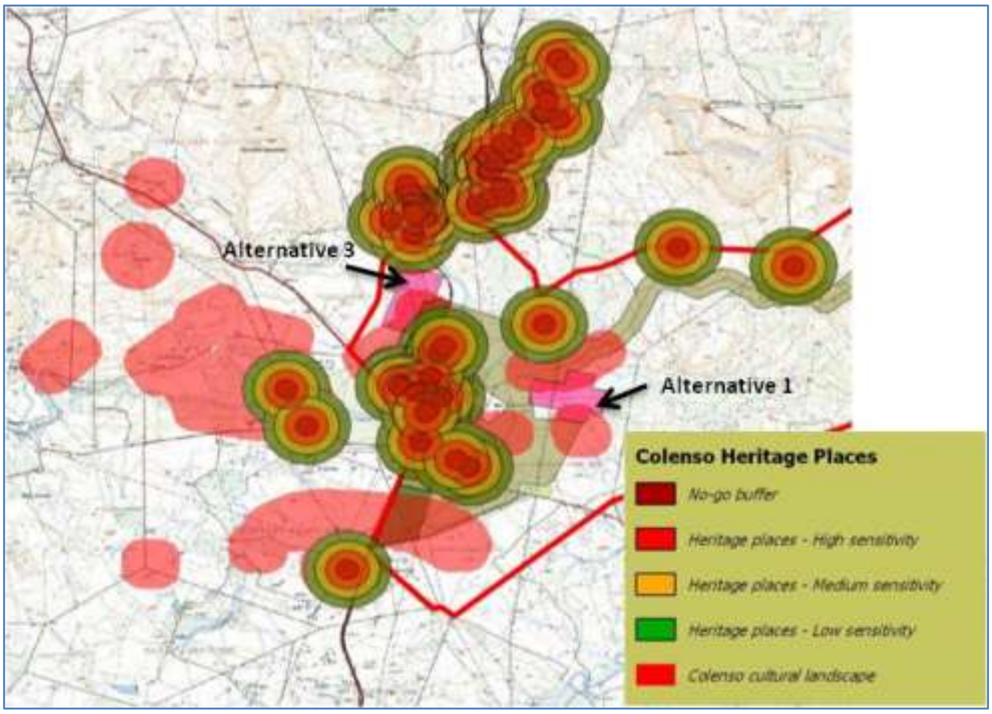


Source: SiVest, Surface Water Assessment (2014)

6.4.2 Site Alternative 3

Cultural heritage places with high significance are located in close proximity of Site Alternative 3. This is considered a fatal flaw and the alternative was discarded as a location for the proposed power station. It should be noted that Alternated Site 1 was located in the buffer zone of

Figure 6-7: Heritage places in proximity of Alternative sites 1 and 3



Source: PGS Heritage Report (2014)

6.5 ASH DUMP ALTERNATIVES

6.5.1 Location

Ash will be generated at approximately 850,000 tonnes per annum and will be deposited by conveyor / rail-veyor on engineered ash dumps which retain any leachate. The ash storage area have been calculated as 70 ha for 25 years of operations, the ash dump will remain on site after closure and specific care and maintenance options must be implemented. The exact location and layout for the ash dump has not been finalised. Initially it was decided to split the ash dump area from the power station area. The air quality and geohydrological assessments were commissioned to assess these areas. Two man-made dams with associated drainage channels are located between these areas and a decision was made not to separate the power station and the ash dump as this would mean that pipelines and conveyors would need to cross these potentially sensitive areas. The initial area identified for the ash dump is located a south west of Alternative Site 2. There is an area of overlap at the north-eastern corner of the initial area and the south-western corner of Alternative site 2. (Refer Figure 6-8).

6.5.1.1 Preferred Ash Dump Location

The goal was to make sure that the ash dump is located on Site Alternative 2 while still remaining in the area assessed by the air quality and geohydrological to ensure that the findings of these assessments can still be applied to the ash dump. However, the size of the overlap area is approximately 38.6 ha and a dump of 70 ha would not fit within this area. The re-use of the ash (described in the next sub-section) means that the area required for the ash stockpile could be reduced. An ash stockpile could thus still be located within the area of overlap and is identified as the preferred option (refer Figure 6-9).

Figure 6-8: Ash Dump Locations

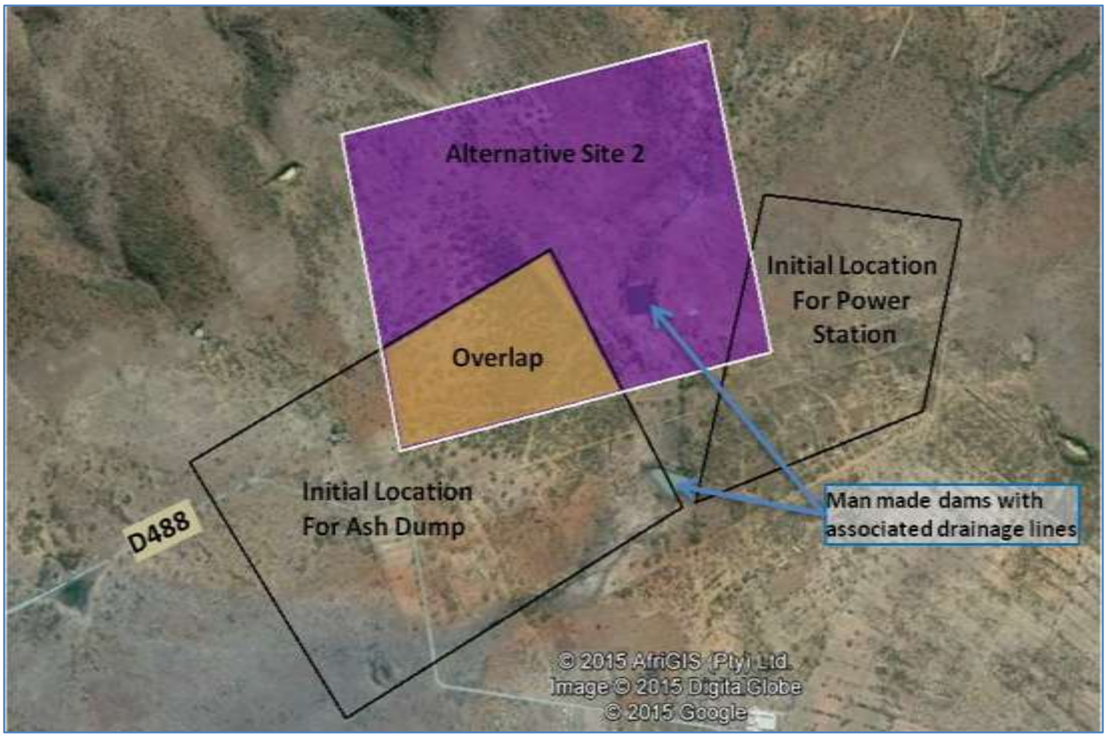
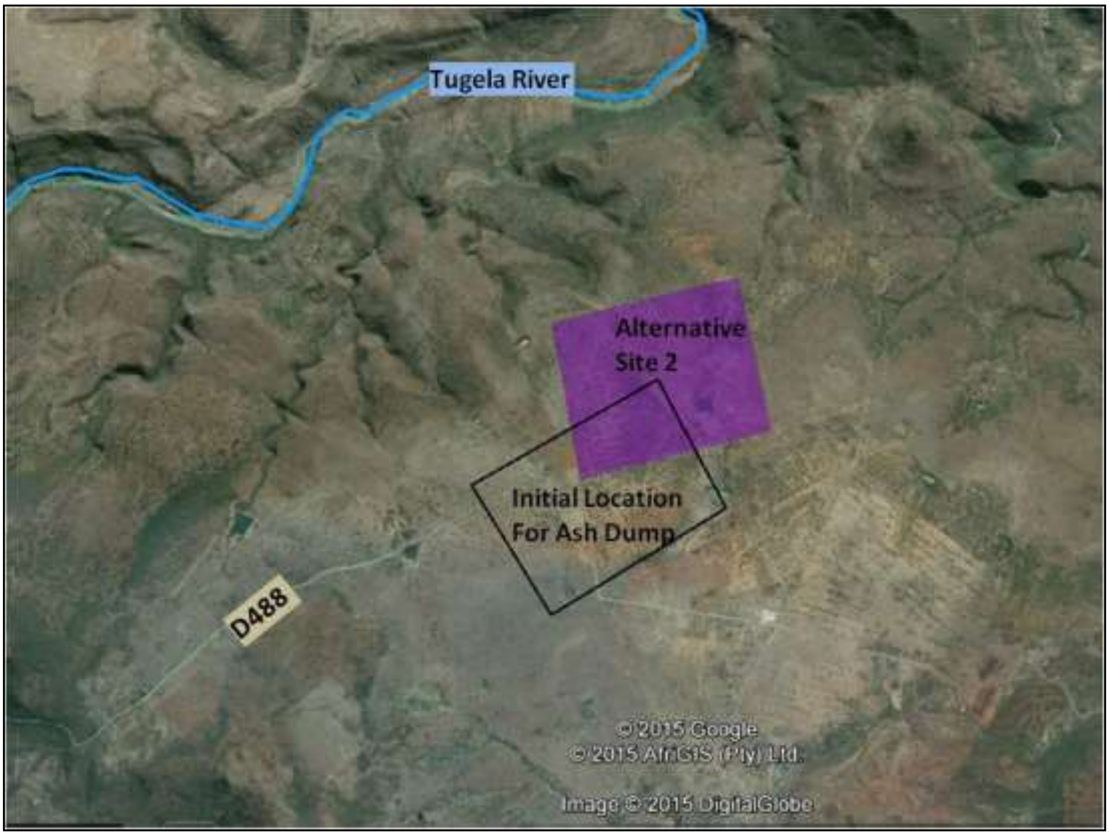


Figure 6-9: Preferred location for ash stockpile

6.5.2 Re-use

The alternative to optimise the use of ash by the local community was considered. This could be done by the development of a brick making facility or alternative material recycling close to the ash dump. If provision is made for the stockpiling of one year's ash then the footprint for the ash stockpile will be reduced from 70 ha to 9 ha. Current cement bricks are produced with 30% ash to conform to SABS standards.

Figure 6-10: Ash Dump Locations



6.6 PREFERRED ALTERNATIVE

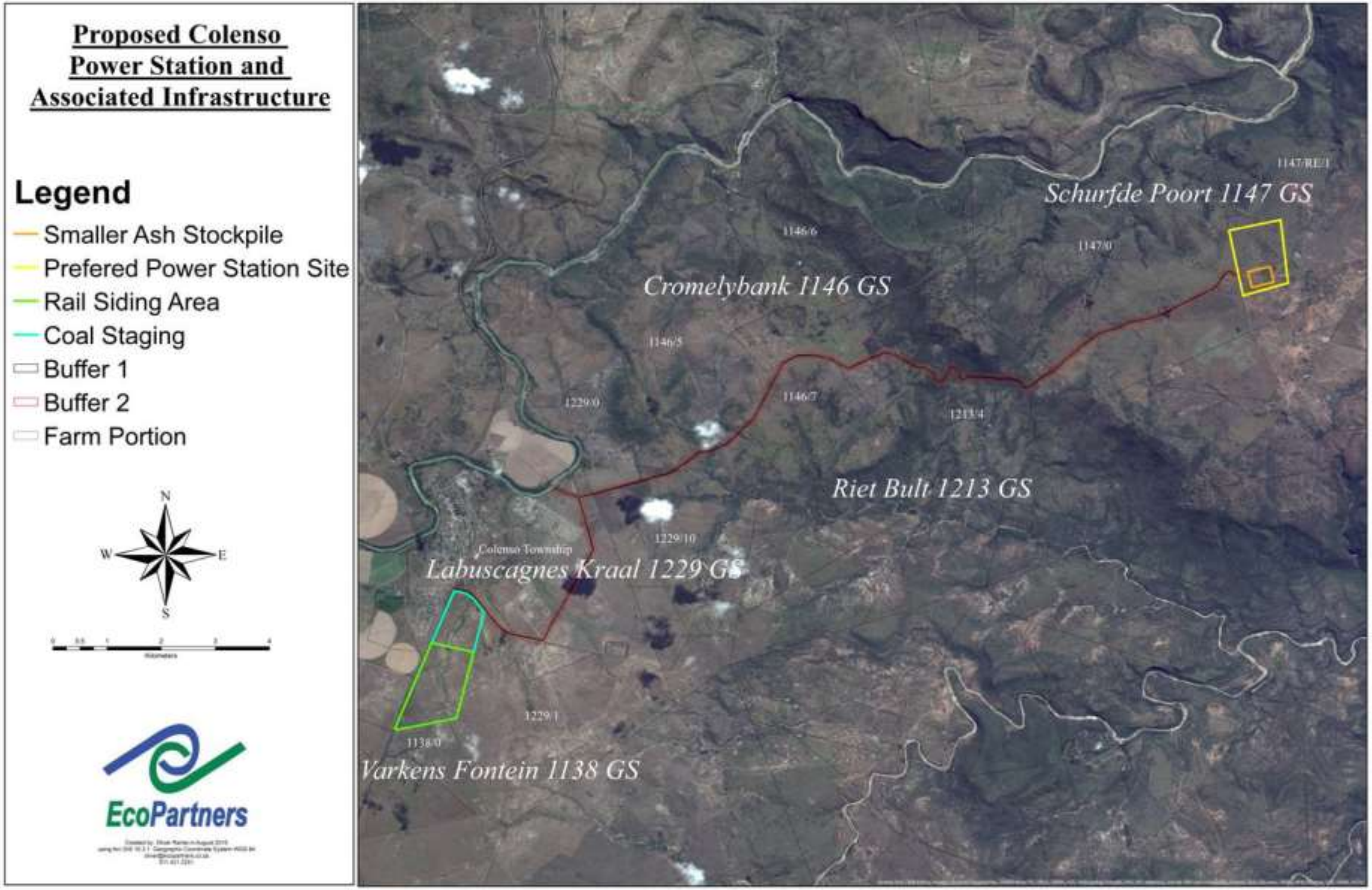
The following components are recommended as the preferred alternative (refer Figure 6-11)

- Site Alternative 2 - a preferred area of 96.6 ha.
- Water supply - The augmentation and upgrade of the old Power Station Abstraction Works on the Thukela River, located close to Colenso town, is recommended as the water supply source for this site. The weir at this structure will be upgraded, a new abstraction system will be constructed along with a new primary treatment system, a new pumping station and a new 250mm diameter pumping main, to cater for the water demand for this site. A suitable alignment for a pumping main will assessed accordingly. Raw water will be pumped to a suitably located reservoir on the site.
- Water pipes to be installed within existing road reserves.
- Sewage - A package Waste Water Treatment Plant is to be provided, to treat and discharge treated water.
- Coal staging area 1 - located to the south–west of Colenso.
- Coal transportation to site - The coal will be stockpiled at the staging area and will be transported by a newly constructed rail-veyor system along a suitable route to the site, for a length of approximately 20.7km.
- Roads - Construction of a new road for a length of 2.2km, intersecting at the R74. The intersection at the R74 would require augmentation, to allow for turning movements of trucks, traffic control and safety. The further intersections that would

require augmentation is the R74/R103 and the R103/P544. D488 would be upgraded to cater for the heavy vehicle traffic and a new access road from the D488 is required to access the site.

- Linear infrastructure to be constructed within a servitude of 10m on either sides of D488. An additional buffer of 40 m (both sides) to be included in the application.
- Technology - Pulferised Fuel Boiler, Dry Cooling, Dry Ash disposal.
- Ash Handling:
  - Re-use of ash through the development of a brick making facility
  - Ash stockpile of 9 ha

Figure 6-11: Preferred Alternative



6.7 No-Go Alternative

The no-go alternative is the option of not establishing a new coal fired Power station near Colenso in the KwaZulu-Natal Province. This option would amount to there being no changes in the regional biophysical and socio-economic situation, or in the national electricity generation situation. With the current generation capacity, this would result in electricity shortfalls in the short and medium term. There will also not be the opportunity establish a new Coal Fired Power Station in KwaZulu Natal, a province with limited energy generation opportunities.

Electricity demand in South Africa is placing increasing pressure on the existing power generation capacity. Should the 1050MW power plant not be built the power generation capacity will need to be sourced from another source in the area close to the coal reserve that could be similar, or from a different source in another area. In order to meet the demand for base load electricity it is important to manage the logistics in the most opportune manner.

The development has the potential to boost the local economy and this injection and associated benefit to the community will be lost if the no-go alternative is implemented. The project is an IPP project and as such will not only benefit the local community but also the broader area with the alleviation of pressure on the national electricity grid.

The opportunities lost to the area and the country should the No-Go option be pursued is that there would be no new jobs, both short term or long term, added to the region; the price of electricity would definitely increase and this would affect the poor in the immediate area and everywhere in the country, more acutely. There could be on-going load shedding with its disruptive effect on the local and national economy; a development node would not stimulate activity in the area and that any spend on maintenance of the facility, nationally but also locally (whether in Ladysmith, Estcourt or Colenso) would be sacrificed.

What should also be considered is that without the electricity generated by the power station, people, in particularly the poorest, would seek to solve their heating and cooking requirements by using biomass of some form (whether wood or other plant materials) and this would still lead to intense biodiversity loss in those areas, as well as around the country in general. The health effects of biomass burning in residences also inflict additional suffering on the young and old in these areas. In many of the rural areas anthracite or coal is burned to cook food, inside the residence.

Energy is a basic human need, one that people will solve regardless. Climate change advocates will therefore need to consider the alternatives to coal fired power stations not as wind or solar energy alternatives, but rather the less efficient burning of coal, anthracite, paraffin, wax, diesel, or other fossil fuels.

The updated IRP2010 (Department of Energy, 2013) suggests that about 2 450 MW of new coal-fired power stations will need to be established by 2030 and should the no-go alternative be preferred the possibility exists that the target set in the IRP will not be met.

7 PUBLIC PARTICIPATION PROCESS

The public participation process is an essential component of the Environmental Impact Assessment (EIA) process. It incorporates the fundamental principles of the National Environmental Management Act (NEMA) and projects must carefully consider environmental and social aspects of a proposed development. Please refer Appendix N for evidence of Public Participation conducted.

The Public Participation Process mainly comprises the engagement with Interested and Affected Parties (I&APs) and is of utmost importance in any environmental assessment process. The PPP, inter alia, involves the following:

- Inform, raise awareness and increase understanding of environmental issues or any other issues that might be affected by the proposed mining process.
- Establish lines of communication between stakeholders, I&APs and the project team.
- Provide opportunity to all parties for the exchange of information and expression of views and concerns.
- Obtain contributions of stakeholders and I&AP and ensure that all views, issues, concerns and queries are documented.
- Identify the significant issues associated with the proposed project.

7.1 Participation: Notification Phase

The public participation started 12 December 2015 with a notification period. The notification period was for the duration of 12 December 2014 to 30 January 2015. Application forms to register I&APs were accepted after 30 January 2015.

The following methods were used for notification:

7.1.1 Written Notification

A list of Stakeholders and possible I&APS was created and included State Departments, landowners, neighbours, stakeholders and I&APs. Written letters were prepared and sent via email and post. An email was sent to those with email addresses and letters were posed when no email address was available. Letters were sent on 12 December 2015.

The written notice was translated into Zulu, and when required a Zulu notification was forwarded to certain I&APs. Many telephone calls were received by EcoPartners by I&APs, and the written notification and registration form was forwarded to them. It seems like the news also spread through word of mouth.

Table 7-1: The following is a list of State Departments notified:

No	Title	Name	Position	Property / Organisation
1	Mr.	Themba Ngubane	Council Chief Whip: Chair- Local Labour Forum & Training Portfolio	Emnambithi/ Ladysmith Local Municipality
2	Ms.	Thulie Hadebe	Chair- Community Services Portfolio Committee	Emnambithi/ Ladysmith Local Municipality
3	Mr.	Thulani Petros	Chair- Development, Planning & Human Settlement Portfolio Committee	Emnambithi/ Ladysmith Local Municipality
4	Mr.	Pieter Hurter	Chair- Development, Planning & Human Settlement Portfolio Committee	Emnambithi/ Ladysmith Local Municipality
5	Mr.	Madoda Khathide	Municipal Manager	Emnambithi/ Ladysmith Local Municipality
6	Mr.	E. H. Dladla	Director: Social & Community Services	Umtshedzi Local Municipality
7	Ms.	P. N. Njoko	Municipal Manager	Umtshedzi Local Municipality
8	Mr.	Municipal Manager	Municipal Manager	uThukela District Municipality
9	Mr.	Zama	Executive Director: Health and Environmental Services	uThukela District Municipality
10	Mr.	Smanga	Executive Director: Water Services	uThukela District Municipality
11	Mr.	Cyril Xaba	MEC : KZN Agriculture and Rural Development	KZNDEA
12	Mr.	Dennis Memela	Senior Manager : Stakeholder Management	KZNDEA
13	Ms.	Dindsree Thanbu	EIA Unit	Ezemvelo KZN Wildlife
14	Dr.	Clinton Carbutt	Ezemvelo Biodiversity Unit	Ezemvelo KZN Wildlife
15	Ms.	Ashley Starkey	Chief Director	DWA
16	Mr.	D Nyathi	Strategic Support	DWA
17	Mr.	Siphiwe Majola	Regional Manager: Ladysmith	Provincial Road Agency
18	Ms.	Makhosi Mzizi	Senior Manager: LED	Department of Economic Development
19	Mr.	Ranveer Persad	General Manager: Local Economic Development	Department of Economic Development

7.1.2 Newspaper Adverts

An advert was placed in the Sunday Tribune on 7 December 2014 and in The Citizen of 3 December 2014. The advert included a description of the activities and the location of these activities by listing the farms and portions. The listed activities triggered were advertised and EcoPartners' contact details were clearly stated.

7.1.3 Site Notices

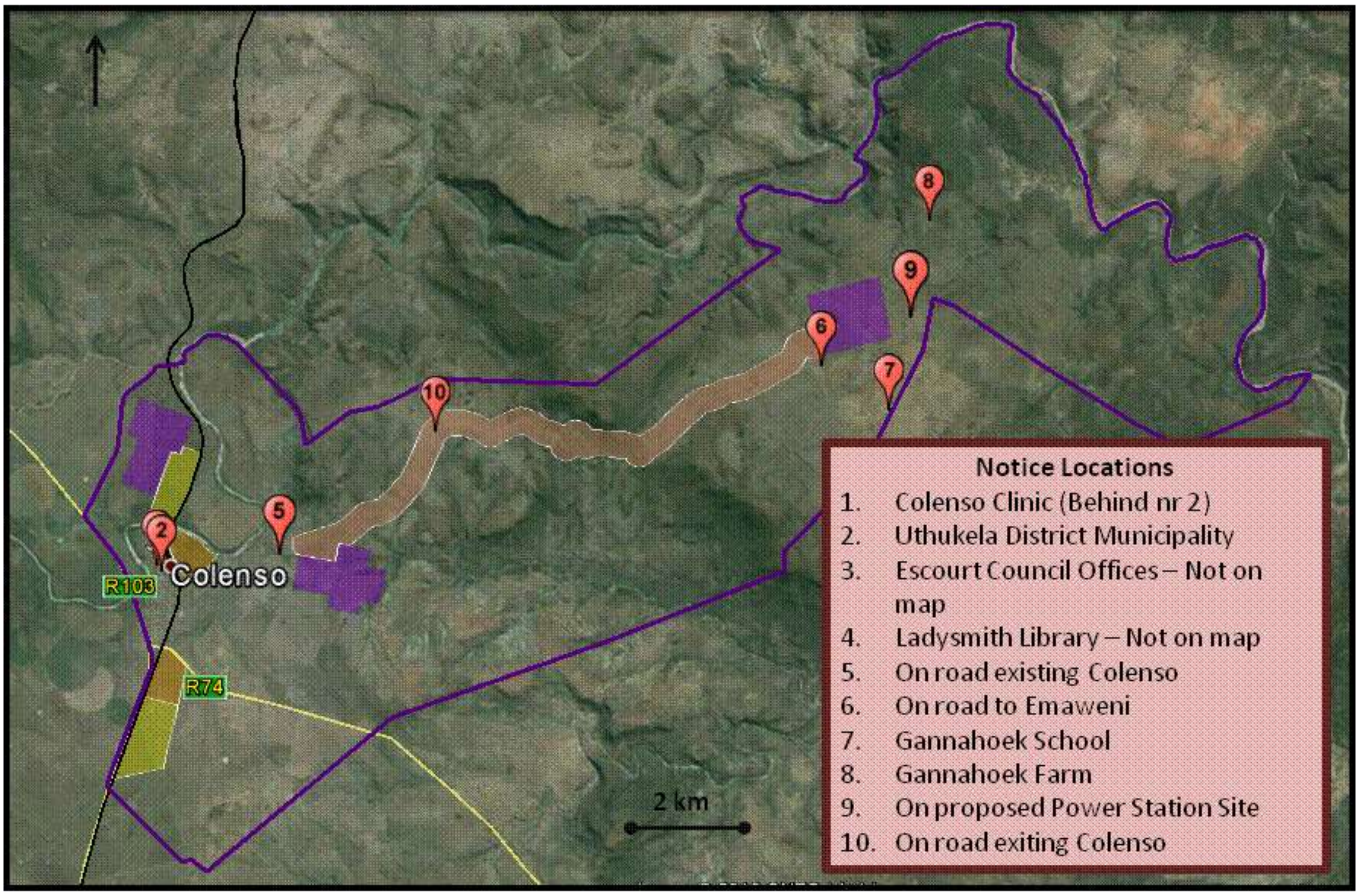
A total of 10 site notices with the same information as in the newspaper advert were placed at the following locations:

- Colenso Clinic
- UThukela District Municipality Office in Sir George Street, Colenso

- Estcourt Council Offices
- Ladysmith Library
- 4 Alongside roads in the proposed area
- At an alternative site for the Power Plant
- At Gannahoek School

Note: Notices 3 & 4 were placed in Estcourt and Ladysmith (not on map)

Figure 7-1 : Map indicating location of site notices



7.1.4 Bulk SMS's

The registration form allowed for space to include the name and contact details of other possible I&APs. A sms was sent to the 34 suggested people that needs to be notified.

7.1.5 Direct Community Consultation

Direct community consultation is being conducted by Mr. K.D. Buthelezi. Mr Buthelezi attended a community meeting on the 1st of February 2015 and during the meeting he explained to the community the proposed development of the power station and mine. Mr Buthelezi is also responsible for fixing the site notices and placements of documents at the libraries and in this capacity he also verbally communicates about the project and what it entails to community members encountered. Please refer to Appendix N for details in this regard.

7.1.6 Summary of Issues Raised by the I&APS

EcoPartners is keeping a register of all Registered I&APs. There are currently 237 registered I&APs. The majority of the registered I&APs are interested in job opportunities.

Communication received during the Scoping period is included in the Public Participation Appendix, Appendix N. All comments are addressed in the comments and response sheet in the same appendix.

Some of the issues raised was related to mining activities. The coal mine and associated environmental authorisation does not form part of this application and a different application and associated public participation process will run for the coal mine application.

Concerns regarding the Coal Fired Power Plant includes impact on environment and associated tourism activities. Concerns were raised regarding health impacts. It was also noted that alternatives must include alternative energy for generating energy.

7.2 PARTICIPATION: SCOPING PHASE

The Final Scoping Report was made available for comment to all registered Interested and Affected Parties. The comment period was from 15 May 2015 to 17 June 2015.

EcoPartners notified all registered I&APs with an email address via email on the availability and location of the Final Scoping Report. All I&APs that do not have email addresses were notified via a bulk sms.

An electronic copy of the full Final Scoping Report was made available on www.Ecopartners.co.za

Hard copies of the Executive Summary of the Final Scoping Report was made available at:

1. Colenso – Uthukela Municipality Office
2. Ladysmith Library
3. Escourt Library

Comment sheets with comment boxes were left at Uthukela Municipality Office, Ladysmith Library and Escourt Library. The comment boxes and comment sheets were collected after 17 June 2015.

All comments received via e-mail, fax and from the comment sheets were copied to the comments and response report.

After the final scoping report was made available to the I&APs more persons registered and a total of 277 people was registered as I&APs at finalisation of the Scoping Phase.

7.2.1 Public Participation Meeting

A public participation meeting was held on the 25th July 2015 in Colenso Town Hall at 14:00. The purpose of the meeting was to describe the impacts the proposed power station may have on the environment, to present the findings of the completed specialist assessments and to request comments on the impacts. It also allowed for open questions that could be responded to in real time.

7.2.1.1 Notification

The notification for the meeting was sent on the 30th of July 2015. EcoPartners notified all registered I&APs using the communication medium prefferd by the I&APs. Of the 277 I&APs there were 111 who were notified through email, 149 were notified through sms and 17 were notified through sending the invitation through the post.

Landowners were notified through postal letters that were sent to their postal address and via e-mail (where e-mail addresses where available). The head chiefs of the area were sent personal letters on the 3rd July 2015.

7.2.1.2 Meeting

A total of 487 people registered on the registers including the EcoPartners team which consisted of 7 people.

The presentation was compiled in English and Zulu. During the meeting the Zulu slide was shown alongside the English slide for all to see. Translation services were available and attendees had the opportunity to ask questions in their own languages. Responses from the EAP could also be translated into the language of preference.

I&APs were given opportunity to take part in an information gathering survey during the meeting. The objectives of the survey were to gain an insight into the perception of the local community of the proposed project, and to gather information on the availability of skills and experience of the local labour for the purpose of identifying potential to employ local population within the working age. The survey was conducted in English and Zulu and consisted of 15 questions. It received 374 responses. In addition to the identification of the skill levels among community members, the survey also aimed at gathering information on the perception around the proposed project being established in the study area.

Comment sheets and comment boxes were available and attendees had the opportunity to complete the forms at the meeting or alternatively mail, fax or e-mail their completed sheets through to EcoPartners after the meeting until the 25th of August 2015.

7.2.2 Summary of Issues Raised by the I&APS

EcoPartners is keeping a register of all Registered I&APs. There are currently 746 registered I&APs. The majority of the registered I&APs are interested in job opportunities.

Communication received to date is included in the Public Participation Appendix, Appendix N. All comments are addressed in the comments and response sheet in the same appendix.

Some of the issues raised were related to mining activities. The coal mine and associated environmental authorisation does not form part of this application and a different application and associated public participation process will run for the coal mine application.

Concerns regarding the Coal Fired Power Plant includes impact on environment and associated tourism activities. Concerns were raised regarding health impacts. It was also noted that alternatives must include alternative energy for generating energy.

8 SPECIALIST ASSESSMENTS

8.1 GEOHYDROLOGICAL IMPACT ASSESSMENT

AGES was appointed to conduct the Geohydrological impact study. Their report is attached as Appendix E. The findings of the study were used to describe the geohydrological baseline in Section 5.5 of this report.

8.1.1 Summary of Findings

It is noted from the geological and lineament map that there are little to no major geological structures or abrupt changes in geology of the area identified for the power plant and ash dump sites. There seems to be a higher concentration of notable structures further north of the sites. This could also be ascribed to the flat topography as well as alluvial cover that occur in some parts of the power plant and ash dump area

From the regional geo-magnetic character of the study area it can be seen that the power plant and ash dump sites are located in an area of lower magnetic flux density where no major regional geo-magnetic anomalies are present. This is indicative of a relatively homogeneous geological terrain and therefore more acceptable for the placement of facilities where groundwater pollution is possible.

Three dolerite sills exist below the power plant site as well as layered Karoo sedimentary rocks consisting mostly of sandstone, with minor layers of grit, shale and mudstone. The dolerite sill intrusions and sedimentary rock directly below the power plant are very solid with little to no water bearing fractures and deep weathering that could form conduits for groundwater movement and major aquifers. This counts in favour of the proposed power plant site in terms of its sensitivity to possible pollution.

There is a small area of alluvium of varying thickness that is present in the area between the proposed power plant and ash dump sites, adjacent to a small artificial wetland. Increased permeabilities can be expected in place where alluvium covers the underlying bedrock. Temporary localised perched groundwater conditions are expected within the alluvium and shallow weathered zones during the rainy season

Higher transmissivities are noted in general in the deeper fractured aquifer than in the shallow unsaturated zone.

The groundwater table directly below the proposed power plant and ash dump site can be expected around 20 mbgl while shallower groundwater tables are noted along small secondary drainages such as the one between the ash dump and power plant site.

The water table mimics surface topography with localised flow expected to be down gradient towards surface water it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions drainages and regionally towards the Thukela River in the north and north east.

Regional groundwater levels which mimic surface topography, results in regional groundwater flow towards the south east. The power plant and ash dump site is located very close to a surface and groundwater divide. Localised groundwater flow at the power plant and ash dump site is towards the north-west and north-east. Groundwater flow at the extreme southern point of the ash dump is expected to be towards the east and possibly the south as the surface water divide is located in this area.

Borehole yields in the study area are relatively low.

Historical and existing groundwater use is related to the community that is located directly south of the power plant site as well as commercial farmers in the region. The community located directly south of the power plant site is supplied with potable water by the municipality through carting of water from Colenso Town.

It is evident from hydro chemical results that groundwater in the direct vicinity of the proposed power plant site is of marginal to poor quality for drinking water purposes. Only one borehole 1.2km east of the site has good water quality.

The geology underlying the site was classified as a minor aquifer system. The proposed power plant and ash dump sites are located in an area of lower aquifer vulnerability which increases to the west of the sites.

Groundwater is in a healthy state within the V14E quaternary catchment with high allocable volumes.

During construction minimal impacts on the groundwater system are expected

The impacts of potential groundwater pollution due to the power plant and associated ash dump during the operational phase are usually associated with the changes in the pH of the water, the increase in salt content and the concentration of potentially toxic trace elements.

The possible plume due to the plant and associated infrastructure has been simulated for a 25 year life time. It is clear from the simulated plume that pollution will not reach the Thukela River and that two artificial wetlands and two boreholes that are not in use, will be impacted if the 70 Ha Ash dump is constructed.

During decommissioning, rehabilitation of the power plant area will occur. Decommissioning is normally too short to see significant impacts on the groundwater.

The pollution plume at the power station and ash dump site will start receding after rehabilitation.

8.1.2 Recommended Mitigations

a. Groundwater quantity and quality monitoring is recommended according to the recommended groundwater monitoring plan.

b. Lining of the ash disposal facility and raw water dams is recommended.

c. Proper storm water management should be implemented to prevent contaminated surface run-off to reach alluvium downstream of the facility.

d. Secondary containment for fuel stored on site should be implemented.

e. Accurate oil records and effective clean-up protocols should be implemented.

f. The ecological integrity of the wetlands should be monitored. This includes water levels and quality within the affected wetlands.

g. Leach tests must be carried out on the ash/waste.

h. A long-term monitoring programme must be developed based on the guideline documented in Best Practice Guideline G3. Water Monitoring Systems (2007) available from DWS.

i. Data and results from the monitoring programme must be captured and managed in an effective database.

j. A comprehensive analysis must be conducted on boreholes within or close to the power plant and ash dump site and a screening analysis must be conducted on boreholes further away or boreholes that are not part of monitoring plan. In addition samples must be tested for trace elements once construction commences. The parameters that must be sampled for have been defined in the EMP.

k. On the completion of every sampling run a monitoring report must be written. Included in the report must be time series trends, Piper and Durov diagrams. These will be used to determine if there are any changes in the system. These changes must be flagged and explained in the report.

l. It is recommended that a compliance report be rendered to DWS every six months.

8.2 AIR QUALITY ASSESSMENT

Rayten Engineering cc was appointed to conduct the air quality impact study. Their report is attached as Appendix D. The findings of the study were used to describe the air quality baseline in Section 5.4 of this report.

8.2.1 Summary of Findings

The Air Quality Impact Assessment consisted of an emissions inventory and subsequent dispersion modelling simulations to determine TSP (as dust fallout), PM_{10}, $PM_{2.5}$, CO, NO_2 and SO_2 concentrations associated with the construction and operational phases of the power station and coal mine. Comparison of the modelled concentrations was made with the South African ambient air quality standards, WHO Guidelines and the South African National dust fallout regulations in order to determine compliance.

The main conclusions of the Impact Assessment for the power station can be summarised as follows for the construction and operational phases:

- An amount of 1066.08 Tonnes CO_2 -eqt emissions per year due to the production of 1050 MW electricity was estimated for Colenso power station. This value only provides as a rough estimation and does not take into account all other direct GHG emission sources. A full GHG inventory and report will need to be compiled on an annual basis once operations commence an activity data is available.
- Based on the dispersion modelling plots the following conclusions can be made:
  - The maximum predicted 99th percentile daily dust fallout concentration due to the construction of the power station is in compliance with the applicable South African dust fallout standards of 600 mg/m^2 /day and 1200 mg/m^2 /day for residential and non-residential areas.
  - The maximum predicted 99th percentile hourly CO concentrations due to stack emissions are in compliance with the South African air quality standard of 30,000 µg/m^3;

- The maximum predicted 99th percentile hourly NO_2 concentrations and maximum predicted annual NO_2 concentrations due to stack emissions are in compliance with the South African air quality standards and WHO guidelines of 200 µg/m^3 and 40 µg/m^3;
- The maximum predicted 99th percentile hourly and daily SO_2 concentrations and maximum predicted annual SO_2 concentrations due to stack emissions are in compliance with the South African air quality standards of 350 µg/m^3; 125 µg/m^3 and 50 µg/m^3. The maximum predicted 99th percentile daily SO_2 concentrations are also in compliance with the WHO guideline of 20 µg/m^3;
- The maximum predicted 99th percentile daily PM_{10} concentrations due to operations at the power station and coal mine exceeded the South African standard and WHO air quality guideline of 75 µg/m^3 and 50 µg/m^3 respectively. The maximum predicted annual PM_{10} concentrations exceeded the South African standard and WHO air quality guideline of 40 µg/m^3 and 20 µg/m^3 respectively;
- The maximum predicted 99 th percentile daily $PM_{2.5}$ concentrations due to operations at the power station and coal mine exceeded the South African standard and WHO air quality guideline of 65 µg/m^3 and 25 µg/m^3 respectively. The maximum predicted annual $PM_{2.5}$ concentrations exceeded the South African standard and WHO air quality guideline of 25 µg/m^3 and 10 µg/m^3 respectively;
- The maximum predicted 99th percentile daily dust fallout concentration due to operations at the power station and coal mine exceeded the applicable South African dust fallout standards of 600 mg/m^2 /day and 1200 mg/m^2 /day for residential and non-residential areas.
- No sensitive receptors were identified to fall within the exceedance zones. Maximum concentrations were recorded less than 50 m from the sources and fell within the power station boundary.

8.2.2 Recommended Mitigations

a. It is recommended that a fugitive dust management plan is developed for the power station that includes the implementation of suggested dust suppression measures.
b. An air quality monitoring program must be followed.
c. It is also recommended that ambient air quality monitoring of PM_{10} and $PM_{2.5}$, dust fallout monitoring and quarterly passive badge sampling of SO_2 , NO_2 and CO is conducted prior to operations in order to determine baseline concentrations of key criteria air pollutants.

8.3 Surface Water

Storm Water Solutions was appointed to conduct the surface water assessment. Their report is attached as Appendix F. The findings of the study were used to describe the surface water baseline in Section 5.6 and the conceptual water flow and stormwater management plan in Section 10.3 of this report.

8.3.1 Summary of Findings

The Project Area is situated in WMA 7: Thukela and in QCA V14E;

The natural catchment surface area size of the predominant catchment on site is 7.90 km2;

The Climatic conditions for the site area are as follows;

- MAP = 851 mm;
- MAE = 1 500 mm;

The Hydrological conditions for the site area are as follows (with relation to the predominant natural catchment area);

- MAR = 968 592 m3;
- TDS = 12 mS/m;

General surface water quality is good with a standard of water of less than 1 000 mg/l (Class 1);

The 100 m buffer is accepted as the exclusion zones around all watercourses;

Only a conceptual layout plan of the Power Plant is available which does not contain detail on the geographical placement and/or the dimensions of associated infrastructures;

SWS anticipates typical infrastructure associated with a Coal Power Plant activity and show the intent of the client to separate clean and dirty water from these different infrastructure components;

An external water source is most probably required to supply the operations with process water;

No details of this external water source is known as of yet;

The quantification of risk associated with the potential impacts when considering different phases of development are summarised below;

- No mitigation = High risk; and
- With mitigation = Low to Medium risk.

8.3.2 Recommended Mitigations

The following recommendations are made for the proposed power plant development based on the SWMP assessment:

a. All the gaps are to be considered when reviewing the SWA;

b. The proposed surface water monitoring program should be implemented;

c. No infrastructure should be placed within the 100 m exclusion zones; unless permission has been granted through the correct legislative means.

d. The PFD, CB,WB, SWMP, and conceptual designs are to be refined once final and exact information regarding the gaps are obtained; and

e. All concepts of Conceptual SWM Planning and Design should be followed closely to ensure successful clean and dirty water separation.

8.3.3 Recommendation

SWS is of the opinion that the Colenso Power Plant project will not be a significant negative environmental (water) risk and should be approved for all applications and processes by Authorities, Stakeholders, and decision makers; and

SWS is of the opinion that detail required from the Gap Analyses and the Recommendations are mostly required for specific Water Use Licence Application purposes and that SWS is of the opinion that the conceptual depth of this document is more than adequate for the Environmental Application purposes.

8.4 Soil Assessment

ARC was appointed to conduct the soil impact study. Their report is attached as Appendix G. The findings of the study were used to describe the soil baseline in Section 5.7 of this report.

8.4.1 Summary of Findings

The soils in the western half are mostly duplex soils (sandy topsoil abruptly overlying a structured clayey subsoil) with dark brown to reddish brown colours and a small patch of greyish brown subsoils, with smaller areas of swelling clays. In the east, there is also large area of shallow rocky soils, as well as eroded area with underlying rock exposed.

Soil analyses results show the difference between the high clay content, black, swelling clay soils (S1) and the duplex soils (S2-S4), which generally have a clear increase in clay from a more sandy topsoil to the clay subsoil. The swelling clay soils are alkaline, with higher CEC values, due mainly to the higher levels of Ca and Mg in the soils.

The duplex soils are moderately to slightly acidic, while the shallower soils are close to neutral. The P levels are low, showing no evidence of any recent cultivation, while the organic carbon values are moderately high.

No abnormal or unexpected values were obtained.

8.4.2 Recommended Mitigations

a. Develop infrastructure where possible on shallow soils.
b. Make sure vegetation removal and soil disturbance is minimized; put in place soil conservation measures.
c. Make sure vegetation removal and soil disturbance is minimized; put in place soil conservation measures.

8.4.3 Recommendation

None of the soils on the Power Station site have a high degree of agricultural potential, and there is little or no evidence of cultivation. The expected impacts in terms of loss of agricultural land will not be great. Nevertheless, due to the prevalence of potentially erodible soils on site and in the vicinity, care should be taken in avoiding unnecessary vegetation removal and/or excavations, and all reasonable soil conservation measures (contouring, culverts etc) should be used where necessary.

8.5 Vegetation Assessment

Dr Johannes J. Le Roux and Mr Jan-Hendrik Keet, sub contracted by Zone Land Solutions, conducted the vegetation impact assessment. Their report is attached as Appendix H. The findings of the study were used to describe the vegetation baseline in Section 5.8.1 of this report.

8.5.1 Summary of Findings

Overall, the site of the proposed development is of relative low conservation and biodiversity value, as evidenced by high levels of disturbance and various signs of human-mediated transformation/degradation. Small pastoral communities are present within close proximity of the study site. Signs of high levels of environmental transformation include: intensive overgrazing, as evidence by the general lack of ground cover (only woody trees present), extensive erosion gullies and high densities of livestock (sheep, cattle and goats) in the area. Overgrazing at the site is likely also the cause of the observed abundant element of short woody shrubs, most notably *Coddia rudis* (Small Bone-apple), and non-native alien weeds such as *Schkuhria pinnata* (Dwarf Marigold), *Solanum* (Nightshade) and *Opuntia* (Prickly Pear) species. None of South Africa's National List of Threatened Ecosystems occurs within or in close proximity to the study site.

Despite the relatively low overall biodiversity value of the site and therefore the conceived low risk of significant environmental impacts, some highly disturbed areas are preferred for development over other less-disturbed areas within the proposed site. More suitable land for the proposed development includes heavily transformed and overgrazed land. This area is characterised by dense woody tree and shrub vegetation as a result of bush encroachment. The adjacent area within the site still has reasonable grass cover and limited bush encroachment and less extensive signs of erosion, overgrazing and transformation.

8.5.2 Recommended Mitigations

a. The areas identified as highly transformed or disturbed, characterised by heavy bush encroachment, disturbance and erosion, be selected for the development in favour of adjacent and less-disturbed areas with reasonable grass cover.

b. The authors also recommended that a portion of the more undisturbed area neighbouring the development be demarcated as an ecological buffer area.

    i. That is, a fenced off area,

    ii. kept clear of alien species and

    iii. actively managed by qualified ecologists.

    iv. This is important in ensuring that the ecological integrity of habitats as well as that existing species populations are not permanently compromised.

c. Specific effort must therefore be made to manage the storm water run-off. Increased erosion in highly disturbed areas may occur during rainy seasons. This is not only due to increased disturbance levels associated with the area but also because of the presence of natural drainage lines at the site.

d. Appropriate erosion management actions are therefore required. Soil erosion can also have impacts that extend outside the development site through the transport of sediment that may result in downstream habitat alterations and biodiversity impacts.

8.5.3 Recommendation

The major foreseen impacts associated with the development, particularly during the construction phase, include complete and permanent removal of native vegetation, increased disturbance and erosion, and increased abundances and spread of pioneer invasive alien species. In the light of these foreseen impacts the specialists recommended the establishment of an ecological buffer area.

8.6 FAUNA

SW van der Merwe was sub-contracted by Zone Land Solutions to conduct the fauna impact assessment. The fauna report is attached as Appendix H. The findings of the study were used to decribned the fauna baseline in Section 5.8.2 of this report.

8.6.1 Summary of findings

There are no environmental policy directives of the relevant municipality and other spheres of government that oppose or constrain the proposed development.

The eco-region within which the study area is located has a low irreplaceability score. It is however noted that the EKZNW C Plan states that notwithstanding their relatively low conservation value, areas in this category are not open for wholesale development. Important species are still located within these areas and should be accounted for in the EIA process.

By nature, Red Data species are difficult to observe. The fact that none of the Red Data species predicted to occur in the area has been observed does not necessarily mean that they do not occur. However, the almost total lack species that are generally readily observed may be construed as a conclusive indicator that the integrity of the faunal life in the area is low.

The *in situ* conservation status of the study area is low primarily due to anthropogenic influences. The site has been subject to uncontrolled resource use which has had a detrimental effect on biodiversity, with specific reference to the faunal component. The only portion to be protected (as a NEMA-based obligation) is the stream (drainage line) and associated features, together with a 32 m buffer on either side of the system.

The site has consequently also lost its natural functionality and concomitant ecosystem services. Due to current and predicted environmental and social factors the prognosis for recovery of the site to a functional state is low.

Accordingly the proposed development would not have a significant impact as it relates to the depletion of the in situ, local and regional faunal biodiversity stock.

8.6.2 Recommended mitigation

a. Adequate resources should be made available for the rehabilitation and in perpetuity protection of land with a high irreplaceability score (preferably in the vicinity of the study area).

b. A detailed procedure needs to be followed under the auspices of EKZNW whereby a beneficiary land unit is identified for those areas that are irreplaceable. The principle of this is to try to achieve a no net loss in faunal assets and, where possible, support and overall improvement in long-term biodiversity.

c. The footprint of the proposed construction and the concomitant activities must be reduced to the extent possible.

d. No development may be undertaken in the defined drainage and seepage area and a buffer of 32 m on each side thereof (the mandatory buffer stipulated by NEMA), unless permission is granted in writing.

e. An Environmental Control Officer (ECO) has to be appointed to ensure compliance with the EMP during construction.

f. Standard practices to avoid bird mortalities due to collision with the exit transmission lines must be instituted.

g. Waste material, including camp sewage, must be stored in an appropriate area from where it should be removed and properly disposed of within a stipulated period.

h. No excavation or building material may be dumped outside the demarcated construction footprint.

i. In the event of accidental spills, immediate action must be carried out to reduce the impact of the spill, followed by a thorough clean-up operation undertaken in terms of standard operating procedures.

j. Any fauna encountered that are at risk of being harmed, or which may have fallen into an excavation, should be removed from the site and relocated to an adjacent area considered suitable for the individual. The ECO should advise whether specialist assistance is required for capturing and relocating specimens.

k. Suitably designed barriers or covers should be used when excavated pits remain open in areas where fauna are at risk of falling in. Construction personnel should be monitored continuously to ensure collection and/or poaching by personnel does not take place.

l. Earth wires of the power line must be marked with a suitable anti-collision marking device according to Eskom Transmission guidelines.

m. A project-specific and global best-practice EMP is to be compiled for the project. This document will detail the specific controls, which must be in place for the duration of construction and operation.

n. Storm water from the development should be stored and re-used.

o. Undertaking and sustaining rehabilitation and management of a portion (at least 5 km) of the river system in accordance with the EMP

8.6.3 Recommendation

The implementation of equitable 'mitigation banking' would create a hugely positive precedent that would give effect to government policy as it relates to unlocking the latent benefits and synergies vested with sustainable development.

From a faunal perspective, the study has conclusively indicated that there are no reasons that could prevent the proposed development from being undertaken.

8.7 FRESHWATER

Mr. Savel Daniels was sub-contracted by Zone Land Solutions to conduct the freshwater impact assessment. The fauna report is attached as Appendix H. The findings of the study were used to decribe the fauna baseline in Section 5.8.3 of this report.

8.7.1 Summary of findings

The site proposed for the proposed power station near Colenso in KwaZulu-Natal is characterised by the presence of a man made dam and a seasonal seepage area. These freshwater systems are not significant and harbour very limited biodiversity since the area has been subject to uncontrolled resource use; which has had a detrimental effect on biodiversity prior to the proposed development. Neither the dam nor the seepage area are physically or geographically connected to the Thukela River, hence there will be no or an extremely limited impact of the proposed development on endemic taxa within the larger Thukela River basin. The in situ conservation status of the study area is low primarily due to the long term influence of human activities. As a result of the uncontrolled resource use through human activities, there has been a detrimental effect on biodiversity.

8.7.2 Recommended Mitigation

a. In consideration of NEMA based guidelines; it is recommended that the stream (drainage line) and associated features, together with a 32 m buffer on either side of the system are the portions to be buffered.
b. Water should be identified for the proposed power station since there is limited freshwater on site.
c. Sewage and waste removal needs to be organised in an efficient manner in order to ensure that the wetland is not polluted by any construction or human waste.
d. The storm water run -off from the site should be contained to limit the pollution of freshwater from dams for the neighbouring communities. No water should be pumped untreated to the Thukela River.

8.7.3 Recommendation

There is a need for a 32 m buffer zone on either side of the freshwater resources, as required by law.

8.8 SOCIO-ECONOMIC IMPACT ASSESSMENT

Urban-Econ Development Economists (U-EDE) was appointed to conduct the Socio-economic impact study. Their report is attached as Appendix I. The findings of the study were used to describe the socio-economic baseline in Section 5.10 of this report.

8.8.1 Summary of Findings

The local government has recognised the importance of the manufacturing sector as well as agriculture and tourism, in driving growth and development in the region. The town of Colenso in particular has become a service centre for the area's agricultural sector since the decommissioning of the old Colenso power station in the 1980's. The broader study area is rich in cultural heritage and scenic beauty. The Natal Battle-routes are in the zone of influence, as well as a variety of tourism and game hunting facilities. Consultation with the potentially directly affected landowners has also revealed that portions of the potentially impacted land has notable cultural value due to the location of burial sites of ancestral of people currently living on these sites. This means that any development envisioned for the region should be sensitive to the possible influence on these sensitive receptors.

U-EDE indicated that the region requires an injection, specifically when considering the high level of unemployment, low literacy and lack of service delivery close to the proposed project site. Consultation with the local municipal authorities revealed that efforts have been made to stimulate the local industrial sector in the region by the development of industry estates. These have been unsuccessful, partly to blame on low occupancy rates as well as a lack of service delivery. When occupancy of the business park is taken, the businesses would typically not last long before closing down. This could in turn be attributed to the struggling local economy. The planned investment into the local economy could result in the revitalisation of the local manufacturing industry. The project will also result in various negative socio-economic impacts. These impacts would have to be properly managed and mitigated should the proposed project be approved for implementation.

The socio-economic impacts are provided in Section 9.10 of this report. Some of the more prominent negative impacts include the potential loss in the tourism and game hunting industry and the possible effects on the demographics and scenic nature of the environment. The area is also home to a host of heritage resources of national importance. Mitigation measures do exists, and they will be able to decrease the significance of most of these negative impacts, if implemented as recommended.

Regardless, the positive impacts for the project area far outweigh the negatives since the much needed injection into the local economy will stimulate local production, job, creation and government revenue. In addition to this the developers will commit to further investment into the local community through the SED and ED initiatives.

On a national level the project will assist government in its goal of job creation and uplifting of previously disadvantaged and marginalised communities. More importantly, however, it will contribute towards national energy security, which is vital for the country's economy.

8.8.2 Recommended Mitigations

U-EDE made the following recommendations in terms of the positive impacts identified.

8.8.2.1 Construction Phase

Implementation of these mitigation measures would increase the benefit to the local economies where feasible:

a. Local procurement and employment of individuals from within the local communities should be increased where possible and feasible to decrease leakage of purchasing power and increase the benefits to the local economy.

b. The applicant should engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods, and products from local suppliers where feasible.

c. The public participation process revealed that there are some local businesses offering their services during the construction period. These service providers could be investigated.

These mitigation measures could potentially increase the positive impacts derived by the local communities:

a. Organise local community meetings to advise local labour on the construction of this component of the proposed project and potential job opportunities they can apply for.

b. Perform a skills audit, so the potential for local labour procurement opportunities can then be determined. This could be done by creating a skills registrar as the local municipal offices.

c. The applicant should recruit local labour as far as feasible.

d. If feasible, make use of labour-intensive construction methods.

e. Sub-contract to local construction companies where feasible.

f. Make use of local suppliers where possible, and arrange with local SMME’s to provide transport, catering, and other services to the construction workers.

g. Where the construction activities of the phases are running consecutively, it should be considered to extend the employment contracts of those working on the previous phase into the next to lengthen the period of benefit for those involved.

Based on the current skill level of the local community, these measures are envisaged to assist in increasing the likelihood of skills transfer to locals from the study area:

a. Facilitate knowledge and skills transfer between workers during the construction phases.

b. Set up apprenticeship programmes to build on existing skills or for the advancement of development of new skills for construction workers, especially those coming from the local communities.

These measures will aid in enhancing the possible positive impacts for the study area’s community; it will not necessarily improve the significance rating.

a. Where possible, local labour should be considered for employment to increase the positive impact on the local economy.

b. Local SMMEs should be approached to investigate the opportunities for supplying inputs and services required for the construction of the facility, as far as feasible.

c. Employ labour-intensive methods in construction where feasible.

d. Sub-contract to local construction companies where possible.

Establishment of the proposed project in a region where the industrial sector has been identified as a potential driver of growth will enhance the municipality's efforts at advancement of the sector in the area. It is therefore, expected that the investment itself will over time result in the anticipated benefits.

8.8.2.2 Operational Phase

a. To enhance the positive impact for local businesses and households, consultation with local authorities can take place to utilise the SED investments and dividends derived from the project to assist the municipality in providing grid connections to more households and small business.

b. The operator should be encouraged to procure inputs required, such as goods and services from local businesses wherever possible. This will increase and enhance the positive impact for the local economy, but will not affect the overall significance rating.

c. The procurement of local labour should be encouraged. This will increase the positive impact on the local economy.

d. Local SMME should be approached to investigate the opportunities for supplying inputs required for operations and maintenance. This will increase the retention of the employment created through multipliers in the local economies, further increasing the benefit to the local communities.

e. Where and when possible, local community members should be empowered to obtain permanent employment at the operations and maintenance of the project:

f. A targeted skills development programme should be devised to ensure optimal skills and knowledge transfer between foreign and domestic workers and specifically those coming from local communities

g. Identify communities to benefit from the project through SED and ED spend.

Compile practical SED and ED plans that are to be updated on a regular basis:

a. Identify the needs of the local communities through a through social infrastructure audit and household surveys.

b. Create a profile of local businesses through a business survey and identify their needs to expand and create new jobs.

c. Identify new business opportunities in the area.

Ensure that the project includes a trust comprising of the local, previously disadvantaged and/or marginalised communities to provide them with an opportunity to benefit in the long-term.

a. Once debt is paid and the trust starts earning dividends, ensure that the funds are allocated towards projects and initiatives that address the core needs of the community.

Recruit local labour where possible to increase the benefits to the local communities.

Local procurement of goods and services required for operations and maintenance, will assist in retaining a bigger share of the income generated though indirect and induced effects in the local economy.

8.8.2.3 Decommissioning

Where feasibly possible, the following measures should be adopted in an effort to increase the magnitude of the benefit felt by the local economy:

a. Subcontract decommissioning activities to local contractors as far as feasible.

b. Procure supplies required for the decommissioning activities from local businesses.

c. Source additional labour requirements from the local economy if possible.

8.8.3 Recommendation

From a socio-economic perspective U-EDE recommends that the Colenso Integrated Power Project should be approved for development, assuming that the mitigations proposed in their report are implemented.

Mitigation measures for possible negative impacts are presented in Part B: Environmental Management Programme.

8.9 NOISE

Enviro Acoustic Research (EAR) was appointed to conduct the Noise impact study. Their report is attached as Appendix J. The findings of the study were used to describe the baseline soundscape in Section 5.11 of this report.

8.9.1 Summary of Findings

Ambient sound level measurements indicate an area with a mixed sound character. Locations around Colenso are impacted by noises generated by the R103 and railway line, although areas further from Colenso is quieter and more typical of a rural area.

With the input data as used, the assessment done by EAR indicated a potential for a noise impact during the construction phase, with this impact being of high significance. This relates to both the day and night-time scenarios. This is due to the proximity of numerous potential noise-sensitive receptors staying close to the conveyor belt and power station. There is a potential for a noise impact of high significance during the operational phase.

8.9.2 Recommendations

a. Mitigation is required and proposed, the most significant likely the cladding of the conveyor belt in sheeting, especially in areas where it passes close to receptors. It may be required that some of the receptors be relocated.

b. Quarterly noise measurements are recommended at locations as defined by an acoustic consultant during both the construction and operational phases, as well as at receptors that registered a valid and relevant noise complaint.
c. The findings of the specialists report should be made available to all potentially noise-sensitive developments in the area with the contents explained to them to ensure that they understand all the potential risks that the development may have on them and their families.

8.10 Visual

MetroGIS was appointed to conduct the visual impact study. Their report is attached as Appendix K. The findings of the study were used to describe potential visual impacts of the development of the proposed power station and associated infrastructure in section 5.12 of the report.

8.10.1 Summary of Findings

The proposed Colenso power station and ancillary infrastructure is expected to have moderate to high visual impact, especially within a 3 – 6km radius of the facility.

The overall finding of the visual impact assessment is that if mitigation is undertaken as recommended, it is concluded that the significance of anticipated visual impacts will generally remain at acceptable levels.

8.10.2 Recommended Mitigations

a. Potential mitigation measures for the proposed power station include the maintenance and general appearance of the facility. These measures focus on the fact that if/when the facility is seen by outsiders; the general impression should be favourable. Timely maintenance of the station, ancillary infrastructure and the general surrounds of the property (gardens, access roads, etc.) can prevent the visual impact of degradation and perceived poor management. The most notable aspect of maintenance on this type of structure is the painting of the cladding of the power station. In this regard and as a further mitigation to the visual impact, overtly contrasting and bright colours should be avoided. Natural hues that complement the natural environment (i.e. light sky blue where the facility is seen against the skyline or pale green where it is seen against vegetation cover) can soften the general appearance of the power plant.
b. It is further highly advisable to engage with adjacent land owners (if required and where identified) in order to amiably and proactively address potential visual concerns. Site specific mitigation measures may be required in some cases and should be undertaken and maintained throughout the lifespan of the power plant.

8.10.3 Recommendations

The anticipated visual impacts are on average expected to be of high significance during the construction phase and of moderate to low significance during the operational phase. MetroGis concluded that the Colenso power station development is not considered to be fatally flawed from a visual perspective, provided that land owners adjacent to the facility are consulted and realistic mitigation measures are proposed and implemented. These site-specific mitigation measures should be undertaken additional to the adherence to, and implementation of, the recommended mitigation measures and the management plan (Part B).

8.11 Traffic

Sturgeon Consulting was appointed to conduct the traffic assessment. Their report is attached as Appendix L. The findings of the study were used to describe the existing transportation conditions in Section 5.13 of this report.

8.11.1 Summary of Findings

The current demand on the existing road network in the vicinity of the site is low and the road network and intersections operate will operate acceptably. The preferred route to the proposed development is via the D488 access off the R74 to the east of Colenso. The surface condition of this gravel road is poor and will deteriorate with the construction traffic volumes. Sections of this route will require upgrading to allow for use by heavy vehicles.

It is expected that the construction phase of the proposed development will generate the most vehicular trips as opposed to the operational stage. The biggest impact will be during the construction stage. During the construction phase and as part of the contract, the contractor is required to monitor the condition of the roads used and repair the road where it becomes damaged due to construction traffic.

8.11.2 Recommended Mitigations

a. Access to the site is via the D488 district road. During construction is it expected that the road surface of D488 will require maintenance at regular intervals. However, once construction is completed, the day to day operation of the proposed power station will generate relatively low traffic volumes which can easily be accommodated by the existing gravel road surface. To mitigate the possible impacts of the construction traffic and to reduce long-term maintenance costs, D488 could be surfaced. However, a well maintained gravel surface should be sufficient to accommodate the expected increase in traffic volumes on D488 during the construction phase.

b. The operational phase of this project is not expected to generate significant traffic volumes. The number of permanent staff on site on completion of all phases is not expected to be more than 1 350 people and therefore no additional upgrades are required to accommodate the operational site staff.

c. Once all 3 phases have been completed the power station will generate approximately 154 vehicle trips per day (135 private trips & 19 buses).

d. No other remedial or mitigation measures will be required to accommodate the additional traffic generated by the proposed coal fired power station facility.

8.11.3 Recommendation

Provided that the above recommendations are adhered to, the proposed development of the coal fired power station facility can be supported from a traffic engineering perspective.

8.12 Heritage

APelser Archaeological Consulting (APAC) was appointed to conduct the Phase 1 Heritage Assessment. Their report is attached as Appendix M. The findings of the study were used to describe the cultural heritage environment in Section 5.14 of this report.

8.12.1 Summary of Findings

Earlier Basic Assessments for in the development area indicated the presence of a range of historical (mainly Anglo-Boer War 1899-1902) sites in and around the area, while desktop research for this assessment indicated that there are a range of archaeological and historical resources known in the larger geographical area as well. The physical assessment conducted during May 2015 identified and recorded a number of sites, features and objects of varying significance within the study area, dating to the Stone Age, Iron Age and Historical time periods.

Eight sites where identified located close to or in the proposed Power Plant area. The Stone Age sites are all open-air sites, consisting of scatters of stone tools located close to and in erosion dongas found in the study area. The Iron Age sites include stone walled settlement sites, forming part of larger settlement complexes (dating to the Later Iron Age). The historical sites include the remains of homesteads and graves.

8.12.2 Recommendations

a. Possible Graves (Sites 2 & 3): Fence-off and manage/protect. If required then the graves could be exhumed and relocated after the necessary permissions have been provided and detailed social consultation has been undertaken.

b. The Phase 1 assessment for the other sites found at the proposed power plant site is seen as sufficient and no further mitigation is required.

9 IMPACT ASSESSMENT PROCESS

The environmental impact assessment phase will include the identification of all activities that have/ or can have direct, indirect or cumulative impact on the physical, social and economic environment. The significance of the impact will be determined using the assessment methodology described below.

9.1 DEVIATIONS FROM SCOPING & PLAN OF STUDY

The impact assessment process as proposed in the Plan of Study for EIA included in the Scoping Reports was followed. Deviations from the Scoping Report and Plan of Study is limited to the additional assessments requested by the Department of Environmental Affairs. These have been addressed in the impact phase and are presented in Section 11.

9.2 IMPACT ASSESSMENT METHODOLOGY

The generic criteria and systematic approach used to identify, describe and assess impacts as outlined in this report is stated under this section. In order to determine the significance of an activity each activity was rated. The following parameters were used:

Consequence

The factor of the Severity x Spatial Scale x Duration = the Consequence (Cons)

- Severity (S): - how severe is the impact that the activity has on the environment?
- Spatial Scale (SS): - over what area does the activity impact?
- Duration (D): - for how long does the activity have a continuous impact?

Likelihood

The factor of the Occurrence of Activity x Certainty of Impact = the Likelihood (Lklh).

- Occurrence of activity (O): - what is the probability for the activity to occur?
- Certainty of the Impact: (C) - How often does the activity impact on the environment?

Each parameter is rated from 1 (Lowest risk) to 5 (Highest risk).

- Consequence x Likelihood = Significance.

Table 9-1: Impact Rating Methodology Table

CONSEQUENCE: Table 1, Table 2 and Table 3	
TABLE 1 - SEVERITY	
How severe does the activity impact on the Environment?	
• Disturbance of degraded areas, which have little conservation value. • Minor change in species occurrence or variety. (Low)	1
• Inactive, benign area. Very deep water tables (>50m). Plentiful and available renewable resources.	2
• Disturbance of areas that have potential conservation value or are of use as resources. Complete change in species occurrence or variety. (Medium)	3
• Sensitive. Threatened, protected and or endangered areas not in immediate proximity, but not far away. Close proximity of large water courses (within 1: 50 year flood line), very high water tables (<1m). Limited non-renewable resources.	4
• Disturbance of pristine areas that have important conservation value. Destruction of rare or endangered species (High)	5

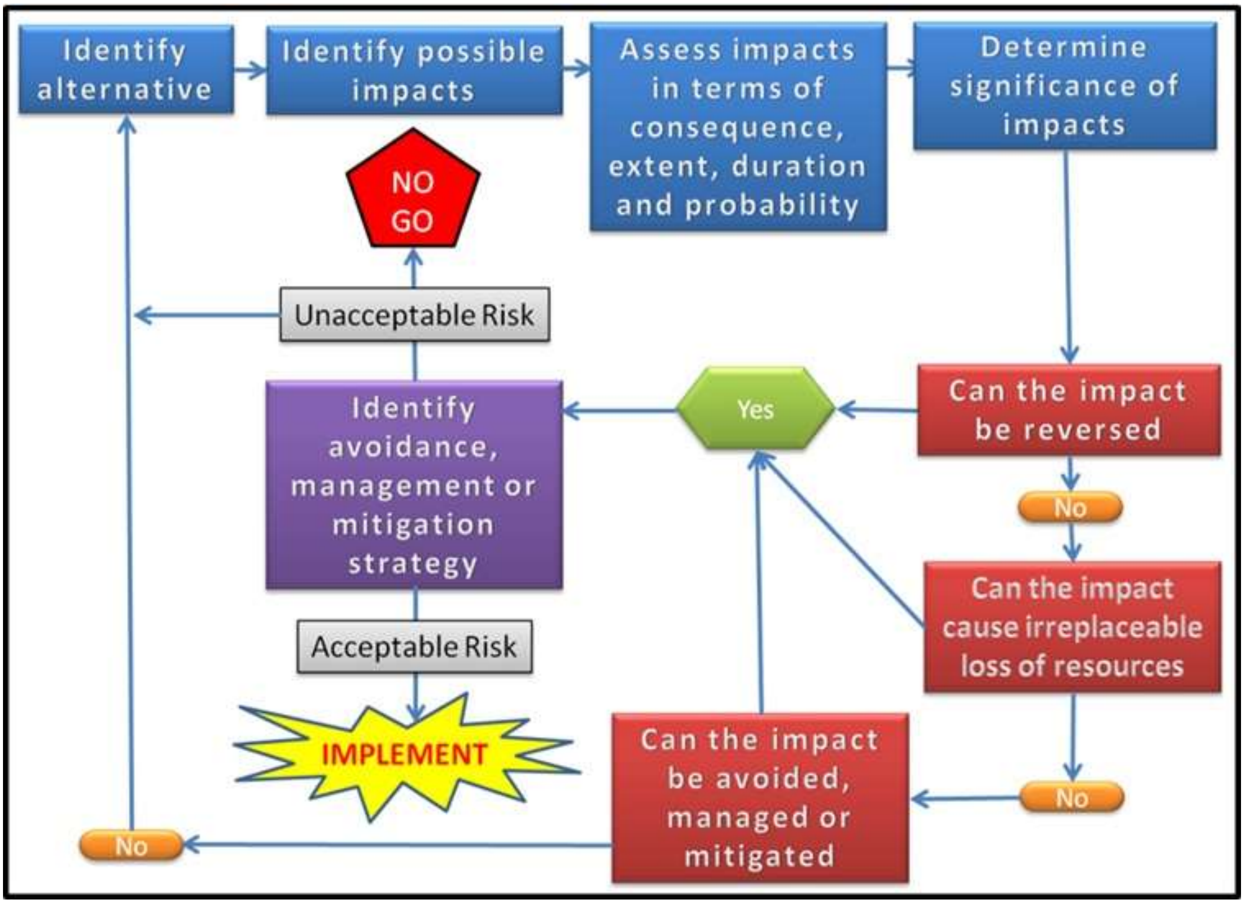
TABLE 2 – SPATIAL SCALE		
How big is the area that the activity is impacting on?		
• Immediate Area		1
• Only the site controlled by the organisation is affected. Within Site Boundary. (Low)		2
• Beyond site boundary. Local area. Neighbours and surrounding properties are affected. (Medium)		3
• Local/Regional. Impact of the substance is noticeable in the surrounding community or municipal region.		4
• Widespread. Far beyond site boundary. National to global (High)		5
TABLE 3 - DURATION		
How long does the activity impact on the Environment?		
• < Few days, no measurable sign of pollutant or its effects. Within one day there is no observable or detectable sign of the pollutant. The substance is no longer impacting on the environment.		1
• Up to 1 month. Substance has dissipated or disappeared within a month of release. Minimal loss of resource, species, habitat.		2
• Quickly reversible. Less than the project lifespan. Short term (0 – 5 years).		3
• Reversible over time. Lifespan of the project. Medium term (5 – 15 years).		4
• Permanent. Beyond decommissioning. Long term (More than 15 years).		5
LIKELIHOOD: Table 4 and Table 5		
TABLE 4 – OCCURRENCE		
What is the probability for the activity to occur?		
• Negligible. Less than 1:20 chance of occurrence (P<0.05).		1
• Occasionally. Less than 1:30 chance of occurrence		2
• Low Likelihood. Less than or equal to a 50:50 chance, but at least a 1:30 chance of occurrence (P<0.5, but >1:30).		3
• High Likelihood Greater than 50:50 chance of occurrence (P>0.5).		4
• 100% chance of occurring		5
TABLE 5 - CERTAINTY OF IMPACTS		
How often does the activity impact on the environment?		
• Unsure. Less than 40% sure of a particular fact or the likelihood of an impact occurring. Rare (could happen but unlikely)		1
• Possible. Only over 40% sure of a particular fact or of the likelihood of an impact occurring. Unlikely (has occurred somewhere		2
• Probable. Over 70% sure of a particular fact of the likelihood of that impact occurring. Likely (known to occur)		3
• Almost certain (occurs often)		4
• Definite. More than 90% sure of a particular fact. Substantial supportive data exist to verify the assessment. Inevitable (Expected to happen often)		5
CALCULATIONS		
Table 1 X Table 2 X Table 3 = Consequence Table 4 X Table 5 = Likelihood Consequence X Likelihood = Impact		
IMPACT SIGNIFICANCE		
How acceptable is the impact?	***Impact Rating***	
• Low (Acceptable). No risk to public health; environment.	**1 – 5 000**	
• Medium (Manageable). With regulatory controls. With project proponent's commitments.	**5 001 – 10 000**	
• High (Unacceptable). Redesign project to remove or avoid impact. • Abandon project if no mitigation is possible	**> 10 000**	

Source: Developed from Combination of sources, including DEAT (2008) Guideline, Professional capacity

9.3 IMPACT ASSESSMENT TABLE

Figure 9-1: Alternative Consideration Decision tree Methodology

Source: Developed from Combination of sources, including DEA Guidelines, Professional capacity



9.4 Air Quality

Rayten Engineering cc was appointed to assess the air quality impacts related to the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the air quality impacts as presented.

9.4.1 Impacts during construction

The air quality impacts, and the uncontrolled significance rating thereof, that can be expected during the construction of the power station and associated infrastructure are presented in the table below.

Table 9-2: Air Quality Impacts associated with construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Land clearing, ground excavation, drilling and blasting, cut and fill operations, vehicle dust entrainment from trucks and the	Dust Fallout(TSP)	5	1	2	10	5	5	25	1 250

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
	construction of infrastructure									

Dust is the main pollutant of concern emitted during heavy construction activities. The impact of dust emissions associated with heavy construction is generally limited to the period of construction where the impact is significantly reduced once construction activities have stopped. Dust emissions from construction activities is associated with land clearing, ground excavation, drilling and blasting, cut and fill operations, vehicle dust entrainment from trucks and the construction of infrastructure. Dust emissions from construction activities will vary depending on the level of activity and prevailing meteorological conditions (USEPA, 1995).

Rayten assumed that construction will occur for 12 hours a day for seven days a week. In addition it was assumed that no dust suppression measures would be implemented during the construction phase. Input parameters for the construction of the power station are summarised in Table 9-3. The input parameters were derived from the conceptual power plant layout (refer Appendix C) provided by the client, where information was not available assumptions were made.

Table 9-3: Input Parameters for the Construction of the Power Station

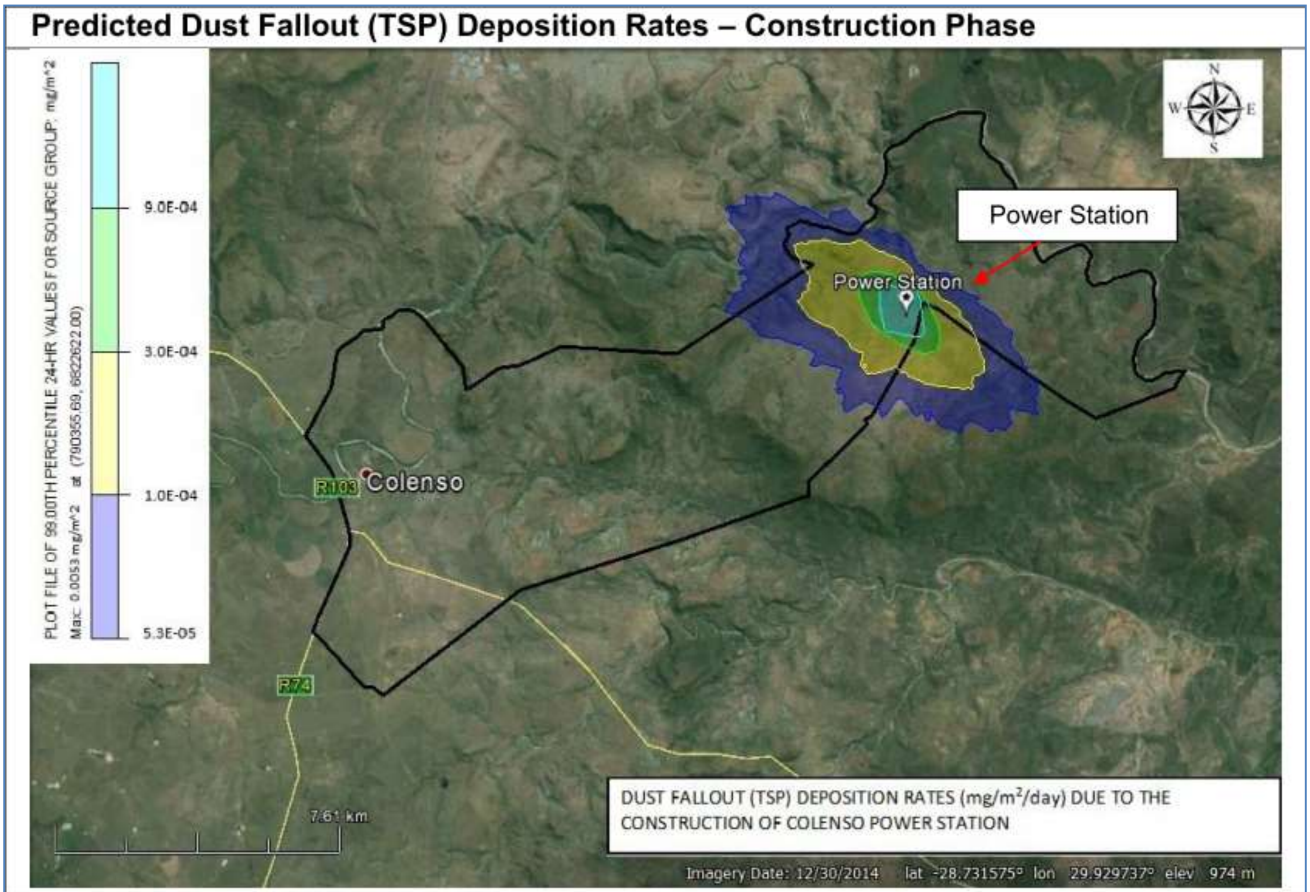
	Width (1)	Length (1)	Emission Source Type	Emission Rate (G/S)
				TSP
Power Station	1000 m	1000 m	Area	0.00010378

[1] Dimensions were derived from conceptual power plant layout

Source: Rayten, Air Quality Assessment (2015)

Predicted incremental dust fallout rates associated with the construction of the power station is given in Figure 9-2. Predicted dust fallout rates are well below the South African dust fallout limits of 600 mg/m^2/day and 1200 mg/m^2/day permissible for residential and non-residential areas respectively. Very low dust fallout rates are predicted along the power station boundary. A maximum daily average dust fallout rate of 0.0053 mg/m^2/day is predicted due to construction activities at the power station.

Figure 9-2: Predicted Dust Fallout Rates during Construction



COMMENTS: No exceedances observed.	**GRID SIZE:** 50 x 50 km	**MODEL:** AERMOD View
	GRID SPACING: 1 km	**OUTPUT TYPE:** 99th Percentile Deposition Rates
	NUMBER OF SOURCES: X 1 area source (power station)	**ASSUMPTIONS:** Construction occur for 12 hours per day - See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available. Vehicle dust entrainment.	**AMBIENT STANDARD:** 600 - 1200 mg/m²/day (non-residential areas) 600 mg/m²/day (residential areas)
		DATE: 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

9.4.2 Impacts during Operational Phase

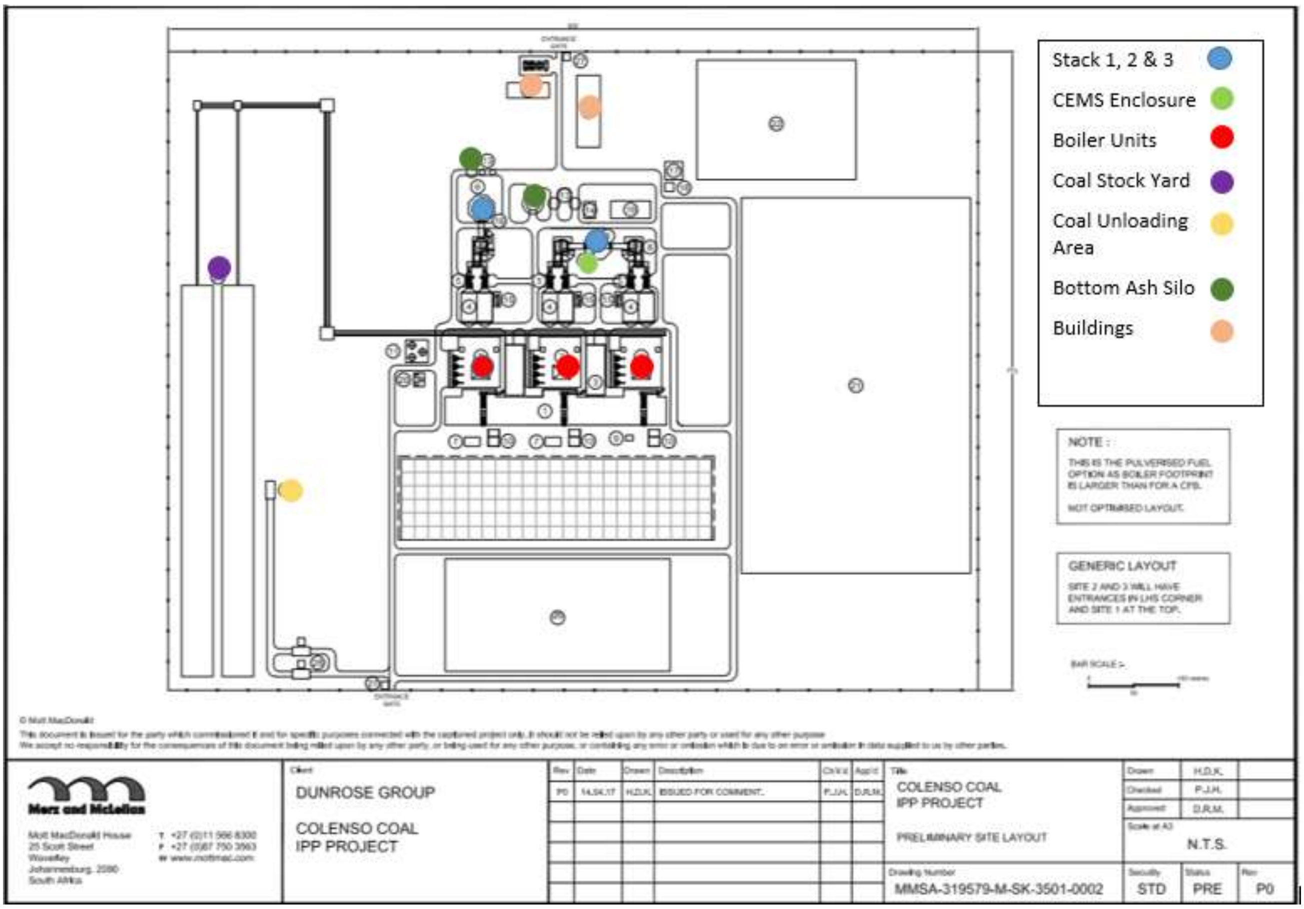
The air quality impacts, and the uncontrolled significance rating thereof, that can be expected during the operational phase of the power station and associated infrastructure are presented in the table below.

Table 9-4: Air Quality Impact associated with operations

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Material handling operations (transfer, loading/offloading of material); Crushing; Storage of material (Coal stock yard and ash dump); Pulverised fuel combustion (stack emissions)	PM_{10}	5	3	5	75	5	4	20	6 000
Operation of Power Station & infrastructure	Material handling operations (transfer, loading/offloading of material); Crushing; Storage of material (Coal stock yard and ash dump); Pulverised fuel combustion (stack emissions)	$PM_{2.5}$	5	3	5	75	5	4	20	7 500
Operation of Power Station & infrastructure	The transfer, loading and offloading of coal and ash by means of a conveyor, scrapers, etc.	Dust Fallout (TSP)	5	2	5	50	5	5	25	6 250
Operation of Power Station & infrastructure	Stack Emissions	Nitrogen Dioxide (NO_2)	5	4	5	100	5	5	25	5 000
Operation of Power Station & infrastructure	Stack Emissions	Carbon Monoxide (CO)	5	4	5	100	5	5	25	5 000
Operation of Power Station & infrastructure	Stack Emissions	Sulphur Dioxide (SO_2)	5	4	5	100	5	5	25	5 000
Operation of Power Station & infrastructure	Stack Emissions	CO_2	5	3	5	75	5	5	25	9 375

The main sources of emissions associated with the proposed operations at the Colenso coal-fired power station spatially represented in Figure 9-3.

Figure 9-3: Site layout showing emission sources



Source: Rayten, Air Quality Assessment (2015)

Table 9-5: Dust fallout, PM_{10} and $PM_{2.5}$ emission sources

Pollutant	Sources Of Emissions	
	At Power Station	At Coal Mine
Dust fallout (TSP)	Material handling operations (transfer, loading/offloading of material); Crushing; Storage of material (Coal stock yard and ash dump).	High wall mining (drilling); Bulldozing; Material handling operations (transfer, loading/offloading of material).
Particulate emissions (PM10 and PM2.5)	Material handling operations (transfer, loading/offloading of material); Crushing; Storage of material (Coal stock yard and ash dump); Pulverised fuel combustion (stack emissions)	High wall mining (drilling); Bulldozing; Material handling operations (transfer, loading/offloading of material).

Notes:

- The handling, storage and transfer of limestone was excluded as not enough information about routes, storage locations and dimensions was known at the time of modelling.
- Vehicle dust entrainment due to trucks was excluded as not enough information was known about the number of trucks to be used, characteristics of trucks, truck routes, etc. at the time of modelling. It is anticipated that very few trucks will be used as the material will be transferred by conveyor.
- It was assumed that all material will be transferred from the mine to the power station by a closed overland conveyor system.

Source: Rayten, Air Quality Assessment (2015)

9.4.2.1 Sources for Dust Fallout, PM_{10} & $PM_{2.5}$

Dust fallout, PM_{10} and $PM_{2.5}$ emissions are also expected to occur during the operational phase of the power station but also at the proposed coal mine operations. Although this application does not relate to the proposed mine development, the impact of these particulates during the operation of the proposed power station and coal mine were modelled together to provide a worst case scenario.

The main sources for dust fallout, PM_{10} and $PM_{2.5}$ associated with the proposed operations at the Colenso coal-fired power station and coal mine are summarised in Table 9-5.

Material Handling Operations – Loading and Offloading at Power Station and proposed Coal Mine

Materials handling operations associated with the Colenso power project that are predicted to result in significant fugitive dust emissions include the transfer, loading and offloading of coal and ash by means of a conveyor, scrapers, etc. The quantity of dust which will be generated from such loading and off-loading operations will depend on various climatic parameters, such as wind speed and precipitation, in addition to non-climatic parameters such as the nature (moisture content) and volume of the material handled. Fine particulates are more readily disaggregated and released to the atmosphere during the material transfer process, as a result of exposure to strong winds.

In the air quality study no dust suppression measures were assumed to occur during material handling operations as not enough information was known about what mitigation measures would be implemented and to what degree. Therefore the worst case scenario was modelled.

The material throughputs and emission rates for material handling operations are given in Table 9-6. Each of the operations were modelled as a separate source. Note that emissions associated with the transfer of limestone to the stockpile were excluded.

Table 9-6: Material Handling Operations Associated with the Colenso Power Project

<table>
<tr><th rowspan="2">Source</th><th rowspan="2">Dimensions</th><th rowspan="2">Tonnes/Hour</th><th colspan="3">Emission Rate (G/S)</th></tr>
<tr><th>TSP</th><th>PM_{10}</th><th>$PM_{2.5}$</th></tr>
<tr><td>Loading of coal onto temporary storage pile at mine</td><td>2 m x 2 m [(1)]</td><td>420</td><td rowspan="2">0.04439</td><td rowspan="2">0.02099</td><td rowspan="2">0.00133</td></tr>
<tr><td>Unloading of coal from temporary storage pile onto conveyor at mine</td><td>2 m x 2 m [(1)]</td><td>420</td></tr>
<tr><td>Unloading of coal from conveyor to coal stock yard</td><td>10 m x 20 m [(2)]</td><td>418</td><td rowspan="2">0.04417</td><td rowspan="2">0.02089</td><td rowspan="2">0.00486</td></tr>
<tr><td>Transfer of coal at transfer points along conveyor at power station</td><td>10 m x 10 m [(2)]</td><td>418</td></tr>
<tr><td>Unloading of ash onto ash dump</td><td>10m x 20 m [(1)]</td><td>116</td><td>0.00152</td><td>0.00072</td><td>0.00017</td></tr>
<tr><td colspan="6">Notes:
[1] Dimensions were assumed as they were not known at the time of modelling.
[2] Dimensions were taken from the dwg drawings provided by the client.</td></tr>
</table>

Source: Rayten, Air Quality Assessment (2015)

Crushing at Power Station

Tertiary crushing of coal will occur at the power station (Table 9-7). There is no specific emission factor for crushing coal therefore the emission factor for uncontrolled crushing of stone was used as an alternative to estimate emissions from crushing activities at the power station.

Table 9-7: Crushing Activities at the Coal-Fired Power Station

Source	Dimensions	Tonnes/Hour	Emission Rate (G/S)		
			TSP	PM_{10}	$PM_{2.5}$
Crushing of coal	20 m x 10 m (1)	418	0.31350	0.13933	0.00941

Notes:
[1] Dimensions were taken from the dwg drawings provided by the client.

Source: Rayten, Air Quality Assessment (2015)

Wind Erosion from Exposed Areas

The ash dump and coal stock yard area will give rise to significant dust emissions. Physical properties namely the shape, size, height, the surface area coverage, moisture content and the surface compaction of the ash dump and stockpiles together with prevailing meteorological conditions will influence the rate at which dust is emitted.

The size, height, width and shape of the stockpiles and ash dump will alter wind field patterns and surface boundary layer interactions thus influencing the dispersion and dilution potential of the dust plume. The moisture content, surface compaction and surface coverage area will affect the quantity of dust emitted from the ash dump and stockpiles. Overtime the water content of the ash dump will decrease due to varying ambient temperatures and relative humidity, thus if the area is not treated for dust suppression it may be a substantial source of fugitive dust emissions.

Significant amounts of dust will be eroded from the stockpiles under wind speeds greater than 5.4 m/s (i.e. threshold friction velocity of 0.26 m/s). Fugitive dust generation resulting from wind erosion under high winds (i.e. > 5.4 m/s) is directly proportional to the wind speed. In the estimation of fugitive dust emissions from the coal stock yard area and ash dump, use was made of the equation for wind erosion and maintenance of an active storage pile.

Source parameters for the coal stockpiles and ash dump are given in Table 9-8

Table 9-8: Stockpiles At Colenso Power Station

Source	Height (M)	Area (M^2)	Emission Rate (G/S)		
			TSP	PM_{10}	$PM_{2.5}$
Ash Dump	40	70 5600	77.616	38.808	2.328
Coal Stock Yard	10(1)	80 000	8.8	4.4	0.264
Limestone Stockpile	Not modelled. Not enough information known.				

Notes:
[1] Assumed to be 10m as the height was not specified

Source: Rayten, Air Quality Assessment (2015)

High Wall Mining - Drilling at proposed Coal Mine

High wall mining is similar to drilling in that the machine drills horizontally into the hard strata or hard overburden in order to extract the coal. There is not a equation specific for high wall mining therefore the emission factor for drilling into coal was used instead.

High wall mining was assumed to occur for 24 hours a day for seven days a week. It was assumed that two high wall mining machines would be used at a time and that no dust suppression measures would be implemented during the mining process. Input parameters for the drilling of coal are summarised in Table 9-9. The input parameters were chosen based on the information provided by the client and where information was not available assumptions were made.

Table 9-9: Input Parameters for High Wall Mining at the proposed Coal Mine

Source	Dimensions Of Drill Hole[1]		Emission Source Type	Emission Rate (G/S)		
	Width	Length		TSP	PM_{10}[2]	$PM_{2.5}$[3]
Drilling into coal	1 m	1 m	Area	0.00116	0.00058	0.00004

[1] Dimensions were assumed as they were unknown at the time of modelling.
[2] PM10 was assumed to be 50% of TSP
[3] PM2.5 assumed to be 3% of TSP

Source: Rayten, Air Quality Assessment (2015)

Bulldozing at the proposed Mine

The USEPA provides an emissions equation specifically for activities from bulldozers since this equation takes silt content and moisture into account. Bulldozing was assumed to occur at the temporary coal storage pile by the transfer point before material is transported to the power station. Bulldozing was assumed to occur for 24 hours a day, seven days a week

As the coal moisture content and silt content was not known at the time of modelling, assumptions were made. Emission rates for TSP, PM10 and PM2.5 from bulldozing the coal at the temporary storage pile at Colenso coal mine are given in Table 9-10.

Table 9-10: Bulldozing Activities at the proposed Coal Mine

Source	Dimensions Of Bulldozing Area[1]		Emission Source Type	Emission Rate (G/S)		
	Width	Length		TSP	PM_{10}	$PM_{2.5}$[2]
Bulldozing of coal	2 m	2 m	Area	3.60478	0.69862	0.10814

[1] Dimensions were assumed as they are not yet known at this stage of the design.
[2] PM2.5 assumed to be 3% of TSP

Source: Rayten, Air Quality Assessment (2015)

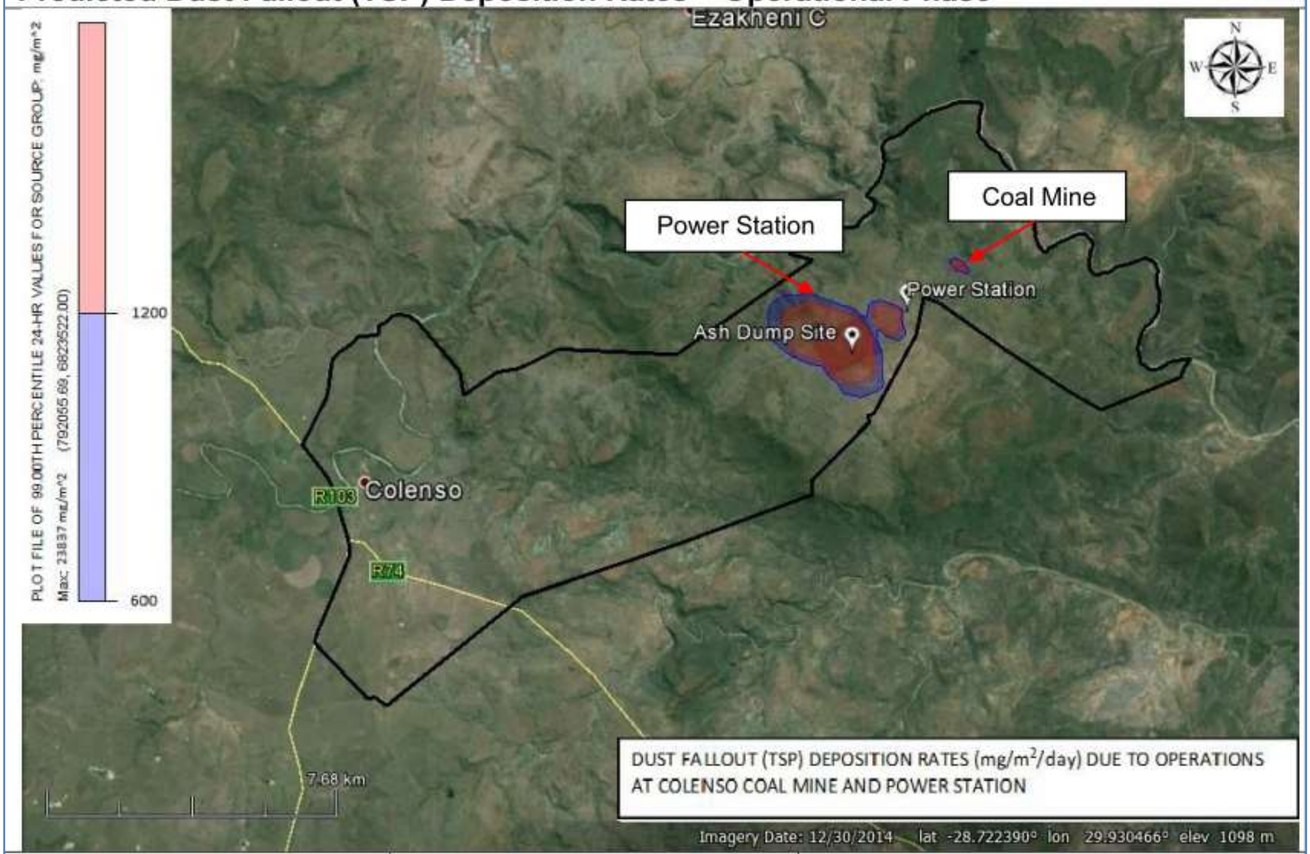
9.4.2.2 TSP Concentrations

Predicted incremental dust fallout rates due to operations at the power station and mine are given in Figure 9-4. Predicted incremental dust fallout rates exceeded the South African dust fallout limits of 600 mg/m2/day and 1200 mg/m2/day permissible for residential and non-residential areas respectively.

At the power station high dust fallout rates were observed around the ash dump, coal stock yard area and crusher, however these did not disperse far from the source and fell within the power station boundary. No residential receptors were identified to fall within the exceedance zones. It should be noted that it was assumed that no dust suppression measures were implemented thus the worst case scenario is presented.

Figure 9-4: Predicted Dust Fallout Rates due to Operations at the proposed Power Station and Coal Mine

Predicted Dust Fallout (TSP) Deposition Rates – Operational Phase



COMMENTS:		
Blue Band – Exceedance of the residential area standard.	**GRID SIZE:** 50 x 50 km	**MODEL:** AERMOD View
Red Band – Exceedance of the non-residential area standard.	**GRID SPACING:** 1 km	**OUTPUT TYPE:** 99th Percentile Deposition Rates
Worst case scenario - No dust suppression mitigation measures were considered for all emission sources.	**NUMBER OF SOURCES:** X 9 area sources X 4 volume sources	**ASSUMPTIONS:** Operations assumed to occur 24h per day. See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available. Handling of limestone and vehicle dust entrainment.	**AMBIENT STANDARD:** 600 - 1200 mg/m²/day (non-residential areas) 600 mg/m²/day (residential areas)
		DATE: 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

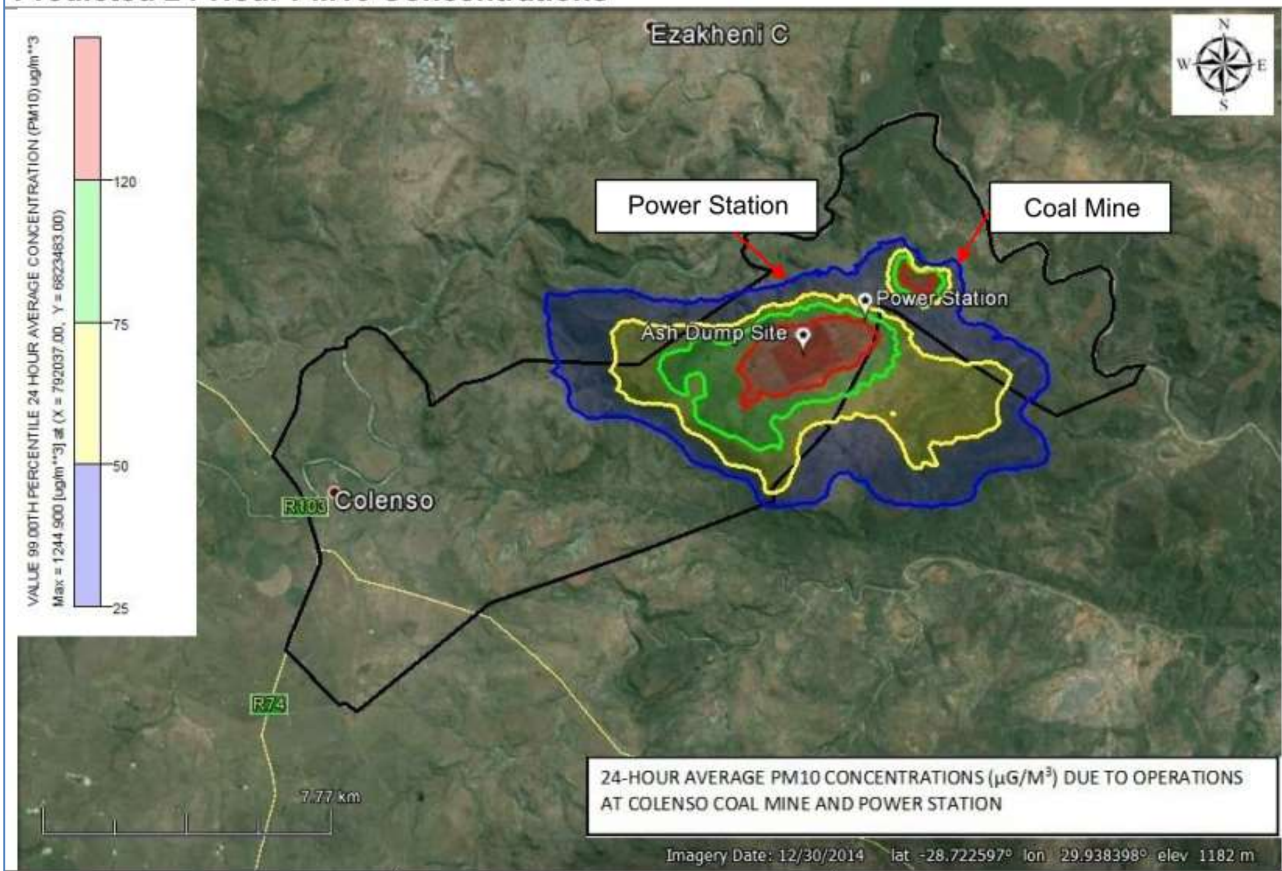
9.4.2.3 *PM_{10} Concentrations*

Predicted incremental daily and annual PM_{10} concentrations associated with operations at the power station and coal mine are given in Figure 9-5 and Figure 9-6. Predicted incremental daily PM_{10} concentrations are in non-compliance with both the South African and WHO daily air quality Standards of 75 µg/m³ and 50 µg/m³ respectively. Similarly predicted incremental annual PM_{10} concentrations are in non-compliance with both the South African and WHO annual air quality Standards of 40 µg/m³ and 20 µg/m³.

At the power station site maximum predicted daily (> 120 µg/m³) and annual (> 80 µg/m³) PM_{10} concentrations were observed around the ash dump site, coal stock yard area and crusher. The isopleth plots for PM_{10} show that the high concentrations of PM_{10} do not occur far from the source, however exceedances of the South African and WHO standards are observed beyond the power station boundary. No residential receptors were identified to fall within the exceedance zones.

Figure 9-5: Predicted 24-Hour Average PM10 Concentrations due to Operations at the proposed Power Station and Coal Mine

Predicted 24-Hour PM10 Concentrations

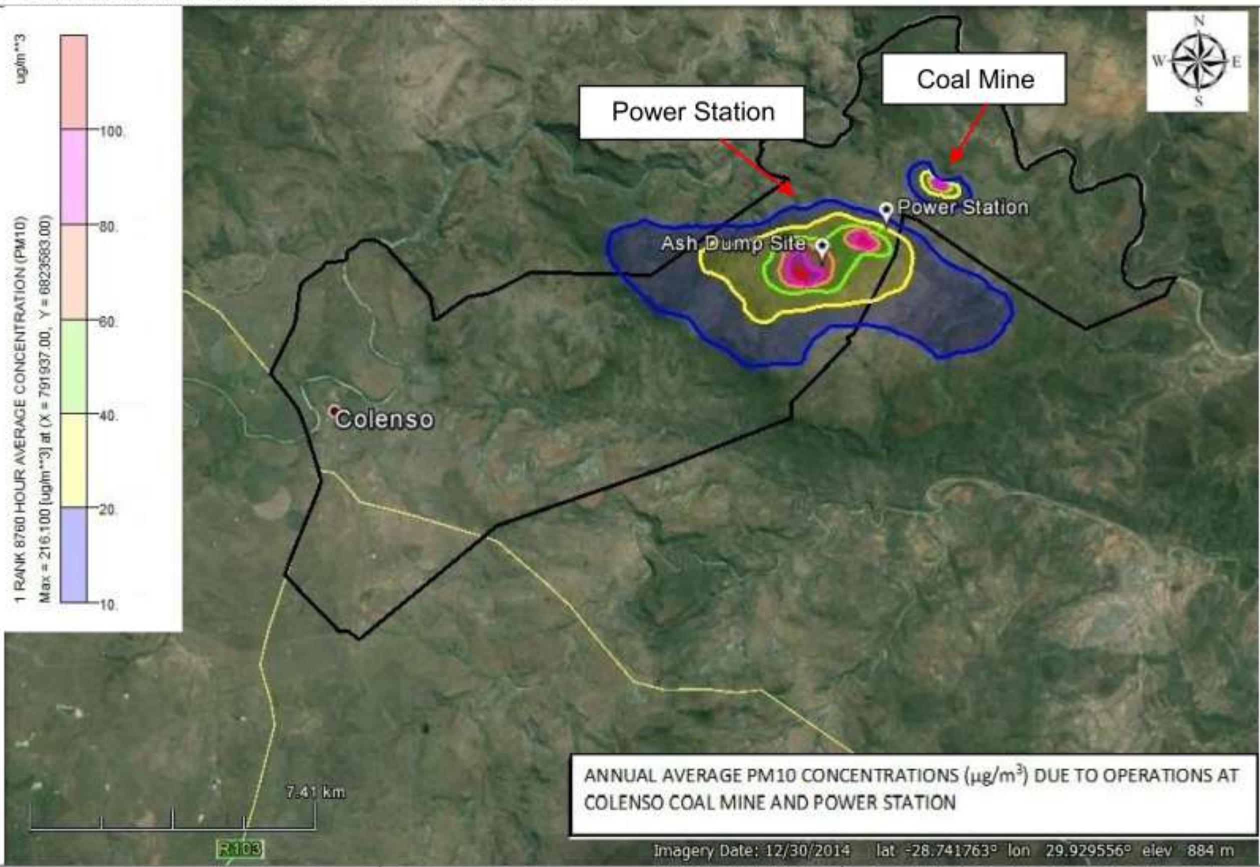


COMMENTS:	GRID SIZE: 50 x 50 km	MODEL: CALPUFF View
Yellow band – exceedance of WHO guideline. Green Band and Red Band – exceedance of SA standard more than 9 times per annum.	GRID SPACING: 1 km	OUTPUT TYPE: 99th Percentile Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks) X 9 area sources X 4 volume sources	ASSUMPTIONS: Worst case scenario - See input parameter tables for details.
No dust suppression measures assumed to be used for area and volume sources. Baghouse assumed to be used 90 – 98% of the time for stack emissions.	EXCLUSIONS: No background concentrations included as they were not available. Handling of limestone and vehicle dust entrainment.	AMBIENT STANDARD: 75 µg/m³ (SA 24-Hour standard) 50 µg/m³ (WHO 24-Hour guideline)
		DATE: 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

Figure 9-6: Predicted Annual Average PM10 Concentrations due to Operations at the proposed Power Station and Coal Mine.

Predicted Annual PM10 Concentrations



COMMENTS: Yellow band – exceedance of WHO guideline. Green, Orange, Pink, Red Bands – exceedance of SA standard more than once per annum. No dust suppression measures assumed to be used for area and volume sources. Baghouse assumed to be used 90 – 98% of the time for stack emissions.	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** Rank 1 Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks) X 9 area sources X 4 volume sources	**ASSUMPTIONS:** Worst case scenario - See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available. Handling of limestone and vehicle dust entrainment.	**AMBIENT STANDARD:** 40 µg/m³ (SA 24-Hour standard) 20 µg/m³ (WHO 24-Hour guideline) **DATE:** 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

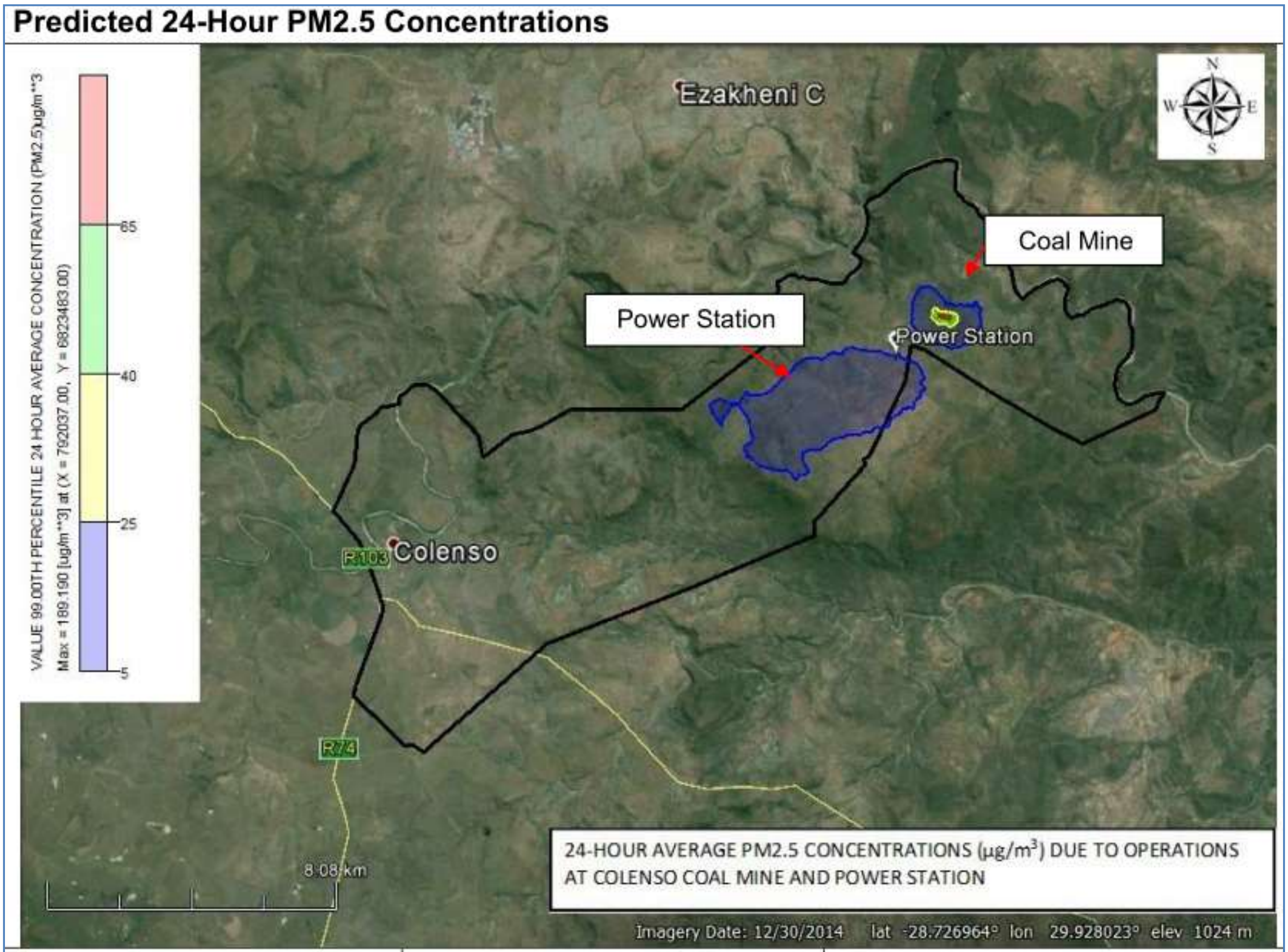
9.4.2.4 *PM2.5 Concentrations*

Predicted incremental daily and annual $PM_{2.5}$ concentrations associated with operations at the power station and coal mine are given in Figure 9-7 and Figure 9-8. Predicted incremental daily $PM_{2.5}$ concentrations at the power station are in compliance with both the South African and WHO daily air quality Standards of 65 µg/m³ and 25 µg/m³ respectively (FIGURE 5-9). Predicted incremental annual $PM_{2.5}$ concentrations at the power station are also shown to be in compliance with both the South African and WHO annual air quality Standards of 25 µg/m³ and 10 µg/m³. Predicted incremental daily and annual $PM_{2.5}$ concentrations at the power station did not exceed 25 µg/m³ or 10 µg/m³ respectively.

It should be noted that it was assumed that a bag house would be used 90 – 98% of the time for stack emissions. A bag house system is associated with approximately 90 - 98%

emission reduction efficiency, thus if maintained to standard and used consistently relatively low $PM_{2.5}$ concentrations are expected due to the stacks.

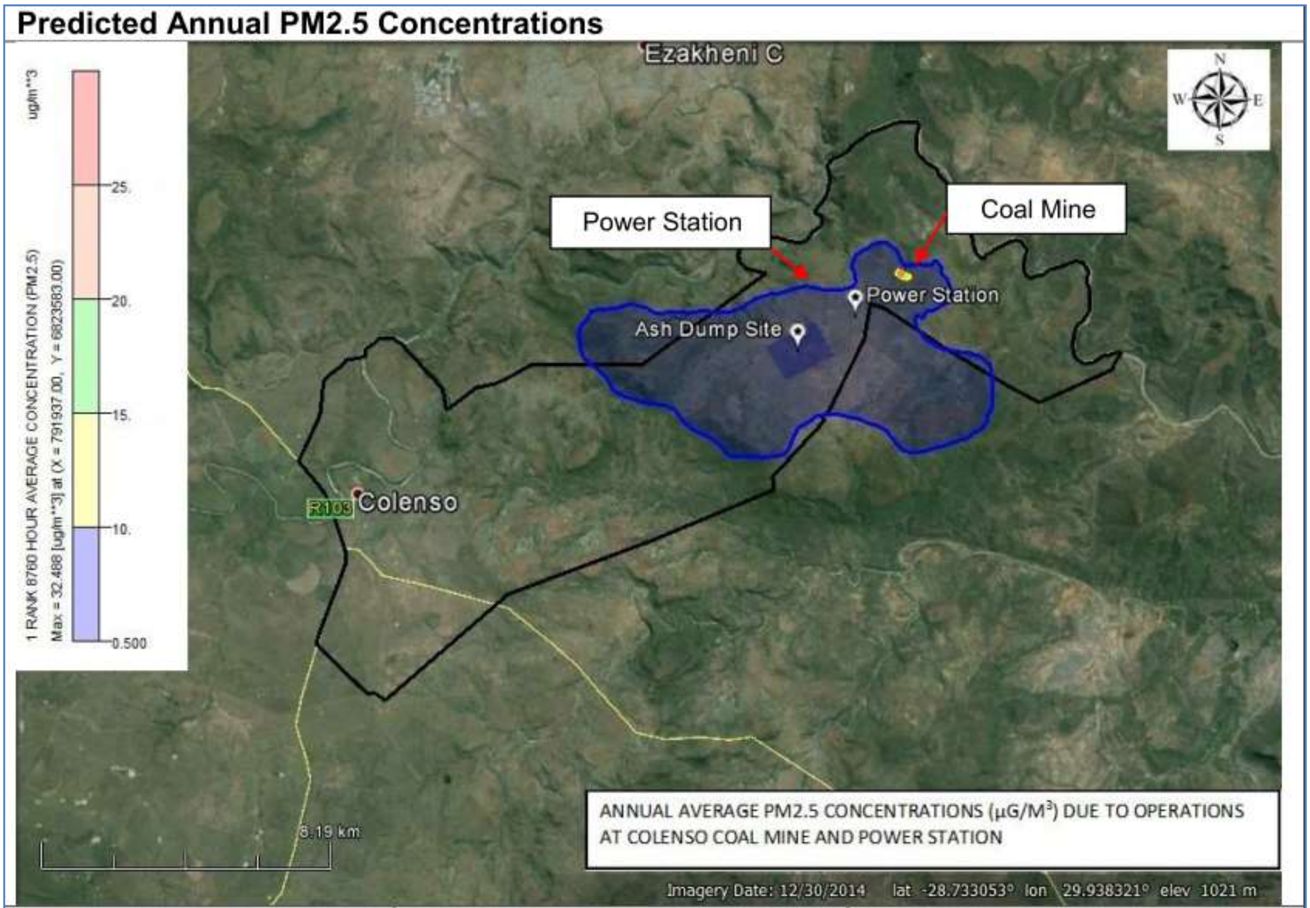
Figure 9-7: Predicted 24-Hour Average $PM_{2.5}$ Concentrations due to Operations at the proposed Power Station and Coal Mine



COMMENTS: Yellow and Green bands – exceedance of WHO guideline. Red Band – exceedance of SA standard more than 3 times per annum. No dust suppression measures assumed to be used for area and volume sources. Baghouse assumed to be used 90 – 98% of the time for stack emissions.	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** 99th Percentile Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks) X 9 area sources X 4 volume sources	**ASSUMPTIONS:** Worst case scenario - See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available. Handling of limestone and vehicle dust entrainment.	**AMBIENT STANDARD:** 65 µg/m³ (SA 24-Hour standard) 25 µg/m³ (WHO 24-Hour guideline) **DATE:** 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

Figure 9-8: Predicted Annual Average $PM_{2.5}$ Concentrations due to Operations at the proposed Power Station and Coal Mine



COMMENTS:		
Yellow, Green, Orange bands – exceedance of WHO guideline. Red Band – exceedance of SA standard more than once per annum. No dust suppression measures assumed to be used for area and volume sources. Baghouse assumed to be used 90 – 98% of the time for stack emissions.	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** Rank 1 Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks) X 9 area sources X 4 volume sources	**ASSUMPTIONS:** Worst case scenario - See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available. Handling of limestone and vehicle dust entrainment.	**AMBIENT STANDARD:** 25 µg/m³ (SA 24-Hour standard) 10 µg/m³ (WHO 24-Hour guideline) **DATE:** 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

9.4.2.5 Coal Combustion Power Generation (Point Sources)

Combustion occurs when solid fuel (i.e. anthracite coal as is the case in this proposed development) is ignited in the presence of oxygen which produces heat that is used to create steam which is used to drive turbines in order to generate electricity. Fuel pre-processing, fuel feeding and combustion are the main sources of particulate and gaseous emissions associated with coal fired power generation. Fuel pre-processing involves crushing, milling and pulverising the fuel to attain the right consistency of feed material needed for the combustion process. Additives such as lime may be added to the fuel during the pre-processing phase to try control emissions during the combustion phase.

Once the right consistency of feed material is attained, fuel feeding commences whereby the modified fuel is fed into the combustion chamber by means of a chute, screw feeder or a pneumatic feeder depending on the type of combustion system in place. The fuel then ignites in the combustion chamber/bed to produce heat. The heat is then absorbed by water and pumped through the boiler to produce steam which is used to drive the turbines to generate electricity. Emissions generated during this process are generally released through emission stacks at a single identifiable point.

A Pulverized fuel combustion system would be used at the proposed power station. The power station will have three main stacks each approximately 210m in height. It was assumed that each unit will be installed with a Flue Gas Desulphurisation (FGD) plant with the use of limestone to abate SO_x emissions. A baghouse system is identified as the preferred abatement equipment for particulate emissions. A SCR system is also proposed for the control of NO_x emissions. The percentage control efficiency of the SCR system and the FGD system were assumed to be 90% and 98% respectively.

The source parameters and emissions rates for the coal-fired power station used as input into the CALPUFF model are given in Table 9-11 and Table 9-12.

Table 9-11: Source Parameters for the proposed Coal-Fired Power Station

Source (1)	Stack Height (m)	Stack Diameter (m)	Gas Exit Temp (°C)	Gas Exit Velocity (m/s)
Stack 1	210	10	140	20 (1)
Stack 2	210	10	140	20 (1)
Stack 3	210	10	140	20 (1)
Notes: [1] The gas exit velocity is not yet known at this stage of the design and at the time of modelling. Therefore the gas exit velocity was assumed to be 20 m/s based on the gas exit velocity for a similar type of power station.				

Source: Rayten, Air Quality Assessment (2015)

Table 9-12: Emission Rates for the proposed Coal-Fired Power Station

Source		Emission Rate (g/s)				
	TSP	PM10	PM2.5	SO_2	NO_2	CO
Stack 1, 2 and 3	N/A	6.54	3.02	37.74	34.83	11.61
Note: Total throughput material is equal to 418 tonnes/hourly burn provided by Colenso						

Source: Rayten, Air Quality Assessment (2015)

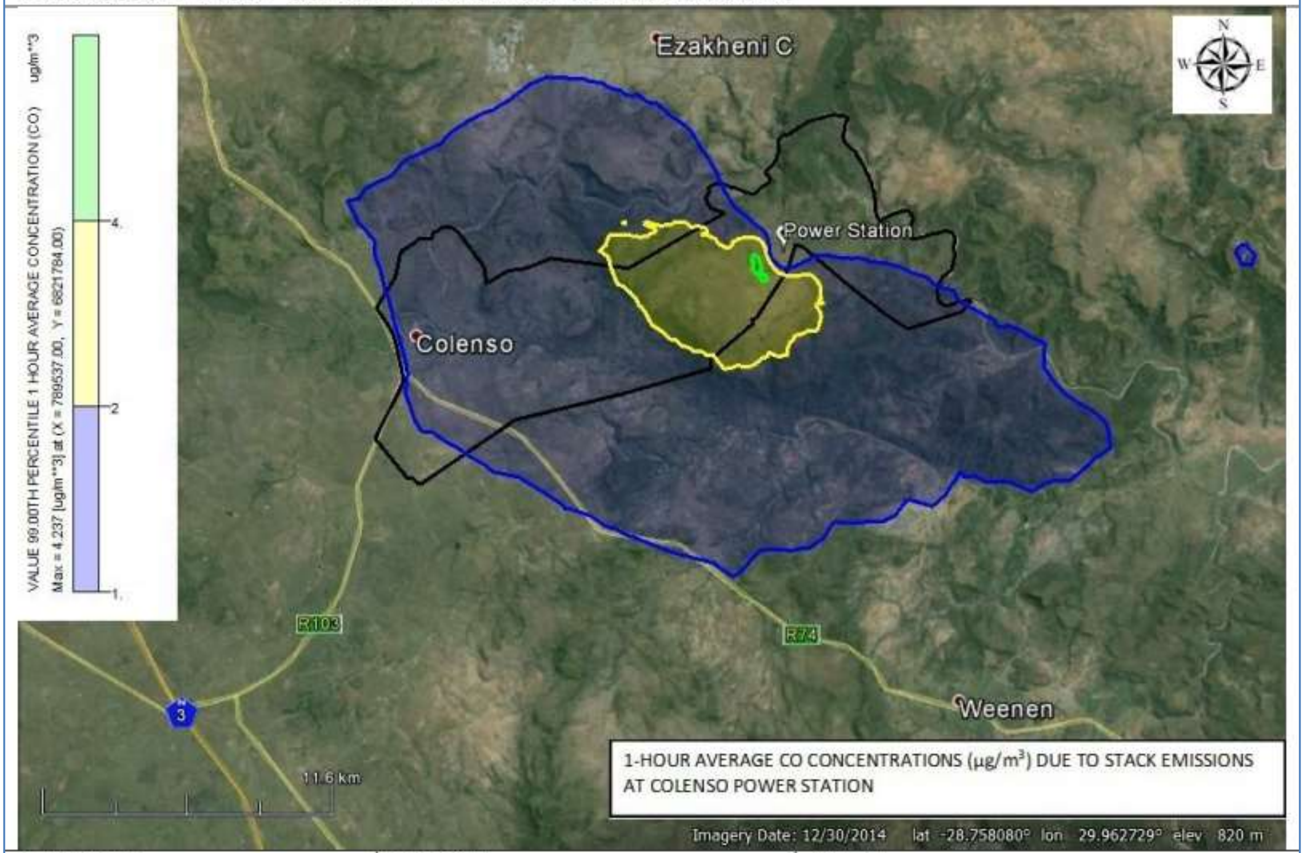
9.4.2.6 CO Concentrations

Predicted incremental CO concentrations associated with the stack emissions at the power station due to the combustion of anthracite coal is given in Figure 9-9. Predicted incremental CO concentrations are predicted to be very low and are in compliance with the hourly South African CO standard of 30 000 µg/m^3. A maximum hourly average CO concentration of 4 µg/m^3 was predicted and observed SW of the power station site.

No background CO concentrations were taken into account as this data was not available. Furthermore it should be noted that abatement equipment was assumed to be used 90 – 98% of the time therefore low CO concentrations are expected.

Figure 9-9: Predicted 1-Hour Average Carbon Monoxide Concentrations due to Stack Emissions at the proposed Power Station

Predicted 1-Hour Carbon Monoxide Concentrations



COMMENTS: No exceedances observed. Abatement equipment: SCR & FGD system assumed to be used 90 – 98% of the time. Emission reduction efficiency assumed to be 90% for SCR and 98% for FGD Plant as per IFC EHS Guidelines for Thermal Power Plants (IFC, 2008).	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** 99th Percentile Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks)	**ASSUMPTIONS:** See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available.	**AMBIENT STANDARD:** 30 000 µg/m³ (SA 1-Hour standard)
		DATE: 15/07/2015

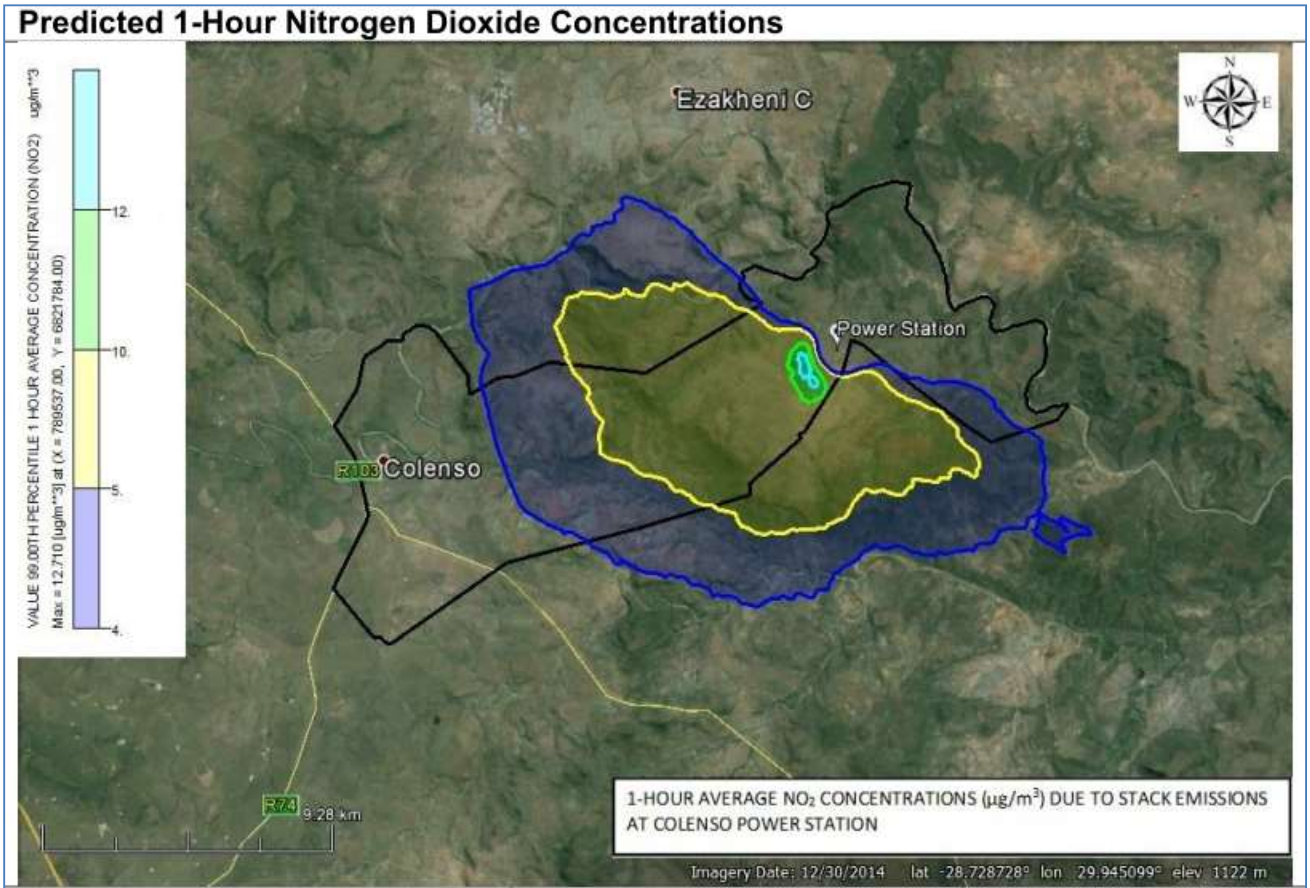
Source: Rayten, Air Quality Assessment (2015)

9.4.2.7 NO_2 Concentrations

Predicted incremental hourly and annual NO_2 concentrations associated with the stack emissions at the power station due to the combustion of anthracite coal are given in Figure 9-10 and Figure 9-11. Predicted incremental NO_2 concentrations are low and fall well below the South African and WHO hourly Standards of 200 µg/m^3 and the South African and WHO annual standards of 40 µgm^3. A maximum hourly and annual concentration of 13 µg/m^3 and 0.4 µg/m^3 were recorded SW of the power station site.

No background NO_2 concentrations were taken into account as this data was not available. The SCR system (Scrubber Plant) was assumed to be used 90 – 98% of the time. The SCR system was assumed to have an emission reduction efficiency of approximately 90% therefore significantly lower NO_2 concentrations are expected.

Figure 9-10: Predicted 1-Hour Average Nitrogen Dioxide Concentrations due to Stack Emissions at the proposed Power Station

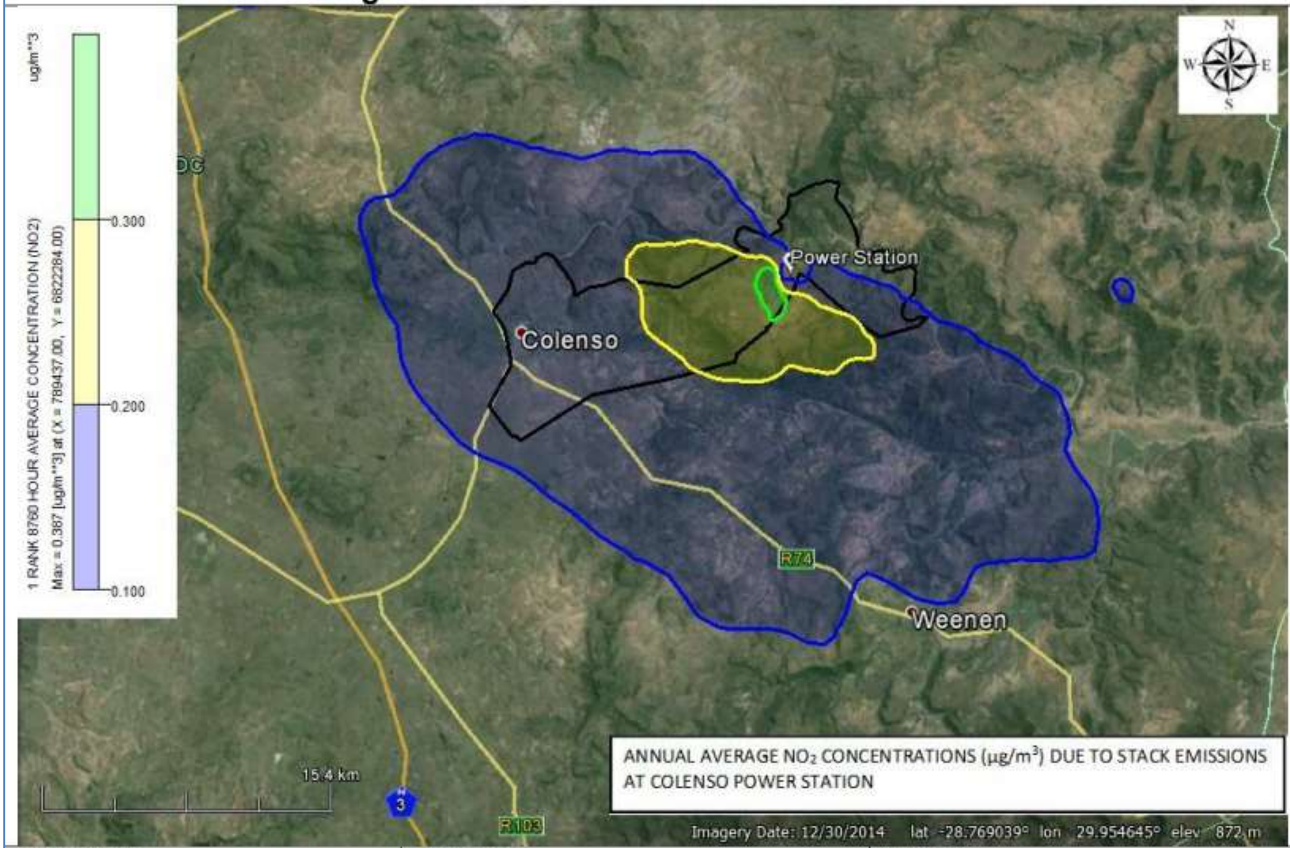


COMMENTS: No exceedances observed. Abatement equipment: SCR system assumed to be used 90 – 98% of the time. Emission reduction efficiency assumed to be 90% as per IFC EHS Guidelines for Thermal Power Plants (IFC, 2008).	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** 99th Percentile Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks)	**ASSUMPTIONS:** See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available.	**AMBIENT STANDARD:** 200 µg/m³ (SA 1-Hour standard & WHO guideline)
		DATE: 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

Figure 9-11: Predicted Annual Average Nitrogen Dioxide Concentrations due to Stack Emissions at the proposed Power Station

Predicted Annual Nitrogen Dioxide Concentrations



COMMENTS:	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
No exceedances observed.	**GRID SPACING:** 1 km	**OUTPUT TYPE:** Rank 1 Ground Level Concentrations
Abatement equipment: SCR system assumed to be used 90 – 98% of the time. Emission reduction efficiency assumed to be 90% as per IFC EHS Guidelines for Thermal Power Plants (IFC, 2008).	**NUMBER OF SOURCES:** X 3 point sources (stacks)	**ASSUMPTIONS:** See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available.	**AMBIENT STANDARD:** 40 µg/m³ (SA 1-Hour standard & WHO guideline)
		DATE: 15/07/2015

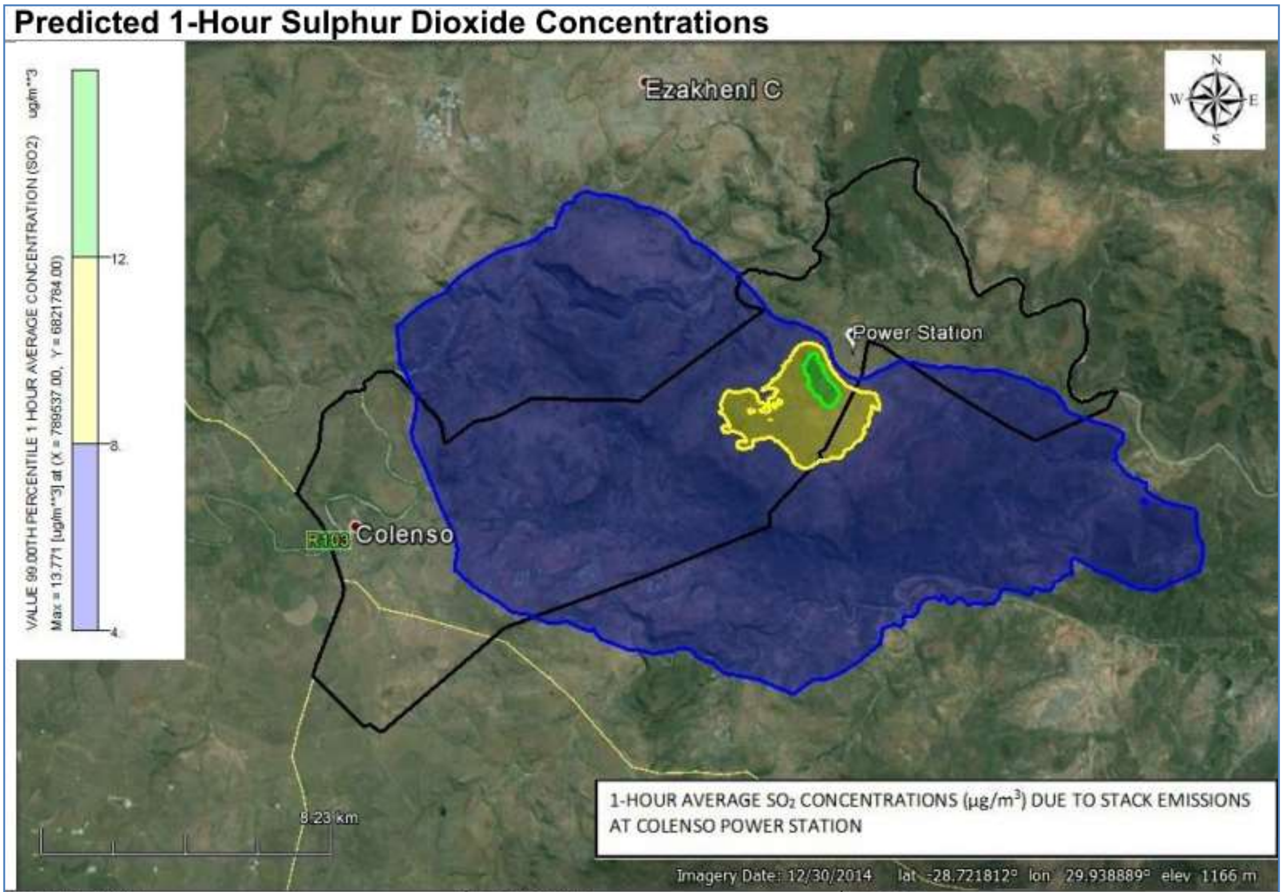
Source: Rayten, Air Quality Assessment (2015)

9.4.2.8 SO_2 Concentrations

Predicted incremental hourly, daily and annual SO_2 concentrations associated with the stack emissions at the power station due to the combustion of anthracite coal are given in Figure 9-12 to Figure 9-13. Predicted incremental hourly SO_2 concentrations are low, falling well below the South African hourly standard of 350 µg/m^3 (FIGURE 5-6). Predicted incremental daily SO_2 concentrations are low and fall below both the South African and WHO daily standards of 125 µg/m^3 and 20 µg/m^3 respectively. Predicted incremental annual SO_2 concentrations are also very low falling below the South African and WHO annual standards of 50 µg/m^3. A maximum hourly, daily and annual SO_2 concentration of 14 µg/m^3, 4.3 µg/m^3 and 0.4 µg/m^3 was recorded SW of the power station site.

No background SO_2 concentrations were taken into account as this data was not available. The FGD plant (Flue Gas Desulphurisation Plant) was assumed to be used 90 – 98% of the time. The FGD plant was assumed to have an emission reduction efficiency of approximately 98% therefore significantly lower SO_2 concentrations are expected.

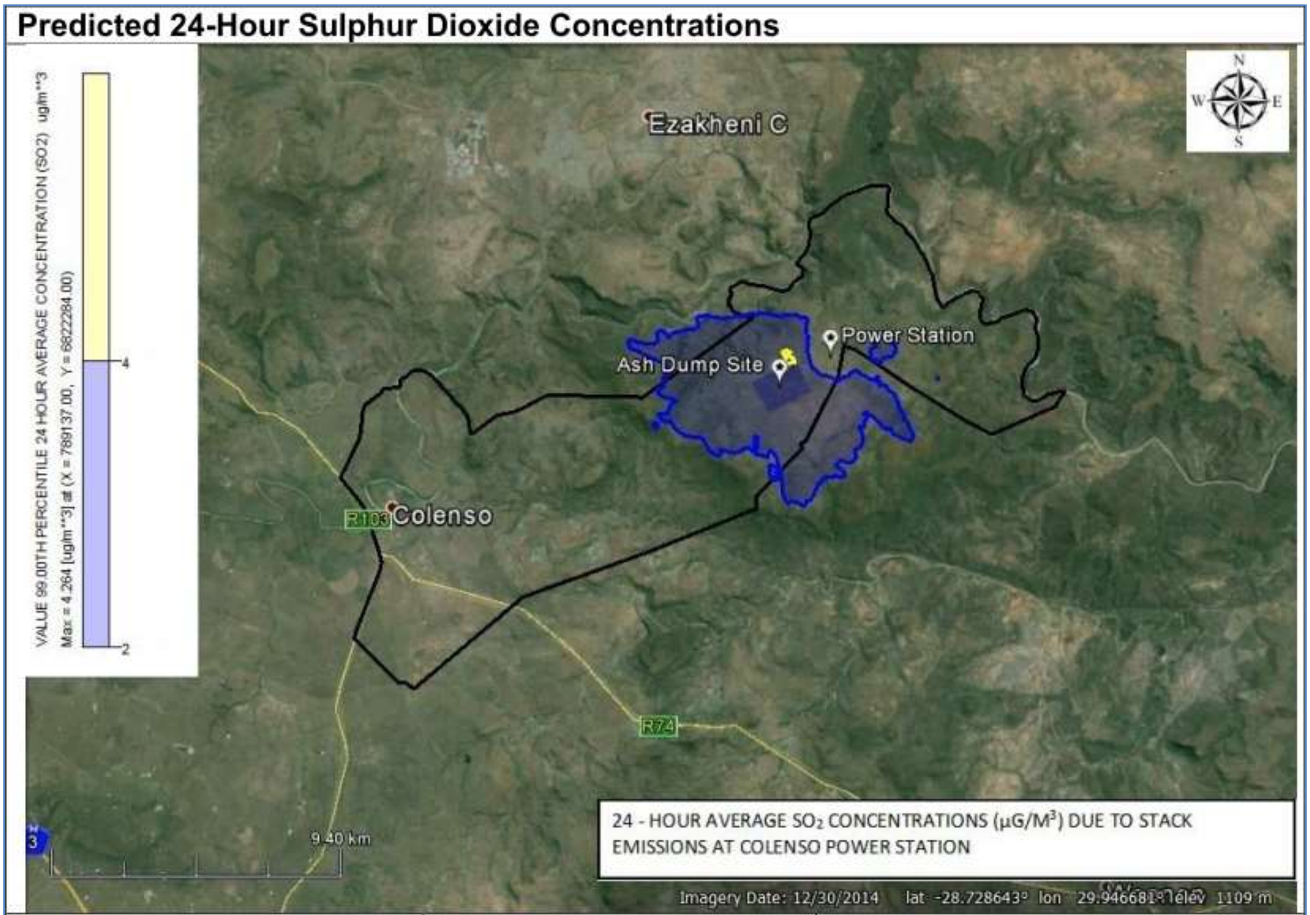
Figure 9-12: Predicted 1-Hour Average Sulphur Dioxide Concentrations due to Stack Emissions at the proposed Power Station



COMMENTS:		
No exceedances observed. Abatement equipment: FGD system assumed to be used 90 – 98% of the time. Emission reduction efficiency assumed to be 98% for FGD Plant as per IFC EHS Guidelines for Thermal Power Plants (IFC, 2008).	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
	GRID SPACING: 1 km	**OUTPUT TYPE:** 99th Percentile Ground Level Concentrations
	NUMBER OF SOURCES: X 3 point sources (stacks)	**ASSUMPTIONS:** See input parameter tables for details.
	EXCLUSIONS: No background concentrations included as they were not available.	**AMBIENT STANDARD:** 350 µg/m³ (SA 1-Hour standard) **DATE:** 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

Figure 9-13: Predicted 24-Hour Average Sulphur Dioxide Concentrations due to Stack Emissions at the proposed Power Station



COMMENTS:	**GRID SIZE:** 50 x 50 km	**MODEL:** CALPUFF View
No exceedances observed.	**GRID SPACING:** 1 km	**OUTPUT TYPE:** 99th Percentile Ground Level Concentrations
Abatement equipment: FGD system assumed to be used 90 – 98% of the time.	**NUMBER OF SOURCES:** X 3 point sources (stacks)	**ASSUMPTIONS:** See input parameter tables for details.
Emission reduction efficiency assumed to be 98% for FGD Plant as per IFC EHS Guidelines for Thermal Power Plants (IFC, 2008).	**EXCLUSIONS:** No background concentrations included as they were not available.	**AMBIENT STANDARD:** 125 µg/m³ (SA 24-Hour standard) 20 µg/m³ (WHO 24-Hour guideline)
		DATE: 15/07/2015

Source: Rayten, Air Quality Assessment (2015)

9.4.2.9 CO_2 Emissions

The proposed power station is identified as a significant contributor of greenhouse gases through the production of electricity and as such the power station should report on their greenhouse gas emissions annually only once operations commence. Detailed activity data such as diesel consumption quantities, total distances travelled by vehicles, electricity consumption, etc. are required in order to accurately calculate Scope 1 (direct) and Scope 2 (indirect) greenhouse gas emissions and develop a greenhouse gas inventory.

At this stage not enough information is known in order to compile a full greenhouse gas emission inventory for the proposed power station. However, the total amount of electricity to be produced by the proposed power station is known thus the anticipated amount of CO_2 emissions can be estimated.

The generic equation used to calculate Scope 1 and Scope 2 greenhouse gas emissions is:

Emissions GHG = Activity Data x Emission Factor

Where in this case:

Activity data is given by the total amount of electricity produced by the proposed power station per year.

An Emission Factor is applied to convert the activity data into a value indicating the amount of greenhouse gas emitted by that particular activity.

Table 9-13 below provides the estimated tonnage of CO_2 to be emitted annually by the proposed power station through the production of electricity. This calculation is only given to provide an indication of the approximate amount of CO_2 to be released by the stacks at the proposed power station and is not representative of all the greenhouse gas emission sources. A full greenhouse gas emissions inventory and report will need to be submitted by the proposed power station on an annual basis only once operations commence and enough activity data is available. The amount of electricity to be produced by the proposed power station and the emission factor used in the calculation is also given.

Table 9-13: Estimated CO_2 Production from Stack Emissions at the proposed Power Station

Total Electricity To Be Generated	CO_2 Emission Factor[(1)]	Estimated CO_2 Emissions Due To Power Generation
1050 MW per annum	1.015 kg CO_2-eqt/kWh	1066.08 Tonnes CO_2-eqt/year
Notes: [1] A carbon dioxide emission factor of 1.015 kg $CO_{2\text{-eqt}}$/kWh was used. This emission factor is specific to South Africa's Eskom electricity generation, transmission and distribution and is based on a coal fired power stations.		

Source: Rayten, Air Quality Assessment (2015)

In this calculation the release of 1066.08 Tonnes CO_2-eqt/year does not require the submission of a pollution prevention plan as it does not exceed 0.1 Megatonnes (10^9 kg) (Mt) annually.

9.5 GROUNDWATER

AGES was appointed to assess the geo-hydrological impacts related to the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the geo-hydrological impacts as presented in the following paragraphs.

9.5.1 Impacts during construction

The geo-hydrological impacts, and the uncontrolled significance rating thereof, that can be expected during the construction of the power station and associated infrastructure are presented in the table below.

During construction minimal impacts on the groundwater system are expected. Main activities that could impact on groundwater in this phase include minor groundwater seepage from localised perched zones during excavation for construction. There can be a slight quality deterioration of groundwater flowing into these areas. One artificial wetland located within the boundaries of the proposed power station site will be affected. Limited hydrocarbon contamination from heavy machinery that is used on site is possible should spillages occur.

These impacts are rated to have a low significance.

Table 9-14: Geo-hydrological impacts associated with construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Small changes to the groundwater system can occur as construction of the power plant commences.	Change in groundwater levels due to dewatering/seepage	2	2	1	4	5	3	15	300
Construction of Power Station & infrastructure	Limited hydrocarbon contamination from heavy machinery if spillages are not prevented and managed.	Impact of change in groundwater quality	2	3	1	6	5	3	15	450
Construction of Power Station & infrastructure	Increase in seepage from wetlands into the groundwater system	One artificial wetland will be impacted due to the construction of the power plant.	2	5	1	10	1	4	4	200

9.5.2 Impacts during operational phase

The geo-hydrological impacts, and the uncontrolled significance rating thereof, that can be expected during the operation of the power station and associated infrastructure are presented in the table below.

Table 9-15: Geo-hydrological impacts associated with operations

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	The operational duration is expected to be 25 years.	Change in groundwater levels due to seepage	2	4	1	8	5	4	20	800
Operation of Power Station & infrastructure	Impact of change in groundwater quality due to power plant activities	Pollution plumes can occur in the direct vicinity of the plant due the possible coal stock piles, ash dams and storm	4	5	4	80	5	5	25	10 000

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
		water ponds. Three wetlands located outside the plant boundary are likely to be impacted. Three boreholes will also be affected.								

The impacts of potential groundwater pollution due to the power plant and associated ash dump activities during the operational phase are associated with the changes in the pH of the water, the increase in salt content and the concentration of potentially toxic trace elements. Even if dry disposal of ash is done, the water content within the ash can be up to 15% due to water used for dust suppression during transport and deposition. Additional water can be introduced through rainfall which can increase the leaching of elements. Water that migrates through the facility can seep along the edges of the ash dump and enter the environment as surface water run-off or infiltrate vertically into the underlying soils and groundwater.

Quality of water that can seep from the ash dump must be determined through leachate and acid base accounting tests. The possible plume due to the plant and associated infrastructure is shown in Figure 9-14. As very little water quality data is available, the pollution plume is simulated as a percentage of its source. It is expected that the life time of this project is 25 years. It is clear from the simulated plume that pollution will not reach the Thukela River and that two artificial wetlands and two boreholes that are not in use will be impacted

Note that no Acid Base Accounting results were available, therefore the expected water quality of the seepage is unknown.

9.5.3 Post closure impacts

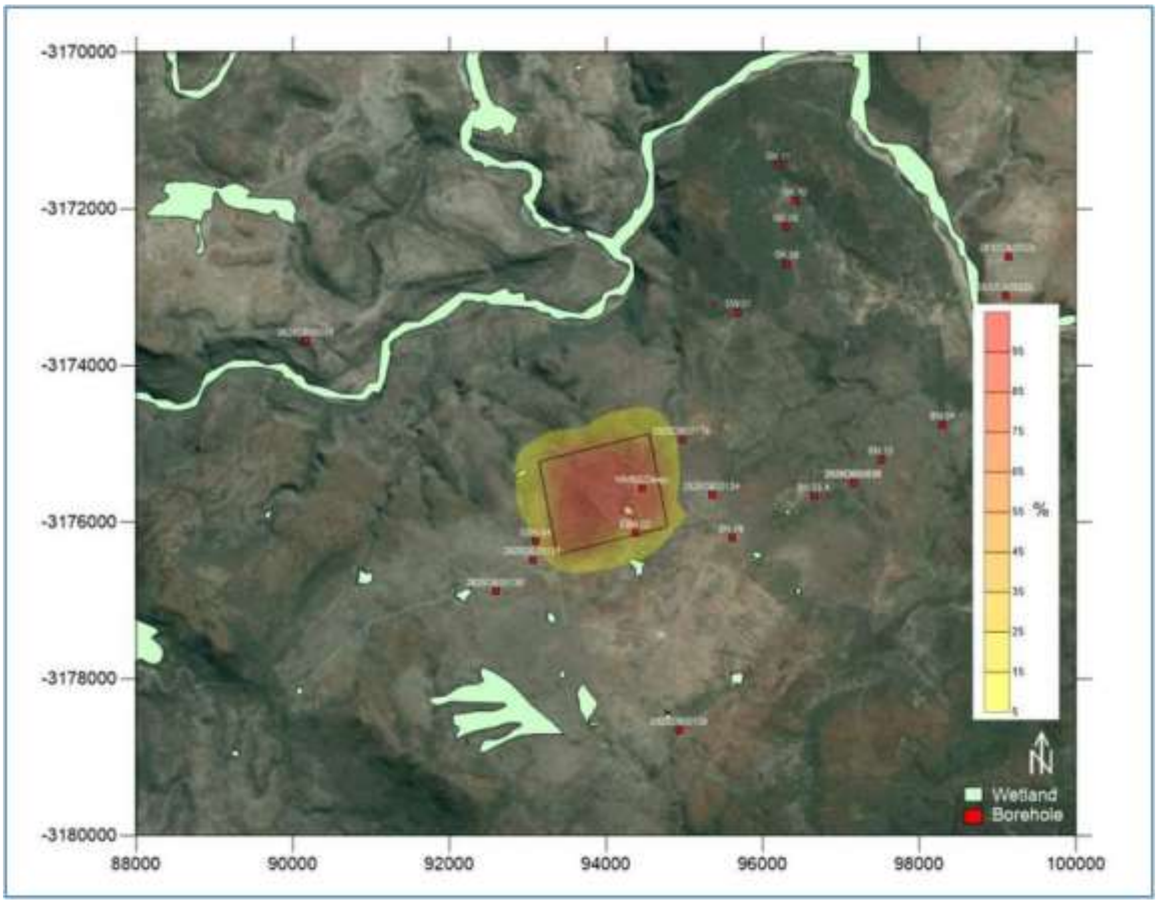
Post closure impacts are presented in the table below. The pollution plume at the power station will start receding after rehabilitation. Thereafter the pollution plumes will start regressing. Lateral groundwater movement will allow the spread of the pollution within the groundwater system. The expected plume after 25 years post closure is shown in Figure 9-15. Only 2 boreholes – none of which are in use, and the artificial wetland on site and one further downstream will be affected by groundwater pollution.

Table 9-16: Post closure geohydrological impacts

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNCONTROLLED IMPACT RATING
Post-closure phase	Pollutants from this area will continue to seep into the groundwater	Polluting groundwater and surface water. The wetland on site and 3	2	4	3	24	5	5	25	3 000

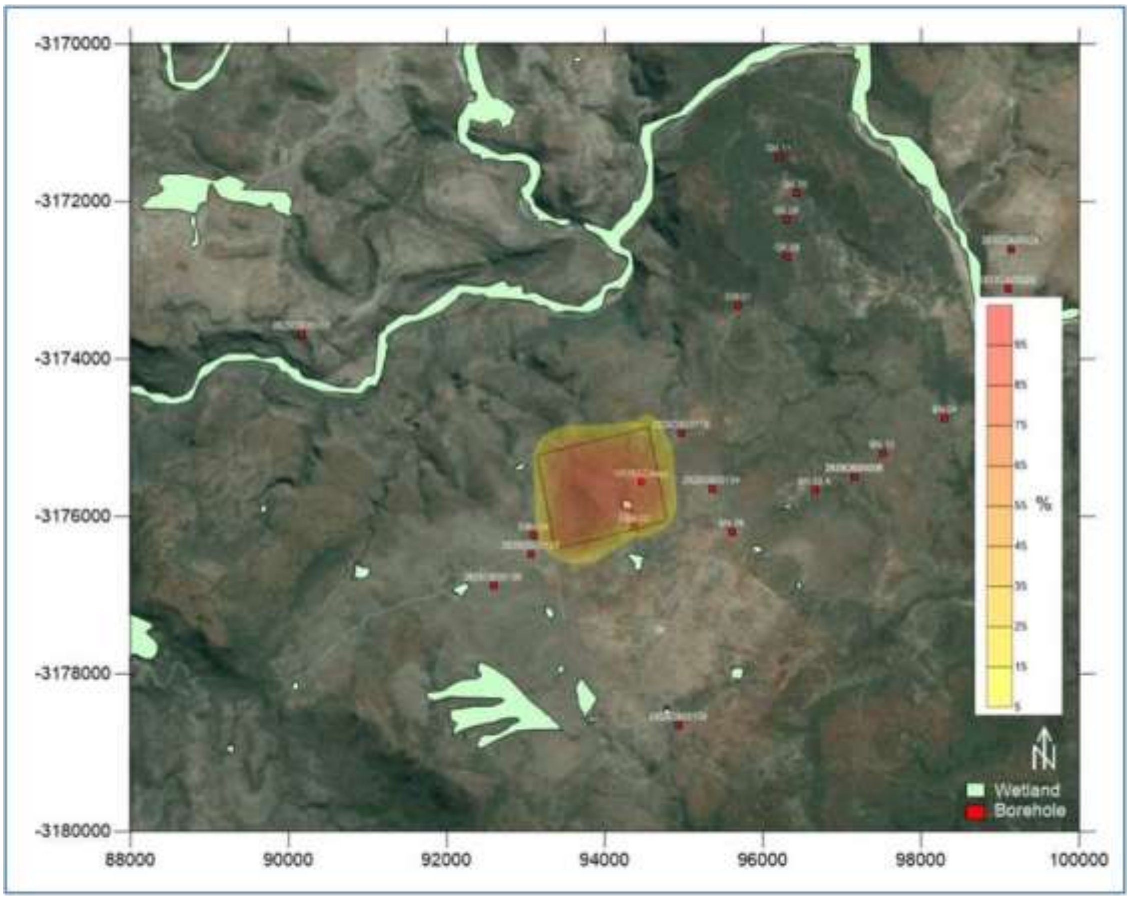
Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNCONTROLLED IMPACT RATING
	system until the plant has been rehabilitated.	boreholes will be affected.								

Figure 9-14: Pollution plume at power plant (25 years)



Source: AGES. Geohydrological Report (2015)

Figure 9-15: Post closure pollution plume (25 years)



Source: AGES. Geohydrological Report (2015)

9.6 SURFACE WATER

Storm Water Solutions was appointed to conduct the surface water assessment. Their assessment was used to determine the soil impacts as presented in the table below.

Table 9-17: Impacts associated with surface water

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power station & infrastructure	Vegetation cover reduces hydrological yield. Vegetation will be removed. Due to an increased percentage of bare surfaces, there is a higher hydrological yield.	Increase in Hydrological Yield	5	5	4	100	5	5	25	12 500

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power station & infrastructure	Vegetation will be removed. Due to an increased percentage of bare surfaces, there is a higher potential for sediment transport during storm events as soil particles are loosened. Construction vehicle movement result in the generation of dust which impacts negatively on surface water	Sediment transport	5	5	4	100	5	5	25	12 500
Construction of Power station & infrastructure	Spillages of construction material as well as hazardous material required for the operation and maintenance of construction vehicles may occur.	Water Quality Deterioration	3	2	3	18	4	4	16	1 440
Operation of Power Station & infrastructure	Failing sewage treatment works impact negatively on the chemical and microbiological characteristics of the receiving water resources The proposed area is located on a steep slope. Steep slopes are associated with high flow velocity	Water Quality Deterioration	5	4	4	80	4	4	16	6 400

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Decommissioning of Power Station & infrastructure	Demolition vehicles' movement result in the generation of dust which impacts negatively on surface water.	Sediment transport	4	2	3	24	3	3	9	432
Decommissioning of Power Station & infrastructure	General waste is sub-divided into paper, metals, glass, plastic, organic, and inert materials (which include builder's rubble).	Water Quality Deterioration	2	2	3	12	3	3	9	540
Decommissioning of Power Station & infrastructure	Vegetation cover reduces hydrological yield. Vegetation will be removed. Due to an increased percentage of bare surfaces, there is a higher hydrological yield.	Increase in Hydrological Yield	3	2	3	18	3	4	12	1 080

9.6.1 Risk-based assessment

A risk-based assessment was undertaken and potential impacts were categorised as follows:

- *Hydrological Yield*

  A change in Hydrological Yield is caused by water collection systems, Infiltration and Evaporation.

  The impacts of underground mining on surface water can range from no noticeable impact to significant ponding, and/or diversion. The formation of subsidence-induced cracks can lead to partial loss of water.

  Water collected in the Pollution control dams will evaporate at a higher rate than in-stream water. Evaporation is considered a water loss because water that evaporates from the study area will not precipitate back where evaporation occurred.

- *Water Quality Deterioration*

Pollution in Hydrological terms occurs when rainwater quality is altered when water gets in contact in contact with exposed rock and/or material with a potential to deteriorate the water quality. Mining and power generation related activities may contribute to the deterioration of water quality.

Another potential impact on water quality is spillages of pollution causing potential material as well as overflows/seepage from the pollution control dams.

- *Erosion/Sediment Transport*

  Erosion is deemed a potential hydrological impact because water from the eroded area is characterised by high suspended and dissolved solids. Erosion occurs from areas where the soil was loosened. This may be due to the construction of infrastructure or other earth moving activities.

9.6.2 Impacts during Construction

During the establishment of infrastructure, soil material will be loosened as vegetation cover is removed. The following impacts are anticipated:

- Footprint clearance result in the increase in runoff as bare surface increase the peak flows;
- Footprint clearance result in the increase in suspended solids during storm events; and
- Footprint clearance results in the higher potential for erosion.

The risk is rated low when mitigation measures are in place.

9.6.3 Impacts during the Operation Phase

During this phase, the study area will be classified into smaller catchment areas (Clean and Dirty Water Catchment Areas) - The following impacts are anticipated:

- There will be a deterioration in storm water yield as storm water from the dirty water area will be collected and stored;
- Poor operation and maintenance of the dirty water collection systems may result in the sediment transport when dams and/or channels overflow; and
- Spillages from dams and dust from trucks may impact on the nearby water resource.

The risk is rated low to medium when mitigation measures are in place.

The biggest infrastructure for the power station is the Dry Ash dump. Ash dumps are associated with high dust yield which can be resolved with dust suppression activities.

9.6.4 Impacts during the Decommissioning Phase

The decommissioning phase entails the removal of infrastructure and reshaping of the topography. The following impacts are anticipated:

- The increase in runoff as bare surface increase the peak flows;
- The increase in suspended solids during storm events; and
- Higher potential for erosion as fixed structures are removed.

The risk is rated low to medium when mitigation measures are in place.

9.6.5 Mitigation ability

Mitigation ability for the high impacts are considered.

Impact: Vegetation cover reduces hydrological yield. Vegetation will be removed. Due to an increased percentage of bare surfaces, there is a higher sediment laden run-off.

Mitigation proposed includes the re-vegetation of all bare surface areas to mimic the natural hydrological yield as much as possible. This will reduce the sediment laden run-off.

By the implementation of mitigation measures the impact may be mitigated to **low.**

Impact: Vegetation will be removed. Due to an increased percentage of bare surfaces, there is a higher potential for sediment transport during storm events as soil particles are loosened. Construction vehicle movement result in the generation of dust which impacts negatively on surface water.

Mitigations measures include the following"

- Vegetation removal must be as minimum as possible.
- All bare surface areas must be re-vegetated in order to avoid the transportation of sediments and the creation of erosion gullies.

By the implementation of mitigation measures the potential impact may be mitigated to **moderate.**

9.7 Soils and Agricultural Potential

ARC was appointed to assess the soil impacts related to the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the soil impacts as presented in the table below.

Table 9-18: Soil impacts associated with construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power station & infrastructure	Soil and agricultural potential	Loss of agricultural land	2	2	4	16	4	4	16	1 280
Construction of Power station & infrastructure	Soil and agricultural potential	Increased level of water erosion	2	3	5	30	4	4	16	2 400

The study area is dominated by low to very low potential soils. The low to moderate potential soils may be cultivated, but their internal drainage will still be poor due to the soil structure and clay texture. These soils will be difficult to work and will be more susceptible to water logging. The shallow soils (**Ms** map unit) should not be cultivated and should be reserved for grazing purposes. The expected impacts in terms of loss of agricultural land will be low.

9.8 BIODIVERSITY

9.8.1 Vegetation

Dr Johannes J. Le Roux and Mr Jan-Hendrik Keet were sub contracted by Zone Land Solutions to assess the vegetation impacts related to the development of the proposed power station and associated infrastructure. Their assessment was used to determine the vegetation impacts as presented in the following paragraphs.

The vegetation impacts, and the uncontrolled significance rating thereof, that can be expected during the development of the power station and associated infrastructure are presented in the table below.

Table 9-19: Impacts on vegetation

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power station & infrastructure	Construction Activities	Permanent loss or disturbance of floral communities and listed plant species	2	5	5	50	5	5	25	6 250
Construction of Power station & infrastructure	Construction Activities - construction of infrastructure (boilers, transformers, roads, buildings, etc.).	Associated disturbance during construction phases leading to rapid establishment of successional species, in particular non-indigenous invasive alien plant species.	3	5	3	45	5	5	25	5 625
Construction of Power station & infrastructure	Construction Activities	Loss of individuals of species of conservation concern as a direct result of habitat loss and/or eradication of existing populations.	5	4	5	100	5	5	25	12 500

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Operational Activities	A potential **positive** impact might be lower risks of erosion within the site due to soil compactment during the development phase and the exclusion of livestock from an ecological buffer area.	4	5	5	100	5	5	25	+ 12 500
Operation of Power Station & infrastructure	Operational Activities	Increased erosion risk due to soil disturbance and loss topsoil and vegetation cover and spill over effects to neighbouring areas (e.g. spread of invasive alien species).	5	4	5	100	5	5	25	12 500

The proposed development could result in permanent loss or disturbance of floral communities and listed plant species due to the construction of infrastructure (boilers, transformers, roads, buildings, etc.). The irreplaceability factor (whether or not the impact is reversible) for the impact is high as vegetation will be permanently impacted/lost at development site, but significant ecological functions of the broader environment will likely not be permanently impacted.

Associated disturbance during construction phases could lead to the rapid establishment of successional species, in particular non-indigenous invasive alien plant species. The irreplaceability factor for the impact is moderate because vegetation will be impacted/lost on a small scale but no significant ecological functions will be permanently impacted.

The loss of individuals of species of conservation concern could occur as a direct result of habitat loss and/or eradication of existing populations during the construction phase. This impact relates particularly to *Hypoxis hemerocallidea* (listed as 'declining') and an unidentified *Ledebouria* sp., which is protected by provincial legislation. The irreplaceability factor for the impact is high as rare plants is likely to be permanently lost from the site.

The proposed development will result in an increased erosion risk due to soil disturbance and loss of topsoil and vegetation cover and possible spillover effects to neighbouring areas (e.g. spread of invasive alien species). The irreplaceability factor for the impact is moderate as natural drainage line ecology might be impacted.

In terms of positive impacts the propose development could lower the risks of erosion within the site due to soil compaction during the development phase and the exclusion of livestock from an ecological buffer area (should a buffer area be identified and managed in an ecological responsible manner).

9.8.2 Mitigation ability

Mitigation ability for high impacts are considered.

Impact: Loss of individuals of species of conservation concern as a direct result of habitat loss and/or eradication of existing populations

The following mitigation measures are recommended:

- Prior to clearing of vegetation each specific site should be inspected by a qualified ecologist for the presence of the Red Data Book / Specially Protected plant species predicted to occur at the site. If any are found the specimen should be buffered via 4m diameter buffer (preferred) or translocated to a suitable buffer area.
- Permits must be obtained from EKZNW for disturbance to Schedule 12 and/or Red listed plants.
- An ecological buffer area is recommended. The buffer area should be fenced off, cleared of any alien vegetation annually and reseeded or replanted with native plants sourced from the surrounding area. The area should be managed by applying proven ecological management principles.

By implementing the mitigation measures the impact can be mitigated from high to **Moderate**.

Impact: Increased erosion risk due to soil disturbance and loss topsoil and vegetation cover and spillover effects to neighbouring areas (e.g. spread of invasive alien species).

The impact can be mitigated by the implementation fo the following:

- Long-term monitoring of erosion occurrence, and immediate mitigation, i.e. compacting of gullies and restoration of vegetation.
- Implementation of storm water management mechanisms.
- Maintenance vehicles restricted to demarcated access roads.

Through the implementation of mitigation measures this impact can be mitigated to **Low**.

9.8.3 Fauna

Mr SW van der Merwe was sub contracted by Zone Land Solutions to assess the faunal impacts related to the development of the proposed power station and associated infrastructure. Their assessment was used to determine the faunal impacts as presented in the following paragraphs.

The faunal impacts, and the uncontrolled significance rating thereof, that can be expected during the development of the power station and associated infrastructure are presented in the table below.

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNCONTROLLED IMPACT RATING
Construction & Operation of Power Station & infrastructure	Construction & Operational activities	Overall loss of natural environment.	3	5	5	75	5	5	25	9 375
Construction & Operation of Power Station & infrastructure	Construction & Operational activities	Permanent loss of existing faunal habitats, or remnants thereof and total displacement of fauna that may occur	3	5	4	60	5	5	25	7 500
Construction & Operation of Power Station & infrastructure	Construction & Operational activities	Fauna mortalities	3	4	5	60	5	2	10	3 000
Construction & Operation of Power Station & infrastructure	Construction & Operational activities	Detrimental impact of construction and operational activities	3	3	4	36	5	5	25	4 500
Construction & Operation of Power Station & infrastructure	Construction & Operational activities	Termination of the ecosystem services presented by the study area	3	4	5	60	5	3	15	4 500

9.8.3.1 Overall loss of natural environment.

This refers to the in perpetuity loss of natural land that may have been rehabilitated to perform defined ecosystem service (although the prognosis for recovery is low) and community-supporting functions (e.g. subsistence farming).

9.8.3.2 Permanent loss of existing faunal habitats, or remnants thereof and total displacement of fauna that may occur

Habitat fragmentation causes faunal populations to become more isolated from each other, resulting in a reduction of inter-population connectivity which compromises the future survival and existence of species.

The clearance of indigenous vegetation generally creates and edge effect as a result of various conditions (e.g. fire, wind, desiccation, etc.).

The fragmentation of the perimeter of a habitat, generally causes transitional habitats along the habitat's boundary. The extent to which edge-effects extend into a habitat depend on the nature of impacts as well as the length of habitat boundary that is affected relative to the area of habitat.

Thus, as soon as a patch of habitat becomes fragmented, the area of habitat becomes smaller and the degree of edge effect becomes greater. This effectively results in the actual size of the habitat becoming much more reduced. From a habitat loss perspective, grasslands on the other hand are less affected, as disturbed areas become recolonised reasonably quickly by grassland plants.

A key concern is the potential indirect impacts to the terrestrial area surrounding the seepage area. These may a negative influence on specific fauna that depend on linkages between both aquatic and terrestrial environments; for certain frogs require grassland habitat situated adjacent to wetlands.

9.8.3.3 Fauna mortalities.

The construction activities and the infrastructure to be erected may result in the death of animals.

The increase in human presence and activity may exacerbate the poaching and other forms of resource depletion that are currently evident in the area.

Collisions are the biggest single threat posed by transmission lines to birds in Southern Africa. Species most at risk are heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions.

9.8.3.4 Detrimental impact of construction and operational activities.

The construction, and long-term operation and maintenance of the power plant may affect fauna through the following:

- Construction camps.
- Generation of waste and pollution.
- Continued servicing and maintenance.
- Alien plant infestations.
- Poaching of fauna and other natural resources.

9.8.3.5 Termination of the ecosystem services presented by the study area, namely:

Providing limited perennial water catchment functions (presented by a small drainage system and concomitant riparian zone and small human-made storage pond).

Presenting a habitat for aquatic organisms associated with the drainage system.

Serving as temporary habitats for migrating small mammals and birds.

Providing subsistence grazing used to the local community.

9.8.4 Freshwater

Mr Savel Daniels was sub contracted by Zone Land Solutions to assess the freshwater impacts related to the development of the proposed power station and associated infrastructure. Their assessment was used to determine the impacts on the freshwater resources as presented in the following paragraphs.

The impacts on freshwater resources, and the uncontrolled significance rating thereof, that can be expected during the development of the power station and associated infrastructure are presented in the table below.

Table 9-20: Impacts on freshwater resources

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Dumping of rubble & clearance of vegetation	Damage caused by dumping of rubble. Removal for road building.	3	2	3	18	4	4	16	1440
Construction of Power Station & infrastructure	Construction noise	Disturbance of birdlife and mammals due to noise pollution	3	2	3	18	4	4	16	1440
Construction of Power Station & infrastructure	Using water from the dam	Water abstraction/stream draining.	4	4	4	64	4	4	16	5 120
Construction of Power Station & infrastructure	Removal of soil, vegetation & pollution	Reduced functionality due to vegetation removal, soil removal and pollution.	4	4	4	64	4	5	20	6 400
Operation of Power Station & infrastructure	Expansion of plant area	Damage caused by removal of vegetation for development enhancements /additions	3	1	3	9	5	5	25	1125
Operation of Power Station & infrastructure	Catching of birds, fish and other small animals for selling or eating	Disturbance of birdlife, fish and other animals	3	1	3	9	5	5	25	1125
Operation of Power Station & infrastructure	Using water from the dam	Water abstraction/Wetland draining.	4	4	5	80	4	4	16	6 400

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Removal of soil, vegetation & pollution	Reduced functionality due to vegetation removal, soil removal and pollution.	3	1	3	9	4	4	16	720
Operation of Power Station & infrastructure	Ineffective storm water management	Alteration of the hydrology due to excessive storm water inputs.	3	4	5	60	4	5	20	6000

Impacts were assed in terms of effects on the following during the construction and operational phases:

- Vegetation
- Fauna
- Hydrology
- Ecosystem functionality

9.8.4.1 Vegetation

During construction the vegetation could be impacted on by ddamage caused by dumping of rubble and the removal of vegetation for road building. During the operational phase the vegetation could be impacted on by damage caused through the removal of vegetation for development enhancements /additions.

9.8.4.2 Fauna

Birdlife and mammals could be disturbed due to noise pollution during construction. During the operational phase catching of birds, fish and other small animals for selling or eating could have a negative impact on the fauna.

9.8.4.3 Hydrology

Sourcing water from the dam for construction activities could have an impact on the hydrology. Long term water abstraction during operational phase could lead to wetland draining and will have a negative impact on the hydrology.

Excessive storm water inputs into the area and the man-made dam could alter the hydrology on the site.

9.8.4.4 Ecosystem functionality

The functionality of the ecosystem could be reduced due to vegetation removal, soil removal and pollution during construction and operational phases.

Storm water management

9.9 LAND USE

9.10 SOCIO-ECONOMIC

Eco-Urban Development Economists was appointed to assess the socio-economic impacts related to the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the socio-economic impacts as presented in the following paragraphs.

9.10.1 Impacts during construction

The socio-economic impacts, and the uncontrolled significance rating thereof, that can be expected during the construction of the power station and associated infrastructure are presented in the table below. Discussions on the impacts are presented in the paragraphs that follow the table.

Table 9-21: Socio-economic impacts associated with construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Demand for products and services	Temporary stimulation of the local and national economy	5	5	4	100	4	4	16	+ 1 600
Construction of Power Station & infrastructure	Demand for employees	Creation of temporary employment opportunities	5	5	4	100	4	4	16	+ 1 600
Construction of Power Station & infrastructure	Demand for skilled workers	Skills development due to the creation of new temporary employment opportunities	5	5	5	125	4	3	12	+ 1 500
Construction of Power Station & infrastructure	Revenue & Income generated result in need to pay government taxes (income & payroll taxes).	Increase in government revenue	3	5	4	60	4	4	16	+ 960
Construction of Power Station & infrastructure	Creation of employment opportunities	Increased household income and an improvement of standard of living of those benefitting	5	5	4	100	4	4	16	+ 1 600
Construction of Power Station & infrastructure	Infrastructure required for the proposed project	Impact on the region's spatial development	3	4	5	60	4	3	12	+ 720

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
		and the benefits to the local community								
Construction of Power Station & infrastructure	Located in close proximity to the Natal Battlefield route and tourism facilities	Impact on the local tourism industry due to the potential loss of tourists	3	3	4	36	4	4	16	576
Construction of Power Station & infrastructure	Relocation of land occupiers	Negative financial and social impacts associated with relocation of affected households	4	2	5	40	4	4	16	640
Construction of Power Station & infrastructure	Migration of people in search of employment	Change in the demographics of the area	3	4	4	48	4	4	16	768
Construction of Power Station & infrastructure	Increase in the number of job seekers and migrants in and around the proposed site	Increase in social pathologies due to the influx of migrant labourers	3	4	4	48	4	4	16	768
Construction of Power Station & infrastructure	Creation of numerous environmental impacts	Deterioration of living and working conditions due to the various environmental impacts	3	4	4	48	4	4	16	768
Construction of Power Station & infrastructure	Influx of job seekers	Added pressure on basic services and social and economic infrastructure	4	4	4	64	4	4	16	1 024

9.10.1.1 Temporary stimulation of the local and national economy

Economic production can be described as an activity carried out that uses inputs of labour, capital, and goods and services to add value and produce outputs such as goods or services. The establishment of the power station and associated infrastructure will involve activities such as site and infrastructure development, civil works, building construction, and other business activities related to the construction of the proposed development. This would create a positive impact on the local and regional economies, as the demand for products and services used in construction will generate new business sales, albeit for a temporary period. The following table outlines the expected impact of the capital expenditure on production in the country during construction of each phase, as well as the total impact expected from the construction of all three phases.

Table 9-22: Impact on production during construction of the power station and auxiliary infrastructure (R'm, 2015 prices)

Production	Direct	Indirect	Induced	Total
Phase 1	R4 277	R5 712	R2 060	R12 049
Phase 2	R2 566	R3 414	R1 245	R7 225
Phase 3	R2 566	R3 414	R1 245	R7 225
TOTAL	R9 410	R12 539	R4 550	R26 499

Source: Eco-Urban Development Economists (2015)

As stated previously, and outlined in Table 9-22, the capital expenditure required for phase one of the construction of the power station and auxiliary infrastructure component of the project is higher than that required for phase two and three. This is due to the fact that the bulk of the auxiliary infrastructure will be established during the first phase of construction of this component of the proposed project.

As outlined here, the capital expenditure of R18 666 million (2015 prices) on the construction of the 1 050 MW power station and auxiliary infrastructure is expected to result in an increase in national production output by R26 499 million. Approximately 35.5% (R9 410 million in 2015 prices) of the increase in new business sales, which will be stimulated by the construction of the power station and auxiliary infrastructure, will be due to direct effects. The direct impact will be experienced by the companies involved in the construction of the power station and the auxiliary infrastructure component of the proposed project. It is estimated that R12 539 million (2015 prices), or 47.3%, of the production output generated during construction will be stimulated through indirect effects. A further R4 550 million in new business sales in 2015 prices will be generated through consumption induced impacts, or spending of income earned by directly and indirectly benefiting households.

As is to be expected, industries in the building and construction sector is set to benefit the most from the anticipated increase in new business sales resulting from the capital expenditure required to establish the 1 050 MW power station and auxiliary infrastructure. Other sectors that will benefit during the construction period include: the manufacturing, trade and accommodation, transport and storage, and real estate and business services sectors. The total increase in new business sales for industries operating within the manufacturing sector is anticipated to be valued at R3 045 million in 2015 prices.

Table 9-23: Impact on GDP during construction of the power station and auxiliary infrastructure (R'm, 2015 prices)

GDP	Direct	Indirect	Induced	Total
Phase 1	R430	R1 751	R787	R2 969
Phase 2	R267	R1 047	R476	R1 789
Phase 3	R267	R1 047	R476	R1 789
TOTAL	R964	R3 845	R1 739	R6 548

Source: Eco-Urban Development Economists (2015)

Table 9-23 indicates that the domestic expenditure of R9 410 million on construction of the power station and auxiliary infrastructure will directly generate R964 million of GDP in 2015 prices. In addition, R5 584 million (2015 prices) will be generated through various multiplier effects, the majority of which will be due to procurement spend on the project and derived indirect effects. The majority of value added will be created by businesses in the buildings and construction, trade, machinery and equipment, and insurance industries.

Although the construction will take place in three phases, with no clarity at this stage on when each phase will be initiated and completed, the significance of the injection into the local economy is clear when considering the size of the study area's economy. In 2011, the economy of the Uthukela DM was valued at R20 735 million in current prices, while that of the Emnambithi LM was valued at R8 423 million. The economy of the Umtshezi LM, the local municipality in which the bulk of the project footprint will be located, was considerably smaller, valued at R4 404 million.

The economies of the above-mentioned municipalities are not sufficiently diversified to attract a significant portion of construction expenditure spend; nonetheless, it can be expected that some of the benefits will be contained in the local economies although their quantification is challenging. Considering the fact that those employed during the construction period will procure goods and services on a daily basis from the area, it can be expected that the local services industries will benefit the most during construction. Furthermore, local construction companies that might be sub-contracted could also experience an increase in their turnover during any period of construction activities.

9.10.1.2 Temporary creation of employment in local and national economies

Employment impacts are calculated in terms of the Full Time Equivalent (FTE) employment positions, which is the same as a FTE job or one man-year of work. This does not directly translate into the headcount of people employed or into new job opportunities. Generally, one FTE man-year is equal to one person working for 40 hours per week for about 50 weeks per year; however, it could vary depending on the industry.

A FTE man-year means that if one person worked only 20 hours per week for 50 weeks in a year, its FTE equivalent would be 0.5; if two people worked for 20 hours per week for 50 weeks in a year, the combined work load would be estimated as one FTE man-year or one FTE job. In the short-term, an increase in FTE employment positions could be absorbed by the existing workforce, either by working overtime or if these labour resources are underutilised in the industry.

It is envisaged that, during the construction of all phases of the 1 050 MW power station and associated infrastructure, about 41 730 FTE employment opportunities will be created throughout the local and national economies, over the estimated eight and a half year construction period. Most of these jobs are likely to be created outside the study area, and even beyond the boundaries of the KwaZulu-Natal Province. However, based on the DOE's RFP, 18% of the direct employment opportunities (2 900 FTE jobs for the first phase, 6 500 FTE jobs in total for all phases) created during the construction period will need to be made available to individuals from within the local area and its immediate surrounds.

Based on the above, it can be stated that a minimum of 522 FTE employment opportunities will be made available to local community members during the construction of phase one. It is expected that these employment opportunities will be created over a period of three and a half years, which means that it could translate into an average of 150 job supported for that period; if construction of phase two overlaps with construction activities of phase one at any stage, local employment opportunities could increase by a further 325 FTE jobs at the least. Overall, if construction overlaps, and at any one point, (construction activities are taking place on all three phases of the power station at the same point in time) the local community would benefit from the creation of at least 1 170 FTE jobs, which would be made available to them.

According to the 2011 census, 61.5% of the population of the Umtshezi LM's population is of working age, while 62.2% and 60.6%, respectively, of the Emnambithi and Indaka LMs populations are aged between 15 and 64 years of age. In addition, it is estimated that 36%, 34%, and 58%, respectively, of these three LM's working age population were unemployed. Moreover, the district had 58 588 unemployed working-aged individuals in 2011 according to the National Census. At the same time, Colenso, the town closest to the proposed project site, had an unemployment rate of 42.3%, or 865 individuals aged 15 – 64, looking for employment who are unable to find gainful opportunities. Taking into consideration the level of discouraged work seekers in the study area, the results of the survey conducted by EcoPartners are in line with the statistics provided. According to the survey results, 64% - 76% of the study area's community is without a viable job opportunity. This means that during construction of phase one of the project only, the possible local job creation (i.e. 149 employment opportunities supported over 3.5 years) would be equal to a 17.2% decrease in unemployment in the town of Colenso for a period of 3.5 years, or perhaps more likely, a 0.3% temporary decrease in unemployment in the district.

Table 9-24: Impact on employment during construction of the power station and associated infrastructure (FTE jobs)

Employment	Direct	Indirect	Induced	Total
Phase 1	2 900	12 479	3 547	18 926
Phase 2	1 800	7 459	2 143	11 402
Phase 3	1 800	7 459	2 143	11 402
TOTAL	6 500	27 397	7 833	41 730

Source: Eco-Urban Development Economists (2015)

As mentioned, it is expected that phase one of the project will result in the creation of 2 900 FTE jobs spanning the three and a half years that is expected to take for phase one to be completed. In addition to these direct opportunities, it is estimated that 12 479 FTE jobs will be created in industries and sectors providing goods and services to support construction activities, while a further 3 547 FTE jobs will be created due to consumption induced impact. Based on the fact that those employed directly at the construction site will require goods and services on a daily basis, it can be concluded that at least some of the consumption induced impacts will occur in the local community. It is estimated that the employment creation patterns will follow mostly the same pattern that the increase in business sales and GDP, indicating that the sectors expected to experience the most significant temporary growth in employment include the building and construction, as well as tertiary industries such as trade, transportation, personal services, and real estate.

9.10.1.3 Skills development due to the creation of new employment opportunities

The construction of the power station and the auxiliary infrastructure component of the proposed project will require general construction experience, as well as expert knowledge. Skills required during the construction phase will include, among others: civil engineers, artisans, machine operators, as well as semi-skilled and unskilled workers. As stated before, it is the requirement of the Coal Baseload Independent Power Producer

Procurement Programme (IPPPP) that at least 50% of those employed during the construction period must be South African. Furthermore, 30% must be black South Africans, with 20% of skilled labour being black. Importantly, at least 18% of those employed during the construction period must be South Africans from the local community. As indicated in the assumptions section, this could translate into 522 FTE jobs for phase one and 1 170 FTE jobs for all three phases, which in turn equates to about 149 employment positions sustained for 3.5 years and 138 jobs sustained over 8.5 years.

Considering the level of literacy of the community, finding appropriately skilled individuals from within the local community might pose a challenge. Based on Census 2011, approximately two thirds of the study area's community aged 20 and older has obtained a matric certificate or at least some level of secondary schooling; while 13.6% of individuals aged 20 and older, residing in the Uthukela DM, has had no formal schooling. Closer to Colenso, this figure improves to 8% of the population aged 20 and older. The above suggests that it is most likely that the requirements for the labour coming from the local community will be met through the employment of unskilled and semi-skilled workers, while an initial high-level training exercise might be required to ensure maximum participation and benefit for the local community.

Assuming the longest possible construction period of 8.5 years materialises, it can be argued that the impact on skills development of those employed by the project will be significant. Unlike the employment opportunities offered, skills developed during the construction period will not expire once the construction is complete; the impact on skills development is therefore, much more sustainable. Those with specialist skills required for the construction phase, will gain experience and improve their skills level; at the same time unskilled, or semi-skilled labourers will have the opportunity to develop a skill over this time, which will significantly improve their marketability on the job market once the construction is completed.

9.10.1.4 Increase in government revenue due to the CAPEX investment

Construction of all phases of the 1 050 MW power station and auxiliary infrastructure is set to last a maximum of 8.5 years. During the construction period, companies will derive revenue and individuals will be earning an income; they will also need to pay government taxes, including income taxes and payroll taxes respectively. Government revenue generated from the construction of the power station and auxiliary infrastructure could possibly increase government spending in the area and will increase national fiscus.

The added revenue earned may assist to fund the delivery of services and infrastructure in the region. It is not possible to associate specific revenue collected by government with a certain budget item. The money will, however, be allocated towards budget items at provincial or municipal level, to help with the improvement of service delivery.

9.10.1.5 Increased household income and improved standard of living resulting from construction of the power station and auxiliary infrastructure component

The construction of phases one to three of the power station and the auxiliary infrastructure components of the Colenso Integrated Power Project is expected to result in the creation of 41 730 FTE employment opportunities and various infrastructure developments. These impacts will contribute towards the reduction of poverty and general promotion of socio-economic development.

Table 9-25: Impact on household income during construction of the power station and auxiliary infrastructure (R'm, 2015 prices)

Income	Direct	Indirect	Induced	Total
Phase 1	R428	R825	R315	R1 568
Phase 2	R265	R493	R190	R949
Phase 3	R265	R493	R190	R949

Source: Eco-Urban Development Economists (2015)

As shown in Table 9-25, it is expected that a total of R3 465 million in wages and salaries will be paid to workers for the construction of the three phases of the 1 050 MW power station and auxiliary infrastructure over a maximum period of 8.5 years. An estimated R959 million in 2015 prices, could be paid to workers directly involved with construction of this component of the proposed project, while R1 811 million will be paid to employees of those companies benefitting from production induced multiplier effects. In addition, due to the consumption patterns of the directly and indirectly benefiting individuals, companies providing consumer goods and services will be paying R696 million in wages and services to their employees over the total construction period.

Considering that the average national household size is approximately 3.5, the household income generated from the construction of the 1 050 MW power station and auxiliary infrastructure could support up to 146 055 people. These people can be expected to experience an improvement in their living standards, albeit for a temporary period.

9.10.1.6 Impact on the region's spatial development and the associated benefits to the local communities

A review of the study area's local and district municipal documents revealed that the officials have identified the development of agricultural, tourism, and manufacturing (industrial), sectors as means to curbing the socio-economic problems currently being experienced by the study area. Tied to this is the recommendation made in the Emnambithi LM's SDF, stating that the revitalisation of the town of Colenso should be prioritised in order to advance socio-economic development in the area.

The municipality's stance on the importance of the manufacturing sector in revitalisation of the region was emphasised during consultation. The consultation process revealed that a part of the Emnambithi LM's LED strategy to stimulate growth in the industrial sector was the establishment of four industrial estates. Even though four manufacturers showed interest, these estates were unsuccessful due to a lack of economic infrastructure and service provision. It is anticipated that the proposed project will assist in improving economic infrastructure and service delivery in the area, thereby increasing the attractiveness of the area for businesses.

Consultation with local community members and the municipal authority revealed that the majority of the citizens of Colenso travel outside of town for work, and that most of them are employed on the surrounding farms. It is estimated that they travel approximately 5 – 10 km, travelling either by minibus taxi, transport provided by the farmer, or by foot. Although the travelling distance is not significant by road, it is quite a distance to travel by foot. Stimulation of the local industrial sector resulting from the establishment of the proposed project should result in a reduced need for transport of workers to farms, since jobs will become available in the manufacturing sector closer to their area of residence and where public transport is freely available.

Based on these considerations, it could be concluded that the positive impact for the study area will be two-fold. The investment in infrastructure required for the proposed project to operate effectively will by default benefit the households of the area. Additionally, an increase in businesses willing to operate from the area, due to the expected improvement in service provision and infrastructure, will result in a new set of multiplier effects benefitting the local community.

It is vital, however, that the importance of the agriculture and tourism sectors be kept front of mind at all times. The progress made in increasing industrialisation and the size of the manufacturing sector's contribution to the study area's economy should, where possible, not be at the cost of the tourism or agricultural sectors.

9.10.1.7 Impact on the local tourism industry linked to the potential loss of tourists

The proposed project site is located in close proximity to the Natal Battlefield route and may influence the following tourism facilities:

- The Thukela Drift Nature Reserve is located outside the town of Colenso.
- The Weenen Nature Reserve found to the west of the town of Weenen is far away from the proposed project area.
- The Stoney Ridge Offroad Academy is located about 13 km from Colenso south-east and accessed from the R74. It is situated about 7.3 km north of the R74, which means that it will be in some proximity to the project site. In relation to the mining site area, it is situated about 8.5 km to the south most point of that zoned area.
- Zingela Safaris and River Camp is another eco-tourism facility that is situated in the area about 23 km from Colenso. It is located on the bank of the Thukela River. It is located about 1.6 km from the closest point of the delineated area for the coal mine.

In addition to the above tourism facilities, located outside of the proposed project boundaries, the Thukela Wildlife CC, operating as Emaweni Game Ranch and Hunting Lodge, is located within the boundaries of the proposed project site, within the proposed mining footprint. Furthermore, various interested and affected parties have raised concerns regarding the impact of the proposed project on the area's tourism industry. As an example, Bushwillow Lodge, located in Sandton, indicated that they send many international tourists to the area, and would be hesitant to do so if its offering is disturbed by the proposed development.

A review of the respective specialist scoping phase studies (i.e. visual, air, and noise), revealed that the zone of influence of the proposed power station and auxiliary infrastructure will extend to some of the above-mentioned sensitive receptors located within the study area. Noise will be the biggest environmental impact during construction, followed by the visual impact that will incur once the stacks are built. All of these will, without doubt, alter the experience of tourists and could lead to them changing the decision to come to the area again. Therefore, it can be expected that the negative impact on the local tourism industry will gradually increase as the construction progresses and visual impacts, as well as project footprint, extends.

9.10.1.8 Negative financial and social impacts associated with relocation of affected households

Any relocation activity will be associated with financial and social/psychological effects on the affected households:

- Potential negative financial impacts will relate to the possible increase in living expenses, moving expenses, increase travelling costs to and from work or to and from nearby town.
- Potential negative social or psychological impacts are associated with the change in living environment and the emotional attachment to a particular home or place of residence. Families with ties to the site where they reside are likely to have greater difficulty adjusting to new places and run the risk of losing community cohesion and social interaction. Such ties could be linked to the proximity of their current location to other family members, neighbors, and community facilities, as well as proximity to their heritage, including ancestral graves.

It is envisioned that the power station component of the proposed Colenso Integrated Power Project will be located on Farm Schurfde Poort 1147 – Portion 1. Consultation with the land owners of this land revealed that they are in support of the project. However, they are likely to be required to relocate to another area (a total of 265 households), which is a concern for the local residents due to a risk of losing cultural heritage. Furthermore, the owners of Farm Schurfde Poort 1147 – Remainder (a total of 300 to 400 households); on which it is expected that some auxiliary infrastructure will be placed, have indicated that relocation is not an option, since the land contains ancestral burial grounds. The residents of farms Labuschagne's Kraal 1229 – Portion 10, 17, and Remainder and Cromleybank 1146 – Portion 7; Clapham Kloof 11318 – Remainder; Riet Bult 1213 – Portion 4, where some of infrastructural components may be located indicated that they would be willing to relocate provided they are offered suitable land.

As indicated above, it is likely that relocation may not be avoidable and some of the residents of the farms mentioned above will need to be moved to new residences. In this instance, having a sound and acceptable by the affected communities' relocation plan will be of utmost importance to reduce adverse effects of relocation impacts.

9.10.1.9 Change in the demographics of the area due to the potential influx of workers and job seekers

Construction projects with a scope of work such as what is anticipated for the proposed project typically attract a large number of people in search of employment to the area. These job seekers could decide to stay in the area regardless of whether they find employment at the proposed project or not. In most cases, job seekers are not accompanied by their families, who may decide to follow at a later stage.

It is estimated that the study area's population comprises approximately 63% of the Uthukela DM's total population. Furthermore, just over half of the district's population resides in traditional dwellings on tribal land, with 55% of the community being female. It can therefore be stated that the proposed project site is relatively rural with a small but very tight community base; therefore, any influx of job seekers will be notable. The project of the proposed magnitude, though, could attract quite a significant number of job seekers considering that employment opportunities in the district in general are limited.

Those migrating to the area for the purpose of seeking employment are generally mostly male. These individuals could either decide to move their families to the area depending on their chances of finding employment post-construction, or move to other parts of the country seeking new employment opportunities. This inward migration trend could lead to an increase in the local population with the proportion of male population within the working age growing, ultimately changing the local demographics.

However, it might be argued that the town of Colenso, the closest town to the project, could benefit from the in migration of skilled and semi-skilled labour. The assistant LED manager of the Emnambithi LM has stated that the town has experienced an out-migration of middle- or working class households since the power station's decommissioning. The project could, therefore, assist in re-establishing the previous demographic trends of this town, further gearing up the town for the planned re-establishment of its industrial or manufacturing sector.

9.10.1.10 Increase in social pathologies due to the influx of migrant labourers

Social pathologies are social problems or social factors that contribute to the disorganisation and/or the ineffectiveness of society. Social pathologies include substance abuse, violence, abuse of women and children, crime, terrorism, corruption, criminality and delinquency, discrimination, segregation, stigmatisation and human rights violations. These are caused by, among others, poverty and unemployment.

Job seekers from within the study area's local municipalities, as well as from outside the study area, will be offered employment opportunities during the construction phase of the proposed project. The increase in the number of job seekers and migrants in and around the proposed site is expected to cause an increase in social pathologies. The study area does not possess a sufficiently skilled workforce to supply all the labour requirements for the construction of the proposed 1 050 MW power station and the auxiliary infrastructure component of the proposed project. It can be expected that some of the unskilled and semi-skilled labour requirements can be procured locally; however, many of the specialised and skilled workers will be migrant workers. Further, in addition to the construction crew, the area's population may increase due to the influx of job seekers as described previously.

At this stage it is unclear, what the timeframes around the construction of the three phases of the proposed power station will be. However, some overlapping of the construction of the three phases may take place; thus, indicating that at some stage during the relatively long construction period, the number of migrant workers is likely to increase to satisfy labour demands at the construction of the different phases of the proposed power station. This could in turn lead to an increase in hopeful job seekers, as word spreads of the availability of new jobs in the area.

Consultation with local community members revealed that the ailing infrastructure of the study area will not be able to handle a large influx of people. An overburden on service provision and adequate housing is, therefore, possible as the proposed project progresses, and could lead to social ills such as squatting.

The influx of people from other parts of the country could result in tension between locals and migrants (who may be of South African and non-south African citizenship) vying for the same job opportunity. As was seen in the recent xenophobic attacks that spread across the country, locals could accuse migrants of “stealing” their jobs. Left without income, the local community members could resort to violent protests and crime.

Moreover, an influx of people from other parts of the country who are unable to find job opportunities at the project site would likely lead to an increase in criminal activity. General sharp increase in the local population due to influx of people to the area could also spike prostitution and the spread of diseases, especially sexually transmitted diseases. A perceived increase in these socio-economic problems by the locals will further increase their unhappiness with having an increased number of migrants in the area, increasing tension in the area.

The above-mentioned impacts are generally difficult to mitigate. However, the effects can be managed, and even prevented to an extent. Strict enforcement of property and human rights, as well as thorough monitoring of the area during the construction phase could help to limit the anticipated negative effects. Stakeholder consultation and relationship building is vital in enforcing law and transparency.

9.10.1.11 Deterioration of living and working conditions due to the various environmental impacts

During the construction phase of the proposed project, numerous environmental impacts will be created that will lead to the deterioration of living and working conditions in the area. It is envisaged that the possible noise and visual impacts during construction will alter the sense of place, and negatively impact on the living conditions of the people residing and working on the impacted land.

The visual impact of the power station and the auxiliary infrastructure component of the proposed project is significant based on the size of the power station’s built structure. The tallest part of a coal-fired power station is typically the cooling stack, which can reach heights similar to that of a 50 – 60 storey building. Considering this, the power station would be visually intrusive, especially in areas where a high visual sensitivity is present, or close to sensitive receptors such as the tourism facilities in close proximity to the proposed site. The proposed power station site is not located close to the existing old Colenso cooling stack, instead it is planned for a relatively rural area where some subsistence agriculture activities have already changed the natural visual characteristics of the area. Moreover, it could potentially impact on the visual experience of tourists travelling the battlefield route or towards the tourism facilities in the scenic part of the proposed study area, where the existing Colenso power station infrastructure is not visible.

The Noise Impact Scoping Report (De Jager, 2014) concluded that there are various sensitive receptors within the zone of sensitivity, which would be negatively impacted during the construction of the three phases of the 1 050 MW power station and its associated infrastructure. Perhaps the most significant source of noise during the construction phase is the increase in traffic on local roads due to the need for transportation of construction materials and workers. The increase in road traffic will affect the local communities and tourism facilities by adding to the number of vehicles utilising the local road network on a daily basis, thus disrupting movement patterns.

As the traffic volumes on the road increases, the likelihood of accidents occurring will increase as well. With more vehicles utilising the road, local road users will be faced with an increased probability of being involved in an accident. Of great concern should be the potential danger to pedestrians and those road users not using motorised transport, such as cyclists. The baseline review of the area's infrastructure revealed that there is a lack of transport infrastructure to accommodate road users such as pedestrians and cyclists, indicating that an increase in heavy vehicles on the local roads could put these road users at risk.

Additionally, an increase in heavy vehicles, as is typically associated with construction, puts additional strain on the roads, causing them to deteriorate at a faster rate. Consultation with local community members revealed that local road infrastructure is already in poor state, with potholes and potential flash floods during times of high rain.

These impacts are not fatal flaws; more of a nuisance to the individuals experiencing them. Mitigation measures exist, such as planning for the delivery of large and abnormal loads to take place before or after peak traffic hours to reduce the pressure on roads. It is recommended that the mitigation measures made by the visual and noise specialist be implemented where feasibly possible.

9.10.1.12 Added pressure on basic services and social and economic infrastructure

Consultation with local municipal officials revealed that it is the municipality's view that infrastructure in Colenso is deteriorating but at the same time underutilised, perhaps indicating that maintenance in the study area is a concern. Although local authorities stated that it is envisaged that existing infrastructure can support the proposed project, a brief situational analysis of the town revealed the obvious run-down and derelict state of the town's infrastructure. The proposed project will likely increase pressure on service delivery and infrastructure in the area.

Housing and basic service delivery

The construction of the three phases of the proposed 1 050 MW power station and auxiliary infrastructure, which will probably lead to an influx of migrant workers and hopeful employment seekers to the area, can be expected to increase the demand for low-cost housing and rental accommodation in the study area. The project developer plans to establish a construction camp that will host the majority of the construction crew, however, local community may still be required to accommodate some workers.

Finding rental accommodation in the area may be problematic and there is a possibility that local residents may offer their own houses to accommodate construction workers, as has been seen in some areas of the country (for, example Postmasburg). Regardless of the location of the chosen accommodation for the construction crew – construction camp or in-town accommodation, the majority of the construction crew will be coming from outside the area and will create an additional demand for basic services, specifically water, electricity, and sanitation. Based on a review of secondary data obtained, as well as interviews with the landowners and other community members, service provision in the study area is already under pressure. According to the 2011 Census, just fewer than half of the households living in the Uthukela DM had access to piped water. At the same time, only about a third of households had a flush toilet in their homes, while approximately 74% of households were using electricity for lighting in their homes. Therefore, any additional increase in demand for services will worsen the situation and will put added pressure on the municipality to provide these services.

In addition to the above, influx of job seekers is likely to increase the demand for low-cost rental accommodation. Based on the 2011 National Census, 1.9% of the Uthukela DM's households where living in informal dwellings, while that figure was recorded at 2.9% for the households of the Emnambithi LM. Consultation with local community leaders revealed that existing RDP houses were in a state of neglect Furthermore, community consultation revealed that some of the houses located in the town of Colenso is now unused, and that the municipal authorities revealed that a housing project is underway. There is therefore a possibility that job seekers may find it difficult to find affordable rental accommodation in the area and may resolve to either occupying unused houses or set up informal housing units, both of which is highly undesirable and may create significant problems for basic service delivery in the area.

Social infrastructure

The availability and distribution of social and recreational infrastructure is still a huge challenge for most of the local municipalities under review.

The Indaka LM faces a severe shortage of social and recreational infrastructure. There are only three health facilities, one library and one police station in the whole of the Indaka LM. It is further reported that there are no institutions of higher learning within the municipality, with school-leavers having to go to other municipalities or districts in order to further their education.

In Umtshezi LM the social and recreational infrastructure is mostly located in urban settlements making such facilities unreachable for the rural communities. There is one hospital in the municipality; and the distribution of nursery, primary, and secondary schools is still a major concern with some learners having to travel long distances in order to access education services. The shortage of teachers in some other schools is another major concern for the Umtshezi LM.

Looking at the facilities available in the town of Colenso, one can also see that the distribution of social and recreational infrastructure in some parts of the Emnambithi/Ladysmith LM is also a challenge. Information gathered from interviews conducted with the local authorities responsible for the town of Colenso shows that the town has one clinic, two primary schools, and one combined primary and secondary school. When faced with serious health issues, the residents of Colenso travel to Ladysmith. The town also has a single library, a sports field, and a swimming pool which is currently being upgraded.

Considering the anticipated scale of the migration of workers for the construction of the proposed project and influx of job seekers, it can be concluded that the study area will experience an increase in the demand for social infrastructure. Furthermore, as the construction of the power station progresses to stages two and three, especially where an overlap in construction takes place, the number of construction workers may grow, increasing the demand for social infrastructure in the area over this period. Moreover, based on the fact that the construction period may extend over a prolonged period (i.e. 8.5 years if no overlapping of the phases take place), it could be concluded that the construction workers are likely to settle with their families, further increasing the potential demand of social infrastructure in the study area.

Road infrastructure

The construction of projects similar to the proposed project requires significant volumes of construction material, machinery, and equipment. The transport of construction of these goods and workers to and from the site will temporarily increase the volume of traffic on primary and secondary roads in the area of the proposed project site.

As discussed earlier, local roads are currently in a state of neglect; this is especially true for the town of Colenso, which together with Ladysmith, is expected to be the main service centre for construction workers during the construction period. Without the proper level of maintenance and upgrade of the local road network prior to the start of construction activities, the development is highly likely will contribute to further decline of local road conditions.

9.10.2 Impact during operations

The following sections describe the potential impacts of the proposed 1 050 MW power station during the operational phase of the project. The project will be constructed in three phases of 350 MW each, with each phase having a project lifespan of 30 years. This means that impacts observed during this phase, regardless of their nature, will be long-lasting. Moreover, at some stage, once construction of all three phases are complete and before the first phase is decommissioned, it is expected that all three phases will be operated concurrently, increasing the magnitude or severity of the observed impacts. For that reason, all impacts described in this section are from the perspective of the proposed power station reaching its full capacity of 1 050 MW.

The socio-economic impacts, and the uncontrolled significance rating thereof, that can be expected during the operational phase of the power station and associated infrastructure are presented in the table below. Discussions on the impacts are presented in the paragraphs that follow the table.

Table 9-26: Socio-economic impacts expected during the operational phase

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Supply of electricity to the grid	Increased electricity generation capacity and the benefit to the local and national economies	3	5	5	75	4	4	16	+ 1 200
Operation of Power Station & infrastructure	Maintenance & operational expenses	Sustained increase in the local and national economies due to operations and maintenance	5	5	5	125	4	4	16	+ 2 000

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Demand for long term employees	Creation of long-term employment opportunities in the local and national economies	4	5	5	100	4	4	16	+ 1 600
Operation of Power Station & infrastructure	Revenue & Income generated result in need to pay government taxes (income & payroll taxes).	Increase in government revenue stream	2	5	5	50	4	4	16	+ 800
Operation of Power Station & infrastructure	Demand for workers with a variety of skills to operate and maintain the coal-based power plant	Skills development and knowledge transfer	4	5	5	100	3	4	12	+ 1 200
Operation of Power Station & infrastructure	Community focused SED and ED initiatives	Investment in SED and ED initiatives	5	4	5	100	4	4	16	+ 1 600
Operation of Power Station & infrastructure	Direct employment opportunities	Improved living standard of households benefitting from sustainable job creation and the associated increase in households income	3	4	5	60	4	4	16	+ 960
Operation of Power Station & infrastructure	Visual, air, and noise intrusion	Altered sense of place	3	4	5	60	4	4	16	960
Operation of Power Station & infrastructure	Change in the study natural and cultural landscape and features of the environment	Impact on the local tourism and game hunting industry	3	4	5	60	4	4	16	960

9.10.2.1 Increased electricity generation capacity and the benefit to the local and national economies

Electricity supply and demand in South Africa is not in equilibrium, forcing Eskom to implement load shedding, which negatively impacts on the economic development and investor confidence in the country. In most likelihood, the need to impose rolling blackouts will remain until the new baseload generation capacity comes online.

Considering the high degree of uncertainty that exists around the expected date of completion of the new build programme, and the fact that the proposed project will be able to supply electricity to the grid within the short- to medium-term (construction of the first phase of the power station will last an estimated three and a half years), it is likely that the proposed project will contribute towards easing the pressure on Eskom and reducing the risk of load shedding.

Currently Eskom has 44 145 MW in installed capacity, while it is estimated that the new build under construction will add an additional 11 120 MW or about 25% of the current capacity to the national grid. Exact completion date of these build programmes is uncertain, which indicates a need for alternative short- and medium-term solutions to address the supply and demand imbalance. Implementation of the proposed project will, therefore, further national government’s goal of providing a stable electricity supply, as it is estimated to increase the current generation capacity by approximately 2.3%.

Moreover, the updated IRP2010 (Department of Energy, 2013) suggests that about 2 450 MW of new coal-fired power stations will need to be established by 2030 to meet the rising demand from household and business consumers. Implementation of the proposed project will provide for approximately 43% of the increased capacity requirement by 2030.

Closer to the project, consultation with municipal officials and a review of the local development strategies, revealed that the lack of electricity provision is hampering economic growth in the study area. In an effort to revitalise the region’s industrial sector, four industrial estates where developed. These are, however, underutilised due to a lack of economic infrastructure and stable service provision. Local municipal officials confirmed that one such estate, the iThala Business Park, has a high tenant occupancy turnover rate due to the prevailing economic and business conditions in the area. However, the municipality did state that there is no lack of businesses interested in the business park, since it seems that as one business closes; the next one opens its doors.

It was further stated that a possible steel manufacturing project is on the cards for the area, which would add to the revitalisation of the region’s manufacturing sector, but that the possible development would depend on the provision of a stable electricity source. The business growth potential associated with the proposed project is one of the main reasons why the local community is in favour of the proposed coal fired power station and auxiliary infrastructure, between 21% and 33% of the community believes that it would increase business opportunities in the study area (EcoPartners Survey, 2015). Considering these factors, it could be concluded that the study area would experience an increase in the manufacturing sector in the area if the electricity supply is improved, leading to development of the region in line with the local SDF plans and strategies.

Of no lesser importance is the potential benefit to households in the area. It is estimated that 75% of the households in the Uthukela DM use electricity for lighting, indicating that about a quarter of households have no access to the grid. In the town of Colenso that figure is at 79%, which means that slightly fewer households have no access to electricity. Regardless, access to the grid in the study area is not universal. Through the socio-economic development spend and community dividends that would be derived throughout the operational life of the power station, alternative forms of electricity supply could be provided or the funds could potentially be used to extend the local distribution network, thus improving access to electricity among local households.

9.10.2.2 Sustainable increase in production and GDP of the local and national economies through operations and maintenance activities

Once all three phases of the construction process are complete, the power station will generate an estimated 8 266 GWh of electricity annually. It is estimated that this level of electricity generation will earn the facility the revenue of R6 778 million in 2015 prices. The R6 778 million in annual revenue is representative of the new business sales or production the power station will generate each year for the entire time that the power station is operating at full capacity. During this time, it is estimated that the total annual impact on the country's production will be R11 286 million in 2015 prices. As shown in Table 9-27, R4 508 million will be as a result of the expected multiplier effects, with R1 572 million being generated through indirect or production induced impacts, and R2 936 million being created through consumption induced impacts.

Table 9-27: Annual impact on production during operations (R'm, 2015 prices)

Production	Direct	Indirect	Induced	Total
Phase 1	R2 259	R524	R979	R3 762
Phase 2	R2 259	R524	R979	R3 762
Phase 3	R2 259	R524	R979	R3 762

Source: Eco-Urban Development Economists (2015)

It is anticipated that the manufacturing sector, followed by the mining and transport and storage sectors, will experience the largest increase in production as a result of the indirect or production induced impacts. Based on expected household consumption patterns, the manufacturing, real estate and business services, and transport and storage sectors will experience the largest increase in demand for their goods and services, and thus comprise the largest share of the consumption induced increase in production across the country.

Table 9-28: Annual impact on GDP during operations (R'm, 2015 prices)

GDP	Direct	Indirect	Induced	Total
Phase 1	R1 545	R220	R375	R2 140
Phase 2	R1 545	R220	R375	R2 140
Phase 3	R1 545	R220	R375	R2 140
TOTAL	R4 634	R661	R1 124	R6 419

Source: Eco-Urban Development Economists (2015)

The new business sales of R11 286 that will be generated through direct and induced impacts are likely to result in an annual average increase of R6 419 million, in 2015 prices, of GDP. Furthermore, it is estimated that R4 634 million, in 2015 prices, will be generated by the power station directly. This is the equivalent of roughly 22% of the Uthukela DM's economy. However, experience dictates that the entire value added generated by a power station is rarely accounted in the same area where the value added is created. It follows that only a portion of the GDP growth generated by the proposed power station will actually be accounted in the local municipality, while the rest will be accounted in the municipality that will host the project developer. However, the fact remains that the study area's economy will grow and become more diversified as a result of the proposed power station.

Routine operations and maintenance at the power station requires inputs. Through its procurement patterns the power station, once operating at full capacity (i.e. 1 050 MW), will be generating an additional R661 million in value added each year, created by indirect or production induced multipliers. The manufacturing sector, followed by mining and transport and storage sectors, will be experiencing the biggest increase in GDP as a result of this impact. Furthermore, it is expected that the manufacturing, real estate and business services, and finance sectors will comprise the bulk of the annual increase in GDP of R1 124 million created due to an increase in household income.

9.10.2.3 Creation of long-term employment opportunities in the local and national economies through operations and maintenance activities

The proposed project will create approximately 1 350 employment opportunities once its reaches its full operational capacity representing all three phases. The bulk of the positions will be permanent and, therefore, will be expected to be retained for a minimum of 30 years. A smaller number of jobs will be created during the first few phases as one phase is completed after another and a reverse situation can be expected at the end of the power station's lifespan, as phases are being decommissioned.

It is important to take note of the fact that initially, the international contingent of workers will be high, while skills transfer and knowledge sharing is taking place. However, based on the RFP requirements, it is estimated that approximately a minimum of 85% of all employment opportunities will be made of South African based employees, of which 270 direct job opportunities will be made available to individuals from within the local communities. Considering that the town of Colenso alone had about 865 people unemployed in 2011, with the study area having an unemployment rate of between 64% and 67% based on the skills survey results, it is likely that the proposed project will significantly improve the employment situation in the area and reduce its unemployment rate by almost a third once all three phases are in operation. Importantly, these jobs are long-term employment opportunities that will ensure that the impacted households have sustainable income over a period of at least 30 years.

In addition to the employment opportunities resulting directly from operations at the power station and ancillary infrastructure, a further 6 959 long-term opportunities will be created across South Africa as a result of the project's multipliers. It is expected that the trade and accommodation, manufacturing, and agricultural sectors will benefit the most from jobs created as a result of production and consumption induced impacts. Overall, a total of 8 309 sustainable jobs are expected to be created and supported by the proposed power station during its full operational capacity (i.e. 1050 MW) over a long-term.

9.10.2.4 Increase in government revenue stream

Throughout the operational phase of the proposed project, a significant amount in income and payroll taxes will be paid to government, leading to a sustainable increase in government revenue. It is difficult to determine exactly how this increase in revenue will be allocated. It can, however, be concluded that it will be added to the national government revenue stream and spent on providing public goods and services.

It can also be assumed that the proposed power station will be responsible for the payment of property rates and taxes, which will in turn increase the local municipality's revenue.

Considering that the current economic base of the local town and the Umtshezi LM is relatively small, the establishment of the power station is likely to significant increase its revenue base directly and indirectly. This increase in local government revenue will undoubtedly assist the municipality to provide infrastructure and improve on service delivery in the project area.

9.10.2.5 Skills development and knowledge transfer

Workers with a variety of skills, ranging from specialised to semi-skilled, are required to operate and maintain coal-based power plants. It is unlikely that many of the skills required will be available in the study area. This means that some positions will probably be taken up by individuals from outside the community who are in possession of the required skills. Furthermore, during five years of operations of Phase 1, a relatively large contingent of foreign workers will be present in the area, who will also be involved in training and offering apprenticeship for the local labour and management.

Therefore, there is a high probability that local community members will be receiving advanced training through focussed training programmes. This means that development of the local communities will take place as individuals with an adequate level of expertise in various disciplines including technicians, mechanics, maintenance, and management can receive training to eventually operate and maintain the power station.

9.10.2.6 Investment in Socio-Economic Development (SED) and Enterprise Development (ED) initiatives

It is anticipated that the proposed project will invest between 0.15% and 0.23% of revenue in community upliftment in the form of focussed SED and ED initiatives. These programmes will be aimed at improving the lives of the study area's communities, and will run for the entire duration of the proposed power station. Based on a minimum operational period of 30 years, it is estimated that each phase of the project will result in the total investment made by the operator close to R102 million. This means that when all three phases are operational, the Independent Power Producer will be investing about R10.2 million in 2015 prices on an annual basis, which will add up to about R306 million in 2015 prices over the entire period of the power station's operation. SED and ED funds will be directed towards improving living standards and creation of new or expansion of existing enterprises in the local communities, ultimately leading to new job creation.

Perhaps more significant over the long-term though, is the R208.7 million per year that will be paid in community trust dividends for each phase. It is estimated that the total community trust dividends to be paid over the 30 year period, will be R6 262 million in 2015 prices which could triple when all three phases are operational. Therefore, once the debt is paid, the beneficiaries of the trust (the impacted communities), will receive an additional, much more significant amount. This money can then be used to further improve the living standard of the community members or the creation of sustainable businesses.

9.10.2.7 Improved living standard of households benefitting from sustainable job creation and the associated increase in household income

It is estimated that once all three phases are in operation, households benefitting from direct employment opportunities related to the operations and maintenance of the power station and its ancillary infrastructure will experience an increase in income to the value of

R830 million. This increase in household income will be sustained for at least the duration of the project's lifespan.

An additional R718 million in household income will be created for households benefitting from employment opportunities created by the project's various multiplier effects. Of this, R268 million will benefit families of the workers who will be employed through indirect impacts. The consumption patterns of those households experiencing an increase in disposable income will lead to the manufacturing and trade, and accommodation sectors making up the biggest share of the estimated R450 million in increased household income that will be generated by these consumption induced impacts.

Table 9-29: Annual impact on income during operations (R'm, 2015)

Income	Direct	Indirect	Induced	Total
Phase 1	R277	R89	R150	R516
Phase 2	R277	R89	R150	R516
Phase 3	R277	R89	R150	R516

Source: Eco-Urban Development Economists (2015)

9.10.2.8Altered sense of place

The sense of place of a region is developed through a combination of the community embracing their environment, familiarising and accepting the physical characteristics of the environment, and the creation of the place's history over time. Various characteristics interact to create a sense of place; these include atmosphere, visual resources, aesthetics, climate, lifestyle, culture, and heritage. It is a subjective matter, highly dependent on the residents and activities located in the area. Intrusions that alter the physical and environmental properties of the area are typically those that would be associated with the largest gains or losses to the community.

The section "deterioration of living conditions" discussed the change in sense of place as a result of the construction activities associated with the proposed power station and the auxiliary infrastructure component of the project. However, the causes, effects and spatial distribution of various environmental impacts taking place during operation will be different to that taking place during construction, which necessitates a separate analysis of the impact during operations.

The largest alterations will be in the form of visual, air, and noise intrusion. Further investigation by various specialists will be done, but the proposed site location for the power station and auxiliary infrastructure is considered to have sensitive receptors based on the relatively rural character of this area. Furthermore, the tourists who normally visit the area's facilities and those doing the battlefield routes, may experience a change in the sense of place that could lead to them deciding against returning to the experience again in the future.

Consultation with some of the local community leaders revealed that many of the community members are concerned about how the proposed project will change the area and their sense of place. Furthermore, the public participation consultation revealed individuals and businesses not directly impacted, who are concerned about the likelihood of a change in place in the area.

- Justin James Advertising, who regularly works in the area, raised concerns about the impact of the study on the pristine area, and the likely impact on the area's natural beauty.
- Sandton's Bushwillow Lodge indicated that they regularly refer their international tourists to the area, and that this practice might be influenced by the proposed project.

Lastly, as stated previously, municipal officials believe that the implementation of the proposed project may lead to revitalisation of the region's manufacturing sector. Should the project be approved, the likelihood exists that a steel manufacturing plant will begin operating in the area; the possibility of the development of an electronics manufacturing sector in the study area could also be realised. This will change the perception of the area to be industrialised, as opposed to the current perception of it being a game hunting and eco-tourism destination.

9.10.2.9 Impact on the local tourism and game hunting industry

The possible negative impacts are expected to first materialise during the construction phase of the proposed power station, and will be fully realised during the operational phase. These negative impacts will likely be as a result of noise and visual disturbances at all times of day. The project is expected to lead to a change in the study area's natural and cultural landscape and features of the environment, impacting on the experience of visitors to the area's tourism and game hunting facilities. Additionally, the full extent of the impact will be reached as operations at the power station progresses into new phases. It can be expected that return visitors will become aware of the proximity of the project to the local facilities, while word of mouth could potentially persuade first time visitors not to visit the area. The potential decline in the number of tourists, and specifically international tourists, could lead to the general area experiencing a loss of revenue in the game farming and tourism industries.

The Thukela Wildlife CC operates on land earmarked for the mining footprint and will, therefore, be in close proximity to the proposed power station. In addition to the visual impact of the power station probably influencing the experience at its facilities, the owner has indicated that it would be unsafe to continue hunting once the power station is erected and in operation, as it will be in close proximity to the game farm's boundary fence. The land will likely be bought from Thukela Wildlife CC, with the owner indicating that operations will not be re-established somewhere else. This would lead to a loss of revenue estimated at R0.6 million a year, and a loss of employment to approximately eight individuals currently employed by Thukela Wildlife CC.

The only other tourism facility in close proximity to the proposed project, which has expressed concerns, is Zingela Safaris and River Camp. Although they will likely be affected by the visual impact of the power station once it is operational, the indication was that their main concern is with the proposed mining operations as they are downstream of the proposed mine site and heavily dependent on the Thukela River for their business. Regardless, the owners have indicated that they are not against the project being implemented, and will continue operations even if the power station is implemented, but have concerns around the public participation process currently being undertaken (a lack of public participation has been raised by other stakeholders as well).

It seems that the most significant impact will be on the Thukela Wildlife CC operations, which will no longer be viable should the project be implemented. Indirectly affected tourism facilities are likely to continue with operations. However, it should be pointed out that a number of foreign experts will be employed at the power station during the first few years while skills and knowledge transfer takes place. The accommodation that is currently available at the Thukela Wildlife CC could then be used to host foreign experts, which could provide revenue to the owners (either existing or new) and sustain the business and some of the existing employment positions over a longer period. Beyond that point, the facility could also become an accommodation place for business people travelling to the area.

5.2.3 Impact during decommissioning

As explained, each phase of the proposed power station is expected to have a project lifespan of 30 years. Once completed, the land will be restored and any structures will be taken down.

Table 9-30: Socio-economic impacts expected during decommissioning

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Decommissioning of Power Station & infrastructure	Expenditure of R400 million for the total closure and removal of all project components	Stimulation of the local economy and job creation during decommissioning	2	5	3	30	5	4	20	+600

At this stage it is not clear to what capability the land will be restored, although it is assumed that the land uses will follow a natural pattern considering the length of time the project will be operating in the area. Regardless, the decommissioning process will require labourers and professionals to oversee the de-commissioning activities, it is expected that this process will cost in total R400 million.

Decommissioning of the power station will be associated with positive and negative impacts. The project, which will act as a significant driver of growth and development in the local economy, will no longer be in operation. If not properly planned for, the decommissioning of the power station could result in the positive impact made over the life of the project being erased. Especially when considering the fact that history dictates that the study area is not able to sustain growth achieved as a result of outside interventions without proper planning and mitigation. However, the possible negative impact of the closure of the proposed project is difficult to quantify, as the status quo does not include the development. It can be assumed, though, that the existence of the project in the community will create a significant stimulus, leading to industry development in the area and the availabilities of opportunities even after decommissioning of the power station and auxiliary infrastructure.

The possible positive impact from the decommissioning process refers to the planned expenditure of R400 million for the total closure and removal of all project components. This expenditure will stimulate the local economy for the duration of the decommissioning phase, which is expected to be three years, and could create additional temporary job opportunities in the study area. This possible direct impact and other multiplier effects will remain for the duration of the rehabilitation process.

9.11 Noise

Enviro Acoustic Research was appointed to assess the noise impacts related to the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the noise impacts as presented in the following paragraphs. Note that possible impacts associated with the proposed coal mine has been taken into account in the determination of the noise impacts, even though the development of the proposed coal mine does not form part of this application.

9.11.1 Impact Assessment Criteria

The word "noise" is generally used to convey a negative response or attitude to the sound received by a listener. There are four common characteristics of sound, any or all of which determine listener response and the subsequent definition of the sound as "noise". These characteristics are:

- Intensity;
- Loudness;
- Annoyance; and
- Offensiveness.

Of the four common characteristics of sound, intensity is the only one which is not subjective and can be quantified. Loudness is a subjective measure of the effect sound has on the human ear. As a quantity it is therefore complicated, but has been defined by experimentation on subjects known to have normal hearing.

The annoyance and offensive characteristics of noise are also subjective. Whether or not a noise causes annoyance mostly depends upon its reception by an individual, the environment in which it is heard, the type of activity and mood of the person and how acclimatised or familiar that person is to the sound.

9.11.1.1 Noise criteria of concern

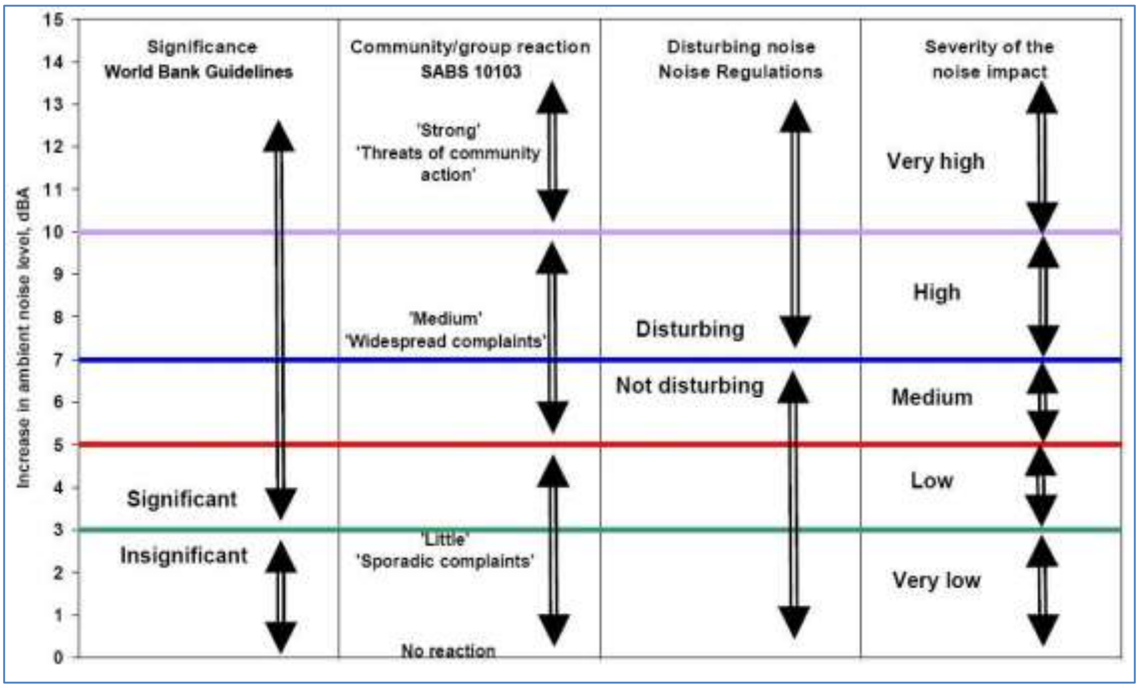
The criteria used in this report were drawn from the criteria for the description and assessment of environmental impacts from the EIA Regulations, published by the Department of Environmental Affairs (June 2006) in terms of the NEMA, SANS 10103:2008 as well as guidelines from the World Health Organization.

There are a number of criteria that are of concern for the assessment of noise impacts. These can be summarised in the following manner:

- *Increase in noise levels:* People or communities often react to an increase in the ambient noise level they are used to, which is caused by a new source of noise. With regards to the Noise Control Regulations (promulgated in terms of the ECA), an increase of more than 7 dBA is considered a disturbing noise. See also Figure 9-16.

- *Zone Sound Levels:* Previously referred to as the acceptable rating levels, it sets acceptable noise levels for various areas. See also Figure 9-16.
- *Absolute or total noise levels:* Depending on their activities, people generally are tolerant to noise up to a certain absolute level, e.g. 65 dBA. Anything above this level will be considered unacceptable.

Figure 9-16: Criteria to assess the significance of impacts stemming from noise



Source: Enviro Acoustic Research (2015)

In South Africa, the document that addresses the issues concerning environmental noise is SANS 10103:2008 (See also Table 9-31).It provides the equivalent ambient noise levels (referred to as Rating Levels), $L_{Req,d}$ and $L_{Req,n}$, during the day and night respectively to which different types of developments may be exposed. Acoustical measurements, site investigations and calculations indicated the following proposed rating levels for receptors in the study area:

- Rural district $L_{Req,D}$ of 45 dBA, $L_{Req,N}$ of 35 dBA (areas further than 2,000 km from the railway line and the R103 road); and
- Urban $L_{Req,D}$ of 55 dBA, $L_{Req,N}$ of 45 dBA (areas within 500 m from the railway line and the R103 Road).

International guidelines should also be considered. The International IFC (Equator Principle) Residential; institutional and educational referenced areas includes ratings of:

- Use of $L_{Req,D}$ of 55 dBA during the daytimes; and
- Use of $L_{Req,N}$ of 45 dBA during the night-times.

For the purpose of the Environmental Noise Impact Assessment EAR adopted the Zone Sound Levels as proposed in SANS 10103:2008 to be acceptable to the noise sensitive developments in the area during periods when the wind speeds are less than 4 m/s.

SANS 10103:2008 also 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 sound level, the following criteria are of relevance:

- **Δ ≤ 3 dBA:** An increase of 3 dBA or less will not cause any response from a community. It should be noted that for a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level would not be noticeable.
- **3 < Δ ≤ 5 dBA:** An increase of between 3 dBA and 5 dBA will elicit 'little' community response with 'sporadic complaints'. People will just be able to notice a change in the sound character in the area.
- **5 < Δ ≤ 15 dBA:** An increase of between 5 dBA and 15 dBA will elicit a 'medium' community response with 'widespread complaints'. In addition, an increase of 10 dBA is subjectively perceived as a doubling in the loudness of a noise. For an increase of more than 15 dBA the community reaction will be 'strong' with 'threats of community action'.

Table 9-31: Acceptable Zone Sound Levels for noise in districts

Type of District	Equivalent Continuous Rating Level, $L_{Req.T}$ for Noise					
	Outdoors(dB(A))			Indoors, with open windows(dB(A))		
	Day-night	Daytime	Night time	Day-night	Daytime	Night time
Rural Districts	45	45	35	35	35	25
Suburban districts with little road traffic	50	50	40	40	40	30
Urban districts	55	55	45	45	45	35
Urban districts with one or more of the following: Workshops; business premises and main roads	60	60	50	50	50	40
Central business districts	65	65	55	55	55	45
Industrial districts	70	70	60	60	60	50

Source: SANS 10103:2008

Note that an increase of more than 7 dBA is defined as a disturbing noise and prohibited (National and Provincial Noise Control Regulations).

9.11.1.2 Other noise sources of significance

In addition, other noise sources that may be present should also be considered. During the day, people are generally bombarded with the sounds from numerous sources considered "normal", such as animal sounds, conversation, amenities and appliances (TV/Radio/CD playing in background, computer(s), freezers/fridges, etc). This excludes activities that may generate additional noise associated with normal work.

At night, sounds that are present are natural sounds from animals, wind as well as other sounds we consider "normal", such as the hum from a variety of appliances (magnetostriction) drawing standby power, freezers and fridges.

9.11.1.3 Representation of noise levels

Noise rating levels will be calculated in this report using the appropriate sound propagation models as defined. It is therefore important to understand the difference between sound or noise level as well as the noise rating level (also see Glossary of Terms, Appendix J).

Sound or noise levels generally refers to a level as measured using an instrument, whereas the noise rating level refers to a calculated sound exposure level to which various corrections and adjustments was added. These noise rating levels are further processed into a 3D map illustrating noise contours of constant rating levels or noise isopleths. In this project it illustrate the potential extent of the calculated noises of the complete project and not noise levels at a specific moment in time.

9.11.2 Construction Phase

The noise impacts, and the uncontrolled significance rating thereof, that can be expected during the construction phase of the power station and associated infrastructure are presented in the table below. Discussions on the impacts are presented in the paragraphs that follow the table.

Table 9-32: Noise impacts expected during construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Construction Activities during the day	Noise - Receptors closer than 300 meters from significant construction activities	5	4	5	100	5	5	25	12 500
Construction of Power Station & infrastructure	Construction Activities at night	Noise - Receptors closer than 300 meters from significant construction activities	5	4	5	100	5	5	25	12 500

9.11.2.1 Potential Noise Sources

Construction activities include:

- Development of access roads,
- Site establishment (contractors camp, equipment and material storage, security and access control, security fence)
- Vegetation and topsoil removal,
- Development of a mining bench;
- Installation of a conveyor system;

- Construction of infrastructure (waste dumps, stockpiles, foundations to completed structure)

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations, in different sequences and at different locations in the project area. Potential maximum noise levels generated by various construction equipment as well as the potential extent of these sounds are presented in Table 9-33. This generally determines the extent of audibility of the activities.

Average or equivalent sound levels impacts on the ambient sound levels and is the constant sound level that the receptor can experience. This is also the descriptor that is used as the performance indicators to determine compliance with relevant guidelines and regulations. Typical sound power levels associated with various activities that may be found at a construction site is presented in Table 9-34.

Table 9-33: Potential maximum noise levels generated by construction equipment

Equipment Description[7]	Impact Device?	Maximum Sound Power Levels (dBA)	Operational Noise Level at given distance considering potential maximum noise levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modeling only considering distance) (dBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Auger Drill Rig	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Backhoe	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Chain Saw	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Compactor (ground)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Concrete Pump Truck	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Concrete Saw	No	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Crane	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Dozer	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drill Rig Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Generator	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Generator (<25KVA)	No	104.7	79.7	73.7	67.6	59.7	53.7	50.1	47.6	44.1	39.7	36.2	33.7	27.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Impact Pile Driver	Yes	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Jackhammer	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Man Lift	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6

[7] Equipment list and Sound Power Level source: http://www.fhwa.dot.gov/environment/noise/construction_noise/handbook/handbook09.cfm

Mounted Impact Hammer	Yes	124.7	99.7	93.7	87.6	79.7	73.7	70.1	67.6	64.1	59.7	56.2	53.7	47.6
Paver	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Pickup Truck	No	89.7	64.7	58.7	52.6	44.7	38.7	35.1	32.6	29.1	24.7	21.2	18.7	12.6
Pumps	No	111.7	86.7	80.7	74.6	66.7	60.7	57.1	54.6	51.1	46.7	43.2	40.7	34.6
Rivit Buster/Chipping Gun	Yes	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Rock Drill	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Roller	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sand Blasting (single nozzle)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Scraper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Sheers (on backhoe)	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Slurry Plant	No	112.7	87.7	81.7	75.6	67.7	61.7	58.1	55.6	52.1	47.7	44.2	41.7	35.6
Slurry Trenching Machine	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Soil Mix Drill Rig	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Tractor	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Vacuum Excavator	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vacuum Street Sweeper	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Ventilation Fan	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibrating Hopper	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Vibratory Concrete Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Vibratory Pile Driver	No	129.7	104.7	98.7	92.6	84.7	78.7	75.1	72.6	69.1	64.7	61.2	58.7	52.6
Warning Horn	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Welder/Torch	No	107.7	82.7	76.7	70.6	62.7	56.7	53.1	50.6	47.1	42.7	39.2	36.7	30.6

Source: Enviro Acoustic Research (2015)

Table 9-34: Potential equivalent noise levels generated by various equipment

Equipment Description	Equivalent (average) Sound Levels (dBA)	Operational Noise Level at given distance considering equivalent (average) sound power emission levels (Cumulative as well as the mitigatory effect of potential barriers or other mitigation not included – simple noise propagation modeling only considering distance) (dBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Bulldozer CAT D10	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D11	113.3	88.4	82.3	76.3	68.4	62.3	58.8	56.3	52.8	48.4	44.8	42.3	36.3
Bulldozer CAT D9	111.9	86.9	80.9	74.9	66.9	60.9	57.4	54.9	51.3	46.9	43.4	40.9	34.9
Bulldozer CAT D6	108.2	83.3	77.3	71.2	63.3	57.3	53.7	51.2	47.7	43.3	39.8	37.3	31.2
Bulldozer CAT D5	107.4	82.4	76.4	70.4	62.4	56.4	52.9	50.4	46.9	42.4	38.9	36.4	30.4
Bulldozer Komatsu 375	114.0	89.0	83.0	77.0	69.0	63.0	59.5	57.0	53.4	49.0	45.5	43.0	37.0
Bulldozer Komatsu 65	109.5	84.5	78.5	72.4	64.5	58.5	54.9	52.4	48.9	44.5	41.0	38.5	32.4
Diesel Generator (Large - mobile)	106.1	81.2	75.1	69.1	61.2	55.1	51.6	49.1	45.6	41.2	37.6	35.1	29.1
Dumper/Haul truck - CAT 700	115.9	91.0	85.0	78.9	71.0	65.0	61.4	58.9	55.4	51.0	47.5	45.0	38.9
Dumper/Haul truck - Terex 30 ton	112.2	87.2	81.2	75.2	67.2	61.2	57.7	55.2	51.7	47.2	43.7	41.2	35.2
Dumper/Haul truck - Bell 25 ton (B25D)	108.4	83.5	77.5	71.4	63.5	57.5	53.9	51.4	47.9	43.5	40.0	37.5	31.4
Excavator - Cat 416D	103.9	78.9	72.9	66.8	58.9	52.9	49.3	46.8	43.3	38.9	35.4	32.9	26.8
Excavator - Hitachi EX1200	113.1	88.1	82.1	76.1	68.1	62.1	58.6	56.1	52.6	48.1	44.6	42.1	36.1
Excavator - Hitachi 870 (80 t)	108.1	83.1	77.1	71.1	63.1	57.1	53.6	51.1	47.5	43.1	39.6	37.1	31.1
Excavator - Hitachi 270 (30 t)	104.5	79.6	73.5	67.5	59.6	53.5	50.0	47.5	44.0	39.6	36.0	33.5	27.5
FEL - CAT 950G	102.1	77.2	71.2	65.1	57.2	51.2	47.6	45.1	41.6	37.2	33.7	31.2	25.1
FEL - Komatsu WA380	100.7	75.7	69.7	63.7	55.7	49.7	46.2	43.7	40.1	35.7	32.2	29.7	23.7
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
Grader - Operational Hitachi	108.9	83.9	77.9	71.9	63.9	57.9	54.4	51.9	48.4	43.9	40.4	37.9	31.9
Grader	110.9	85.9	79.9	73.9	65.9	59.9	56.4	53.9	50.3	45.9	42.4	39.9	33.9
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
Road Transport Reversing/Idling	108.2	83.3	77.2	71.2	63.3	57.2	53.7	51.2	47.7	43.3	39.7	37.2	31.2
Road Truck average	109.6	84.7	78.7	72.6	64.7	58.7	55.1	52.6	49.1	44.7	41.1	38.7	32.6
Vibrating roller	106.3	81.3	75.3	69.3	61.3	55.3	51.8	49.3	45.8	41.3	37.8	35.3	29.3
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8

Traffic

Additional traffic to and from the site as well as traffic on the site are significant sources of noise during the construction phase. This includes trucks transporting equipment and material, contractors as well as workers. Construction traffic is expected to be generated throughout the entire construction period, however, the volume and type of traffic generated will be dependent upon the construction activities being conducted, which will vary during the construction period.

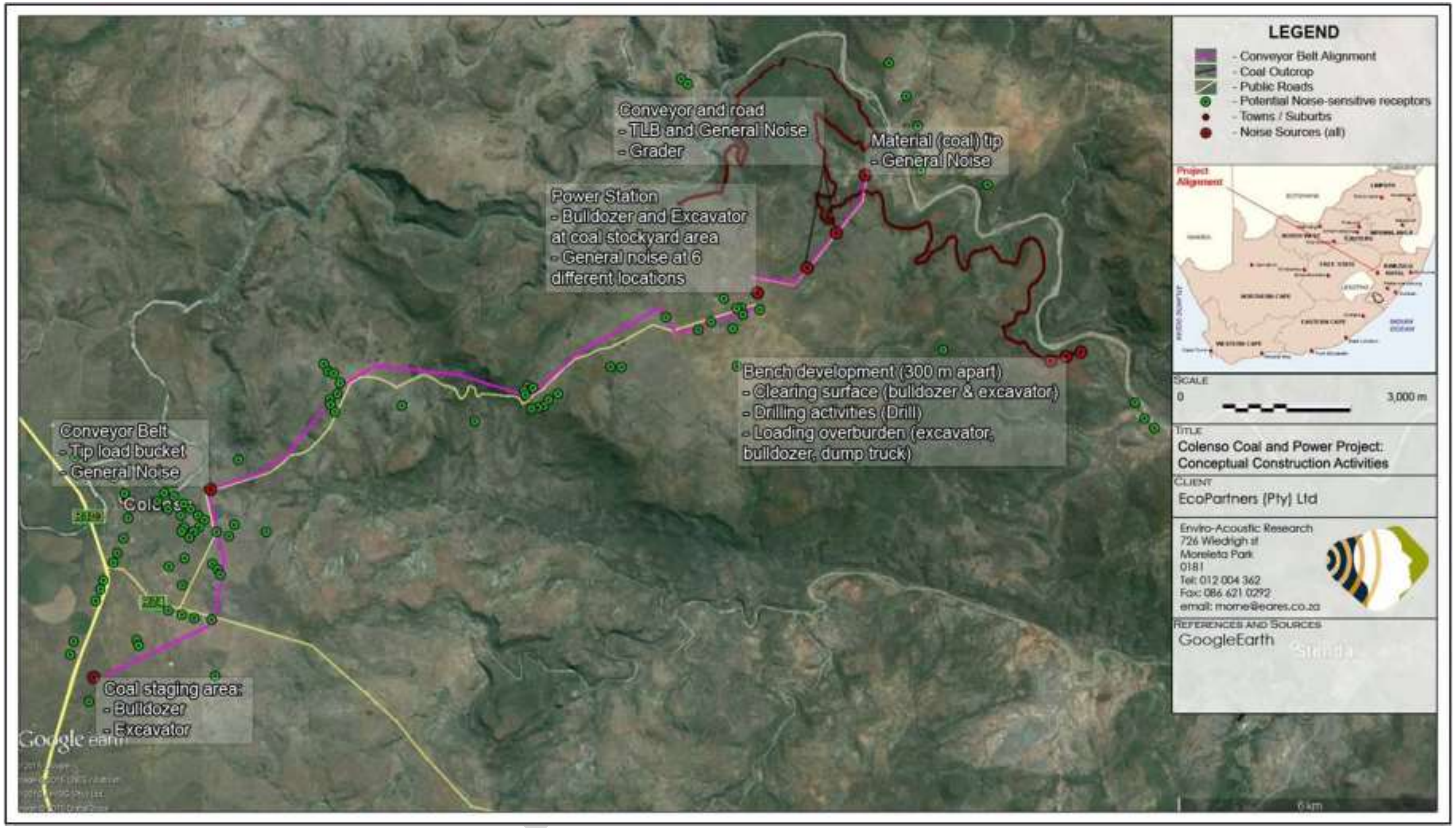
Blasting

Blasting may be required as part of the civil works to clear obstacles or to prepare open casts. However, blasting will not be considered during the EIA phase for the following reasons:

- Blasting is highly regulated, and control of blasting to protect human health, equipment and infrastructure will ensure that any blasts will use the minimum explosives and will occur in a controlled manner. The breaking of obstacles with explosives is also a specialized field and when correct techniques are used, causes significantly less noise than using a rock-breaker.
- People are generally more concerned over ground vibration and air blast levels that might cause building damage than the impact of the noise from the blast. However, these are normally associated with close proximity mining/quarrying.
- The site is located within an area where blasting takes place from numerous mining activities.
- Blasting associated with construction activities is generally very small and localized. The noise (and vibration) effects are minor and cannot be compared with typical mining blasting.
- Blasts are infrequent occurrences with a loud but a relative instantaneous character.
- Potentially affected parties generally receive sufficient notice (siren) and the knowledge that the duration of the siren noise as well as the blast will be over relatively fast, result in a higher acceptance of the noise.
- Noise from blasting can be controlled with the use of correct blasting methods including the use of different explosives, tamping and limiting the size of the blast.

A provisional layout as conceptualised is presented in Figure 9-17. As can be seen from this layout, a number of different activities will take place, each with a specific impact on the closest potentially noise-sensitive developments. The one-hour equivalent noise rating was calculated with the potential noise impact illustrated for the night-time period.

Figure 9-17: Conceptualised Construction Activities



Source: Enviro Acoustic Research (2015)

The following activities were assumed:

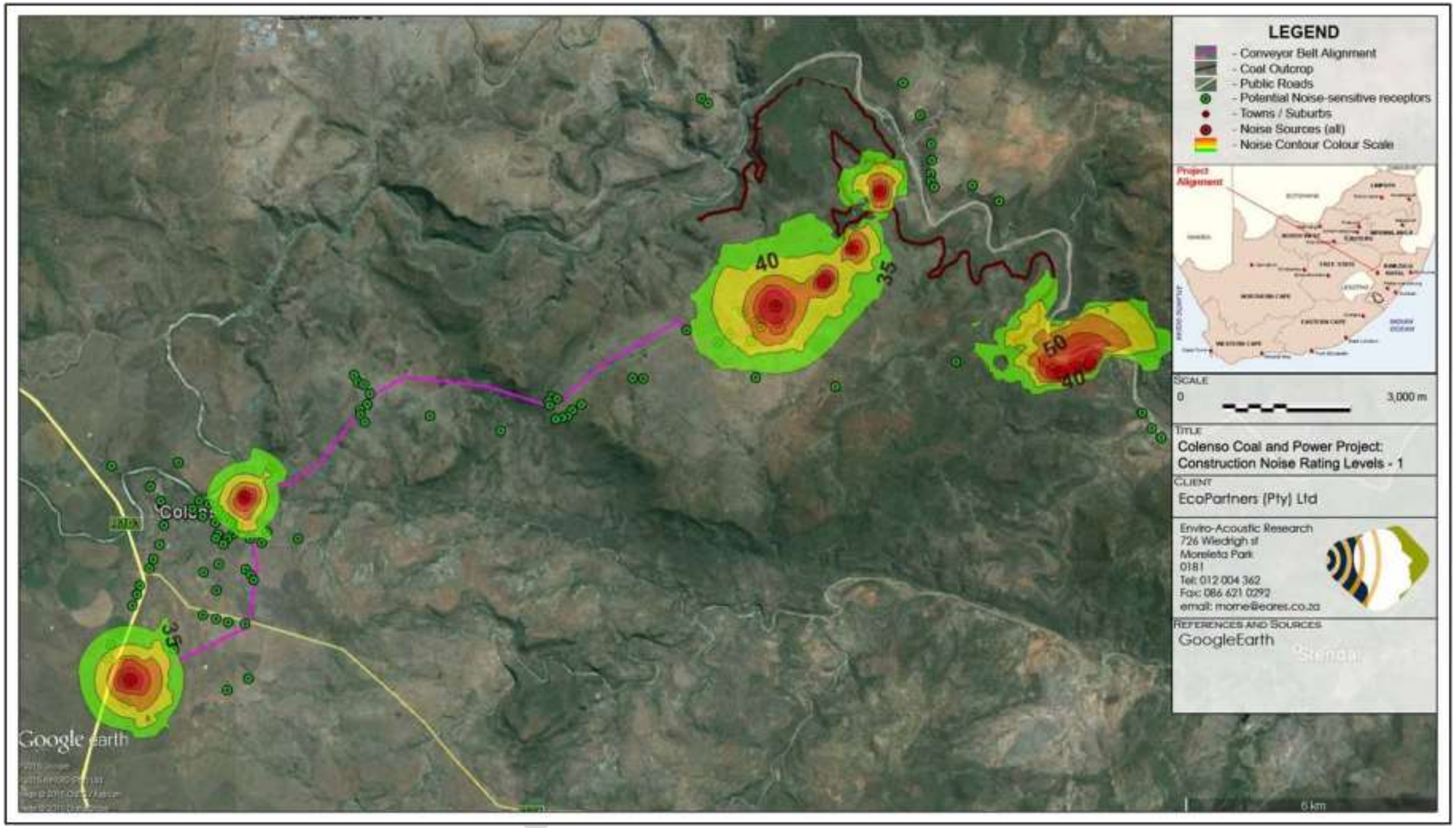
- Mining area: Surface work at the location of the highwall mining. Activities include the stripping of vegetation (***bulldozer***) and an excavator.
- Mining area: Bench development along the outcrop. Activities include the drilling of blast holes to develop a flat bench.
- Mining area: Loading of overburden using an **excavator**, **bulldozer** and **dump truck**.
- Mining area: Development of a coal tipping area (**general noise**).
- Power Station Construction: Surface development at the location of the Coal Stockpile area. Activities include the stripping of vegetation (***bulldozer***) and the excavation of topsoil (***excavator***).
- Power Station Construction: Surface development at the location of the coal staging area near Colenso. Activities include the stripping of vegetation (***bulldozer***) and an excavator.
- Power Station Construction: Construction activities (**general noise**) at six different locations as illustrated Figure 9-18. This noise will be impulsive and a penalty of 5 dB will be added to the calculated noise level.
- Conveyor belt: Activities include the use of a **TLB** to dig foundations and general noise (with impulsive component).
- Access road: Along the conveyor belt from the power station to the mine using a grader to remove the vegetation and topsoil.
- Traffic: An additional 10 heavy and 20 light vehicles travelling the access roads between the coal staging area and power station per hour (at a speed of 60 km/h – peak traffic).
- Traffic: An additional 5 heavy and 10 light vehicles travelling the access roads between the power station and the mine per hour (at a speed of 60 km/h – peak traffic).

Day and night-time temperature averages 20 ^{o}C with humidity at 80% (very good conditions for sound propagation – mornings and evenings). Relative soft ground absorption conditions will be modelled, with 50% of sound waves hitting the ground being absorbed by vegetation and soils.

9.11.2.2 Assessment of impact

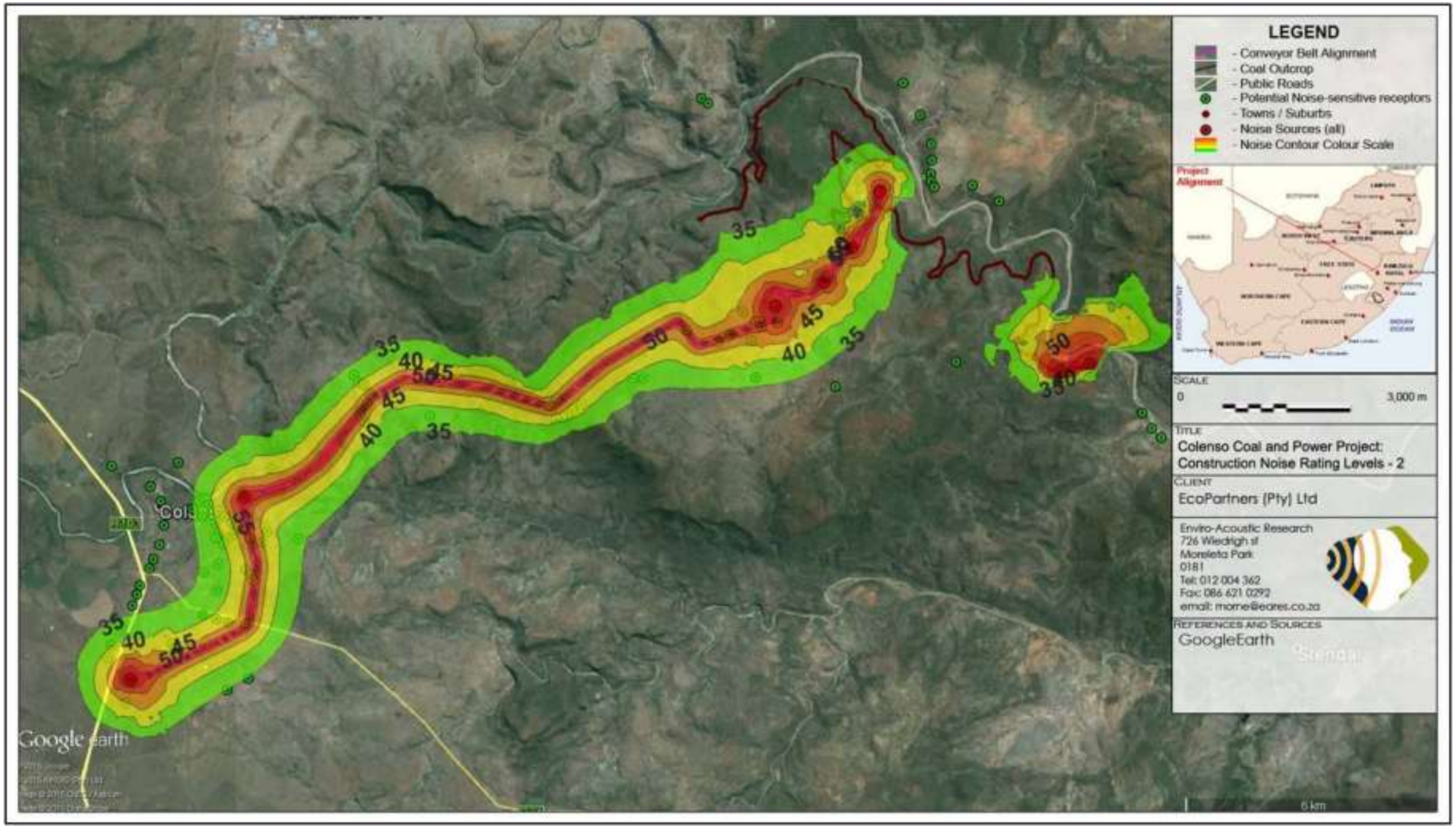
Figure 9-19 presents the projected total noise rating at some time during the construction phase. The worst case scenario was presented with all the activities taking place simultaneously during wind-still conditions, in good sound propagation conditions (20^{o}C and 80% humidity).

Figure 9-18: Construction noise: Contours of constant rating levels – conceptual at a certain time



Source: Enviro Acoustic Research (2015)

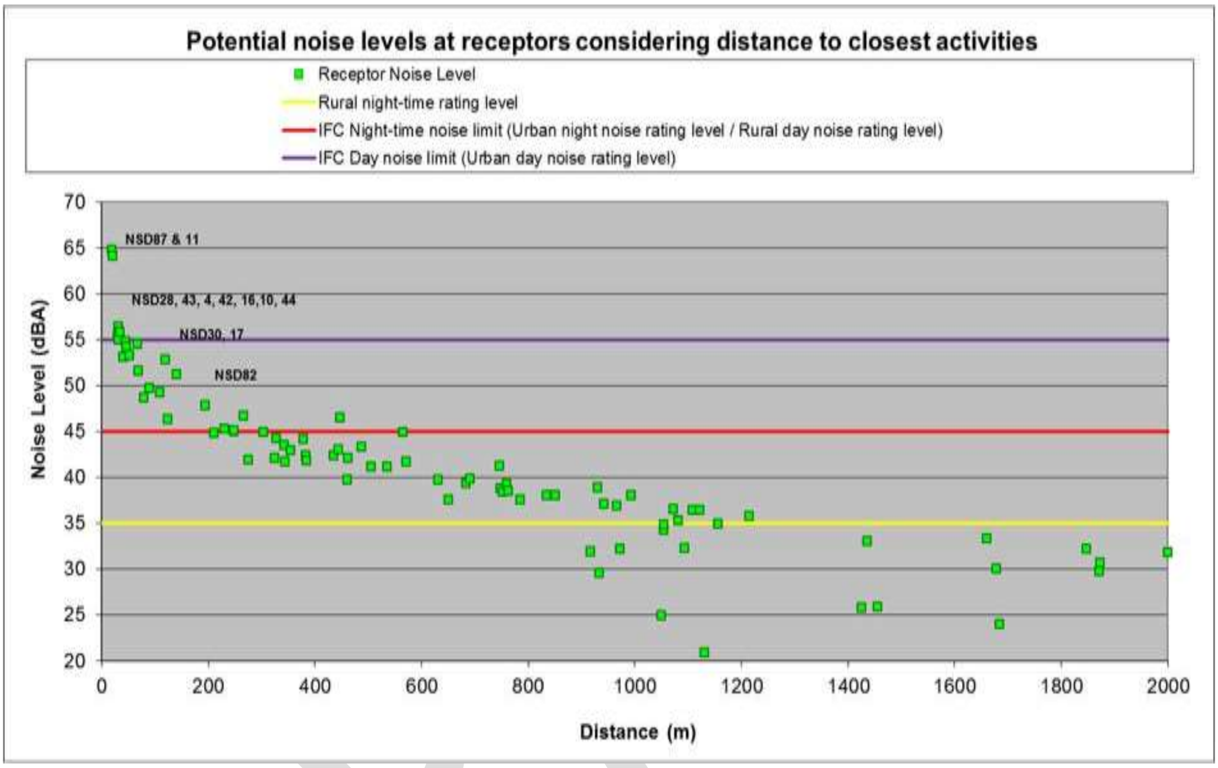
Figure 9-19: Construction noise: Contours of constant rating levels – conceptual for duration of construction



Source: Enviro Acoustic Research (2015)

This data was used to develop composite contours around the conveyor routes, with Figure 9-19 (along the routes) at some time during the full construction phase. Figure 9-20 illustrates the potential maximum equivalent noise levels that a receptor may experience at some time during the construction phase.

Figure 9-20: Potential noise levels at receptors considering distance from closest construction activities



Source: Enviro Acoustic Research (2015)

9.11.3 Operational Phase

Only the night-time (22:00 – 06:00) future operations were assessed as this is the most critical time when a quiet environment is desired (at night for sleeping, weekends etc.) The possible impacts associated with the operation of the power station and associated infrastructure (and operation of proposed coal mine) are presented in the table below.

Table 9-35: Noise Impacts expected during the operational phase

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Operation of Power Station & infrastructure	Operational Activities at night	Noise - Receptors closer than: - 90m from the conveyor belt in the vicinity of Colenso (urban area) - 200m from	5	4	5	100	5	5	25	12 500

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
		the conveyor belt in the rural areas - 300m from the power station area								

9.11.3.1 Potential Noise Sources

Power Generation

The majority of South Africa's electricity comes from thermal power stations which use coal (a natural resource / fossil fuel) as fuel for electricity production. A power station converts energy into a form which can be used by people i.e. electricity.

The following is a basic description of the process flow (equipment or processes that generates noise indicated in ***bold italics***) for the generation of electricity:

- Fuel: When required by the boiler, a ***stacker-reclaimer*** serves coal onto a ***conveyor system*** which transports the coal to the ***day silos (material handling)*** next to the ***boiler***. The coal is then drawn from the day silos directly into the ***boiler building*** for combustion;
- The developer is considering Pulverised Coal Boiler (PF) technology;
    - PF ***(air intake fans (induced and forced draft fans), blowers, steam venting, coal pulveriser, etc.)***: Coal is first crushed from where it is fed into a pulveriser where it is heated before the coal dust is blown directly into the boiler. A PF system does not require cyclones after the boiler but will require other air quality management systems (than a CFB).
- Smoke stacks ***(Electrostatic Precipitator (ESP), possibly Bag Houses)***: Gases that are released from combustion in the furnaces are filtered and then released into the atmosphere through smoke stacks;
- ***Ash disposal***: Ash is removed from the exhaust gasses and could be disposed on ash-dams near the power station or alternatively removed from the site where it can be used (e.g. brick making or road building). Disposal could be either hydraulic or via ***conveyor belt system***;
- Cooling ***(large cooling fans - induced and forced draft fans)***: The proposed power plant will be designed with dry cooling technology in order to significantly reduce water consumption;
- Turbine and generator ***(steam turbine generators)***: The high pressure steam is piped to the turbines, causing the blades to turn. The movement of the steam through the turbines causes the thermal (heat) energy to be converted to mechanical

energy. The turbine is linked to the rotor of the generator. The rotor is an electromagnet which spins inside large coils of copper to generate electricity (alternating current (AC), which is essentially what is produced by a power station.

The main source of noise is associated with the intake and cooling fans as well as material handling activities at the coal stockpile. Boilers, steam turbines and generators are generally constructed within fixed structures that will attenuate the noise from this equipment. Noise from ancillary services and activities such as pumps (boiler feed, water, chemical, condensate and vacuum), air compressors and onsite traffic generally is far less than the noise from the main sources. Considering the potential noise sources, a list of potential noise sources was compiled in Table 9-32.

The equipment defined in Table 9-33 was be used for the purpose of the noise impact assessment. Sound power levels of equipment likely to be located within buildings will be reduced using the typical sound transmission loss values of 1.6 mm galvanised steel sheeting. It should be noted that the Furnace and turbine generators are normally enclosed in a generator building with the cooling fans (not indicated on figures) placed on top of, or just next of the generator building. While there are a number of noise sources at the proposed facility, the main noise source is generally the cooling fans and intake fans.

Conveyor Belt Systems

Large outdoor conveyor belt systems transporting bulk materials are a major source of industrial noise and frequently become an environmental emission issue at existing and proposed facilities. Conveyor noise is a composite of noise generating systems, the most dominant being the dynamic interaction at the belt/idler roll interface. Other noise generation mechanisms include:

- Idler roll bearing noise,
- Idler roll shell noise, and;
- Air pumping, belt/idler roll.

Measured sound power levels of a conventional conveyor belt (unmitigated) can be as high as 119 dBA per 100 m for a typical 10,000 TPH 5 m/s coal conveyor[8].

Coal will be transported from the proposed new coal mine to the power station and coal and lime will be transported from the siding south of Colenso to the power station.

Highwall Mining activities (future application)

Highwall mining can be grouped into four main mining activities (excluding the conveying of coal), namely:

- The development of a mining bench in front of the highwall miner. These activities can include drilling and blasting, the excavation or the loading of the broken material and the hauling of the material to dumps.

[8] Brown, SC. 2004: *"Conveyor noise specification and control"*, Proceeds of Acoustics 2004, Gold Coast, Australia (Heggies Australia)

- The active mining bench with the highwall continuous miner (sound power level of a diesel generator used);
- The hauling of coal to the main tip (start of conveyor);
- Rehabilitation activities of the mined areas behind the highwall miner. Activities depend on the requirements of the Department of Mineral Resources, which likely will require the refilling and sloping of the mining benches. This is generally a reverse of the initial development of the bench, with the loading of the overburden material, hauling to the rehabilitation area with a bulldozer sloping the material. While there are other activities such as the planting of vegetation, these activities are generally much quieter than the load-haul-slope activities.

Conceptual activities modelled as defined is illustrated in Figure 9-21.

A list of potential noise sources is defined in Table 9-35.

Figure 9-21: Conceptual operational activities

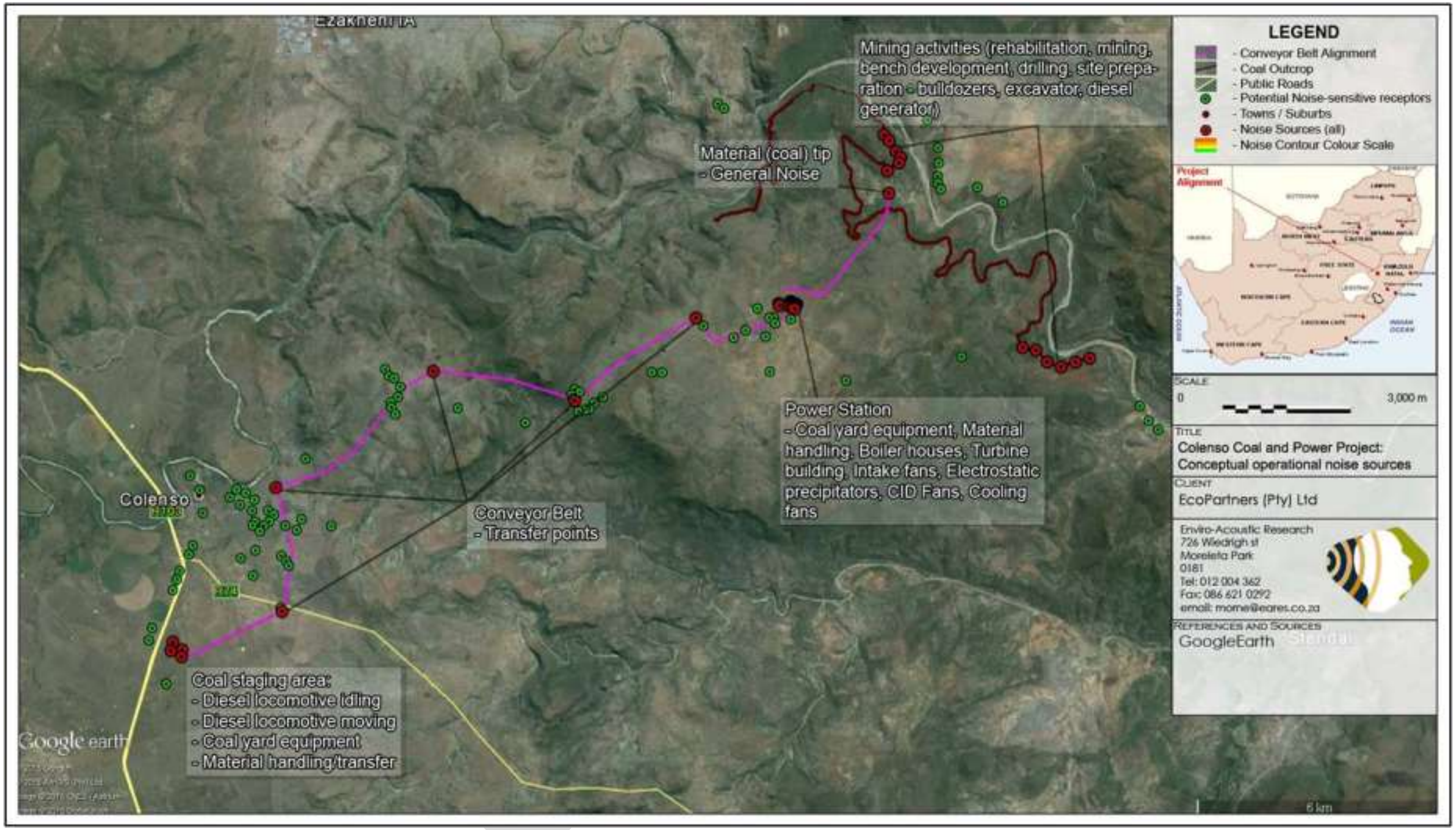


Table 9-36: Third Octave Sound Power Emission Levels used for modelling during operational phase[9]

Equipment / process	Sound power level, dB re1 pW, in octave band, Hz							SPL
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	dBA
Bulldozer CAT D11	121.2	112.2	111.4	110.9	110.4	101.5	93.7	113.3
Coal Pulverisers	99.0	99.0	95.0	93.0	90.0	89.0	84.0	96.0
Coal Yard Equipment	110.0	107.0	104.0	105.0	101.0	99.0	96.0	106.8
Conveyor Transfer points	98.3	97.3	97.5	96.7	95.1	90.9	87.6	99.4
Diesel Generator (Large – mobile: representing Highwall miner)	107.2	104.0	102.4	102.7	100.2	99.5	97.4	106.1
Drilling Machine	107.2	109.4	109.2	106.1	104.7	101.2	99.8	109.6
Dumper/Haul truck - CAT 700	107.9	113.2	116.9	114.4	110.6	106.8	100.2	115.9
Electrical Turbine Generator	115.0	123.0	109.0	110.0	110.0	111.0	109.0	116.7
Excavator - Hitachi EX1200	112.9	114.3	116.7	107.9	107.6	102.9	102.5	113.1
FEL - CAT 988	105.0	117.0	113.0	114.0	111.0	107.0	101.0	115.6
General noise	95.0	100.0	103.0	105.0	105.0	100.0	100.0	108.8
Generator building	79.9	84.3	82.8	89.0	95.4	79.1	66.9	96.0
Grader – Hitachi	107.7	107.9	106.8	106.2	104.2	101.1	97.2	108.9
Material Handling	111.6	104.1	105.2	102.2	97.1	91.3	87.9	103.2
Steam turbine condenser	108.0	108.0	107.0	102.0	100.0	97.0	92.0	105.4
TLB - JLB	101.0	105.0	104.0	105.5	104.5	101.0	99.0	108.8
Turbine Generator	115.0	123.0	109.0	110.0	110.0	111.0	109.0	116.7
Water Cooling Fans	118.5	115.5	116.0	111.2	104.3	103.9	100.0	113.0
	Typical sound transmission loss values							
	63	*125*	*250*	*500*	*1000*	*2000*	*4000*	
1.6 mm galvanised steel sheet	4	14	21	27	32	37	43	

Source: Enviro Acoustic Research (2015)

<u>Traffic</u>

Traffic during the operational phase will mainly be limited to workers and contractors travelling around the site, as well as traffic associated with shift changes. Noise generated from traffic during the operational phase is considered to be minimal compared to typical mining noises.

9.11.3.2 Assessment of impact

As mentioned only the night-time (22:00 – 06:00) future operations were assessed as this is the most critical time when a quiet environment is desired (at night for sleeping, weekends etc.).

The following assumptions were considered in the model:

- Future operational activities are defined and conceptualised in Figure 9-22 as red dots. A worst-case scenario was assessed whereby the noise generating activities are operating under full load simultaneously;

[9] Various sources – Mainly the database of Soundplan

- No penalties have been added for potential noise sources with an impulsive or tonal character;
- Operational mining activities will take place along the outcrop area and the noise contours reflect the potential equivalent noise levels that may impact on the surrounding environment for the duration of the mining operational phase;
- Receptors are regarded as 1.5 m height in relation to the surrounding environment. Noise sources considered at between 1.5 and 3 m ground level elevation depending on the activity.

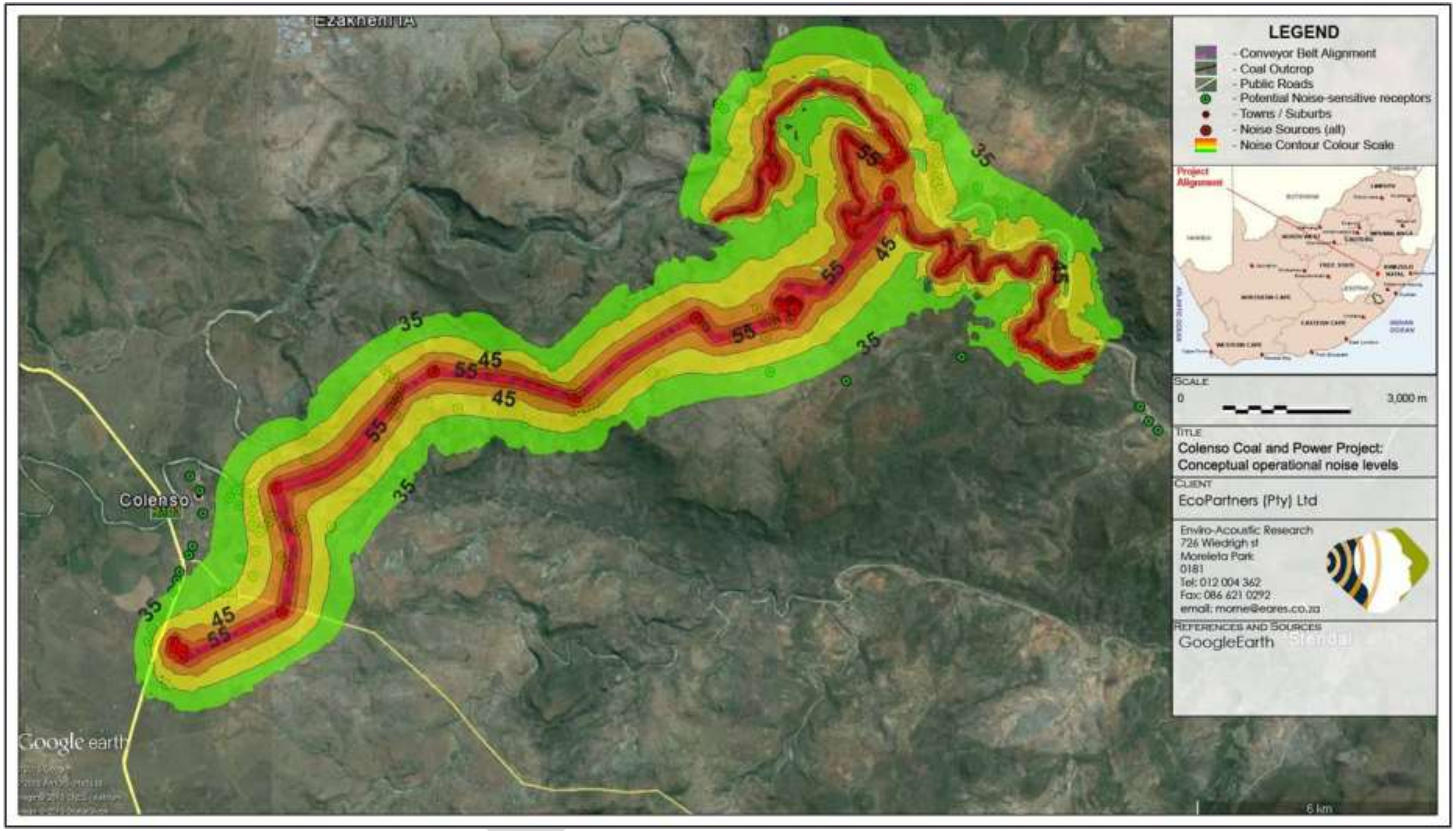
Projected rating levels for noise are illustrated in the figures below. Noise contours are illustrated from the 35 dBA isopleth for the night.

9.11.4 Closure Phase

Noises generated during the construction phase are generally less than the noise generated during other phases, including the construction phase. This is because the there is a lower “urgency” to complete the project and the number of simultaneous activities is less than both the construction and operational phase, using the least amount of people with the least number of equipment. The significance would therefore be similar or less than the significance of the noise impact during the daytime construction phase. Closure activities generally relates to care and maintenance activities that have a very low noise impact.

The low magnitude of the potential noise level and short duration results in low significance of a noise impact and the closure phase was therefore not investigated further.

Figure 9-22: Night-time operational noise: Contours of constant rating levels



9.11.5 Mitigation ability

The mitigation ability for the high impacts are considered.

Construction

<u>Impact</u>: Day time Noise - Receptors closer than 300 meters from significant construction activities

<u>Impact</u>: Night time Noise - Receptors closer than 300 meters from significant construction activities

The potential noise impact would be of high significance, mainly due to the proximity of receptors to construction activities.

The following mitigation measures are proposed for consideration:

- Community involvement needs to continue throughout the project. Annoyance is a complicated psychological phenomenon; as with many industrial operations, expressed annoyance with sound can reflect an overall annoyance with the project, rather than a rational reaction to the sound itself. At all stages surrounding receptors should be informed about the project, providing them with factual information without setting unrealistic expectations. It is counterproductive to suggest that the activities (or facility) will be inaudible due to existing high ambient sound levels. The magnitude of the sound levels will depend on a multitude of variables and will vary from day to day and from place to place with environmental and operational conditions. Audibility is distinct from the sound level, because it depends on the relationship between the sound level from the activities, the spectral character and that of the surrounding soundscape (both level and spectral character).
- The developer must implement a line of communication (i.e. a help line where complaints could be lodged. All potential sensitive receptors should be made aware of these contact numbers, or alternative means to communicate issues. The facility should maintain a commitment to the local community and respond to concerns in an expedient fashion. Sporadic and legitimate noise complaints could develop and if valid, should be investigated.
- All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment.

Mitigation options included both management measures as well as technical changes. Options to reduce the noise impact during the construction phase include:

- Where possible only operate during the day. If night-time activities is required, do not operate closer than 300m from any receptors (prevent noise impact of high significance)

- Ensure a good working relationship between site management and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 500m from them at night). Information that should be provided to potentially sensitive receptor(s) includes:
    - Proposed working dates, the duration that work will take place in an area and working times;
    - The reason why the activity is taking place;
    - The construction methods that will be used; and
    - Contact details of a responsible person where any complaints can be lodged should there be an issue of concern.
- When simultaneous noise emitting activities are to take place close to potential noise-sensitive receptors, co-ordinate the working time with periods when the receptors are not at home. An example would be to work within the 8 am to 2 pm time-slot, as:
    - Potential noise-sensitive receptors are most likely to be at school or work; and
    - Normal daily household activities (cleaning, listening to TV/Radio, etc.) will generate other noises that would most likely mask construction noises, thus minimizing the effects of cumulative noise impacts.
- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Acoustical mufflers (or silencers) should be considered on equipment exhausts on open cast pits and stockpile areas. A noise absorption braid could be mounted on the front of heavy equipment radiators (ADT's, FEL's etc.) to prevent excess mechanical fan noise into the surrounding environment. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised;
- The use the smaller/quieter equipment when operating near receptors;
- The developer should investigate the use of white-noise generators instead of tonal reverse alarms on heavy vehicles operating on roads, in mine pits and at stockpile areas[10]. This option is highly recommended although it must be noted that reverse alarms is exempt from an acoustical assessment due to Government Notice R154 of 1992 (Noise Control Regulations) – Clause 7.(1) – *"the emission of sound is for the purposes of warning people of a dangerous situation";*

It is difficult to say whether the implementation of the mitigation measures will result in the day time noise impacts to be mitigated to Medium or even Low. The effectiveness of the

[10] White Noise Reverse Alarms: http://www.brigade-electronics.com/products.

mitigation measures can only be determined by noise monitoring at the sensitive receptors located within 300 m of the construction activities. Should no construction activities occur at night the night time noise impact will not be relevant and there will be **no noise impact**.

Operations

Impact: Night time Noise - Receptors closer than:- 90m from the conveyor belt in the vicinity of Colenso (urban area)- 200m from the conveyor belt in the rural areas- 300m from the power station area.

The impact is considered high mainly due to the proximity of sensitive receptors to the activities. Mitigation measures include:

- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures. This is critical for the conveyor belt system.
- All equipment (especially conveyor systems) should be enclosed where practically possible, especially the sections that pass close to receptors. Galvanized metal cladding is a good example of such a screen to be considered around structural steel.
- Noise levels must be monitored a selected receptors living very close to the operational activities (mainly the coal staging area, conveyor belt system and power station) with the implementation of a noise monitoring program to identify high noise levels.
- The developer should investigate the use of white-noise generators instead of tonal reverse alarms on heavy vehicles operating on roads, in mine pits and at stockpile areas. This option is highly recommended although it must be noted that reverse alarms is exempt from an acoustical assessment due to Government Notice R154 of 1992 (Noise Control Regulations) – Clause 7.(1) – "the emission of sound is for the purposes of warning people of a dangerous situation.
- Compliance with the Noise measurements of the Environmental Management Plan.

The effectiveness of the mitigation measures can only be determined by noise monitoring at the sensitive receptors located within 90m from the conveyor belt in the vicinity of Colenso (urban area), within 200m from the conveyor belt in the rural areas and 300m from the power station area.

9.12 VISUAL

MetroGIS was appointed to conduct the visual impact assessment for the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the visual impacts and is presented in the following paragraphs.

The potential visual impacts on sensitive receptors, and the uncontrolled significance rating thereof are presented in the table below.

Table 9-37: Visual impacts on sensitive receptors

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Activities related to construction - Trucks & heavy equipment travelling between the town and the power station construction site; Construction activities on site.	Visual impact of construction on observers in close proximity to the proposed power station	5	4	5	100	5	5	25	12 500
Operation of Power Station & infrastructure	Operational Activities	Potential visual impact on observers within a 3km radius of the power station (local impact)	5	4	5	100	5	5	25	12 500
Operation of Power Station & infrastructure	Operational Activities	Visual impact on sensitive visual receptors within the region (regional impacts)	4	4	5	80	4	3	12	4 800
Operation of Power Station & infrastructure	Operation Activities at night - Lightninig	Visual impact of lighting on sensitive visual receptors	5	4	5	100	5	5	25	12 500

9.12.1 Potential visual exposure

The results of the viewshed analyses for the proposed power station are indicated in Figure 9-23.

The location of the power station on the plateau clearly influences the potential visual exposure. It becomes evident that the core area of potential visual exposure (i.e. within a 3-6km radius), where the power station and smoke stacks may be visible, is largely contained by the hills surrounding the plateau. Observers residing on this plateau (e.g. residents of Brakfontein and Gannahoek) or travelling along the access road will have a high level of exposure to the facility.

The visual exposure to the south (i.e. the Bloukrans River valley), east and west is interrupted by the topography and it is expected that only longer distance observations of the smoke stacks may occur from elevated vantage points within this zone.

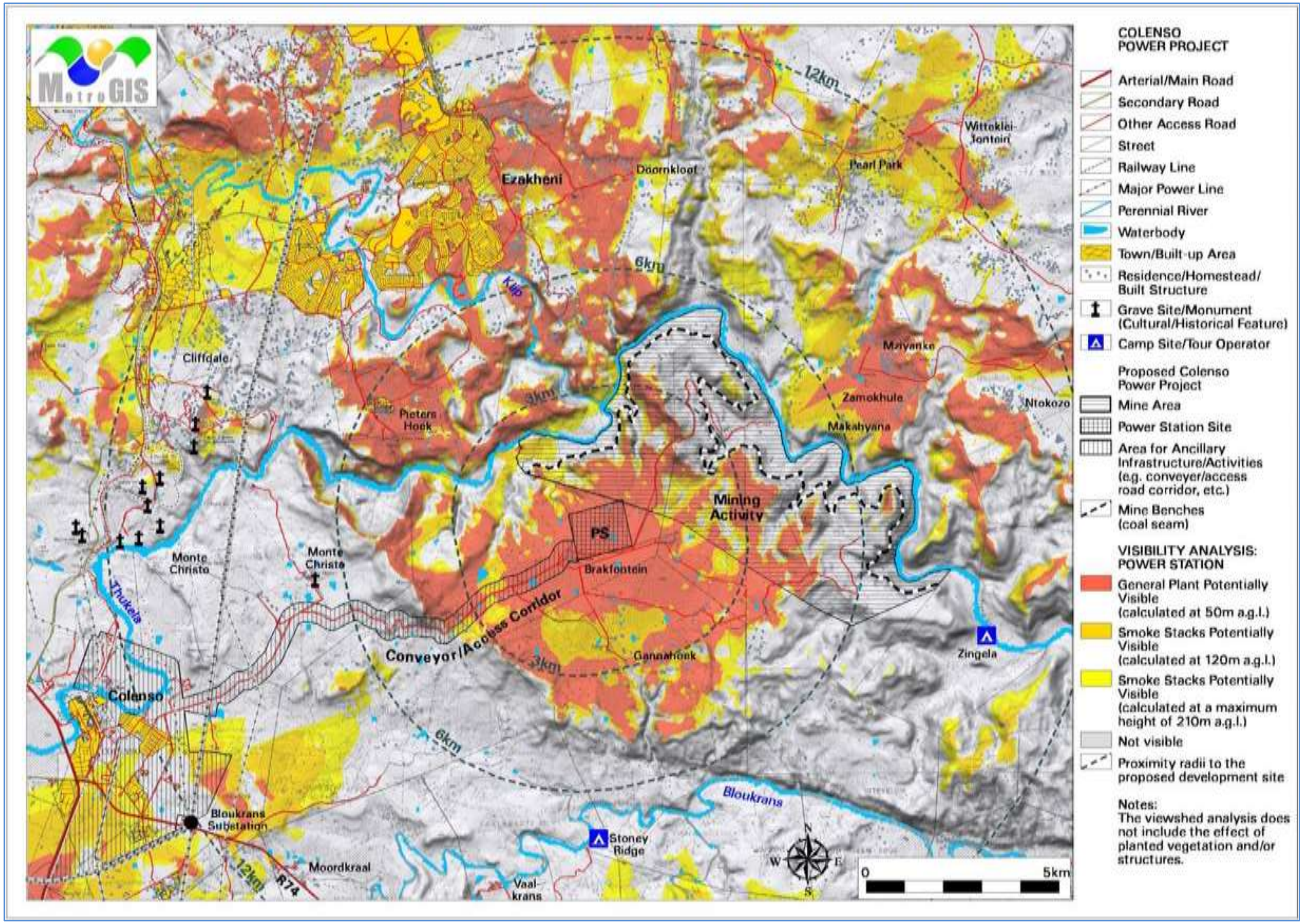
Exposure to the north, north-east and north-west is more extensive. Large sections of land, especially elevated land, may be exposed to the power station structures. This area includes settlements, homesteads and towns (Ezakheni) from where the power station and/or smoke stacks may be visible.

The results of the viewshed analyses for the ancillary infrastructure are shown Figure 9-24.

The area identified as a corridor for conveyors, coal staging, water treatment, rail siding assessment, access road and water supply, is expected to experience varying degrees of visual exposure. This is due to the varying dimensions of the structures and the varying levels of activity at specific times during the project (e.g. the movement of trucks and heavy equipment along the access road during the construction phase of the project). There is also a number of criteria that may mitigate the potential visual exposure (and ultimately the visual impact) of the infrastructure placed within the immediate surrounds of the town. The presence of exiting visual clutter and disturbances (e.g. power lines, railway line infrastructure, buildings, etc.) may for instance mitigate or even negate potential visual impacts. The visual exposure for these visual intrusions were calculated for a radius of 2 km from this road, as these features were expected to generally have a more localised potential visual impact.

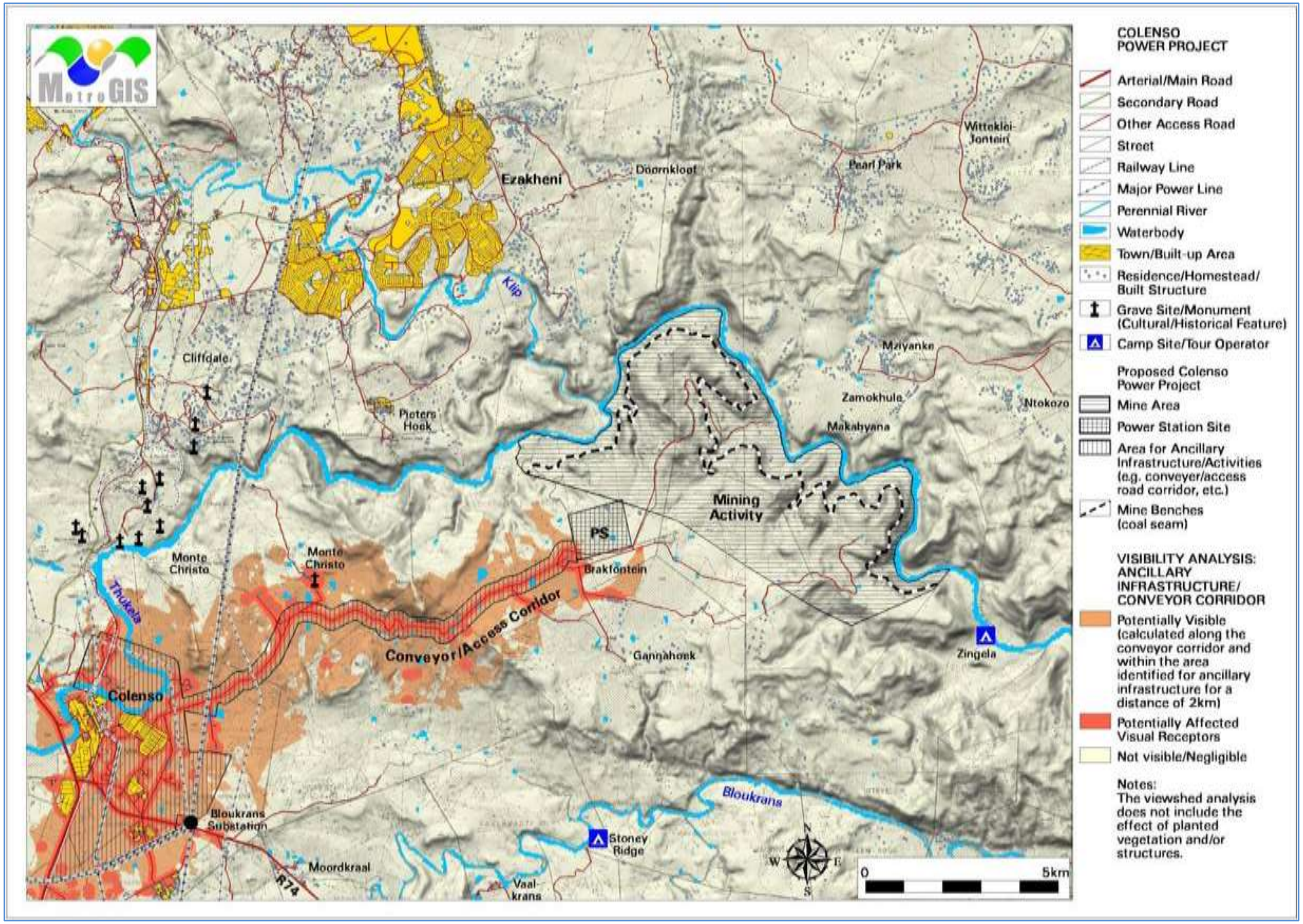
Trucks, heavy equipment and the conveyor belt spanning or travelling between the town and the power station construction site, is expected to be visible to observers travelling along this road (e.g. visitors to the Monte Christo battle fields site) or people who reside nearby.

Figure 9-23: Visibility analysis – power station



Source: MetroGIS, Visual Assessment (2014)

Figure 9-24: Visibility analysis – ancillary infrastructure/conveyer corridor



Source: MetroGIS, Visual Assessment (2014)

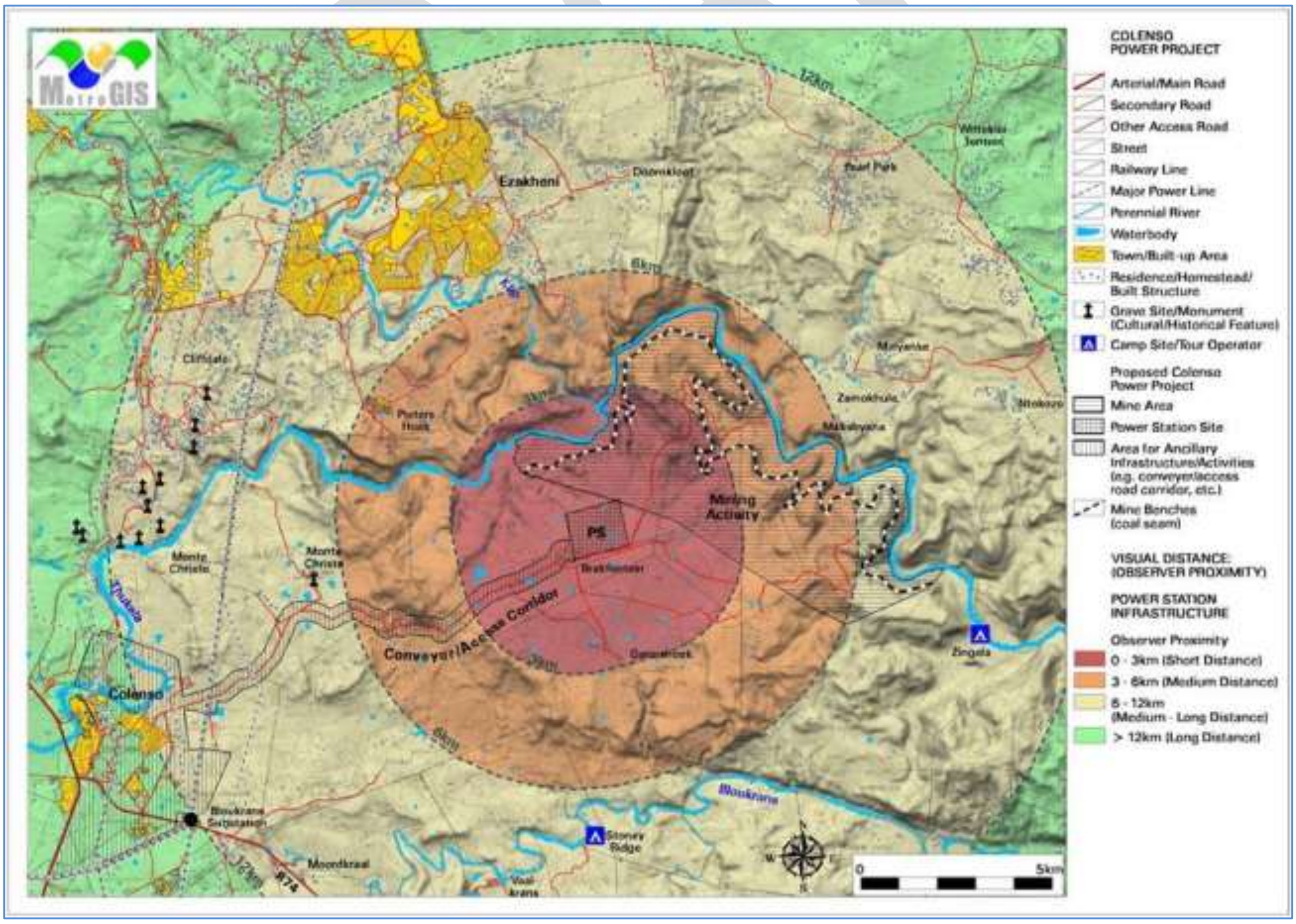
9.12.2 Visual distance/observer proximity to the power station

MetroGIS determined the proximity radii based on the anticipated visual experience of the observer over varying distances. The distances are adjusted upwards for larger power station facilities and downwards for smaller facilities (i.e. depending on the size and nature of the proposed infrastructure).

The proximity radii (calculated from the power station footprint) are shown on Figure 9-25 and are as follows:

- 0 – 3km. Short distance view where the facility would dominate the frame of vision and constitute a high visual prominence.
- 3 - 6km. Medium distance view where the facility would be easily and comfortable visible and constitute a moderate visual prominence.
- 6 - 12km. Medium to longer distance view where the facility would become part of the visual environment, but would still be visible and possibly recognisable if the complete facility is exposed. This zone constitutes a low visual prominence.
- Greater than 12km. Long distance view of the facility where it could potentially still be visible though not as easily recognisable. This zone constitutes a very low visual prominence for the facility where any views of it will be regarded as insignificant.

Figure 9-25: Visual distance - power station



Source: MetroGIS, Visual Assessment (2014)

9.12.3 Viewer incidence/viewer perception (potential sensitive visual receptors)

It is necessary to identify areas of high viewer incidence (i.e. major roads, residential neighbourhoods, homesteads, etc.) in order to determine the presence of potentially sensitive visual receptors that may be negatively affected by the proposed power station and mining activities and infrastructure. Some receptor areas may have higher incidences of potential sensitive visual receptors (e.g. observers travelling along roads) than other (e.g. canoeists utilising the Thukela River).

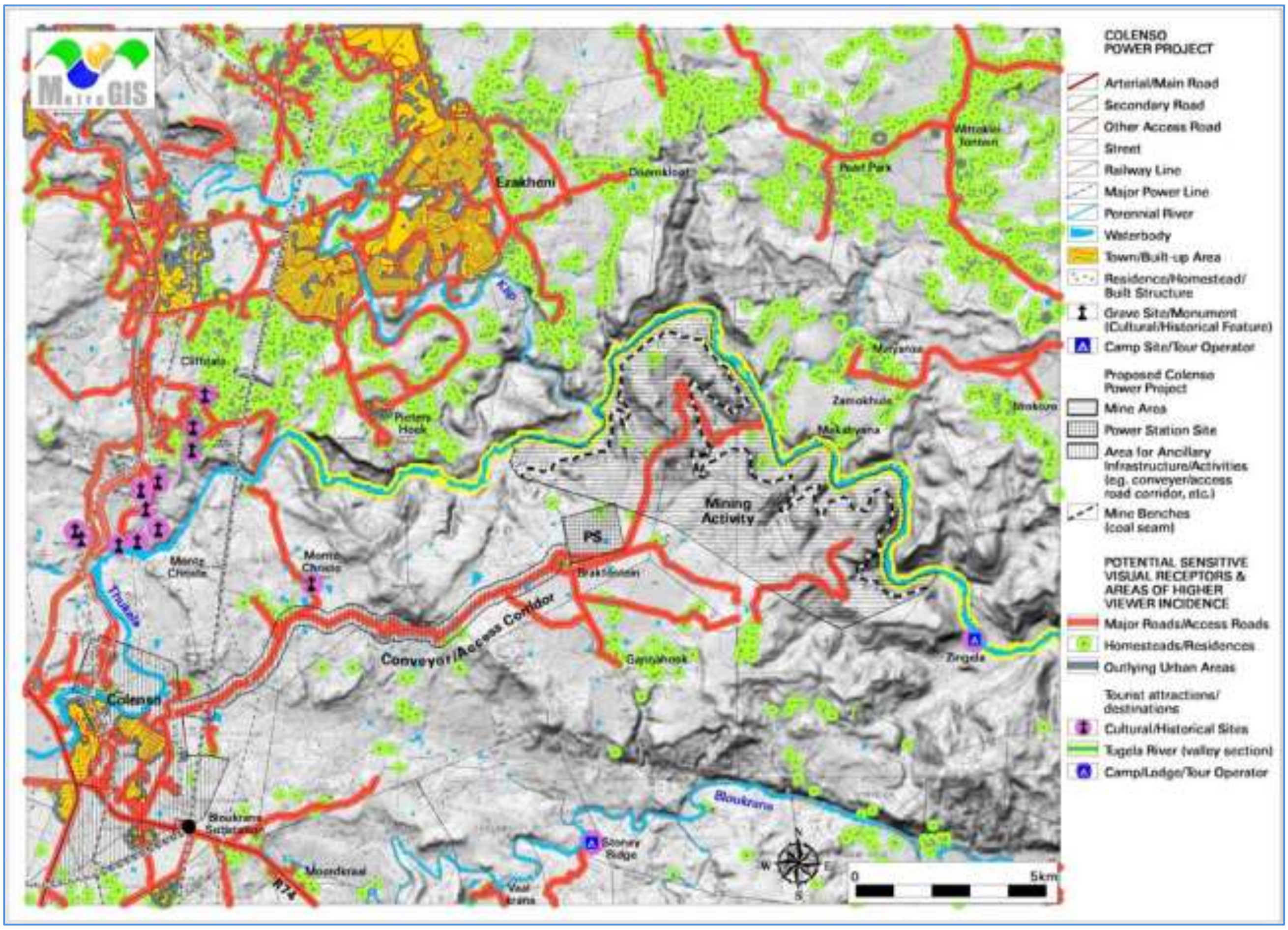
Some observers may also be more sensitive to the proposed development than others. A tourist visiting the battlefields sites may for instance be more negatively affected by the sight of a coal-fired power station than a local resident seeking employment.

Refer to Figure 9-26 for the geographical location of the identified potential sensitive visual receptors and areas of higher viewer incidence listed below:

- Major roads/access roads (e.g. battlefields routes)
- Homesteads/residences (e.g. Pieters Hoek, Gannahoek, Makahyana, Zamokhule, etc.)
- Outlying urban or residential areas (of Colenso and Ezakheni)
- Cultural/historical features or attractions
- Thukela River (e.g. a tourist attraction utilised for outdoor recreation)
- Tourist destinations (e.g. Zingela Lodge and Stoney Ridge Camp)

It is expected that observers at these receptor areas may have a negative perception about the proposed infrastructure where visible.

Figure 9-26: Areas of higher viewer incidence and potential sensitive visual receptors



Source: MetroGIS, Visual Assessment (2014)

9.12.4 Visual impact index

The combined results of the visual exposure, viewer incidence/perception and visual distance of the proposed power station are displayed in Figure 9-27.

The quantitative analyses of possible impact have been integrated as a visual impact index. The sum of values assigned for each visual impact parameter is used to identify and visualise areas of high, moderate and low visual impact. Typically a location with close proximity to the proposed facility, a high viewer incidence, a predominantly negative perception and high visual exposure would have a high value on the index, thereby signifying a high visual impact.

The focus for the power station will be on the areas identified as potentially having a high or very high visual impact. This is generally restricted to potential sensitive visual receptors located within a 6km radius of the development.

The following is of relevance:

- The visual impact index indicates a core zone of potentially high visual impact located on top of the plateau and to the north-west. Where sensitive visual receptors (i.e. observers travelling along the access roads, or residents of Gannahoek) occur within a 3km radius of the power station, the visual impact is expected to be very high.

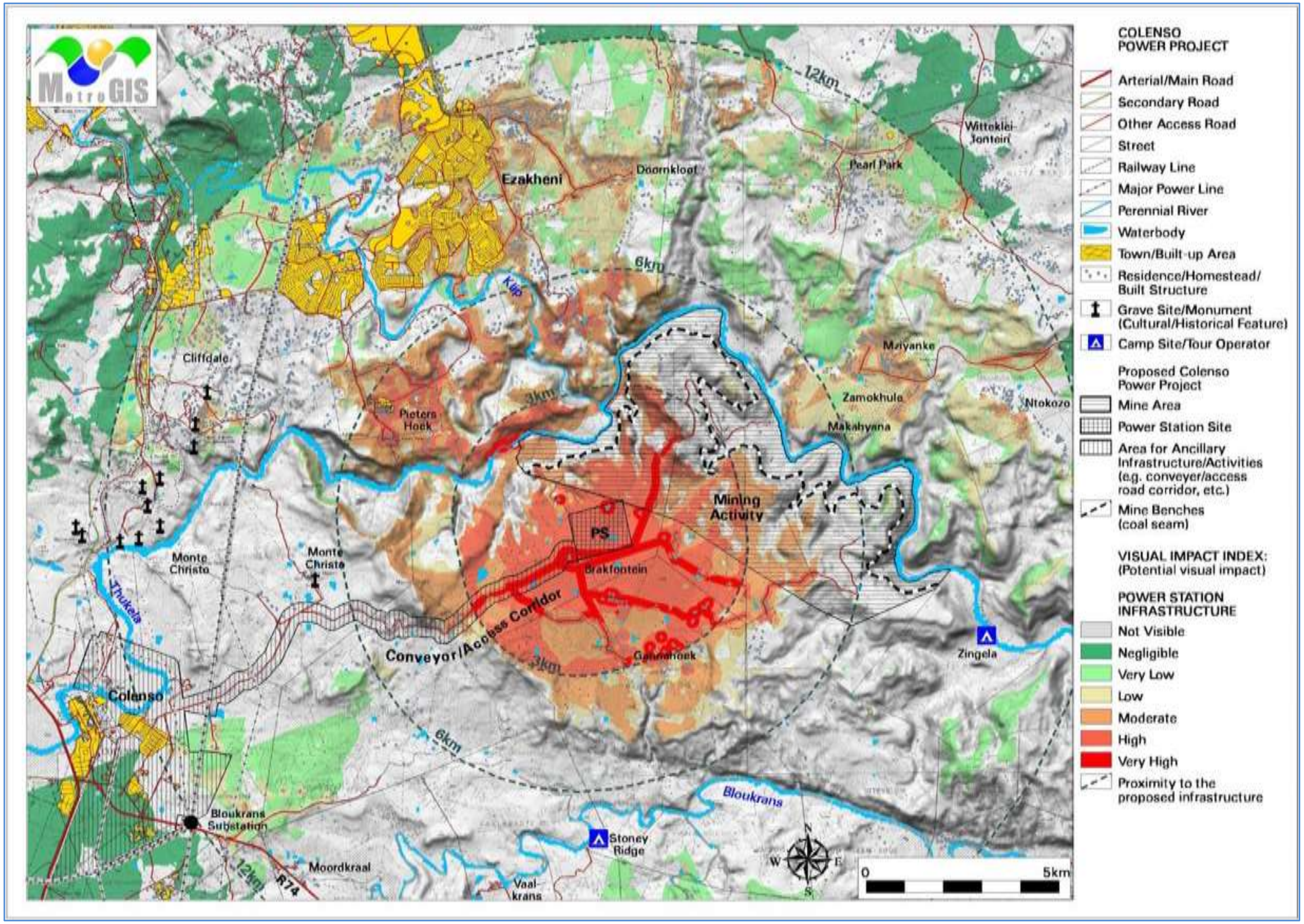
- A section of the Thukela River (north-west of the site) may experience short distance sightings (within 3km) of the power station, with a potentially very high visual impact on observers (e.g. tourists, canoeists) utilising this section of the river.
- Observers located between a 3km to 6km radius of the facility (e.g. Pieters Hoek and other settlements/homesteads), to the north-west, may experience high visual impacts. This is applicable to most of the south-facing and elevated slopes located within this zone.
- The visual impact index indicates a reduction in the level of potential visual impact beyond a 6km radius of the power station. Sensitive visual receptors, primarily located to the north, may experience moderate visual impacts.
- Visibility beyond 12km from the proposed development is expected to have a negligible or very low visual impact.
- The proposed power station is not expected to be visible from most of the identified cultural/historical sites, or may at worst be visible from distances exceeding 10km from the site.
- The Zingela and Stoney Ridge base camps will not be exposed to the power station.

The infrastructure associated with the power station access corridor (spanning between Colenso and the power station site), is expected to have a high visual impact on the following potential sensitive visual receptors:

- Observers travelling along the local access roads (e.g. visitors to the Monte Christo battle field site).
- Residents of homesteads within close proximity (less than 2km) to the corridor.

The visual impacts are expected to be particularly high during the construction phase of the power station project, where construction vehicles and construction activities will take place along/within this corridor (refer Figure 9-28).

Figure 9-27: Visual impact index - power station



Source: MetroGIS, Visual Assessment (2014)

9.12.5 Mitigation ability

Mitigation ability for the high impacts are considered.

Impact: Visual impact of construction on observers in close proximity to the proposed power station

Mitigation measures include:

- Ensure that vegetation is not unnecessarily cleared or removed during the construction period.
- Reduce the construction period through careful logistical planning and productive implementation of resources.
- Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.
- Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
- Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.
- Reduce and control construction dust through the use of approved dust suppression techniques as and when required, especially on internal construction (i.e. whenever dust becomes apparent).
- Internal access roads to the site should ideally be upgraded to tar roads before construction activities commence.
- Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.
- Rehabilitate all disturbed areas, construction areas, roads, slopes, etc. immediately after the completion of construction works.

By the implementation of mitigation measures the potential (short term) visual impact may be mitigated to **moderate.**

Impact: Potential visual impact on observers within a 3km radius of the power station (local impact)

The following mitigation measures are recommended.

- Planning:
    - Retain and maintain natural vegetation in all areas outside of the development footprint.
- Operations:
    - Maintain the general appearance of the facility as a whole.
- Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the facility.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Mitigation of this impact is possible, and both specific measures as well as general “best practice” measures are recommended in order to reduce/mitigate the potential visual impact. The visual impact is however still expected to be **high**, due to the contrasting nature of the development/activities to the receiving environment.

Impact: Visual impact of lighting on sensitive visual receptors

The following mitigation measures should be considered during the planning phase of the development:

- Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself);
- Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights;
- Making use of minimum lumen or wattage in fixtures;
- Making use of down-lighters, or shielded fixtures;
- Making use of Low Pressure Sodium lighting or other types of low impact lighting.
- Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.

With the implementation of mitigation measures the impact may be mitigated to **moderate**

9.13 Traffic

Sturgeon Consulting was appointed to conduct the traffic impact assessment. The traffic impacts expected during the construction and operation are presented in the table below.

Table 9-38: Traffic Impacts expected during construction & operational phase

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Construction Activities - Movement of vehicles & equipment	Construction vehicles and equipment may impact pedestrian safety.	5	4	3	60	5	4	20	6 000

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Construction Activities - Movement of vehicles & equipment	Construction vehicles may increase the occurrences of road accidents around the town & project site.	4	4	3	48	5	3	15	3 600
Construction of Power Station & infrastructure	Construction Activities - Movement of vehicles & equipment / Abnormal Roads	Increase in traffic during the construction phase could result in the deterioration of the paved & unpaved roads	4	4	3	48	5	4	20	4 800
Operation of Power Station & infrastructure	Operational Activities - Movement of vehicles	Increase in traffic as a result of the operational activities.	3	4	5	60	2	5	10	3 000
Operation of Power Station & infrastructure	Operational Activities - Movement of vehicles	Employee & company vehicles may impact pedestrian safety.	5	4	4	80	5	3	15	6 000
Operation of Power Station & infrastructure	Operational Activities - Movement of vehicles	Increase in traffic during the operational phase could result in the deterioration of the paved & unpaved roads.	3	4	4	48	2	4	8	1 920

Based on the expected number of employee trips generated by the proposed development it is expected that the existing road network has sufficient capacity to accommodate the additional trips during the construction and operational phases. A gravel road such as D488 can accommodate between 300 and 400 vehicles per day, depending on the type of vehicles. During construction it is expected that the road surface of D488 will require maintenance at regular intervals. However, once construction is completed, the day-to-day operation of the proposed power station will generate relatively low traffic volumes which can easily be accommodated by a gravel road surface.

The operational phase of this project is not expected to generate significant traffic volumes. The number of permanent staff on site is not expected to be more than 1 350 people and therefore no additional upgrades are required to accommodate the operational site traffic.

Please refer to Figure 9-28 for the elevation profiles for the three possible access options.

D488 off the R74 - This section of D488 is approximately 2.87km long and in a very poor condition. This section of the access road to the power station will allow easy access for heavy vehicles and abnormal loads without having to drive through the streets of Colenso and Inkanyezi preventing damage to the internal street network of the town. The R74 /D488 intersection will have to be upgraded with a right turn lane and a large enough bell mouth to allow for long heavy vehicles to easily enter and exit D488

Sir George Road off the R74 through town and over the railway line and through Inkanyezi - Colenso can be accessed from the north off the R103 via Sir George Road for a distance of 1.33km before connecting onto the route from the R74. The road is paved but also in a poor condition and not suitable for high volumes of heavy vehicles. It also crosses the one-way bridge over the Thukela River.

Sir George Road off the R103 also via Inkanyezi - This route requires traveling approximately 4.05 km through Colenso over the existing railway line and though Inkanyezi before connecting with D488. Cars and small delivery vehicles can use this route as the road over Rail Bridge is limited to 3 ton vehicles. Time wise this route may also be longer than using the D488 off the R74 because of the speed limit and many intersections along the route. The condition of the streets in Colenso is also in a poor condition and additional traffic will have an even higher detrimental effect on the roads. The existing access at the Sir George/R74 intersection will have to be upgraded with the necessary turning lanes.

The main access road (D488) is approximately 13.2km over mountainous terrain (refer Figure 9-29) that will require major upgrading to allow heavy vehicles and abnormal loads to reach the power station safely during construction.

Figure 9-28: Elevation profile of access options

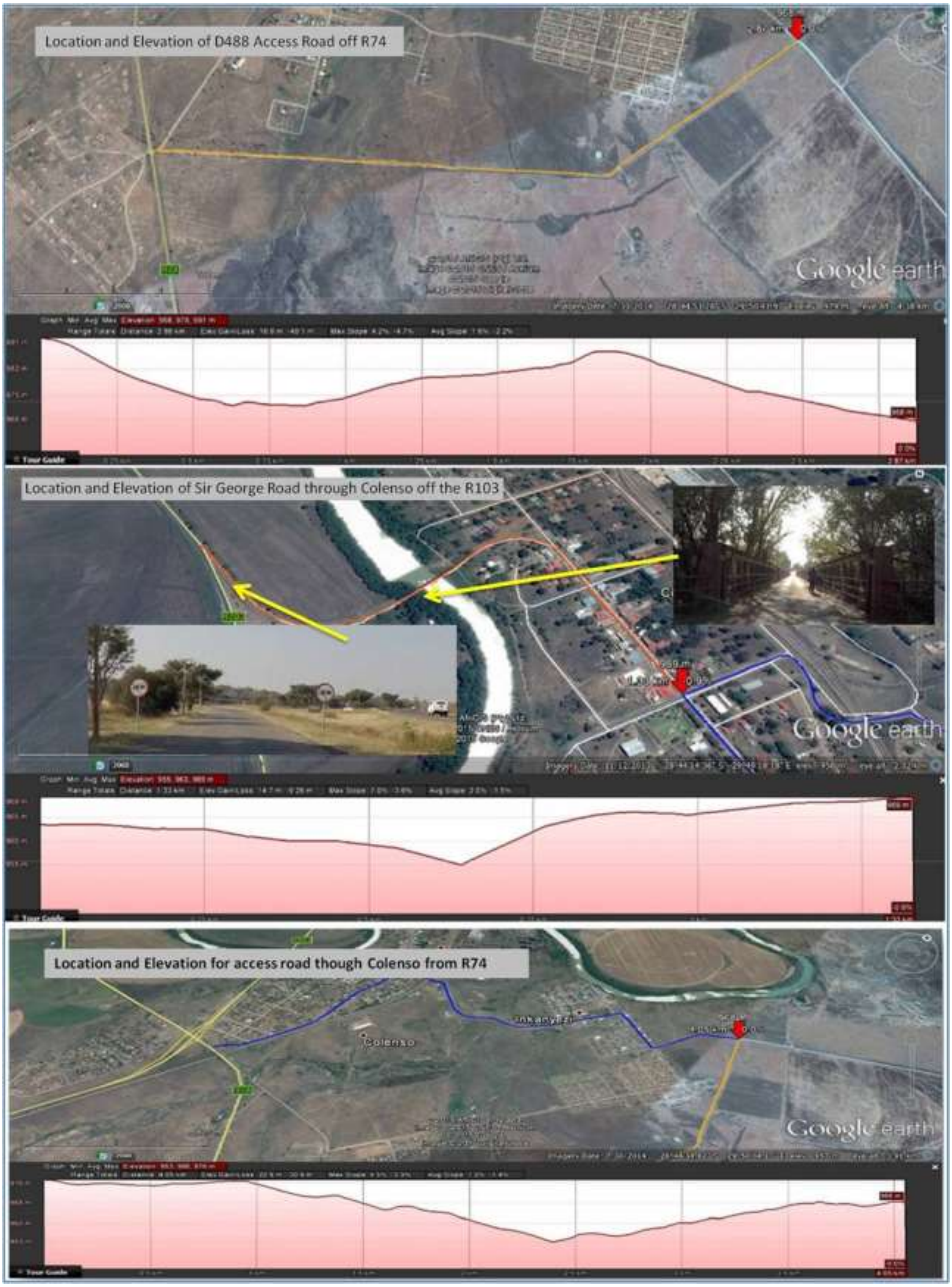
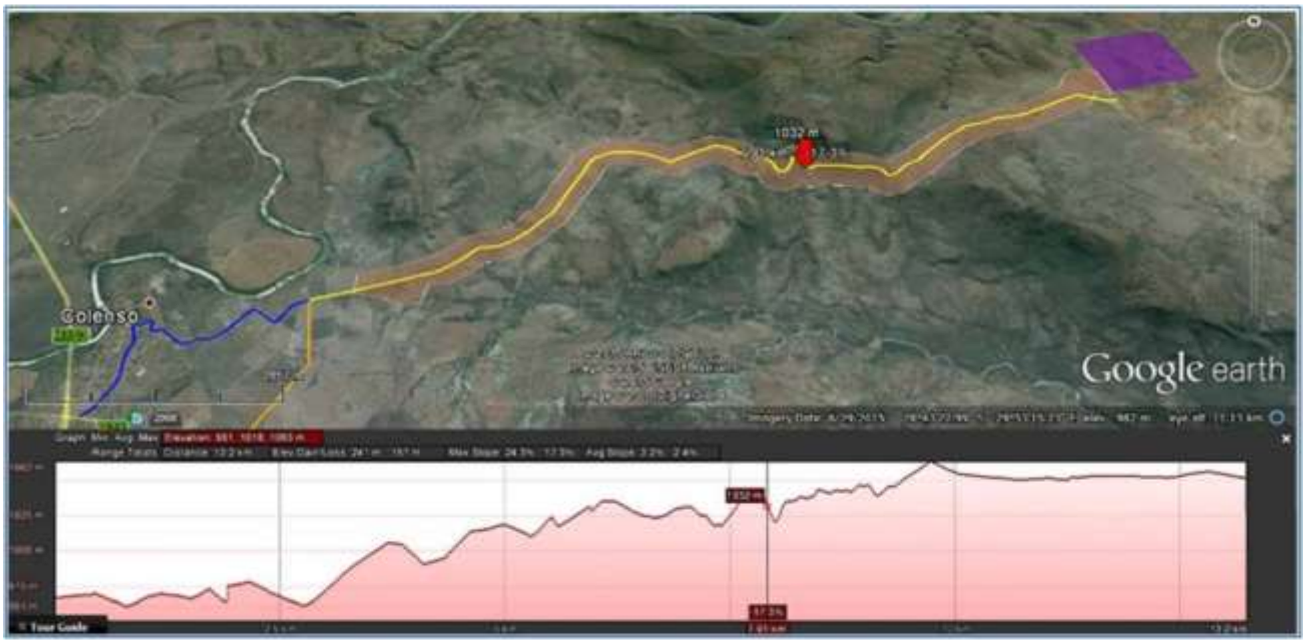


Figure 9-29: Elevation profile of D488



Source: Sturgeon Consulting, Traffic Assessment (2015)

9.13.1 Abnormal loads

For the power station and mine development it will be necessary for large equipment/ machinery, materials to be delivered to the site. It is also expected that many abnormal loads vehicles will be travelling from major centres via the National Roads, Provincial and District roads to access the mine site. The major cities which have been identified are the City of Durban, Richards Bay and Johannesburg.

The following are possible routes to be used:

- Travelling from Durban, using the N3 and exiting off at exit 194 (R74 to Colenso)
- Travelling from Johannesburg, using the N3 and exiting off at exit 230 (N11 to Ladysmith)
- Travelling from Richards Bay, using the N2 and exiting off at exit 233 (R74 to Stanger)

The R74 bridge over the R103 also has a height restriction of 4.45m which could be a limiting factor for abnormal loads.

With the exception of the N3 most of the district and provincial roads are in a poor condition, as a result of the high percentage heavy vehicles, and will require upgrading along the main routes into Colenso.

9.13.2 Public transport assessment

9.13.2.1 Road-based public transport

The road conditions are generally very poor (gravel at most) except for the main road which is tarred blacktop. The community mostly uses non-motorised transport (NMT) and minibus taxis as a mode of transport. Minibus taxis mostly provide long distance transport to nearby towns and other provinces. Public transport is limited to bus and minibus taxi operations providing services between Ladysmith and Colenso.

9.13.2.2 Non-motorised transport assessment

Non-Motorised transport (NMT) is an important pre-requisite in ensuring the livelihood of sustainable developments and communities. Given the rural nature of the area as well as the predominant rural settlement presence, non-motorised transport plays an important role in the local community.

Non-motorised transport in South Africa can be classified as all modes (non-mechanised) of transport excluding motorists. These include personal transport (walking and cycling) as well as passenger transport (wheelbarrow, carts, wheelchairs, rickshaws) to transport elderly or disabled people or goods (wheelbarrow, cars, rickshaws).

9.13.3 Commuter rail

The existing railway line running through Colenso does not carry daily commuters and would therefore not be able to assist in getting workers to/from other towns once construction has started. However, rail passenger services are limited to between 3 - 4 trains operating between Durban and Johannesburg 3 days a week.

9.14 HERITAGE

A Pelser Archaeological Consultants was appointed to conduct the Phase 1 HIA for the development of the proposed power station and associated infrastructure near Colenso. Their assessment was used to determine the impacts on the heritage resources that were identified on site and is presented in the following paragraphs.

Impacts on heritage resources are most likely to occur during the construction phase. The possible impacts on the heritage sites are presented in Table 9-39: Impacts on Heritage resources expected during construction below.

Table 9-39: Impacts on Heritage resources expected during construction

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Site preparation, Vegetation clearance, Excavations, Movement of construction vehicles and equipment on site	Damage or destruction of any identified aspect of archaeology, cultural or heritage site 1 detailed in the (A Pelser Archeological Consulting Phase 1 report) during construction activities	1	1	5	5	5	5	25	125

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
Construction of Power Station & infrastructure	Site preparation, Vegetation clearance, Excavations, Movement of construction vehicles and equipment on site	Damage or destruction of any identified aspect of archaeology, cultural or heritage sites 2&3 (possible graves) detailed in the (A Pelser Archeological Consulting Phase 1 report) during construction activities	5	4	5	100	5	5	25	12 500
Construction of Power Station & infrastructure	Site preparation, Vegetation clearance, Excavations, Movement of construction vehicles and equipment on site	Damage or destruction of any identified aspect of archaeology, cultural or heritage sites 4, 5 & 8 detailed in the (A Pelser Archeological Consulting Phase 1 report) during construction activities	1	2	5	10	5	5	25	500
Construction of Power Station & infrastructure	Site preparation, Vegetation clearance, Excavations, Movement of construction vehicles and equipment on site	Damage or destruction of any identified aspect of archaeology, cultural or heritage site 6 detailed in the (A Pelser Archeological Consulting Phase 1 report) during construction activities	1	2	5	10	5	5	25	250
Construction of Power Station & infrastructure	Site preparation, Vegetation clearance, Excavations, Movement of construction vehicles and	Damage or destruction of any identified aspect of archaeology, cultural or heritage site 7 detailed in the (A Pelser	1	1	5	5	5	5	25	250

Activity Description	Aspect Description	Impact Description	S	SS	D	CONS	O	C	LKLH	UNMITIGATED IMPACT RATING
	equipment on site	Archeological Consulting Phase 1 report) during construction activities								

The heritage sties identified on site were rated in terms of cultural significance, heritage significance and a field rating.

Cultural significance is rated as follows:

- **Low**: A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.
- **Medium**: Any site, structure or feature being regarded less important due to a number of factors, such as date and frequency. Also any important object found out of context.
- **High**: Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorized as of a high importance. Also any important object found within a specific context.

Heritage significance is rated as follows:

- **Grade I**: Heritage resources with exceptional qualities to the extent that they are of national significance
- **Grade II**: Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate
- **Grade III**: Other heritage resources of local importance and therefore worthy of conservation

The following field ratings can be assigned to a heritage site:

- **National Grade I** significance: should be managed as part of the national estate
- **Provincial Grade II** significance: should be managed as part of the provincial estate
- **Local Grade IIIA**: should be included in the heritage register and not be mitigated (high significance)
- **Local Grade IIIB**: should be included in the heritage register and may be mitigated (high/ medium significance)
- **General protection A (IV A)**: site should be mitigated before destruction (high/medium significance)

- **General protection B (IV B)**: site should be recorded before destruction (medium significance)
- **General protection C (IV C)**: phase 1 is seen as sufficient recording and it may be demolished (low significance)

Sites 1, 4, 5, 6, 7 & 8 were all rated as having low cultural significance with a filed rating of General Protection C (IV C).

Sites 2 & 3 (possible grave sites) were allocated a high cultural significance, a Local Grade III heritage significance with a Local Grade IIIB field rating.

9.14.1 Mitigation ability

Mitigation ability is described for high impacts.

Impact: Damage or destruction of any identified aspect of archaeology, cultural or heritage sites 2&3 (possible graves) detailed in the (A Pelser Archeological Consulting Phase 1 report) during construction activities

The impact can be mitigated by the following measures:

- Fence-off and manage/protect.
- If required then the graves could be exhumed and relocated after the necessary permissions have been provided and detailed social consultation has been undertaken.

With the implementation of the proposed mitigation measures the impact rating will change from a high to low.

10 ASSUMPTIONS, UNCERTAINTIES & GAPS

Only a schematic layout of the proposed power station is available and the exact location of the power station structure are not fixed. However, the area proposed for the construction of the power station was assessed. The location of the ash stockpile site has been determined (preferred alternative).

Coal is not considered a dangerous goods.

10.1 Air Quality Assessment

The following key assumptions and limitations of the study are given below:

Assumptions:

- Data input into the model has been based on the information provided by the Applicant. It is assumed that the information provided by the Applicant is accurate and complete at the time of modelling;
- The Pulverised fuel combustion option was assumed to be the preferred option and thus modelled as both options could not be modelled under this current scope of work;
- Some of the dimensions for the different sources were assumed where information was not yet known at the time of modelling;
- Abatement equipment (FGD plant, SCR system and Baghouse system) was assumed to be used 90 – 98% of the time;
- Coal material properties including moisture content and silt content were assumed as these details were not yet known at the time of modelling;
- The stack exit velocity was assumed to be 20 m/s as this was not yet known at the time of modelling;
- Material from the mine was assumed to be transported via an overland closed conveyor at the time of modelling.

Exclusions:

The following exclusions were made as too little information was known and assumptions could not be made at the time of the modelling:

- Vehicle dust entrainment from trucks at the mine and power station;
- Handling and storage of limestone at the power station;
- Background concentrations that accurately represent the study area could not be obtained.

10.2 Geo-Hydrological Assessment

In order to develop a model of an aquifer system, certain assumptions have to be made. The following assumptions were made during the geo-hydrological assessment:

- The system is initially in equilibrium and therefore in steady state, even though natural conditions have been disturbed.
- No abstraction boreholes were included in the initial model, however they may be included in some of the scenarios.
- The boundary conditions assigned to the model are considered correct.
- The impacts of other activities (adjacent mines and agriculture) have not been taken into account.
- No information was available concerning the hydraulic parameters/characteristics of the wetlands. Only wetland delineations were available. The hydraulic characteristics / parameters were therefore assumed.
- It is important to note that a numerical groundwater model is a representation of the real system. It is therefore at most an approximation, and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes.

10.2.1 Gaps in knowledge

At the time of writing the geohydrological report no Acid Base Accounting results were available, therefore the expected water quality of the seepage is unknown.

Very little water quality data is available and therefore the pollution plume was simulated as a percentage of its source.

The extent of topsoil and alluvium is not accurately defined and should be delineated and monitored during geotechnical studies and construction and treated as zones of possible increased infiltration that could link with the deeper fractured aquifer where higher transmissivities were noted.

10.3 Surface Water Assessment

The following gaps are identified for the study:

- The exact geographic locations of all infrastructure should be confirmed;
- All outstanding infrastructure should be included with its exact geographic locations, use, water volumes, and operational philosophies;

Additional surface water quality samples could be taken on small water features on site (such as the 1 farm dam) and on the non-perennial streams when water is present;

10.4 Vegetation

The following limitations to the vegetation assessment approach were identified by the specialists:

- Red List species by their nature are normally rare and therefore difficult to locate. Moreover, broader scale patterns of biodiversity that are present in and around specific areas might be under-representative due to a lack of collection records and expert knowledge. Therefore, it is always possible that a species not listed for a particular area may be unexpectedly located in the future.

- Temporal variation plays an important role in the structure and patterns of biodiversity, communities and species occurrences. A single site visit may therefore not fully catalogue species diversity in an area, e.g. due to seasonal variation of vegetation. Indeed, the survey for the current study was conducted in the dry season of the study region and some annual, short-lived, geophytic, etc. species may not have been easily observed. For example, some members of the families Hyacinthaceae, Amaryllidaceae, Eriospermaceae, Orchidaceae, Iridaceae and Hypoxidaceae are known to completely die back in winter and survive as dormant bulbs, corms, tubers or rhizomes that are underground and can therefore remain undetected. Ezemvelo KZN Wildlife recommends vegetation surveys to be done between the end of November and beginning of April, but the current study did the survey later, during the beginning of May 2015. A gap in knowledge is declared as to the potential presence of species that were not observable/detectable on site as a result of their potential dormant nature during the time of the field survey.
- Similarly, small spatial scale surveys may not locate all species within a particular region, especially those with clumped, i.e. localised, distributional ranges.

10.5 Fauna

No evidence could be found in the relevant literature that there are seasonal differences in distribution patterns and distribution densities. It was therefore assumed that the season would not have a material influence on the outcome of the study.

10.6 Freshwater

The only current gap is the knowledge is the fact that sampling was done during the dry season, hence the local diversity of the fauna may have been underestimated. A summer follow up (during the wet season) would provide additional insight into the functionality of the dam and the adjacent wetland.

10.7 Bats

The Bat Sensitivity Study highlighted the following assumptions and limitations:

- The migratory paths of bats are largely unknown, thus limiting the ability to determine if the power station will have a large scale effect on migratory species. However this impact is considered highly improbable.
- The satellite imagery partly used to develop the sensitivity map may be slightly imprecise due to land changes occurring since the imagery was taken.
- Species identification with the use of bat detection and echolocation is less accurate when compared to morphological identification, nevertheless it is a very certain and accurate indication of bat activity and their presence with no harmful effects on bats being surveyed.

- It is not possible to determine actual individual bat numbers from acoustic bat activity data, whether gathered with transects or the passive monitoring systems. However, bat passes per night are internationally used and recognized as a comparative unit for indicating levels of bat activity in an area.
- Exact foraging distances from bat roosts or exact commuting pathways cannot be determined by the current methodology. Radio telemetry tracking of tagged bats is required to provide such information only if needed. It is not required in this assessment . Costly radar technology is required to provide more quantitative data on actual bat numbers as well as spatial distribution of multiple bats. This is also not required in this assessment.

10.8 Socio-Economic Assessment

The assumptions made during the Socio-economic assessment include the following:

- Construction, operational, and decommissioning assumptions applicable to the power station and auxiliary infrastructure component of the proposed project.
- Assumptions related to the socio-economic environment within the envisaged zone of influence and specifically footprint of the project.

10.8.1 Modelling assumptions and limitations

This section outlines the assumptions associated with the power station and the auxiliary infrastructure component of the proposed project that was used to perform the economic modelling exercise. They include assumptions related to the construction, operations and decommissioning of the power station and infrastructure component. It needs to be taken into account that the assumptions are applicable to the inputs as they relate to the economic modelling. Any changes to this information would, therefore, have an effect on the modelling results obtained. However the information presented represents the most accurate data that can be gathered at this stage of the project.

10.8.1.1 Construction phase assumptions

The proposed project includes the construction of a 1 050 MW coal-fired power station and its auxiliary infrastructure. It is envisioned that the power station will be erected in three phases of 350 MW each. The first phase, during which the auxiliary infrastructure will be established, is estimated to span 42 months. It is intended that construction of phases two and three, which will each require 30 months, will overlap with the construction activities of the previous phase, decreasing the total construction period. However, if the development of different phases did not overlap, the construction period could extent to 102 months, or eight and a half years, which represents the worst case scenario from a project timeframes perspective.

Overall, it is estimated that the power station and auxiliary infrastructure will require a capital investment of R26 400 million (2015 prices). Excluding various development costs, the total capital expenditure (CAPEX) for this component of the integrated project is estimated at R18 202 million. CAPEX for phase one of this component of the project is estimated at R8 274 million, higher than CAPEX for phase two and three (R4 964 million each) due to the fact that the major investment associated with the auxiliary infrastructure will take place during Phase 1 construction. Moreover, it is envisioned that 52% of the total construction costs of the power station and auxiliary infrastructure will be domestic spend, which translates into a South African expenditure valued at R4 277 million in constant 2015 prices for construction of the first phase alone. The total domestic expenditure for all three phases of the power station will equate to R9 649 million in 2015 prices.

It is estimated that labour costs will be equal to 10% of the domestic expenditure, which means that labour costs associated with phase one will be R427.7 million, to support a total of 2 900 Full Time Equivalent (FTE) job opportunities. As indicated in Table 10-1it is assumed that the average monthly salary of those employed during construction of this component of the project would be on par with the average monthly salary in the construction industry in the KwaZulu-Natal Province.

Table 10-1: Power station and auxiliary infrastructure CAPEX (constant 2015 prices)

Power station and infrastructure	Phase 1	Phase 2	Phase 3	TOTAL
Capacity	350 MW	350 MW	350 MW	1 050 MW
Duration of construction	42 months	30 months	30 months	102 months
Total investment (R'm)	R 12 000	R7 200	R7 200	R26 400
CAPEX (R'm)	R8 274	R4 964	R4 964	R18 202
CAPEX: local content (R'm)	R4 277	R2 566	R2 566	R9 410
Employment (FTE jobs/person-years)	2 900	1 800	1 800	6 500
Labour costs (R'm)	R427.7	R265.5	R265.5	R958.7

Source: Urban-Econ Development Economists (2015)

It is assumed that labour procurement patterns will follow the requirements as set by the Department of Energy (DOE) Request for Qualification and Proposal (RFP) guidelines. Table 10-2 therefore indicates that, based on total employment creation of 2 900 FTE job opportunities during the construction of phase one of the project, at least 522 of these opportunities must be offered to individuals from the local community.

Table 10-2: Labour procurement requirements for the construction of the power station and infrastructure component based on assumed FTE jobs to be created

Power station and infrastructure	Phase 1	Phase 2	Phase 3	TOTAL
Employment	2 900	1 800	1 800	6 500
Minimum South African based employees	1 595	990	990	3 575
SA employees who are black	870	540	540	1 950
SA employees who are white	1 160	720	720	2 600
SA employees who are women	290	180	180	650
SA employees who are from the local community	522	324	324	1 170

Source: Urban-Econ Development Economists (2015)

10.8.1.2 Operational phase assumptions

It is estimated that each phase of the power station (phase one to phase three), will have a project life of 30 years. Considering the expected construction timeframes and assuming that construction of different phases follow one after another, it can be assumed that phase two will become operational two and a half years after phase one, while phase three will become operational five years after phase one. It follows that the decommissioning of phase one will be done first, with decommissioning of phase two, two and a half years later; and phase three five years after phase 0ne was decommissioned.

When operating at full capacity, once construction of all three phases is completed and before decommissioning begins, the power station will generate an estimated 8 266 153 MWh of electricity on an annual basis, thus assuming that each phase will generate 2 755 384 MWh per annum. As is illustrated in Table 10-3, it is expected that the operating costs associated with this generating capacity will R2 967 million per annum (i.e. R989 million pa for each phase) and the derived average annual revenue will equate to R6 778 million; thus, the expected average annual Gross Operating Surplus (i.e. before tax, depreciation and other deductions) will be R3 812 million if all three phases of the project were developed.

It is envisioned that once phase one of the project component is operational, total employment will equate to about 450 employment positions, with 300 of these opportunities being permanent. Based on the industry average annual salary for the sector, the annual labour costs for phase one will be R276.6 million. At full capacity, once all three phases are operational, total employment will be 1 350 individuals (of which 300 opportunities are expected to be temporary).

Table 10-3: Power station and auxiliary infrastructure OPEX (constant 2015 prices)

Power station and infrastructure	Phase 1	Phase 2	Phase 3	TOTAL
Capacity	350 MW	350 MW	350 MW	1 050 MW
Annual electricity generated	2 755 384 MWh	2 755 384 MWh	2 755 384 MWh	8 266 153 MWh
Project life	30 years	30 years	30 years	
Total electricity generated (MWh)	82 661 527	82 661 527	82 661 527	247 984 581
Revenue (30 years) (R'm)	R67 782	R67 782	R67 782	R203 347
OPEX (30 years) (R'm)	(R29 666)	(R29 666)	(R29 666)	(R88 997)
Profit (30 years) (R'm)	R38 117	R38 117	R38 117	R114 351
Average annual revenue (R'm)	R2 259	R2 259	R2 259	R6 778
Average annual OPEX (R'm)	(R989)	(R989)	(R989)	(R2 967)
Average annual profit (R'm)	R1 271	R1 271	R1 271	R3 812
Employment (FTE persons-years)	450	450	450	1 350
Total labour costs (R'm)	R276.62	R276.62	R276.62	R829.86

Source: Urban-Econ Development Economists (2015)

As with the construction phase, the DOE's RFP has certain guidelines for labour procurement during the operational phase of the proposed project. As shown in Table 10-4, it is expected that during operations of phase one of the project, 90 FTE persons-year opportunities will be provided to individuals from the local community. At full capacity, the power station and auxiliary infrastructure will be supporting an estimated 270 local jobs.

Table 10-4: Labour procurement estimates during operations of the power station and ancilliary infrastructure as per DOE's RFP

Power station and infrastructure	Phase 1	Phase 2	Phase 3	TOTAL
Employment	450	450	450	1 350
Minimum South African based employees	383	383	383	1 148
SA employees who are black	180	180	180	540
SA employees who are white	225	225	225	675
SA employees who are women	90	90	90	270
SA employees who are from the local community	90	90	90	270

Source: Urban-Econ Development Economists (2015)

10.8.1.3 Decommissioning phase assumptions

It is estimated that the decommissioning of all the components of the Colenso Integrated Power Project will cost R400 million in 2015 prices in total, and will span three years. It is furthermore envisioned that 100% of the decommissioning costs will be spent in South Africa. With regard to the envisioned land use capability after rehabilitation, it is assumed that the area will follow natural land use patterns based on the area becoming significantly more economically self-sufficient over the project's lifespan.

10.8.2 Assumptions and limitations regarding land ownership

U-EDE consulted and interviewed the majority of landowners. Some of the landowners were interviewed telephonically; however, the landowners of Farm Varkens Fontein 1138 – Portion 19, and Farm Cromleybank 1146 – Portion 5, and Labuschagne's Kraal 1229 – Portion 1 could not be reached either by phone or during the U-EDE site visit. The information regarding socio-economic profile of each land parcel that forms part of the power station's and its ancillary infrastructure footprint is provided below.

Table 10-5: Land ownership associated with land possibly impacted by the power station and auxiliary infrastructure

Impacted land portions	Land use info	Stance on project
Proposed location of power station		
Schurfde Poort 1147 – Portion 1	Qubeka Community Trust – approximately 265 households located on the land	Supports the project. No agricultural activities taking place. Consultation revealed that relocation would not be favourable due to a fear of losing cultural heritage.
Proposed location of auxiliary infrastructure		
Tugela Drift 1062 - Remainder	Gugwini Community Trust – 55 households reside on the land	Supports the project. Commercial farming taking place. But not concerned, and do not believe that the project would have a big impact on them, have stated that they would relocate if needed and suitable land is provided.
Labuschagne's Kraal 1229 – Portion 10, 17, and Remainder	Nhlangwini-Gomba Community Trust – 44 households reside on the land	Supports the project. Only subsistence farming taking place. Previously commercial maize farming was taking place. Will relocate if required and suitable land is provided.

Impacted land portions	Land use info	Stance on project
Labuschagne's Kraal 1229 – Portion 1	Ekuthuleni Community Trust	Stakeholders could not be reached before submission of the report.
Varkens Fontein 1138 – Portion 19	Mr. Nkabinde Nqaba Refuge	Stakeholders could not be reached before submission of the report.
Cromleybank 1146 – Portion 5	Mr. Erwin Carl Alfred Wortman	Stakeholders could not be reached before submission of the report.
Cromleybank 1146 – Portion 7; Clapham Kloof 11318 – Remainder; Riet Bult 1213 – Portion 4	Esikhaleni Community Trust – 77 households reside on the land	Supports the project. No commercial activity taking place. Some subsistence farming. Have indicated that they would relocate if required and suitable land is provided.
Schurfde Poort 1147 - Remainder	Induna Community Trust – 300 to 400 households located on the land	Supports the project. Some subsistence farming taking place. No commercial agriculture, although previously there was. Relocation not an option – ancestors are buried on the land.

Source: Urban-Econ Development Economists (2015)

As indicated in Table 10-5, none of the potentially impacted land owners contacted are opposed to the project. The owners of the land demarcated for the proposed power station and some of the auxiliary infrastructure (Farm Schurfde Poort 1147 – Remainder) have, however, indicated that relocation would not be a desirable option for the people residing on these land parcels due to the fear of them losing cultural heritage. The results of the survey conducted by EcoPartners revealed that 7% of the survey respondents were concernedabout the impact the proposed power station and auxiliary infrastructure could have on the area's cultural heritage. The respondents though stated that if the process is managed adequately and their concerns as well as needs are taken into account, they could relocate to new areas.

The communities occupying the land earmarked for development of the auxiliary infrastructure have indicated that they are willing to relocate. The land owners potentially impacted by the auxiliary infrastructure have all indicated that they are in favour of the project and will relocate if required, assuming that suitable alternative land will be acquired.

Not taking into consideration those landowners who could not be interviewed, the majority of the impacted land is not used for any commercial agricultural activities, but is widely used for subsistence farming. The Farm Tugela Drift 1062 – Remainder was the only land parcel that mentioned that some commercial farming taking place on that land. The owner has, however, indicated that if relocated, the activities will be re-established.

It is, therefore, assumed that no loss in employment or production should result in the commercial agricultural sector from this component of the proposed project. As far as subsistence farming is concerned, if any relocation will take place, the need for land to continue with subsistence farming will have to be taken into consideration.

10.9 Noise Assessment

10.9.1 Limitations: Acoustical Measurements and Assessments

Limitations due to environmental acoustical measurements include the following:

- Ambient sound levels are the cumulative effects of innumerable sounds generated at various instances both far and near. A high measurement may not necessarily mean that the area is always noisy. Similarly, a low sound level measurement will not necessarily mean that the area is always quiet, as sound levels will vary over seasons, time of day, dependant on faunal characteristics (mating season, dawn chorus[11] early hours of the morning, temperature etc.), vegetation in the area and meteorological conditions (especially wind). This excludes the potential effect of sounds from anthropogenic origin;
- As mentioned above seasonal changes in the surrounding environment can change the measured soundscape. Many faunal species are more active during warmer periods than colder periods. Cicada is usually only active during warmer periods. Certain cicada species can generate noise levels up to 120 dB for mating or distress purposes, sometimes singing in synchronisation magnifying noise levels they produce from their tymbals[12];
- Defining ambient sound levels using the result of one 10-minute measurement may be very inaccurate (very low confidence level in the results) relating to the reasons mentioned above;
- Determination of noise sources of environmental significance are important factor to consider when compiling an environmental acoustical report;
- Measurements over wind speeds of 3 m/s could provide data influenced by wind-induced noises;
- Ambient sound levels recorded near rivers, streams, wetlands, trees and bushy areas can be high due to faunal activity which can dominate the sound levels around the measurement point (specifically during summertime, rainfall event or during dawn chorus of bird songs). This generally is still considered naturally quiet and accepted as features of the natural soundscape, and in various cases sought after and pleasing;
- Considering one or more sound descriptor or equivalent can improve an acoustical assessment. Parameters such as L_{Amin}, L_{AIeq}, L_{AFeq}, L_{Ceq}, L_{Amax}, L_{A10}, L_{A90} and spectral analysis forms part of the many variables that can be considered. The South African Legislation however is the L_{AIeq} setting, and must at all times be considered;
- It is technically difficult and time consuming to improve the measurement of spectral distribution of large equipment in an industrial setting. This is due to the many correction factors that need to be considered (e.g. other noise sources active in the

[11] Environ. We Int. Sci. Tech. *Ambient noise levels due to dawn chorus at different habitats in Delhi*. 2001. Pg. 134.

[12] Clyne, D. *"Cicadas: Sound of the Australian Summer, Australian Geographic"* Oct/Dec Vol 56. 1999.

area, adequacy of average time setting, surrounding field non-uniformity etc. [13] as per SANS 9614-3:2005);

- Exact location of a sound level meter in an area in relation to structures, infrastructure, vegetation, wetlands and external noise sources will influence measurements. It may determine whether you are measuring anthropogenic sounds from a receptors dwelling, or environmental ambient soundscape contributors of significance (faunal, roads traffic, railway traffic movement etc.); and
- As a residential area develops the presence of people will result in increased dwelling related sounds. These are generally a combination of traffic noise, voices, animals and equipment (incl. TV's and Radios). The result is that ambient sound levels will increase as an area matures.

10.9.2 Sound Propagation: Calculation and Impact Assessment Limitations

Limitations due to the calculations of the noise emissions into the environment include the following:

- Many sound propagation models do not consider sound characteristics as calculations are based on an equivalent sound power level. These include intrusive sounds (such as reverse alarms) or amplitude modulated sounds (such as from fans);
- Sound propagation models do not calculate the increase of the ambient sound levels due to wind shear (masking noise);
- Most sound propagation models do not consider refraction through the various temperature layers (specifically relevant during the night-times);
- Most sound propagation models do not consider the low frequency range (third octave 16 – 31.5 Hz). This would be relevant to facilities with a potentially low frequency issues;
- Many environmental models consider sound to propagate in hemi-spherical way. Certain noise sources (e.g. a speakers, exhausts) emit sound power levels in a directional manner;
- The octave sound power levels selected for processes and equipment accurately represents the sound character and power levels of processes/equipment. The determination of these levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;
- Sound power emission levels from processes and equipment change depending on the load the process and equipment is subject too. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load. Normally these measurements are collected when the process or

[13] SANS 9614-3:2005. "Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning".

equipment is under high load. The result is that measurements generally represent a worse-case scenario;

- As it is unknown which processes and equipment will be operational, modelling considers a scenario where all processes and equipment are under full load 100% of the time. The result is that modelling over-estimate noise (rating) levels;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify; and
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. 50% soft ground conditions will be modelled as the area where the operation is taking place is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions;

Due to these assumptions modelling generally could be out with as much as +10 dBA although realistic values ranging from 3 $\leq$ 5 dBA[14] is more common in practice.

10.10 Visual Assessment

The visual assessment was undertaken during the planning stage of the project and is based on information available at that time. Information supplied by the project proponent included maps, drawings, reports and Shape files indicating the likely placement of the project components, and the proposed project activities/infrastructure. In some instances detailed spatial data was not available (i.e. exact alignment of coal conveyor belts) and only assessment corridors were provided. The detailed drawing of the power station and its components was not spatially referenced and the consultant focused instead on the site footprint as supplied.

10.11 Traffic

During construction the materials and equipment it is assumed could be routed to the site via various routings, through Colenso town from the R103 and R74 or to the east of the town via a gravel road off the R74.

There are no permanent counting stations on the R74 in the vicinity of Colenso however it is assumed that that the traffic volumes along this road will be lower than on the R103. Both of these roads carry low volumes of traffic however the percentage heavies indicated on the R103 is high.

Trip Generation Rates do not exist for mining operations and associated activities based on the DoT's South African Trip Generation Rates, 2nd Edition, 1995. Therefore the Trip Generation was calculated based on employee figures received from EcoPartners and based on typical traffic generation assumptions relating to similar operations.

It was assumed that most of the employees will stay in Colenso or surrounding towns.

[14] Noise from an operation is normally over-estimated rather than under-estimated. Monitoring during the operational phase can assist in the calibration of the model to improve modelling values should this be required.

It is estimated that 2 900 people will work on the powers station site during the construction of Phase 1. It is estimated that approximately 5% (±145) of the employees will come to the site with their own or company vehicles. It is assumed that the remaining 2 755 employees will be transported by buses with an average capacity of 65 which will require around 45 bus trips. If employees work in shifts these numbers will be the same but spread throughout the day which would allow for buses to make more than one trip per day. Therefore during Phase 1 approximately 190 vehicles will move to/from the construction site on a daily basis.

As soon as Phase 1 is completed the construction employees will drop to 1 800 plus the 450 staff members who will be employed by Phase 1. It is estimated that 10% (45) of the Phase 1 staff members will drive to/from work in their own vehicles. For the construction of Phase 2 the same assumptions were taken with 5% (±90) employees using their own vehicles while the remaining 1 710 employees will travel via bus. Therefore during the construction of Phase 2 approximately 135 private vehicles and 27 bus trips will be made to and from the power station.

During Phase 3, the construction employees will stay the same while an additional 450 staff members will join the Phase 1 workforce to work on Phase 1 and 2 once commissioned. Assuming the same rationale as above it is estimated that approximately 335 vehicles will be using the road on a daily basis to get to/from the site.

It was assumed that most employees will stay close to Colenso.

10.12 Heritage Assessment

Limitations to the assessment is related to time and accessibility. Limited time available makes it difficult to cover such a large area in its entirety, and the focus was therefore to a large extent on visiting easily accessible areas and areas suitable for human habitation and settlement. The Heritage Specialist Team also concentrated on areas such as erosion dongas, unnatural clumps of trees and vegetation, the foothills of ridges and larger hills and saddles in between hills, where evidence of human utilization would more easily be visible. As a result of very dense vegetation in certain sections there were sections that could not be covered by vehicle or by foot. It is therefore possible that more sites than those physically recorded could be present in the study area. However, aerial images (Google Earth) assisted in determining the localities of more archaeological and historical sites and is indicated on the Site Maps/Images of the area.

11 SPECIFIC INFORMATION

11.1 Competent Authority

The Department of Environmental Affairs in their letter indicating that they are satisfied with the Scoping Report and with The Plan of Study for EIA a acceptance letter dated 7 July requested that the following additional information are required in the Environmental Impact Report (Refer Appendix B).

a) Details of the future plans
    - for the site and infrastructure after decommissioning in 20-30 years
    - and the possibility of upgrading the proposed infrastructure to more advanced technologies.

b) The total footprint of the proposed development should be indicated. Exact locations of the coal fired power station, and associated infrastructure should be mapped at an appropriate scale.

c) Should a Water Use License be required, proof of application for a license needs to be submitted.

d) Possible impacts and effects of the development on the vegetation ecology with regard to lowland-highland interface in the locality should be indicated.

e) The impacts of the proposed facility on avifauna and bats must be assessed in the EIA phase.

f) Possible impacts and effects of the development on the surrounding industrial area.

g) The EIR should include information on the following:
    - Environmental costs vs benefits of the coal fired power station; and
    - Economic viability of the facility to the surrounding area and how the local community will benefit.

h) Information on services required on the site, eg. sewage, refuse removal, water and electricity. Who will supply these services and has an agreement and confirmation of capacity been obtained?

A construction and operational phase EMP to include mitigation and monitoring measures.

Should blasting be required, appropriate mitigation measures should be provided.

11.1.1 Future Plans

The power station is a catalyst for Social and Economic Development activities and so any future plans will involve activities that improve the lives of the local communities. These activities are still being developed and will be developing as the construction and operation of the power station contribute to the local economy.

After decommissioning, the entire infrastructure will be removed unless there is a feasible case for leaving parts of the infrastructure in place – such as sewage and water facilities.

The possibility of upgrading the proposed infrastructure to more advanced technologies does exist, as the more advanced technologies are made firm. There is also the possibility of testing more advanced technologies on site.

11.1.2 Total Footprint

The total footprint of the proposed development is presented in Appendix P. The footprint of the preferred alternative consists of:

Area for Power station	87.6 ha (excluding ash stockpile)
Dump	9 ha
Road Servitude	37.3ha
Road buffer	185 ha

(Siding - 118 ha; Staging - 60 ha; sub-station - 20 ha)- This does not form part of the application, but is included for reference.

11.1.3 Proof of Water Use Licence Application

The proof of the submission of the Water Use Licence will be included in the Final EIR.

11.1.4 Effects on the vegetation ecology - lowland-highland interface

The possible impacts on the vegetation are included in the vegetation impact description presented in Section 5.8.1 of the report. Although the proposed site is located in transition zones, the impact on vegetation ecology is expected to be low.

11.1.5 Impacts on Avifauna and Bats

11.1.5.1 Avifauna

David Allan, Curator of Birds at the Durban Natural Science Museum, was appointed to assess the possible impacts that the proposed development could have on birds. The Avifauna Impact Assessment report is attached as Appendix O.

The assessment indicated that the primary avifaunal habitats in the project area comprise mainly woodlands, with some grassland, and some scattered small farm dams. Several cliffs used by cliff-nesting bird species are present on, or close to, the project area.

The avifaunal analysis was based on data from the First and Second Southern African Bird Atlas Projects and from two days spent in the field in the project area.

The primary issues for consideration were the displacement of birds by habitat loss and disturbance, and potential collisions of birds with overhead power lines. Red Data birds were the key focus species.

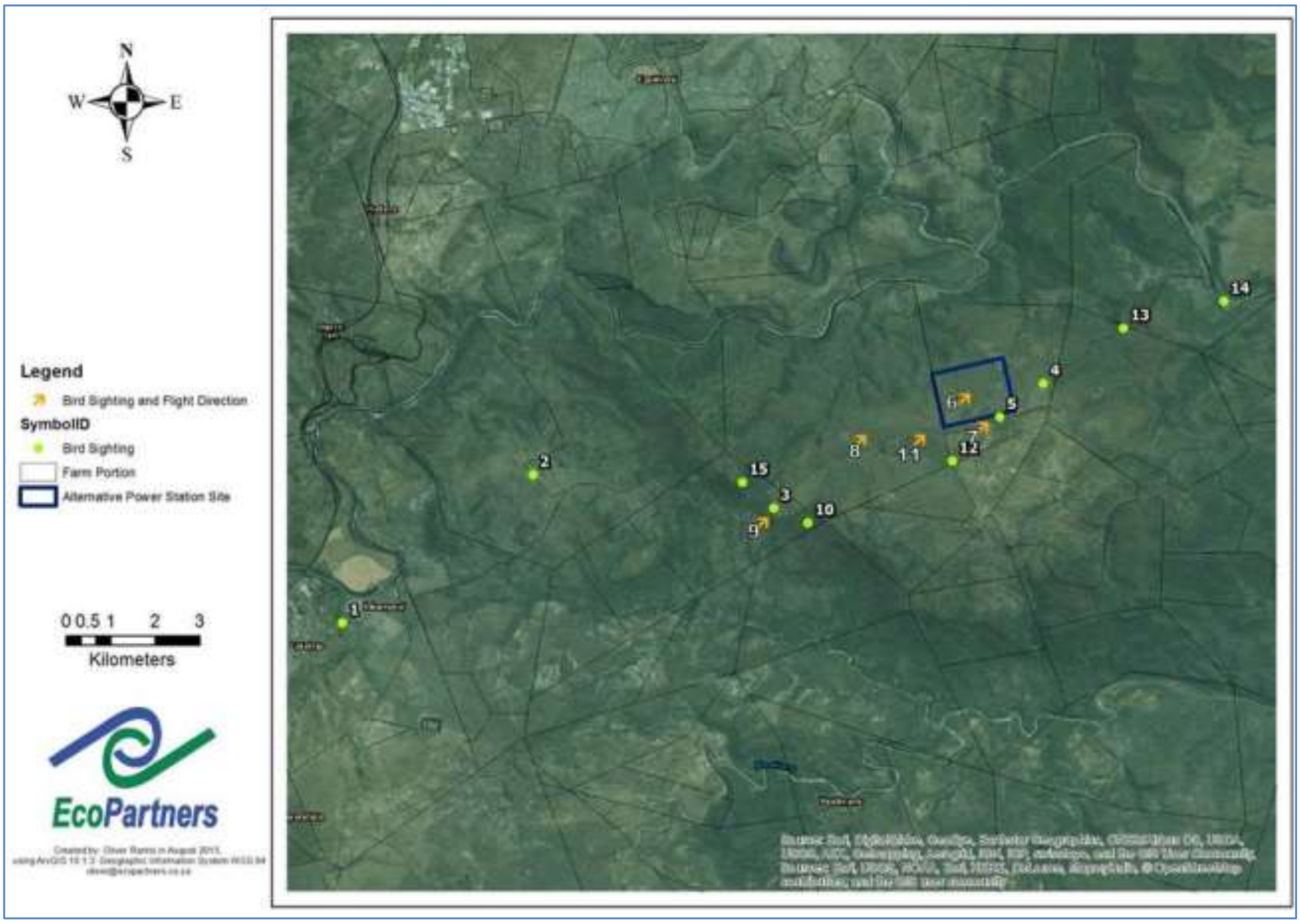
Eighteen Red Data bird species may occur at least occasionally in, or close to, the project area and the presence of four of these (White-bellied Korhaan, Lanner Falcon, Southern Bald Ibis and Black Stork) was confirmed during the field surveys. The field surveys resulted in 17 records of these four species at 15 localities in, or close to, the project area (Refer Table 11-1 and Figure 11-1). The White-bellied Korhaan was found close to the proposed power station site, *no nesting sites were found*. This species can be expected to be totally displaced from the proposed power-station site should these developments proceed. Southern Bald Ibises were found to have a major flight path passing directly over the eastern part of the project area between their breeding and foraging areas and was observed flying over the proposed site. All four of these Red Data species are vulnerable to collisions with overhead power lines.

Table 11-1: Details of records of the four Red Data bird species recorded in the project area and immediately adjacent areas

Sighting locality no.	Date	Red Data bird species	Details
1	8 Aug. 2015	Southern Bald Ibis	5 foraging in natural grassland
2	8 Aug. 2015	Southern Bald Ibis	1 perched on wooden power pylon
3	8 Aug. 2015	Lanner Falcon	Pair of adults perched on wooden pylon below Monte Cristo
4	8 Aug. 2015	White-bellied Korhaan	Heard calling
5	8 Aug. 2015	Lanner Falcon	1 adult perched
6	8 Aug. 2015	Southern Bald Ibis	3 flying towards north-east
7	8 Aug. 2015	Southern Bald Ibis	1 flying towards north-east
8	8 Aug. 2015	Southern Bald Ibis	2 flying towards north-east
9	10 Aug. 2015	Southern Bald Ibis	3 flying through Cingolo Nek towards north-east
10	10 Aug. 2015	Lanner Falcon	1 juvenile perched
11	10 Aug. 2015	Southern Bald Ibis	2 flying towards north-east
12	10 Aug. 2015	White-bellied Korhaan	Group of 3 flushed
13	10 Aug. 2015	Lanner Falcon Southern Bald Ibis Black Stork	Pair of adults at cliff, likely breeding At least 3 visible on cliff, likely breeding 1 at nest on cliff
14	10 Aug. 2015	Southern Bald Ibis	At least 20 on cliff likely breeding
15	10 Aug. 2015	Lanner Falcon	Pair of adults flying in front of cliff on Monte Cristo, likely breeding, and chasing a juvenile

Source: David Allan, Avifaunal Report (2015)

Figure 11-1: Localities of records of the four Red Data bird species found in the project area



Source: Adapted from David Allan's Avifaunal Assessment (2015)

This assessment also investigated the situation relevant to water-bird populations associated with five small farm dams in the area, although these are largely not of significant avifaunal concern.

The most important avifaunal issue relevant to the proposed power-station development relates to habitat loss and the resultant displacement of the White-bellied Korhaan population, estimated at 10-12.5 birds maximum, currently present near the site. This impact cannot be mitigated and can only be avoided (by abandoning or re-locating these two developments) or offset. Whether it comprises a 'fatal flaw' to the development seems unlikely though, due to the relatively small number of individual birds involved.

The most significant avifaunal issue relevant to the proposed power lines is the potential collision risk to the Southern Bald Ibises especially in the eastern section of the power-line route. This risk can be mitigated and the risks minimized by re-configuring and re-routing the power-line corridor in this area.

Of the two power-line route options considered (essentially relevant only to the western half of the route though, as both current options share the same corridor in the east) the northern option is preferred and the reasons for this are presented. It is recommended that the entire length of power line (northern option) from the power station to the link with the existing 275 kV lines should be marked or, at very least, the length of line between the power station and a point 1 km west of where the line passes through Cingola Nek should be marked.

Summary of recommendations

The assessment provided the following key recommendations relevant to avifaunal issues related to the proposed development, i.e. the proposed power-station and ash dump development and associated power lines, should these developments be pursued:

- The issue of potential offset measures to compensate for habitat lost by White-bellied Korhaans as the proposed power-station and ash-disposal site should be decided on.
- The proposed northern power-line route option should be selected relevant to the western part of this line.
- Relevant to the single proposed eastern power-line corridor, a potential re-configuration and re-routing to the south of the currently proposed routing should be investigated.
- The entire length of power line from the power station to the link with the existing 275 kV lines should be marked or, at very least, the length of line between the power station and a point 1 km west of where the line passes through Cingola Nek should be marked.
- A monitoring programme should be implemented post construction to determine the position with bird collisions along the marked stretch of power line, i.e. regular searches for bird carcasses along this stretch, focusing in particular on Red Data bird species.

Please note that the route determination and development of the transmission lines is outside the scope of this application. A separate application will be made by Eskom once they have determined and confirmed the route and grid connections.

11.1.5.2 Bats

Animalia Zoological & Ecological Consultation CC was appointed to assess the possible impacts that the proposed development could have on bats. The Bat Sensitivity Study is attached in Appendix O.

The site has a variety of features that can and does contribute to the ecology of bats in the area. These features are as follows.

- Visual confirmation has been made of bats utilizing the house building just east of the farm dam as a roost, since observations have been made of bats leaving the house roof at dusk. to bats.
- The eastern corner of the site is dominated by a seasonal water draining line flowing towards the Thukela River. A farm dam with accessible surface water is present in this drainage line. .
- The western side and the center of the site consist of grassland with clumps of woody Acacias that thickens to a denser woodland area in the south and south west.

- No fruiting trees that can be utilised by fruit bats have been observed on site.

Miniopterus natalensis

Miniopterus natalensis, also commonly referred to as the Natal long-fingered bat, occurs widely across the country but mostly within the southern and eastern regions and is listed as Near Threatened (Monadjem et al. 2010).

This bat is a cave-dependent species and identification of suitable roosting sites may be more important in determining its presence in an area than the presence of surrounding vegetation. It occurs in large numbers when roosting in caves with approximately 260 000 bats observed making seasonal use of the De Hoop Guano Cave in the Western Cape, South Africa. Culverts and mines have also been observed as roosting sites for either single bats or small colonies. Separate roosting sites are used for winter hibernation activities and summer maternity behaviour, with the winter hibernacula generally occurring at higher altitudes in more temperate areas and the summer hibernacula occurring at lower altitudes in warmer areas of the country (Monadjem et al. 2010).

Mating and fertilisation usually occur during March and April and is followed by a period of delayed implantation until July/August. Birth of a single pup usually occurs between October and December as the females congregate at maternity roosts (Monadjem et al. 2010; van der Merwe 1979).

The Natal long-fingered bat undertakes short migratory journeys between hibernaculum and maternity roosts. Due to this migratory behaviour, they may be at lesser risk of fatality from the construction of the power station depending on the time in which the construction takes place and if it coincides with them being in that general area. Very little is known about the migratory behaviour and paths of *M. natalensis* in South Africa with migration distances exceeding 150 kilometres. If the site is located within a migratory path of the Natal long-fingered bat precaution should be taken to ensure that construction does not occur while large quantities of *M. natalensis* are present.

A study by Vincent et al. (2011) of the habitat preference for foraging activities of *M. schreibersii* in Southern France showed that urban areas were the most used habitat category (54.0%), followed by open areas (19.8 %), woodlands (15.5%), orchards and parks (9.1 %), and water bodies (1.5 %). On a finer scale, urban areas and deciduous or mixed woodlands were preferred as foraging habitats (types of artificial lighting effects were unmeasured in the urban areas during this study), followed by crops and vineyards, pastures, meadows and scrublands bordered by hedgerows or next to woodland, orchards, parks and water bodies (Vincent et al. 2011). Similar preferences for habitat use and foraging activities of *M. natalensis* in South Africa are expected. Therefore areas of wooded and agricultural habitats were prioritised in the sensitivity maps as *M. natalensis* has a higher vulnerability to mortality in these areas.

Tadarida aegyptiaca

The Egyptian Free-tailed Bat, *Tadarida aegyptiaca,* is a Least Concern species as it has a wide distribution and high abundance throughout South Africa, and is part of the Free-tailed bat family (Molossidae). It occurs from the Western Cape of South Africa, north through to

Namibia and southern Angola; and through Zimbabwe to central and northern Mozambique (Monadjem et al. 2010). This species is protected by national legislation in South Africa (ACR 2010).

They roost communally in small (dozens) to medium-sized (hundreds) groups in caves, rock crevices, under exfoliating rocks, in hollow trees and behind the bark of dead trees. *Tadarida aegyptiaca* has also adapted to roosting in buildings, in particular roofs of houses (Monadjem et al. 2010). Thus man-made structures and large trees on the site would be important roosts for this species.

Tadarida aegyptiaca forages over a wide range of habitats, flying above the vegetation canopy. It appears that the vegetation has little influence on foraging behaviour as the species forages over desert, semi-arid scrub, savanna, grassland and agricultural lands. Its presence is strongly associated with permanent water bodies due to concentrated densities of insect prey (Monadjem et al. 2010).

The Egyptian Free-tailed bat is highly abundant and the species is widely distributed, high mortality rates due to the construction of the power station would be a cause of concern as these species have more significant ecological roles than the rarer bat species.

After a gestation of four months, a single young is born, usually in November or December, when females give birth once a year. In males, spermatogenesis occurs from February to July and mating occurs in August. Maternity colonies are apparently established by females in November.

Neoromicia capensis

Neoromicia capensis is commonly called the Cape serotine and has a conservation status of Least Concern as it is found in high numbers and is widespread over much of Sub-Saharan Africa.

High mortality rates of this species would be a cause of concern as N. capensis is abundant and widespread and as such has a more significant role to play within the local ecosystem than the rarer bat species. They do not undertake migrations and thus are considered residents of the site.

It roosts individually or in small groups of two to three bats in a variety of shelters, such as under the bark of trees, at the base of aloe leaves, and under the roofs of houses. They will use most man-made structures as day roosts which can be found throughout the site and surrounding areas (Monadjem et al. 2010).

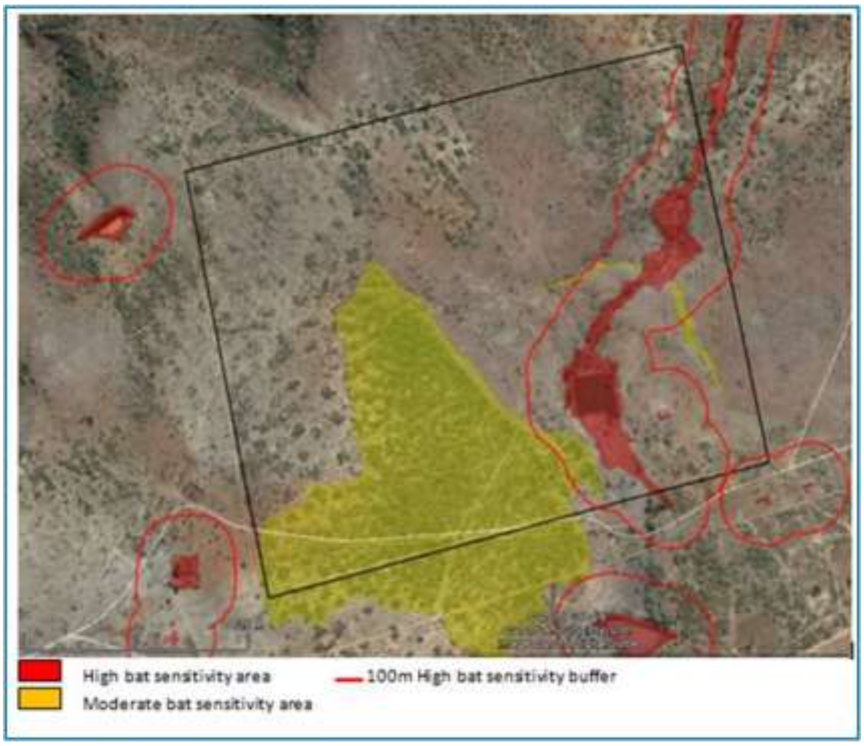
They are tolerant of a wide range of environmental conditions as they survive and prosper within arid semi-desert areas to montane grasslands, forests, and savannas; indicating that they may occupy several habitat types across the site, and are amenable towards habitat changes. They are however clutter-edge foragers, meaning they prefer to hunt on the edge of vegetation clutter mostly, but can occasionally forage in open spaces.

Mating takes place from the end of March until the beginning of April. Spermatozoa are stored in the uterine horns of the female from April until August, when ovulation and fertilisation occurs. They give birth to twins during late October and November but single pups, triplets and quadruplets have also been recorded (van der Merwe 1994 and Lynch 1989).

The passive bat detector at the dam recorded the highest bat activity and diversity, followed by the detector located in the wooded area. The detector set up in open grassland terrain with a slightly higher elevation showed the lowest levels of bat activity.

A sensitivity map was drawn up indicating potential roosting and foraging areas (Figure 11-2). Construction within the Moderate bat sensitivity areas are allowed, but discouraged if other options feasible are available. No construction is allowed within High bat sensitivities and their buffers. The High Bat Sensitivity areas are expected to have elevated levels of bat activity and support greater bat diversity.

Figure 11-2: Bat sensitivity Map



Source: Animalia, Bat Sensitivity Report (2015)

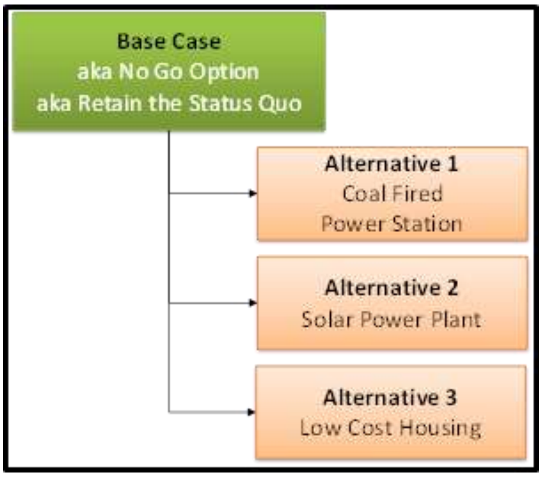
11.1.6 Impacts and effects on Surrounding Industrial Area

The possible impacts of the proposed development on the surrounding industrial area are included in the Socio-Economic impact description presented in Section 9.12 of the report.

11.1.7 Environmental Costs vs Benefits

A Cost Benefit Model (CBM) was developed by EcoPartners (2015) and is attached in Appendix O. The CBM was developed for a base case (the No-Go option) and three alternatives. These alternatives were to establish a Coal Fired Power Station, establish a Solar Plant with the same output as the coal fired power station and to use the area for low cost housing (refer Figure 11-3).

Figure 11-3: Alternatives considered in the CBM



Source: EcoPartners, Cost Benefit Model (2015)

In its planned form the area where the power station is to be built will be approximately 100ha. This includes an allocation for a 71ha fly ash dump to be built on the site. By comparison, to develop a solar farm of the same output, 1050MW, an area of 4,200ha will need to be cleared and sterilized to develop that.

The coal fired power station has several innovations which are designed to reduce its environmental footprint. Foremost, this power station will utilise the higher grade anthracitic coal, prevalent in the KwaZulu-Natal region. This is a better grade coal to that utilised by Eskom, which is largely a lower grade bituminous coal. The calorific value and emissions of the anthracite is expected to be lower. In addition, the use of three emission control mechanisms will reduce the harmful emissions. An additional feature of the plant is that it will be air cooled so this will remove the need to extract cooling water from the nearby Tugela River.

Currently South Africa is facing an electricity shortage. The load shedding experienced in the country is an outcome of South Africa having electricity supply lower than demand. To assist in its electricity supply Eskom has invested in solar and wind projects as well as it continues to run a series of Open Cycle Gas turbines (OCGT) which consume diesel. This OCGT generated electricity is known to be the most expensive electricity available in South Africa (close to R2.50/kWhr) and it is hoped that the solar and wind generated electricity will increase to offset this high cost electricity. Wind and Solar electricity is known to be substantially more expensive than coal generated electricity. The Colenso Coal Fired Power Plant can be utilised to produce base load or peak load.

11.1.7.1Findings

Of the three alternatives modeled, it was found that the Solar Power Plant was flawed due to the following: It had a negative Net Profit Value (NPV), the cost of land was too high; and the capital costs are very high. The project would require deep subsidization by government, by as much as R79-billion, for it to proceed. The cost-benefit ratio of the Solar Power Plant was calculated at 0.55

Two Go-options were assessed further and through a process of investigating the NPV and conducting a Multi Criteria Analysis (MCA). The MCA looked at four variables of importance which were the capital outlay (investment required to initiate the project), the projects capacity to support and drive economic diversification (the ability to attract or support large, diverse activities that strengthen the economy), the time it would take to develop, and the ability of the project to create short and long term employment. It was found that the Low Cost Housing alternative had a positive NPV and a positive Cost-Benefit ratio (118%). This alternative though did not score very high on economic diversification and its overall contribution to the economy. It also scored low in the creation of meaningful long term employment.

The Coal Fired Power Station alternative was found to have a positive NPV, it had a high cost-benefit ratio (144%) and was an important contributor towards long term employment and was an important catalyst in economic diversification in the immediate area and nationally. The preliminary recommendation was that the Coal Fired Power Station be advanced as a Preferred Alternative.

Improvements were considered to the Coal Fired Power Station to assess whether the apparent negative impact on climate change can be decreased. It was found that by using a higher grade of coal; using multiple emission control devices and making a significant contribution towards carbon tax, the project could lessen its impact.

11.1.7.2 Recommendation

It is recommended that the Power Station plant be developed with the following abatement method:

- The power plant design be confirmed for high grade coal (such as anthracite) with lower CO_2 emissions;
- That the design incorporate emission reducing technology;
- That the plant design looks towards lessening its need for water abstraction;
- The size of the waste storage facility (the fly ash dump) be reduced or eliminated in its entirety through various mitigation measures. In this study it is suggested that the fly ash be used as a pozollic binder in the manufacture of bricks which is then on-sold in the area. Taken together, this enhanced method of the Coal Fired Power Station will have an improved impact on the environment, on the economy and provide an improved NPV within the national economy.

This report shows clearly that there is a need for a project such as this and even though it has some detrimental effects, it represents a net benefit to the economy, the country as well as the region where it is planned to be built. The Preferred Alternative, a Coal Fired Power Station at Colenso, is therefore socially and economically desirable.

11.1.8 Economic Viability - Surrounding Area & Community

The possible impacts of the proposed development on the surrounding area and possible benefits to communities are included in the Socio-Economic impact description presented in Section 9.12 of the report.

11.1.9 Information on services required on the site

Colenso Power (Pty) Ltd intends entering into a Public Private Partnership (PPP) with the district municipality and local municipality for services provided by the municipality or district (as appropriate). Council approval for the water supply PPP have already been obtained and is going through the relevant processes with national government. A similar arrangement for sewage and refuse removal will be presented to the relevant municipality in the near future (provisional date is set for 28 August).

11.2 Other Information

11.2.1 Climate Change

August 1997 the Republic of South Africa joined the majority of countries in the international community in ratifying the United Nations Framework Convention on Climate Change (UNFCCC) .

11.2.1.1 What is Climate Change

Climate change is the long term change in climatic conditions across the earth. These would include temperature, rainfall, and evaporation and thereby also have an impact on biome distribution. The time scale which is being considered significant for climate change is considered to be approximately 30 year timeframes and above[15]. Anything shorter is merely considered normal changes to weather.

There is a popularly accepted postulation that CO_2 is the main driver for climate change. There is also a global debate about which is more liable for CO_2 emissions, anthropogenic contributions or non-anthropogenic. When turning our attention to anthropogenic sources of CO_2 it is the coal fired power stations which stand out as the most significant contributors.

What is important to consider is that coal fired sources of electricity are cheaper. In South Africa solar energy is considered to be a replacement for the most expensive electricity generated, diesel fired OCGT turbines where the electricity cost is about R2.85/kWhr This compares very unfavorably for the much cheaper coal generated electricity, often sold to end users at the R0.90/kWhr level.

The issue then to consider is what the alternatives to ameliorate CO_2 emissions are.

Internationally the following four levers are considered significant to reduce emissions:

- Utilising better quality coal;
- Reducing emissions from the power plant;
- Utilising penalties such as carbon-taxes to influence emissions and
- Carbon sequestration.

Of the above interventions the following are considered at the Colenso Power Project:

- Anthracite is the feedstock for the plant. This is the highest grade of coal available.

[15] https://www.science.org.au/publications/scienceofclimatechange-q-and-a-2015/what

- The emissions from the plant are being addressed by using an improved scrubber system[16].
- Carbon taxes have been considered in the CBA model and the project can remain viable.
- No sequestration is being considered at this time.

If the power station is not built then the following will likely transpire:

- Electricity costs in South Africa will increase, whether through lower electricity availability or through the supply of higher cost electricity. The poor of South Africa cannot afford this.
- If communities revert to supplying their own energy needs then the biodiversity over vast areas becomes destroyed as firewood and other biomass is collected for domestic burning. These areas where collection takes place can quickly become larger than the footprint of the power station.
- Burning wood fires and other biomass fires indoors, or even the use of paraffin stoves lead to an increase in respiratory problems.

Climate Change is leading to a change in how businesses respond to consumer pressures. This means that businesses will be required to invest in more environmentally effective technologies and run their businesses better.

In this instance there are several interventions which makes the Colenso Power Station operation a lower CO_2 emitter.

Looking at a wider context, the impact of climate change on the power station can be economically detrimental if it is not managed and mitigated. Important would be the pricing levels of electricity from the Power Station to the 1st tier consumer (Eskom) and then onwards to the final consumer (the Public).

[16] The project proponent reports that they will use a FGD (<147 SO_2 (mg/Nm^3 under normal conditions of 10% O_2, 273 Kelvin and 101.3 kPa), Denitrification (<147 NOx expressed as NO_2 (mg/Nm^3 under normal conditions of 10% O_2, 273 Kelvin and 101.3 kPa), and High Frequency Power Electrostatic Precipitator (<20 PM (mg/Nm^3 under normal conditions of 10% O_2, 273 Kelvin and 101.3 kPa).

12 ENVIRONMENTAL IMPACT STATEMENT

12.1.1 Summary of Findings

12.1.1.1 Geology

There are little to no major geological structures or abrupt changes in geology of the area identified for the power plant and ash dump sites. There seems to be a higher concentration of notable structures further north of the sites. This could also be ascribed to the flat topography as well as alluvial cover that occur in some parts of the power plant and ash dump area.

Three dolerite sills exist below the power plant site as well as layered Karoo sedimentary rocks consisting mostly of sandstone, with minor layers of grit, shale and mudstone. The sedimentary rock and dolerite sill intrusions directly below the power plant are very solid with little to no water bearing fractures. There is little to no deep weathering that could form conduits for groundwater movement and major aquifers.

Finding 1: The power plant site is underlain by solid sedimentary rock and dolerite sill intrusions. There is little to no water bearing features.

Finding 2: There is little to no deep weathering that could transport groundwater.

Finding 3: There are no major aquifers directly below the selected power station site. (Site alternative 2: Preferred option).

Finding 4: The groundwater contamination underneath the ash dump (worst case scenario) will not contribute to a pollution plume that can affect the Thukela River or any drainage line in the area, provided the recommended mitigation measures are implemented.

12.1.1.2 Topography

At the site identified for the power station, the high-ground forms a plateau bounded by hills (escarpments) on all sides where the mountainous terrain evens out on top. There is a small section where the access road cross onto the plateau. The natural lie of the land will be altered from the structures associated with the proposed power station (coal stockpiles, ash stockpile, ash dump).

Note that should the Preferred Alternative be followed, the ash stockpile will be reduced to an area covering only 9ha, which will be depleted by the end of life of the power station. Should the preferred option not be followed the ash dump will remain a permanent feature and form part of the future topography of the area.

The change in topography could lead to the siltation of drainage lines, as steeper topography contributes to more run-off. This impact can effectively be mitigated by the construction of storm water control facilities.

Finding 5: The ash dump will alter the topography of the land, the visual impact is mitigated due to the plateau bounded by hills (escarpments) on all sides, except where the access road crosses onto the site.

Finding 6: The steeper slopes of the ash dump will alter the topography contributing to the siltation of drainage lines, this can be mitigated by constructing effective stormwater control facilities.

12.1.1.3 Air Quality

An amount of 1066.08 Tonnes CO_2 -eqt emissions per year due to the production of 1050 MW electricity was estimated for Colenso power station. This value only provides a rough estimation and does not take into account all other direct GHG emission sources.

The maximum predicted 99th percentile daily dust fallout concentration due to the construction of the power station is in compliance with the applicable South African dust fallout standards.

The maximum predicted 99th percentile hourly CO concentrations, NO_2 concentrations, maximum predicted annual NO_2 concentrations, 99th percentile hourly and daily SO_2 due to stack emissions are in compliance with the South African air quality standard.

The maximum predicted 99th percentile daily dust fallout, PM_{10} and $PM_{2.5}$ concentrations due to operations at the power station and coal mine exceeded the South African standard and WHO air quality guideline.

No sensitive receptors were identified to fall within the exceedance zones. Maximum concentrations were recorded less than 50 m from the sources and fell within the power station boundary

12.1.1.4 Groundwater

The groundwater table directly below the proposed power plant and ash dump site can be expected around 20 mbgl. Regional groundwater levels which mimic surface topography, results in regional groundwater flow towards the south east. The power plant and ash dump site is located on a surface and groundwater divide. Borehole yields in the study area are relatively low. It is evident from hydro chemical results that groundwater in the direct vicinity of the proposed power plant site is of marginal to poor quality for drinking water purposes. Only one borehole 1.2km east of the site has good water quality.

During construction minimal impacts on the groundwater system are expected. The possible plume due to the plant and associated infrastructure has been simulated for a 25 year life time. It is clear from the simulated plume that pollution will not reach the Thukela River and that two artificial wetlands and two boreholes that are not in use, will be impacted.

12.1.1.5 Soils, Land Use and Land Capability

None of the soils on the Power Station site have a high degree of agricultural potential. The expected impacts in terms of loss of agricultural land will not be great.

Due to the prevalence of potentially erodible soils on site and in the vicinity, unnecessary vegetation removal and/or excavations should be avoided, and all reasonable soil conservation measures (contouring, culverts etc) should be used where necessary.

12.1.1.6 Biodiversity

Overall, the site of the proposed development is of relative low conservation and biodiversity value, as evidenced by high levels of disturbance and various signs of human-mediated transformation/degradation. The almost total lack fauna species that are generally readily observed may be construed as a conclusive indicator that the integrity of the faunal life in the area is low. The *in situ* conservation status of the study area is low primarily due to anthropogenic influences.

Despite the relatively low overall biodiversity value of the site and therefore the low risk of significant environmental impacts, some highly disturbed areas are preferred for development over other less-disturbed areas within the proposed site. The adjacent area within the site still has reasonable grass cover and limited bush encroachment and less extensive signs of erosion, overgrazing and transformation. The only portion to be protected (as a NEMA-based obligation) is the stream (drainage line) and associated features, together with a 32 m buffer on either side of the system.

The man-made dam and associated drainage channels were identified as having high sensitivity for bats and no development should be allowed within these areas and the associated 100m buffer.

Note that the preferred option recommends development in the degraded areas and recommends that the development to be located 150 m from the stream (drainage line).

12.1.1.7 Surface Water

General surface water quality is good with a standard of water of less than 1 000 mg/l (Class 1). The 100 m buffer is accepted as the exclusion zones around all watercourses.

Only a conceptual layout plan of the Power Plant is available which does not contain detail on the geographical placement and/or the dimensions of associated infrastructures. Typical infrastructure associated with coal fired power stations were utilised to show the intent of the applicant to separate clean and dirty water from different infrastructure components associated with a coal fired power plant.

An external water source is most probably required to supply the operations with process water during the first few years of operation and possibly has to be available as emergency measures when rainfall expectations are not met throughout the life of mine.

The quantification of risk associated with the potential impacts when considering different phases of development indicated that the high risk that were identified (mainly associated with construction phase) can effectively be mitigated to **Moderate - Low**.

12.1.1.8 Socio-Ecomomic

The local government has recognised the importance of the manufacturing sector as well as agriculture and tourism, in driving growth and development in the region. The region requires an injection, specifically when considering the high level of unemployment, low literacy and lack of service delivery close to the proposed project site. Consultation with the local municipal authorities revealed that efforts have been made to stimulate the local industrial sector in the region by the development of industry estates.

Some of the more prominent negative impacts include the potential loss in the tourism and game hunting industry and the possible effects on the demographics and scenic nature of the environment. The area is also home to a host of heritage resources of national importance. Mitigation measures do exists, and they will be able to decrease the significance of most of these negative impacts, if implemented as recommended.

Regardless, the positive impacts for the project area far outweigh the negatives since the much needed injection into the local economy will stimulate local production, job, creation and government revenue. In addition to this the developers will commit to further investment into the local community through the SED and ED initiatives.

On a national level the project will assist government in its goal of job creation and uplifting of previously disadvantaged and marginalised communities. More importantly, however, it will contribute towards national energy security, which is vital for the country's economy.

12.1.1.9 Noise

A potential for a noise impact during the construction phase was identified, with this impact being of high significance. This relates to both the day and night-time scenarios. The significant noise impact is due to the proximity of numerous potential noise-sensitive receptors staying close to the conveyor belt and power station. There is a potential for a noise impact of high significance during the operational phase at sensitive receptors located within 90m of the site.

12.1.1.10 Visual

The proposed Colenso power station and ancillary infrastructure is expected to have moderate to high visual impact, especially within a 3 – 6km radius of the facility.

The overall finding of the visual impact assessment is that if mitigation is undertaken as recommended, it is concluded that the significance of anticipated visual impacts will generally remain at acceptable levels.

12.1.1.11 Traffic

The current demand on the existing road network in the vicinity of the site is low and the road network and intersections operate will operate acceptably. The preferred route to the proposed development is via the D488 access off the R74 to the east of Colenso. The surface condition of this gravel road is poor and will deteriorate with the construction traffic volumes. Sections of this route will require upgrading to allow for use by heavy vehicles.

It is expected that the construction phase of the proposed development will generate the most vehicular trips as opposed to the operational stage. The biggest impact will be during the construction stage. The operational phase of this project is not expected to generate significant traffic volumes.

12.1.1.12 Heritage

Eight sites where identified located close to or in the proposed Power Plant area. It is recommended that the possible graves (Sites 2 & 3): be Fence-off and manage/protect. If required then the graves could be exhumed and relocated after the necessary permissions have been provided and detailed social consultation has been undertaken.

The Phase 1 assessment for the other sites found at the proposed power plant site is seen as sufficient and no further mitigation is required.

12.1.1.13 Cumulative Impacts

The cumulative impacts of the proposed development (power station, ash dump, upgraded and new roads, pipelines, rail-veyor and, water abstraction) current agricultural and tourism have been assessed.

Although the proposed project will impact on most of the environmental parameters the cumulative impact of the development and other activities is not considered to be significant. This can mainly be attributed to the low level of impact that the tourism and scattered agricultural activities have on the environment, as well as the limited disturbance of the proposed new power station and associated infrastructure.

Note that should the preferred option be followed the cumulative impacts of the proposed power station development will be limited as the ash dump will be reduced from 70 ha to an ash stockpile of only 9 ha. There will also be no ash dump on decommissioning of the power station.

12.1.2 Recommendations

After careful assessment of the risks posed to the heritage, biodiversity and especially the air quality and visual character of the area and the feedback from the public participation process, it is EcoPartners recommendation that the impacts associated with the preferred alternative could effectively be managed and mitigated (refer Fidure ??) . In our opinion the benefit to the socio-economic development and the positive impacts of electricity supply acts in the nation’s interest, provided the mitigation measures specified are implemented and maintained.

The following recommendations are proposed should the preferred alternative be followed:

- Groundwater quantity and quality monitoring is recommended according to the recommended groundwater monitoring plan.
- It is further recommended for lining of the ash disposal facility and raw water dams.
- Secondary containment for fuel stored on site should be implemented. Accurate oil records and effective clean-up protocols should be implemented.
- Leach tests /Waste classification must be carried out on the ash/waste.
- A fugitive dust management plan is developed for the power station that includes the implementation of suggested dust suppression measures and an air quality monitoring program
- Abatement technology to be maintained and to be used 99% of the time.
- Soil conservation measures to be put in place during construction.
- Appropriate erosion management actions are therefore required.

- No excavation or building material may be dumped outside the demarcated construction footprint.
- Suitably designed barriers or covers should be used when excavated pits remain open in areas where fauna are at risk of falling in. Construction personnel should be monitored continuously to ensure collection and/or poaching by personnel does not take place
- Adequate resources be made available for the rehabilitation and in perpetuity protection of land with a high irreplaceability score (preferably in the vicinity of the study area). This must be done in conjunction with EKNZW.
- Specific effort must therefore be made to manage the storm water run-off
- No development may be undertaken in the defined drainage and seepage area and a buffer of 32 m on each side thereof (the mandatory buffer stipulated by NEMA).
- Waste material, including camp sewage, must be stored in an appropriate area from where it should be removed and properly disposed of within a stipulated period.
- Local procurement and employment of individuals from within the local communities should be increased where possible and feasible.
- Employ labour-intensive methods in construction where feasible
- Set up apprenticeship programmes to build on existing skills or for the advancement of development of new skills for construction workers, especially those coming from the local communities.
- Local SMME should be approached to investigate the opportunities for supplying inputs required for construction, operations and maintenance
- Quarterly noise measurements are recommended at locations as defined by an acoustic consultant during both the construction and operational phases, as well as at receptors that registered a valid and relevant noise complaint.
- Timely maintenance of the station, ancillary infrastructure by means of painting of the cladding of the power station.
- Engage with adjacent land owners (if required and where identified) in order to amiably and proactively address potential noise and visual concerns.
- The preferred route to the proposed development is via the D488 access off the R74 to the east of Colenso. The surface condition of this gravel road is poor and will deteriorate with the construction traffic volumes. Sections of this route will require upgrading to allow for use by heavy vehicles.
- Fence-off and manage/protect possible graves identified (Sites 2 and 3). If required then the graves could be exhumed and relocated after the necessary permissions have been provided and detailed social consultation has been undertaken.

13 IMPACT MANAGEMENT OBJECTIVES

A number of methods are available to reduce dust emissions from mining and processing operations. Most dust control techniques use wet suppression, although there are other methods such as the use of chemical agents. Recommended control measures and their efficiency for reduced dust emissions are given in Table 13-1.

Table 13-1: Control Measures to Control Dust Emissions during Operation

Source	Recommended Control Measures	Control Efficiency (%)
Offloading trucks	Water sprays	70
Loading stockpiles	Variable height stacker	25
	Water sprays	50
	Telescopic chute with sprays	75
	Total enclosure	99
Unloading from stockpiles	Water Sprays	50
	Wind breaks	30
Loading to trains/rail wagons	Enclosure	70
	Enclosure and use of fabric filters	99
Miscellaneous transfer and conveying	Water sprays with chemicals	90
	Enclosure	70
	Enclosure and use of fabric filters	99
Hauling	Level 1 watering (2 litres/m^2/hr)	50
	Level 2 watering (>2 litres/m^2/hr)	75
	Sealed or salt encrusted roads	100
Wind erosion from stockpiles	Water sprays	50
	Wind breaks	30
	Total enclosure	99
	Rock armour and/or topsoil applied	30
Wind erosion	Primary rehabilitation	30
	Secondary rehabilitation	60
	Vegetation	40
	Re-vegetation	90
	Fully rehabilitated	100

PART B: ENVIRONMENTAL MANAGEMENT PROGRAMME

ENVIRONMENTAL MANAGEMENT PROGRAMME

14 ASPECTS OF ACTIVITY COVERED BY EMPR

The EMP covers the construction and operational activities of the development of the proposed power station and associated infrastructure. The aspects of these activities relates to the impact they might have on the following:

- Existing Air Quality situation
- Current Groundwater quality & quantity
- Current Surface water quality & quantity
- Soils & agricultural potential
- Existing Biodiversity status
- Socio-economic conditions'
- Noise environment
- Visual character
- Traffic flow and impact on roads
- Existing heritage resources

Please refer to Appendix P for a sensitivity map that indicates environmental sensitive areas and areas to be avoided including buffers.

15 IMPACT MANAGEMENT OBJECTIVES & OUTCOMES

The objectives of the impact management process are as follows:

Air Quality:

To ensure that the construction and operation of the proposed development has a minimal adverse impact on air quality. Adherence to the Monitoring Plan proposed by Rayten Engineering Solutions cc as prepared in accordance with the NEM:AQA

Groundwater:

To ensure that the construction and operation of the proposed power station has minimal adverse impact on the surrounding groundwater water quality and prevents pollution of existing groundwater resources. Adherence to the Monitoring Plan proposed by AGES (Pty) Ltd cc as prepared in accordance with the NEMWA

Surface Water

To ensure that the construction and operation of the proposed power station effectively utilise the consumption of freshwater, has minimal adverse impact on the surrounding surface water quality and prevents pollution of surrounding surface water resources.

Soils

To ensure that the development and operation of the proposed power station has a positive impact on land and soils by mitigating potential erosion, preventing contamination and pollution.

Biodiversity

To ensure that the development of the proposed power station does not have an adverse impact on the current biodiversity (including bats & avifauna). To ensure a buffer area of high irreplaceability is identified and managed to aid in the protection of biodiversity in the KZN.

Socio-Economic

To aid in the improvement of current, local, regional and national economies and improve the social environment of communities affected by the development of the proposed power station.

Visual

To mitigate and possibly negate the visual impacts associated with the planning of the proposed Colenso power station during planning, construction, operation and decommissioning phases.

Noise

To control noise pollution stemming from the construction and operational activities of the proposed power station.

Traffic

To ensure that the development of the proposed power station does not have an adverse impact on traffic in the region and that the road used are capable to handle the traffic (abnormal and heavy loads) associated with the development of the power station resources of significance .

Heritage

To ensure that the construction and operation of the proposed power station avoids adverse impacts on the heritage resources of significance.

Waste

To ensure that the proposed power station adopts and implements waste management principles that are environmentally responsible and limit the amount of waste produced during construction and operational phases.

Handling & storage of dangerous/hazardous materials

To ensure the safe handling and storage of dangerous/hazardous materials within the proposed power station area of operation.

16 EMP TABLE

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop

Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
A. Air Quality							
Dust Fallout (TSP) during construction	1. Choose appropriate mitigation measure/s as described in PART A: Table 6-1 for hauling. 2. All main hauling roads should be treated to suppress dust.	C	ASTMD1739 Standard and reporting	Dust fallout monitoring	Monthly	Site Manager	C
Nitrogen Dioxide (NO_2) emissions Carbon Monoxide (CO) emissions Sulphur Dioxide (SO2) emissions	3. Use of abatement equipment: a. FGD plant b. SCR system c. Baghouse system 4. All abatement equipment should be maintained according to manufacturer's specifications and used 90 – 98% of the time. 5. Maintain the use of a tall stack (210 m)	C	-	a. Baseline monitoring: b. Once off quarterly passive badge sampling of SO_2, NO_2 and CO to determine baseline concentrations prior to operations. c. Quarterly reporting d. Continuous stack emissions monitoring: e. Install and maintain a CEMS (Continuous Emissions Monitoring System) unit to monitor PM, SO_2, NO_x and GHG once operations commence. f. Monthly reporting g. CEMS unit will also allow for assessment	Baseline - Quarterly & Continuous Stack - Monthly	Project manager & environmental specialist	O

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
				of performance of abatement equipment.			
PM_{10} emissions $PM_{2.5}$ emissions Dust Fallout (TSP)	6. Develop a fugitive dust management plan that includes: Appropriate mitigation measures as described in PART A: Table 6-1 7. Dust suppression measures should be focused around material handling operations, ash storage and coal stock yard.	C	ASTMD1739 Standard and reporting	a. Monthly dust fallout monitoring as per ASTMD1739 Standard and reporting; b. Monthly PM_{10} and $PM_{2.5}$ ambient monitoring and reporting (e.g. E-Sampler). c. Install a Davis weather station on site in order to obtain site specific meteorological data.	Monthly	Project manager & environmental specialist	O
CO_2 emissions	8. GHG reduction: 9. Investigate, identify and implement suitable GHG emission reduction strategies for the short to long term.	C	GHG Reporting	Once operations commence: Compile annual GHG Inventory and report as per SA legislative requirements.	As prescribed by GHG emission reporting legislation	Project manager & environmental specialist	O
Geohydrological							
Small changes to the groundwater system can occur as construction of the power plant commences.	1. Monitoring is recommended according to the monitoring plan in the EMP.	A	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Site Manager	C
Limited hydrocarbon contamination from heavy machinery if spillages are not	2. Secondary containment for fuel stored on site. Accurate oil records and effective clean-up protocols. Monitoring is recommended	A	Best Practice Guideline G3. Water Monitoring	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Site Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
prevented and managed.	according to the monitoring plan in the EMP.		Systems (2007)				
Increase in seepage from wetlands into the groundwater system	3. Water levels within the nearby wetlands should be monitored. 4. The ecological integrity of the wetlands should be monitored.	A	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water & wetland specialists		C
The operational duration is expected to be 25 years.	5. Groundwater levels must be monitored according to the proposed groundwater monitoring plan.	C	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Operations manager & environmental specialist	O
Impact of change in groundwater quality due to power plant activities	6. Lining of ash disposal facility and raw water dams. 7. Proper storm water management to prevent contaminated surface run-off to reach alluvium downstream of facility. 8. Leach tests to be carried out on the ash/waste. 9. Monitoring is recommended according to the monitoring plan in the EMP.	A	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Project manager & environmental specialist	O
Pollutants from ash storage facility will continue to seep into the groundwater system until the plant has been rehabilitated.	10. Monitoring is recommended according to the monitoring plan in the EMP.	A	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Operations manager & environmental specialist	PC

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Pollution plumes will regressing after plant rehabilitation.	11. Monitoring is recommended according to the monitoring plan in the EMP.						
The wetland on site and 3 boreholes will be affected. Lateral groundwater movement will result in the spread of the pollution within the groundwater system.	12. Water quality of the wetlands should also be measured.	A	Best Practice Guideline G3. Water Monitoring Systems (2007)	As recommended in Section 4 of the EMP	As prescribed by ground-water specialist	Operations manager & environmental specialist	PC
Surface Water							
Increase in Hydrological Yield due to footprint clearance	1. Develop infrastructure where possible on shallow soils	A		Design of plant	Prior to Constructi on	Site manager	C
Sediment transport as a result of loosening the soil and vehicle movement	2. Make sure vegetation removal and soil disturbance is minimized; put in place soil conservation measures. 3. Road surface must be compacted in order to increase stability. Dust suppression activities must be initiated	C		Construction Plan Inspections	Monthly	Site Manager	C
Water Quality Deterioration due to spillages, operation & maintenance of construction vehicles	4. Ensure tanks and hazardous material storage areas are appropriately bunded and covered. 5. Ensure that spill response procedures are in place and the spill clean-	C		Tank design Inspections Spill response procedures	Monthly	Site Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	up/containment equipment is maintained. 6. Refuelling infrastructure to be bunded and covered.						
Water Quality Deterioration during operations	7. During operation a waste water treatment facility will be operated on site 8. Storm water collection systems must be designed and constructed in order to collect and discharge surface runoff to the environment.	A		Design & Management of Waste water treatment Plan Design & Management of storm water control measures	Ongoing	Operations Manager / Environmental Scientist	O
Sediment transport as a result of un-rehabilitated areas	9. Affected areas must be rehabilitated as soon as possible and re-vegetation activities put in place in order to avoid the transportation of sediments and the creation of erosion gullies	C		Rehabilitation Plan		Site Manager	D
Water Quality Deterioration	10. All spillages must be handled as pollution incidents. Emergency response protocol must be established for contractors	A		Spill response procedures & Waste Management Plan		Site Manager	D
Soil							
Loss of agricultural land	1. Develop infrastructure where possible on shallow soils	A		Design	Prior to Constructio n	Site manager	C
Increased level of water erosion	2. Make sure vegetation removal and soil disturbance is minimized; put in place soil conservation measures	M		Construction Plan Inspections	Monthly	Site Manager	C

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Vegetation							
Permanent loss or disturbance of floral communities and listed plant species due to the construction of infrastructure (boilers, transformers, roads, buildings, etc.).	1. Vegetation clearing to be restricted to disturbed areas as identified in the study area. 2. An ecological buffer area is recommended: areas of more significant disturbance should be targeted for development first. The buffer area should be fenced off, cleared of any alien vegetation annually and reseeded or replanted with native plants sourced from the surrounding area (see above) 3. * Existing access roads must be used, where possible.	C		Power Plant Design Inspections		Project Manager	Prior to C
Associated disturbance during construction phases leading to rapid establishment of successional species, in particular non-indigenous invasive alien plant species.	4. Annual monitoring and clearing programs to remove alien vegetation – but only if no further disturbance will result. 5. Disturbed/cleared areas should be re-vegetated with seed stock derived from locally occurring native successional species prior to the rainy season. 6. Control of alien plants colonizing. Development-related disturbances should form part of an alien	C		Visual identification	Annually	Site Manager / Environmental Ecologist	During C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	vegetation management procedure						
Loss of individuals of species of conservation concern as a direct result of habitat loss and/or eradication of existing populations during construction phase.	7. Prior to clearing of vegetation each specific site should be inspected by a qualified ecologist for the presence of the Red Data Book / Specially Protected plant species predicted to occur at the site. If any are found then the specimen should be buffered 4m diameter (preferred) or translocated to a suitable buffer area (see above). 8. Permits must be obtained from EKZNW for disturbance to Schedule 12 and/or Red listed plants.	A	EKZN Wildlife Requirements	Visual screening by ecologist Permits issued by EKZN Wildlife	Bi-annually	Site Manager / Ecologist	Prior to C
Increased erosion risk due to soil disturbance and loss topsoil and vegetation cover and spill over effects to neighbouring areas (e.g. spread of invasive alien species).	9. Long-term monitoring of erosion occurrence, and immediate mitigation, i.e. compacting of gullies and restoration of vegetation. 10. Maintenance vehicles restricted to demarcated access roads.	C		Visual erosion monitoring	As and when needed	Operation Manager / Environmental Scientist	During O after rainfall events

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Fauna							
Overall loss of natural environment.	1. Adequate resources be made available by Colenso Power (Pty) Ltd for the rehabilitation and in perpetuity protection of land with a high irreplaceability score (preferably in the vicinity of the study area). The closure cost calculations need to form part of the environmental management plan that needs to be reviewed as part of the annual internal audit assessment. 2. A detailed procedure needs to be followed under the auspices of EKZNW whereby a beneficiary land unit is identified for those areas that are irreplaceable. 3. The principle of this is to try to achieve a no net loss in faunal assets and, where possible, support and overall improvement in long-term biodiversity. 4. The offset programme should also develop appropriate management guidelines to ensure the long-term viability of the beneficiary area.	R		Budget Environmnetal Management Plan Communications with EKZNW Benificiary Land Unit	Ongoing	Project Manager Environmental Scientist	C, O

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Permanent loss of existing faunal habitats, or remnants thereof and total displacement of fauna that may occur	5. The footprint of the proposed construction and the concomitant activities must be minimised to the extent possible. 6. No development may be undertaken in the defined drainage and seepage area and a buffer of 32 m on each side thereof (the mandatory buffer stipulated by NEMA) 7. Standard practices to avoid bird mortalities due to collision with the exit transmission lines must be instituted 8. Waste material, including camp sewage, must be stored in an appropriate area from where it should be removed and properly disposed of within a stipulated period. 9. No excavation or building material may be dumped outside the demarcated construction footprint. 10. In the event of accidental spills, immediate action must be carried out to reduce the impact of the spill, followed by a thorough clean-up operation undertaken in	C		Construction Plan		Sitie Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	terms of standard operating procedures.						
Fauna mortalities	11. Any fauna encountered that are at risk of being harmed, or which may have fallen into an excavation, should be removed from the site and relocated to an adjacent area considered suitable for the individual. The ECO should advise whether specialist assistance is required for capturing and relocating specimens. 12. Suitably designed barriers or covers should be used when excavated pits remain open in areas where fauna are at risk of falling in. 13. Construction personnel should be monitored continuously to ensure collection and/or poaching by personnel does not take place. 14. Earth wires of the power line must be marked with a suitable anti collision marking device according to Eskom Transmission guidelines.	R				Site Manager Environmental Control Officer	C, O
Detrimental impact of construction and	15. A project-specific and global best-practice EMP is to be compiled for the	C		Environmental Management Plans Appointment of ECO		Project Manager	Pre Const

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
operational activities	project. This document will detail the specific controls, which must be in place for the duration of construction and operation. 16. An Environmental Control Officer (ECO) has to be appointed to ensure compliance with the EMP during construction.			Inspection reports			ructio n
Termination of the ecosystem services presented by the study area	17. Refer to the mitigations recommended previously 18. Protect the riverine area together with the mandatory buffer of 32 m (on either side of the river (refer to NEMA) by means of the following: 19. Restoring and sustaining required stream flow quality and quantity. 20. Storm water from the development should be stored and used for this purpose. 21. Undertaking and sustaining rehabilitation and management of a portion (at least 5 km) of the river system in accordance with the EMP	A		Storm water Management Plan Environmental management Plan		Operations Manager Environmental Scientists	O
Freshwater							
Damage caused by dumping of rubble.	1. Impact on the vegetation around dam should be minimised.	A		Construction Plan; Waste Management Procedure		Site Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Removal for road building.							
Disturbance of birdlife and mammals due to noise pollution	2. Fauna and flora around dam of no conservation value	C	Noise standards	Refer to monitoring recommended by Noise Specialists	As stipulated by Noise Specialist	Site Manager	C
Water abstraction/ stream draining.	3. Water can be sourced from the dam.						
Reduced functionality due to vegetation removal, soil removal and pollution.	4. Sewage and waste removal needs to be organised in an efficient manner in order to ensure that the wetland is not polluted by any construction or human waste.	A		Delivery and maintenance schedule f portable chemical toilets	As and when required	Site Manager	C
Damage caused by removal of vegetation for development enhancements /additions	5. Areas disturbed should be rehabilitated.	R		Conditions of Environmental Authorisation (if required) Management Plan for buffer area		Operations Manager / Environmental Scientist	O
Disturbance of birdlife, fish and other animals	6. Faunal loss will be limited but the animal species are common in the province and country.	A		Inspections Environmental Management Plan / System		Operations Manager / Environmental Scientist	O
Water abstraction/ Wetland draining.	7. If possible an alternative water source should be identified or created (through damming or water collection) for the proposed power station since there is limited freshwater on site.	A		Water Supply Plan		Project Manager	O

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
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Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Reduced functionality due to vegetation removal, soil removal and pollution.	8. Areas disturbed should be rehabilitated.	R		Inspections	Seasonal	Operations Manager / Environmental Scientist	O
Alteration of the hydrology due to excessive storm water inputs.	9. The storm water run -off from the site should be contained to limit the pollution of freshwater from dams for the neighbouring communities. No water should be pumped untreated to the Thukela River.	C	GN 704	Storm water Management Plan		Operations Manager / Environmental Scientist	O
Socio-economic							
Impact on the local tourism industry due to the potential loss of tourists	1. Mitigation proposed by visual and noise experts should be implemented as far as feasibly possible. 2. Construction activities should be scheduled during day-time hours only and outside weekends. 3. Vehicles should adhere to speed limits to reduce dust and noise disturbances.	C	Dust Standards Traffic Act 40km/h on dirt roads	As prescribed by visual & noise specialists	As prescribed by visual & noise specialist	Site Manager	C
Relocation of land occupiers	4. Relocation of potentially affected homesteads should be seen as the last resort. Ensuring that traditions are respected will reduce the severity of the potential negative impact.	M		Relocation Plan (if required)	Ongoing	Project Manager	Prior C

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	5. Employ a relocation specialist/advisor to advise on the process. 6. Develop a relocation plan for the communities affected: 7. Ensure that it is compiled in close consultation with the affected communities. 8. Ensure that it is approved by the affected communities prior implementation. 9. Ensure that it addresses potential financial implications on the affected communities and does not disadvantage them financially.						
	10. Ensure that potential social negative impacts are mitigated to the best of the ability. 11. Ensure that the new site will allow communities to continue with subsistence farming. 12. Ensure that family and community ties are maintained. 13. Ensure that cultural heritage is maintained						
Change in the demographics of the area	14. As mentioned, the demographics of Colenso have changed due to the old power station being decommissioned. The	A	Job specification	Appointments	Ongoing	Project Manager	Prior & During Constr uction

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	possibility exists to re-establish the working class or middle class households in the area: ▪ All available positions should be clearly communicated to minimise the influx of unwanted job seekers. ▪ If skilled labourers are attracted to the area during the construction period, permanent employment should be investigated where feasible. Potentially prompting these individuals to relocate their families to the study area.						
Increase in social pathologies due to the influx of migrant labourers	15. The establishment of central recruitment offices and the enforcement of labour and recruitment legislation. 16. Ensure strict security checks to and from the construction site, as well as proper fencing around the site to deter illegal entry. 17. Employ locals as far as is feasibly possible. Inform the local municipality of the development and the anticipated influx of workers to the area and assist local authorities in devising an	C	RFP requirements?	Establishment of recruitment offices Appointment Statistics	Ongoing	Project Manager & Site Manager	Prior & During C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	adequate strategy to address the potential effects. 18. Ensure that job seekers are not allowed to loiter around the gates or set up informal settlements in the vicinity of the site.						
Deterioration of living and working conditions due to the various environmental impacts	19. Implement mitigation measures proposed by the various specialists. Including the traffic, visual and noise specialists. 20. Provide public transport alternatives for workers so as to decrease the number of vehicles on the road during peak hours 21. Partner with local municipal authorities and other prominent users of the local roads to upgrade them to meet the required capacity and intensity of the vehicles related to the construction of this component of the proposed project.	R	As prescribed by Specialists; Road design standards	As prescribed by Specialists	Ongoing	Project Manager	C
Added pressure on basic services and social and economic infrastructure	22. Engage with local authorities to inform them of the development as well as discuss with them the ability of the municipality the meet the demands for social and basic services created by the migrant construction workers.	A	Municipal Infrastructure standards; Road design standards		Ongoing	Project Manager	Prior & During C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	23. Partner with local municipalities and other prominent users of the local roads to upgrade them to meet the required capacity and intensity of the vehicles related to the planned construction activities.						
Altered sense of place	24. Adherence to the mitigation measures proposed by the noise, air quality and visual specialists.	C	Noise Standards Dust Standards	As prescribed by visual & noise specialists	As prescribed by visual & noise specialists	Environmental appointee	O
Impact on the local tourism and game hunting industry	25. The mitigation measures proposed by the visual, noise and air pollution specialists should be adhered to. 26. Natural areas that are not affected by the footprint should be retained as such. Any possible disturbance to these areas during operations should be avoided and minimised. 27. It would be advisable to investigate the possibility of changing the business model of Tugela Wildlife CC and convert it into a lodge to host foreign experts during their prolonged stay at the power station as well as business people travelling to the site.	C & R	Noise Standards Dust Standards	As prescribed by visual & noise specialists	As prescribed by visual & noise specialists	Environmental appointee	O

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
Noise							
Increased noise levels at potentially noise-sensitive receptors; and Increasing ambient sound levels above 45 dBA at night, 55 dBA during the day (IFC Noise limits). - Any construction activities taking place within 300 m from the closest receptors at night, 60m during the day.	1. It is recommended that a project representative discuss the calculated noise levels in this document with the receptors living in the vicinity of the project. If the projected noise levels are unacceptable to these receptors no night-time activities should be allowed within this buffer area (at least 300m from receptors).	A	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the adjacent receptors) or the SANS 10103:2008 guidelines.	It is recommended that quarterly noise measurements are taken at over a period of at least 24 hours during the entire construction period. Measurements should be collected in 10 minute bins and co-ordinated with the construction activities. The variables recommended to be analysed include $\mathbf{L_{AMin}}$, $\mathbf{L_{Aeq}}$,, $\mathbf{L_{AMax}}$, $\mathbf{L_{A10}}$, $\mathbf{L_{A90}}$ and spectral analysis.	Quarterly	Project Manager	Prior & during C
	2. The developer should consider using the smallest (quietest equipment) when operating near the receptor at night. The developer should ensure that the equipment is well-maintained and fitted with the correct and appropriate noise abatement measures. Implementation of white noise (not tonal) reverse alarms on vehicles traversing the proposed site should be assessed by the developer. Acoustical mufflers (or silencers) should	R	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the adjacent receptors) or the SANS 10103:2008 guidelines			Project Manager	During C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	be considered on equipment exhausts.						
	3. During the construction phase of the project it is recommended to implement a quarterly noise measurement programme by an acoustical consultant at various receptors in the area.	C	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the adjacent receptors) or the SANS 10103:2008 guidelines	It is recommended that quarterly noise measurements are taken at over a period of at least 24 hours during the entire construction period. Measurements should be collected in 10 minute bins and co-ordinated with the construction activities. The variables recommended to be analysed include $\mathbf{L_{AMin}}$, $\mathbf{L_{Aeq}}$,, $\mathbf{L_{AMax}}$, $\mathbf{L_{A10}}$, $\mathbf{L_{A90}}$ and spectral analysis.	Quarterly	Acoustical Consultant and Project Manager	During C
	4. Add noise measurement points at the location of any receptors that registered a valid noise complaint relating to the construction activities of the proposed project.	C	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the adjacent receptors) or the SANS 10103:2008 guidelines	If a valid and reasonable complaint is registered relating to the construction of the facility, additional noise measurements should be undertaken as recommended by an acoustic consultant.	With Annual measure-ments	Acoustical Consultant and Project Manager	During C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	5. The developer must implement a line of communication (i.e. a help line where complaints could be lodged). All potential sensitive receptors should be made aware of these contact numbers. The developer should maintain a commitment to the local community and respond to concerns in an expedient fashion as sporadic and legitimate noise complaints could develop. For example, sudden and sharp increases in sound levels could result from mechanical malfunctions, changes in equipment or procedures. Problems of this nature can be corrected quickly, and it is in the developer's interest to do so.	R	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the adjacent receptors) or the SANS 10103:2008 guidelines	If a valid and reasonable complaint is registered relating to the construction of the facility, additional noise measurements should be undertaken as recommended by an acoustic consultant.		Project Manager	Prior to C
Increased noise levels at receptors; Changing ambient sound levels could change the acceptable land use capability.	6. Add noise measurement points at any complainants that registered a valid noise complaint relating to the operation of the proposed project	C	Noise Control Regulations (GN R154 – due to the temporary increase in noise levels when working in close vicinity to the	It is recommended that quarterly noise measurements are taken at over a period of at least 24 hours during the entire construction period. Measurements should be collected in 10 minute bins and co-ordinated with the construction activities.	Quarterly	Acoustical Consultant and Project manager	During O

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
			adjacent receptors) or the SANS 10103:2008 guidelines	The variables recommended to be analysed include L_{AMin}, L_{Aeq},, L_{AMax}, L_{A10}, L_{A90} and spectral analysis. L_{A90} and spectral analysis. If a valid and reasonable complaint is registered relating to the operation of the facility additional noise measurements should be undertaken as recommended by an acoustic consultant considering the monitoring requirements proposed for the Construction Phase.			
Visual							
Visual impact of construction on observers in close proximity to the proposed power station	1. Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	C		Monitoring of vegetation clearing during construction (by contractor as part of construction contract).	N/A	Site Manager	C
	2. Reduce the construction period through careful logistical planning and productive implementation of resources.	M		Construction Plan	N/A	Site Manager	C
	3. Plan the placement of lay-down areas and temporary construction equipment	M		Power plant design	N/A	Site Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	camps in order to minimize vegetation clearing (i.e. in already disturbed areas) wherever possible.						
	4. Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.	M		-	N/A	Site Manager	C
	5. Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	C		Waste management plan Visual inspections	Daily	Site Manager	C
	6. Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	C	Dust Regulations		N/A	Site Manager	C
	7. Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	A		Construction Planning	N/A	Site Manager	C
	8. Rehabilitate all disturbed areas, construction areas, servitudes etc. immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist	M		Monitoring of rehabilitated areas quarterly for at least a year following the end of construction (by contractor as part of construction contract).	N/A	Site Manager	C

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	or give input into rehabilitation specifications.						
Potential visual impact on observers within a 3km radius of the power station (local impact) and within the region	9. Maintain the general appearance of the facility as a whole, including the power station, servitudes and the ancillary structures.	M	-	Maintenance Plan	N/A	Operations manager	O.
	10. Monitor the implementation of mitigation measures, and implement remedial action as and when required.	C	-	Environmental Monitoring Plan (Biodiversity, Waste Air Quality, Rehabilitation)	N/A	Operations manager / Environmental Scientist	O.
	11. Maintain roads and servitudes to forego erosion and to suppress dust.	M	-	Maintenance Plan	N/A	Operations manager	O
	12. Monitor rehabilitated areas, and implement remedial action as and when required.			As per rehabilitation plan		Operations manager / Environmental scientist	O
Visual impact of lighting on sensitive visual receptors	13. Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); 14. Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; 15. Making use of minimum lumen or wattage in fixtures; 16. Making use of down-lighters, or shielded fixtures; 17. Making use of Low Pressure Sodium lighting or other types of low impact lighting.	M, C	-	Power Station designs	N/A	Project Manager	O

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	18. Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.						
Traffic							
Construction vehicles and equipment may impact pedestrian safety.	1. The current demand on the existing road network in the vicinity of the site is low and the road network and intersections operate will operate acceptably. 2. Ensure safety aspects are implemented to reduce traffic collisions and increase pedestrian safety.	A	-	N/A	N/A	Site Manager	C
Construction vehicles may increase the occurrences of road accidents around the town & project site.	3. The current demand on the existing road network in the vicinity of the site is low and the road network and intersections operate will operate acceptably. 4. General road rules will be enforced and complied with at all times	A	-	N/A	N/A	All	C
Increase in traffic during the construction phase could result in the deterioration of the paved & unpaved roads	5. The surface condition of D488 gravel road is poor and will deteriorate with the construction traffic volumes. Sections of this route will require upgrading to allow for use by heavy vehicles.	R	-	Monitor condition of roads	Monthly	Site Manager / Contractor	C especially after rain events

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
	6. The contractor is required to monitor the condition of the roads used and repair the road where it becomes damaged due to construction traffic.						
Increase in traffic as a result of the operational activities.	7. The operational phase of this project is not expected to generate significant traffic volumes. 8. All company vehicles travelling on public roads to adhere to the relevant traffic laws and regulations.	A	-	-	-	All	O
Employee & company vehicles may impact pedestrian safety.	9. The operational phase of this project is not expected to generate significant traffic volumes. 10. Management is to respond immediately to any incident involving a company vehicle.	A	-	Emergency Preparedness plan	N/A	Health & Safety Manager	O
Increase in traffic during the operational phase could result in the deterioration of the paved & unpaved roads.	11. The number of permanent staff on site on completion of all phases is not expected to be more than 1 350 people and therefore no additional upgrades are required to accommodate the operational site staff	R	-	N/A	N/A	N/A	N/A
Heritage							
Damage or destruction of site 1 (as detailed in the Heritage report)	1. The Phase 1 assessment for the sites found here is seen as sufficient and no further mitigation is required and it	N/A	N/A	N/A	N/A	N/A	N/A

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop
Time Period: C= Construction; O=Operation; D=Decommissioning; PC =Post Closure

Impact	Mitigation measures	Objective	Applicable standards / practices	Monitoring / Management method	Frequency	Responsibility	Time period
during construction activities.	may be demolished (low significance)						
Damage or destruction of sites 2&3 (as detailed in the Heritage report) during construction activities.	2. Fence-off and manage/protect. 3. If required then the graves could be exhumed and relocated after the necessary permissions have been provided and detailed social consultation has been undertaken.	A		Visual checks to ensure fencing is in place	6 monthly	Site Manager	Prior and During C
Damage or destruction of sites 4, 5 & 8 (as detailed in the Heritage report) during construction activities	4. The Phase 1 assessment for the sites found here is seen as sufficient and no further mitigation is required and it may be demolished (low significance)	N/A	N/A	N/A	N/A	N/A	N/A
Damage or destruction of site 6 (as detailed in Heritage report) during construction activities	5. The Phase 1 assessment for the sites found here is seen as sufficient and no further mitigation is required and it may be demolished (low significance)	N/A	N/A	N/A	N/A	N/A	N/A
Damage or destruction of site 7 (as detailed in the heritage report) during construction activities	6. The Phase 1 assessment for the sites found here is seen as sufficient and no further mitigation is required and it may be demolished (low significance)	N/A	N/A	N/A	N/A	N/A	N/A

Objectives: A=Avoid, M=Modify, R=Remedy, C=Control or S=Stop

Time Period: C= Construction; O=Operation; D=Decommissioning

17 SPECIFIC MONITORING PLANS

17.1 Air Quality Monitoring

The air quality monitoring plan should include:

- Monthly dust fallout monitoring as per ASTMD1739 Standard and reporting;
- Monthly PM10 and PM2.5 ambient monitoring and reporting (e.g. E-Sampler).
- Install a Davis weather station on site in order to obtain site specific meteorological data.
- Baseline monitoring:
    - Once off quarterly passive badge sampling of SO_2, NO_2 and CO to determine baseline concentrations prior to operations.
    - Quarterly reporting
- Continuous stack emissions monitoring:
    - Install and maintain a CEMS (Continuous Emissions Monitoring System) unit to monitor PM, SO_2, NO_x and GHG once operations commence.
    - Monthly reporting

17.2 Groundwater Monitoring

The overarching water management action that is of interest for the proposed power station site is to:

- Develop an understanding of the current surface water and groundwater flow patterns and monitor how it changes over time.
- Assess impacts of the changes of these flow patterns on the receiving environment and the performance of associated prevention measures.
- Prevent pollution and thereby protect the receiving water environment.
- Develop an understanding of the current pollution and monitor how it changes over time.
- Assess performance of pollution prevention measures, i.e. compliance with license conditions and catchment objectives.

The positions of the proposed monitoring points are shown in Figure 17-1 and include the following boreholes:

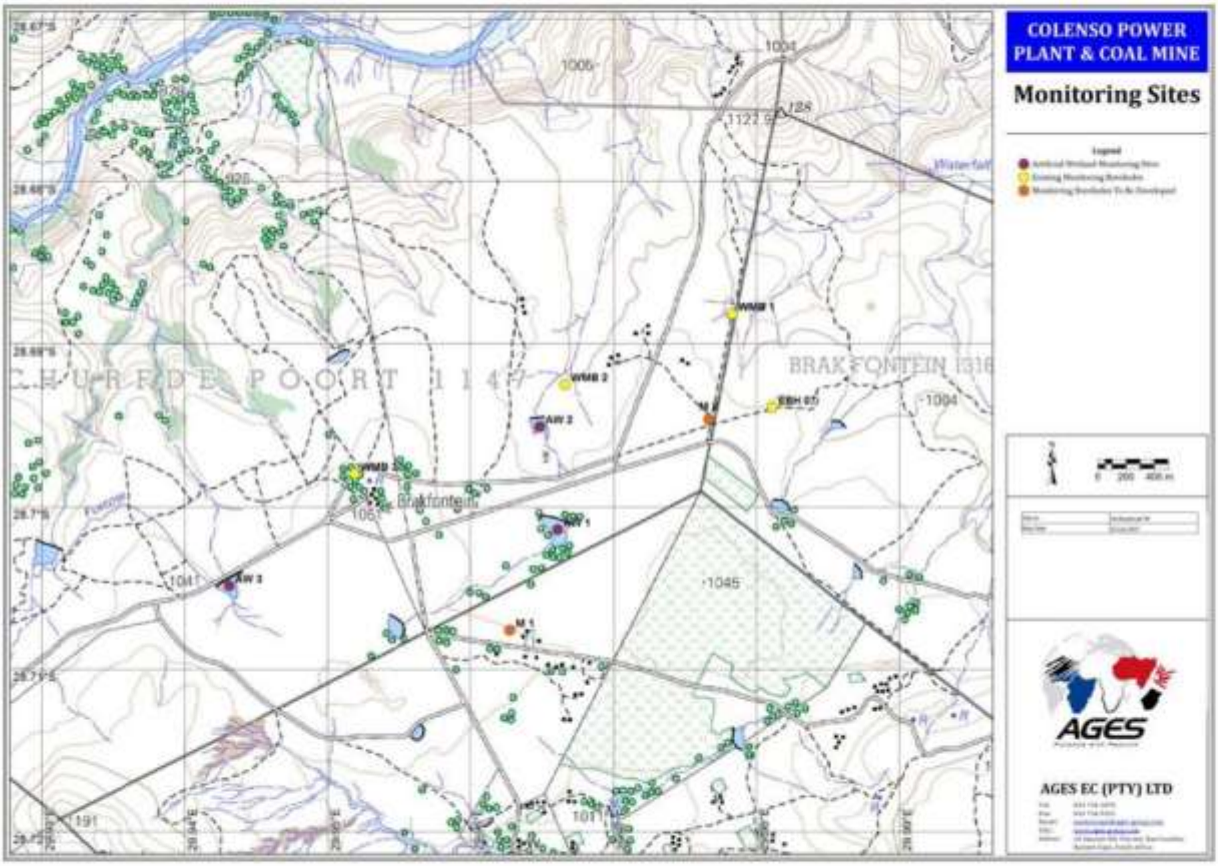
- Boreholes that have already been developed and equipped for monitoring:
    - WMB02 – Shallow
    - WMB02 – Deep
    - WMB03 – Shallow
    - WMB03 – Deep
    - WMB01 – Deep
    - EBH07

- New monitoring boreholes to be developed:
  - M1 - Deep
  - WMB02 – Deep
  - WMB03 – Shallow
- Artificial wetlands to be monitored:
  - AW1
  - AW2
  - AW3

The potential monitoring points are chosen to:

- Determine any changes in groundwater levels and quality at the power plant site before affecting the down gradient environment towards the Thukela River and existing groundwater users.
- Monitor the shallow alluvium and weathered zone
- Monitor the deep fractured aquifer
- Monitor artificial wetlands downstream of the facility

Figure 17-1: Positions of proposed monitoring points



17.2.1 Parameters to be measured and frequency of measurements

There are three sets of monitoring parameters. A comprehensive analysis must be conducted on boreholes within or close to the power station and a screening analysis (B) must be conducted on boreholes further away or boreholes that are not part of monitoring plan. In addition samples must be tested for trace elements once operations commence. The parameters that must be sampled for are listed in Table 17-1. The 4 hand pump equipped boreholes at the local community should be included as screening boreholes.

Table 17-1: Sampling Parameters

A (Standard set of parameters)	B (Screening parameters)	C (Trace elements)
pH	pH	Ba
EC	EC	As
Ca		Co
Mg		Cr
Na		Ni
K		Pb
Total Alk		Se
F		Sr
Cl		V
NO_2 (N)		Zn
NH_4 (N)		Nb
NO_3 (N)		Mn
PO_4		Cu
SO_4		Ga
Al		Ge
Fe		Rb
Mn		Y
		Zr
		Sn
		W
		Bi
		Th
		U
		Hg

The frequency and type of sampling is summarised in Table 17-2

Table 17-2: Frequency and type of sampling

Parameter list as presented in the table above	Type of sampling	Flow measurement/ Groundwater level	Frequency
A, C*	Grab	Water level #	A = Every 4 months C = Once an annum
* If any parameters exceed SANS241-1: 2011 guidelines (or WHO guidelines if no SANS guideline available) then that parameter must become part of list A. # If water levels in any of the boreholes vary with more than 1 m between monitoring runs, these boreholes must be monitored monthly until they stabilise, unless there is a valid reason (e.g. farmer abstracting)			

Laboratory analysis techniques must comply with SABS guidelines and laboratories must be accredited.

18 COMPLIANCE PROGRAMME

It is recommended that a compliance report be rendered to DWS every six months.

19 ENVIRONMENTAL AWARENESS PROGRAMME

Environmental awareness will be conducted via a site induction process and via daily toolbox talks.

The Site Induction training will focus on the following:

- Discussion of environmental impacts.
- Waste management –The location of waste bins on site, the identification of general and hazardous waste and the separation of waste.
- Water usage – Conservation of water, correlation between water & erosion.
- Driving protocol – Pre-start vehicle checks prior to driving, speed on dirt roads.
- Environmental mitigation – Example no collection of wood, no open fires, no snaring of animals, no unnecessary destruction of natural vegetation, clean-up of hydrocarbon spills, etc.
- Emergency procedure – Type of emergencies, type of alarms, emergency equipment, and location of assembly point and identification of trained emergency personnel.

During the daily toolbox talks the following will be discussed:

- Any incidents that may have occurred the previous day
- Mitigation requirements for the day
- Status of housekeeping on site
- Ad hoc refresher in terms of emergency procedures

20 SPECIFIC INFORMATION

Refer Part A Section 15.

References

A Pelser Archaeological Consulting (APAC). 2015. Phase 1 HIA Report For The Proposed Colenso Power Project Near Colenso, KwaZulu-Natal

Ages. 2015 Colenso Power Station Geohydrological Investigation - KwaZulu Natal Province

Agricultural Research Council (ARC). 2015. Soil Survey For Proposed Power Station Project At Colenso, Near Ladysmith, Kwazulu-Natal

Allan, D. 2015. Specialist Avifaunal Report Relevant To An Eia For The Proposed Colenso Coal-Fired Power Station, Ash-Disposal Site And Associated Power Lines

Animalia. 2015. Bat Sensitivity Impact Assessment Report - For the proposed Colenso coal power station, Kwa-Zulu Natal

ARC. (2015). Phase 1 HIA Report for the proposed Colenso Power Project near Colenso, Kwa-Zulu Natal.

CSIR/ARC. 2000. National Land-cover Database 2000 (NLC 2000).

Daniels, S. 2015.Biodiversity Investigation East of Colenso (Kwazulu-Natal Province) Proposed Power Station Site, Freshwater component to Biodiversity Assessment

De Jager, M. (2014). Noise Study for Scoping Purposes: Proposed Colenso Coal Fired Power Station and Coal Mine near the town of colenso, KwaZulu-Natal.

De Jager, M. (2014). Noise Study for Scoping Purposes: Proposed Colenso Coal Fired Power Station and Coal Mine near the town of colenso, KwaZulu-Natal.

DEA, 2013. Greenhouse Gas Inventory for South Africa: 2000 – 2010

Department of Economic Development. (2010). New Growth Path: Framework .

Department of Economic Development. (2010). New Growth Path: Framework .

Department of Energy. (2011). Integrated Resource Plan (IRP) 2010.

Department of Energy. (2011). Integrated Resource Plan (IRP) 2010.

Department of Energy. (2013). IRP 2010-2030 Update Report.

Department of Energy. (2013). IRP 2010-2030 Update Report.

Department of Environmental Affairs. 2009. National Ambient Air Quality Standards. GN 1210, 24 December 2009

Department of Environmental Affairs. 2014. . Listing notice 1: List of activities and competent authorities, GNR 985 of 4 December 2014, The Government Printer

Department of Environmental Affairs. 2014. . Listing notice 2: List of activities and competent authorities, GNR 984 of 4 December 2014, The Government Printer

Department of Environmental Affairs. 2014. Listing notice 1: List of activities and competent authorities, GNR 983 of 4 December 2014, The Government Printer

Department of Environmental Affairs. 2014. National Environmental Impact Regulations, GN 982 of 4 December 2014, The Government Printer

Department of Environmental Affairs. 2015. National Norms and standards for disposal of waste to landfill, GNR 636, 23 August 2015, The Government Printer

Department of Trade and Industry (DTI). (2014). Industrial Policy Action Plan 2014/2015-2016/2017.

EcoPartners. 2015. Colenso Power Station Cost-Benefit Analysis

Enviro Acoustic Researc (EAR) 2015. Noise Study For Environmental Impact Assessment, Establishment of the Colenso Coal-fired Power Station and Coal Mine near Colenso, Kwa-Zulu Natal

Fourie, W. (2014). Establishment of a 250MW Coal Power Station and Coal Mine, close to Colenso, KwaZulu Natal: Heritage Scoping Report .

IFC, 2007: Environmental Health and Safety Guidelines, General EHS Guidelines: Environmental Air Emissions and Ambient Air Quality, World Bank Group

IFC, 2008: Environmental Health and Safety Guidelines, Thermal Power Plant, World Bank Group

Isibuko se-Africa. (2008). Umtshezi Municipality SDF.

Isibuko se-Africa. (2008). Umtshezi Municipality SDF.

Isibuku se Africa. (2012). Ladysmiht/Emnambithi Spatial Development Framework .

Isibuku se Africa. (2012). Ladysmiht/Emnambithi Spatial Development Framework .

KZN Provincial Planning Comission. (2011). Provincial Spatial Development Framework: Draft 2.

KZN Provincial Planning Commission. (2011). Provincial Spatial Development Framework: Draft 2.

Le Roux, J& Keet, J. 2015. Biodiversity Investigation East of Colenso (Kwazulu-Natal Province) Proposed Power Station Site, Botanical /Flora component of Biodiversity Assessment

MetroGIS. 2015. Proposed Colenso Coal-Fired Power Station And Related Infrastructure, Kwazulu-Natal Province, Visual Impact Assessment Report

National Park Services ,“Soundscape Preservation and Noise Management”, 2000.

National Planning Comission . (2011). National Development Plan: Vision for 2030.

National Planning Commission . (2011). National Development Plan: Vision for 2030.

Paterson, D. (2014). SOILS AND AGRICULTURAL POTENTIAL FOR THE COLENSO POWER PROJECT, KWAZULU-NATAL PROVINCE.

PGS. 2014. Heritage Survey for the Colenso Power Project - Scoping Report

Quantec. 2014. Standardised Regional Database

Rayten Engineering Consultants. 2015. Air Quality Impact Assessment – Colenso Coal Fired Power Station And Coal Mine In Kwazulu Natal

Republic of South Africa. 1998. National Environmental Management Act (no 107 of

1998). Pretoria: The Government Printer.
Republic of South Africa. 1999. National Heritage Resources Act (No 25 of 1999). Pretoria: the Government Printer.
Republic of South Africa. 2004. National Environmental Management: Air Quality Act, No. 39 of 2004. The Government Printer
SAHRA database.
SANBI (South African National Biodiversity Institute). 2011. SANBI web-site:.http://bgis.sanbi.org/ecosystems/project.asp. (Date accessed: April 2012).
SANS 10103:2008 “Determination of sound power levels of noise sources using sound intensity – Part 3: Precision method for measurement by scanning”.
SiVest .2014. Surface Water Assessment for Colenso power Project - Scoping Report
South African National Standards (SANS). 2008. SANS – Code of Practice 10103:2008, The measurement and rating of environmental noise with respect to annoyance and to speech communication, Standards South Africa, 6th Edition (ISBN 978-0-626-20832-5)
Stats SA. (2014). Census 2011.
Storm Water Solutions. 2015 Colenso Power Project, Power Plant Surface Water Assessment
Sturgeon Consulting. 2015 Traffic Impact Investigation East of Colenso, Proposed Power Station Site
The Indaka LM. (2010). Indaka LM: Spatial Development Framework .
The Indaka LM. (2013). Integrated Development Plan 2013/2014 (draft).
Tingay. J. 2011. http://www.cirrusresearch.co.uk/blog/2011. Accessed June 2015.
Urban-Econ Development Economists (UDE). 2015. Socio-Economic Impact Assessment Study, Draft Report
Van der Merwe., S.W. Biodiversity Investigation East of Colenso (Kwazulu-Natal Province) Proposed Power Station Site, Faunal Component of Biodiversity Assessment
World Health Organisation (WHO). 1999. Guidelines for Community Noise. Available online at:http://www.who.int/docstore/peh/noise/guidelines2.html
World Health Organisation (WHO). 2000: Air Quality Guidelines, World Health Organisation, April 2000, Geneva.
World Health Organization (WHO). 1999. Protection of the Human Environment.
World Health Organization (WHO) . 2009. Night Noise Guidelines for Europe.Global Update (2005)