



EON Consulting

Ixopo Renewable Energy Plant: Draft Environmental Impact Assessment Report (EIAR)

DEA Reference: 14/12/16/3/3/3/212

Biomass Investments (Pty) Ltd

31 August 2016

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Executive Summary

This Draft Environmental Impact Assessment Report (EIAR) has been compiled by EON Consulting on behalf of Biomass Investments (Pty) Ltd, in response to the undertaking of the proposed construction of facilities for a renewable energy plant - the construction and operation of a 25MW net renewable energy plant near Ixopo, KwaZulu-Natal. The site is part of an existing sawmill. The plant will make use of sawmill dust and chips obtained from sawmills in the vicinity as well as from biomass from pine/eucalyptus plantations in the area. The energy plant will consist of a conventional steam Rankine cycle. The energy from direct combustion of biomass is carried over to hot water in a pressurised boiler system. Electricity is generated by a turbine at a pre-defined voltage supplied to an existing grid and distribution network.

Ash from the combustion plant will be disposed of in the surrounding plantations - this will act as fertilizer.

The legislative regulations followed for this document represents the draft EIA Report as required by the National Environmental Management Act, 1998 (Act No. 107 of 1998): Environmental Impact Assessment Regulation R982, dated 4 December 2014. These regulations define the aspects of the legislation required for certain listed activities, which may be detrimental to the environment as a whole.

The objectives of the EIA process are as follows:

- To identify issues/ concerns that should be included into the scope of the Environmental Impact Assessment process;
- To inform stakeholders about the proposed project and provide them with an opportunity to raise their concerns that will contribute towards the EIA process; to establish/confirm the scope and contents of the Scoping and EIA Report and to identify possible specialist studies to be conducted to address significant issues;
- To understand and thoroughly document the issues/concerns and comments submitted raised by stakeholders in such a way that delay due to misunderstanding will be prevented at all costs;
- To assess the relevant biophysical environmental components of the site to an appropriate level of detail. This includes the physical, biological, and socio-economic components;
- To identify/ describe possible environmental issues associated with the construction and operational phases of the training facilities and its associated infrastructure; and
- To reflect all the required information/ findings in a logical and systematic way in order to assist the DEA with the evaluation of the proposed activity in terms of the requirements of the National Environmental Act, 1998 (Act No. 107 of 1998) as amended.

The following listed activities are triggered by the proposed development:

Indicate the number and date of the relevant notice:	Activity No.(s) (in terms of the relevant or notice):	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):
R 984 Listing Notice 2:	Activity 28	The commencement of an activity for which an air emission license is required: The combustion plant requires an AEL as the heat input exceeds 50MW.
R 984 Listing Notice 2	Activity 1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20 megawatts or more: The plant will generate 25MW of electricity will be generated through the combustion of biomass.
R 983 Listing Notice 1	Activity 11	The development of facilities or infrastructure for the transmission and distribution of electricity outside an urban area with a capacity of more than 33 KV but less than 275KV: A connection with existing Eskom substation will be developed to transmit 88KV
R 983 Listing Notice 1	Activity 16	The development and related operation of facilities for the desalination of water with a design capacity of more than 100 cubic meters of treated water per day: A Demineralization plant will be operated on site to provide water to the boiler – the plant will treat more than 100m ³ per day
R 983 Listing Notice 1	Activity 27	The clearance of an area of 1Ha or more but less than 20Ha of indigenous vegetation: 4Ha will be cleared to construct the plant and related facilities
R 983 Listing Notice 1	Activity 28	The site is zoned for agricultural purposes and will now be used for industrial purposes – energy generation

ACTIVITIES APPLIED FOR IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 AND THE ENVIRONMENTAL IMPACT REGULATIONS, 2014

<p>Act No. 26 of 2014 National Environmental Management: Waste Amendment Act, 2014: GN921</p>	<p>Category B: activity #8</p>	<p>Thermal waste from combustion: In terms of Act No. 26 of 2014 National Environmental Management: Waste Amendment Act, 2014: Category B, ash from the combustion plant falls within #8: Thermal waste from combustion. Wood ash from the combustion process will be spread in the existing plantations to serve as a soil pH amendment and soil fertilizer. Quantities will be about 3,6 tons per day and 1188 ton per annum with an expected plant uptime of 330 days per annum. The facility will allow for at least three days ash storage on site. The total volume of ash to be applied to the plantations as fertilizer falls within the threshold of category B listed Activity #8 due to application to an area larger than 200m².</p> <p>Ash from the biomass will be disposed of in the surrounding plantations for the purpose of fertilizer</p>
	<p>Category B: activity #3</p>	<p>Recovery of waste: In terms of NEMWA (Act No. 59, 2008 NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008) “recovery” means the controlled extraction of a material or the retrieval of energy from waste to produce a product. The recovery of waste including the refining, utilization or co-processing of waste in excess of 10 tons but less than 100 tons of general waste per day) relevant to this activity, given that 700 tons of biomass per day will be used to generate electricity.</p> <p>Energy will be retrieved from sawmill offcuts, sawmill dust, plantation residues and round logs.</p>
	<p>Category B: Activity #10: The construction of a facility for waste management activity listed in category B</p>	<p>The renewable energy plant will be constructed and will utilise waste as fuel and will re-use combustion ash as fertilizer which will be temporary stored onsite</p>
	<p>Category B: Activity #2: The re-use or recycling of hazardous waste in excess of 1 ton per day, excluding re-use or recycling that takes place as an internal manufacturing process within the same premises</p>	<p>Wood ash will be used as Fertilizer in surrounding plantations.</p> <p>The competent authority required the inclusion of this listed activity, given that the ash might be classified as hazardous</p>

An application was submitted to DEA with respect to the above. The application was accepted and the following Reference Number provided: 14/12/16/3/3/212



This document represents the draft EIA report as required by the ***National Environmental Management Act, 1998 (Act No. 107 of 1998): Environmental Impact Assessment Regulations, 2014 R982 of December 2014.***

All environmental impacts are being investigated during the EIA phase and appropriate mitigation will be adhered to as governed by the above Regulation. Following which all stakeholders and registered I&APs will be informed of the proposed development and consulted on an on-going basis during the EIA process. This will give them an opportunity to provide comments and/or raise issues. The Draft EIAr has been made available for public review and comment from **September 2016 to October 2016**. After the public comment period, the report has been updated. Subsequent to these findings a Final EIA Report will be submitted to the DEA.

Public review of the Draft EIA Report:

Registered Interested and Affected Parties (I&AP's) have been provided via email with a copy of the Draft EIAr. Hard copies of the report were delivered to the local municipality as well as the Competent Authority. The report was also made available on the EON Consulting Website: www.eonconsulting.co.za

The comments received during the public participation process will be included in the Final EIAr.

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Glossary of Terms

Environment: The surroundings (biophysical, social and economic) within which humans exist and that are made up of:

- I. the land, water and atmosphere of the earth;
- II. microorganisms, plant and animal life;
- III. land part or combination of (i) and (ii) and the interrelationships among and between them;
- IV. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.

Environmental Aspects: Elements of an organisation's activities, products or services that can interact with the environment.

Environmental Degradation: Refers to pollution, disturbance, resource depletion, loss of biodiversity, and other kinds of environmental damage which may be the result of accidental or intentional human activities.

Environmental Impacts: Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organization's activities, products or services.

Abbreviations

BID	Background Information Document
CRR	Comments and Response Report
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
FSR	Final Scoping Report
GN	Government Notice
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
NEMA	National Environmental Management Act, Act 107 of 1998 as amended
NEMWA	National Environmental Management Act: Waste Management Act
PM	Particulate Mater
PPP	Public Participation Process
R	Regulation
SANBI	South African National Biodiversity Institute

Chemical symbols

C	Carbon
Ca	Calcium
CL	Chlorine
H	Hydrogen
HCL	Hydrochloric acid
K	Potassium
N	Nitrogen
O	Oxygen
S	Sulphur
CO2	Carbon Dioxide

1 Project Details

Reference Number	14/12/16/3/3/2/825. National Department of Environmental Affairs (DEA)
Project Title	Ixopo Renewable Energy Plant situated near Ixopo, KZN
Applicant	Biomass Investments (Pty) Ltd
Compiled By	EON Consulting, Adri Venter
Date	20 August 2016

2 Introduction

2.1 Applicant

Applicant	Biomass Investment (Pty) Ltd		
Registration Number (if applicant is as company)	2016/002250/07		
Trading name (if any)	Biomass Investment (Pty) Ltd		
Responsible person name (if the applicant is a company)	Albert Janse van Rensburg		
Responsible position, eg Director, CEO, etc.:	Chief Technical Officer		
Physical Address	33 The Valley Road, Parktown, Johannesburg		
Postal Address	Same as physical address		
Postal Code	2193	Cell	082 4484 263
Telephone	011 486 0982	Fax	n/a
Email	albert@cleanenergyafrica.co.za	BBBEE Status	Level 4 Contributor

2.2 Appointed Environmental Assessment Practitioner

Environmental Assessment Practitioner	EON Consulting		
Contact Person	Adri Venter		
Postal Address	P.O. Box 12389, Vorna Valley, Midrand		
Postal Code	1686	Cell	082 372 8186
Telephone	011 564 2300	Fax	011 534 2371
Email	Adri.venter@eon.co.za		
Qualification and Relevant experience	MSc (Geography and Environmental Studies, 10 years)		
Professional Affiliation	SACNASP (Pr.Sc.Nat: 400062/14)		

2.3 Project Site Details

Province	Kwa-Zulu Natal
District Municipality	Harry Gwala
Local Municipality	Ingwe Local Municipality
Ward Number	10
Nearest Town	Ixopo
Farm names (s) and number (s)	The Remainder of Lot FP 379 No. 10055

2.4 Proposed Locality

The locality of the proposed project on The Remainder of LOT FP 379 No. 10055 near Ixopo in KZN is provided in the map below:

Latitude	-29.869672°
Longitude	29.765740°

The Surveyor General (SG) code is indicated below:

0	0	0	0	0	0	0	0	1	0	0	5	5	0	0	0	0	0	0	0	0
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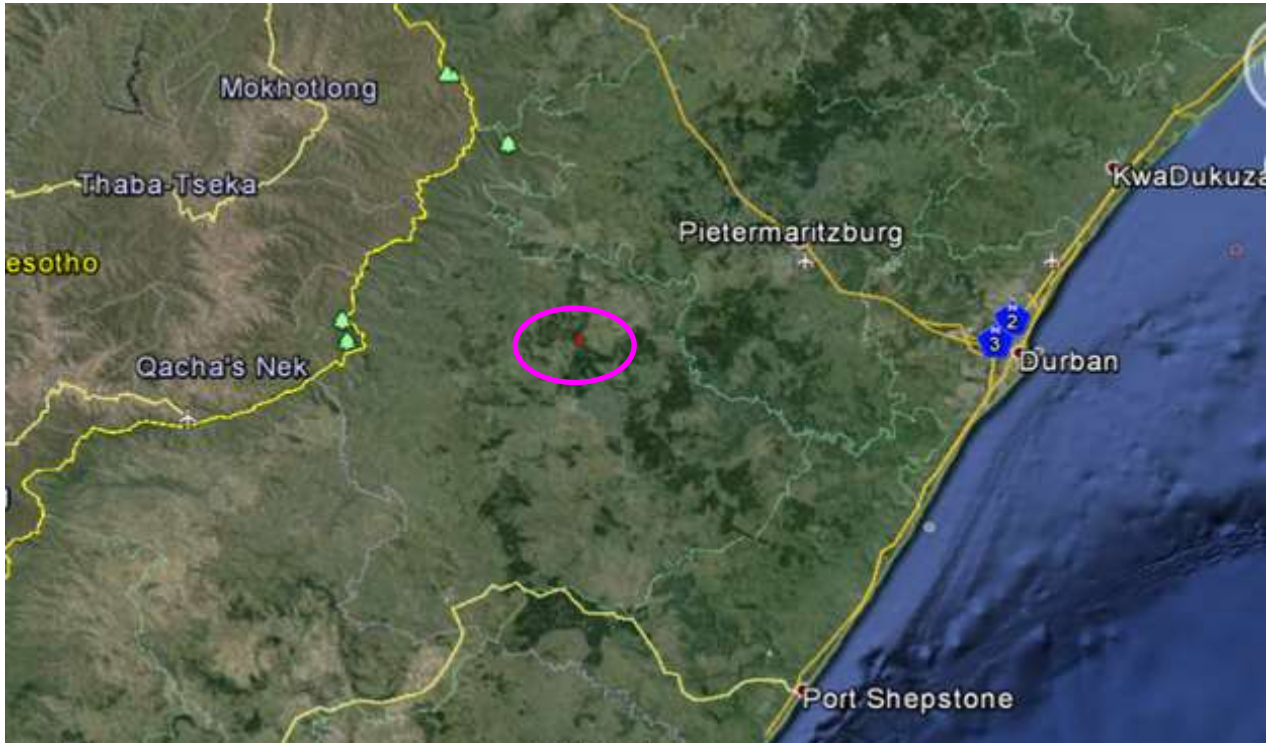


Figure 1: The location of the proposed Renewable energy plant inside the pink circle

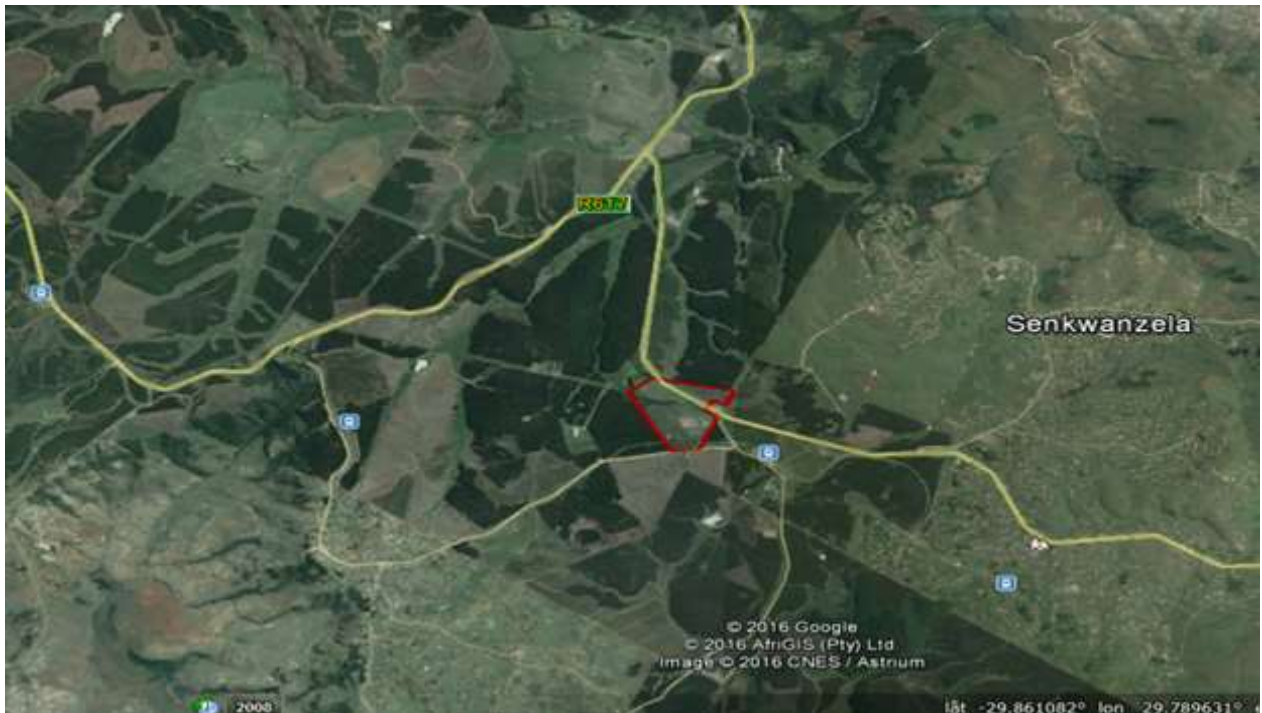


Figure 2: The main road in the vicinity is the R617 and R612. Access to the site will be from R612



Figure 3: Development Site

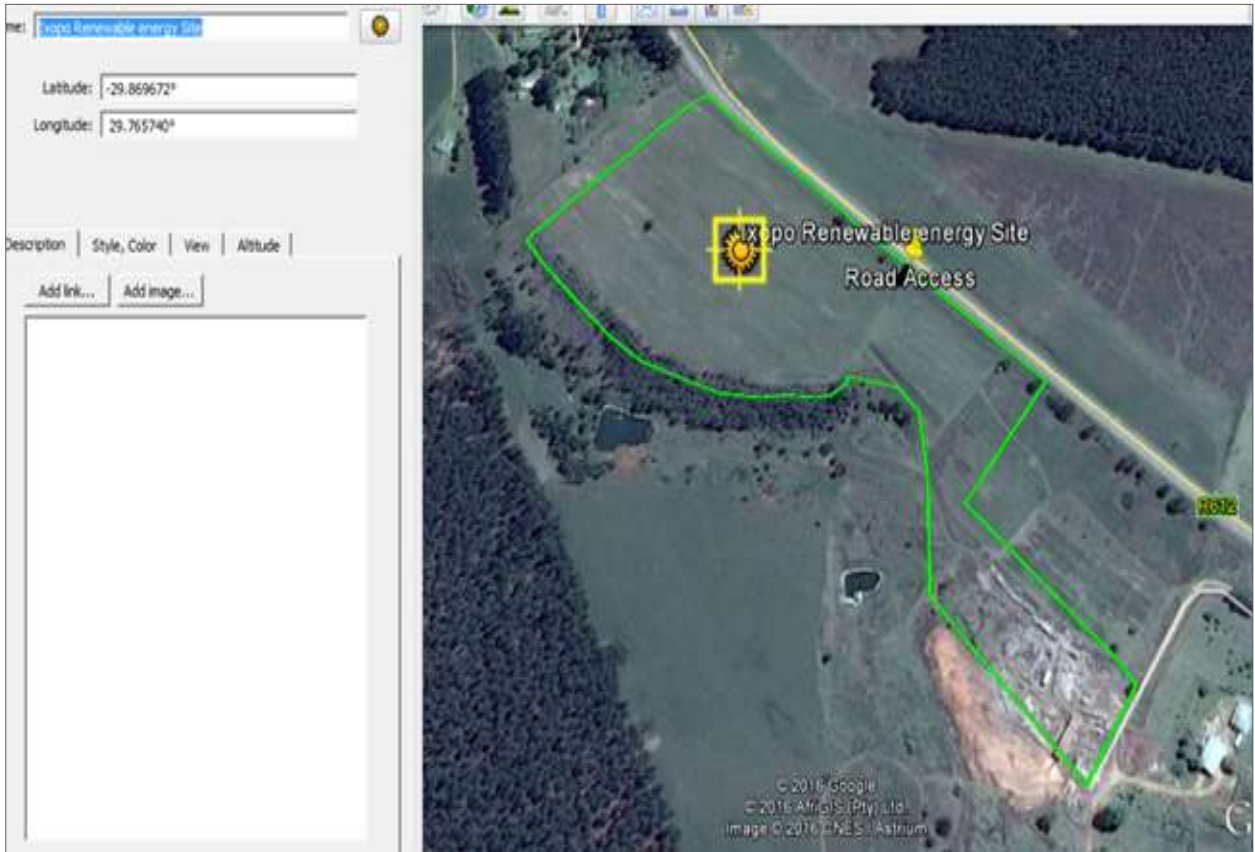


Figure 4: Development boundaries and access road



Figure 5: Lay-out of proposed activities on-site

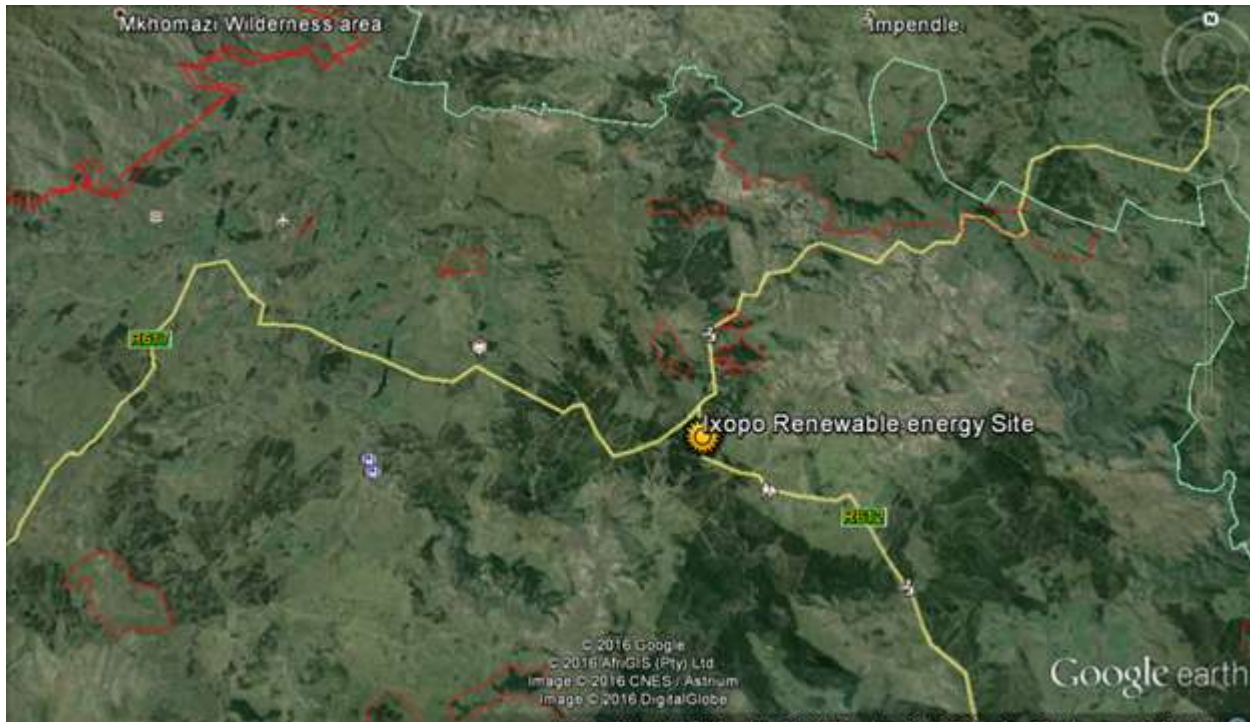


Figure 6: Protected Areas outlined in red

2.5 Activities Applied for the Purposes of an Environmental Authorisation

The following listed activities are triggered by the proposed development:

Indicate the number and date of the relevant notice:	Activity No.(s) (in terms of the relevant or notice):	Describe each listed activity as per the detailed project description (and not as per wording of the relevant Government Notice):
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		<p>day:</p> <p>A Demineralisation plant will be operated on site to provide water to the boiler – the plant will treat more than 100m³ per day</p>
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3 Description of the Proposed Activity

3.1 Power Generation Description

The power generation facility can be divided into the following main sections:

- **Biomass conditioning, storage and feed:**

The plantation round logs, residues and felling biomass will be chipped and stockpiled in combination with the wood chips, sawdust and off-cuts from the Sawmill. The biomass quality, moisture content and calorific value will vary with seasonal and diurnal changes. To minimize the impact of external factors, biomass will be:

- Reclaimed from stockpile and fed from different feed hoppers into the combustion plant
- Waste heat from the flue gas will be used to pre-dry the biomass from 30% moisture (on average) to 10-13% moisture content.

- **Combustion:**

The biomass is converted to thermal energy through direct combustion in a furnace. The proposed combustion technology is a moving grate system that ensures sufficient residence time for complete conversion and introduces air at different temperature and locations through the grate.

Air will be pre-heated by the flue gas after heat recovery steam generation and used for combustion and partially for drying the fuel. The air to fuel ratio will be adapted according to the specific moisture content and biomass quality.

- **Heat recovery steam generation (HRSG):**

The thermal energy in the hot flue gas is carried over to hot water in a pressurised boiler system. The boiler feed water is treated to maintain the levels of dissolved solids and composition according to the boiler pressure and design specifications. Feed water will be de-aerated with bleed steam from the turbine/boiler blow down to control the level of dissolved oxygen. Flue gas after the steam generator is used to heat the boiler feed water in an economizer to maximize energy recovery. The water is then evaporated and superheated at low, medium and high pressure.

- **Electricity generation:**

Superheated steam from the HRSG unit is expanded in a turbine and the pressure and volume change is converted to shaft work. The selected turbine technology is of the full condensing type. The condensing turbine is a technology preferred for power generation maximise electrical output.

The method of steam supply will be blow-down from the boiler drum. The process steam will be condensed and recovered back as boiler feed water to the HRSG unit. The steam used completely for power generation will be condensed in a vacuum condenser to maximise electricity production. The cooling method will be dry cooling and heat dissipated with air coolers, condenser temperature approaching the air dry bulb temperature.

- **Flue Gas treatment:**

The fly ash collector for the flue gas adopts an electrostatic precipitator (ESP). The flue gas accesses the ESP via the inlet hoods. The inlet hoods are equipped with gas distribution screens, made of perforated plates that are provided with mechanical rapping devices. The ESP casing is equipped with discharge electrodes (DE) and collecting electrodes (CE) which are arranged in parallel, thus forming gas passage. The DE is connected to the negative pole of a HV set. The collecting electrodes are positively poled and earthed. Due to the high field strength in the ambience of the DE they produce a corona- discharge whereby the gas is ionized. The gas ions adhere to the dust particles. Due to the influence of the electrical field the charged dust particles migrate to the CE forming a dust layer. Accumulated particulate matter is removed from the collection plates at the periodic intervals by rapping or hitting the plates with rappers. Heavy particles will fall to the base of the ESP system. The ESP has the following characteristics:

- Low pressure loss
- High efficiency of ash collecting > 99%
- Resistance to high temperature, about 3000°C
- Low cost of maintenance

- **Water supply and water treatment:**

Fresh water will be supplied to the plant from boreholes. The applicant is in the process of applying for a water use license for the abstraction of ground water. The total water demand for the new plant will be 150m³ per day.

The water will be pumped to the plant via a 50mm PVC underground pipeline where it will be dosed with 0.3 mg/l free chlorine to eliminate any bioactivity, prior to entering a 1 MI holding tank on site.

From the holding tank 6.25 m³/h water will go through an ultrafiltration system. Of this 0.25 m³/h will be available for domestic use and 6 m³/h will be sent to an and demineralisation plant, of this:

- 3 m³/h will be available for power plant utilities (turbine, de-aerator, boiler grate)
- 3 m³/h will be used to supplement boiler blowdown losses
- 1 m³/h will be utilised for ash quenching (irrigation quality effluent).

The proposed demineralisation system for the Plant is based on a reverse osmosis system followed by a Continuous Electro de-ionisation (CEDI) system. This system produces an effluent stream (2.5 m³/h) with an electrical conductivity (EC) around 100 mS/m, suitable for irrigation. This effluent stream will be used for ash quenching, basically making this a Zero Liquid Discharge plant.

It is anticipated that the membrane skid will require a cleaning treatment at a frequency of once every 2 months. A normal chemical cleaning sequence will have a typical duration of approximately 6 to 12 hours. The chemical cleaning system is a Cleaning-In-Place system, which means that the membrane modules do not have to be dismantled to be cleaned. Effluent water will be generated during the cleaning sequence. It is expected that the cleaning will generate 5 m³ of acetic and basic solution every 2 months. This effluent will be stored on site in containers and removed by a reputable waste removal company to a licensed landfill site, before the total volume reach 35 m³.

- **Boiler Ash:**

Boiler ash from biomass represents a rich source of plant nutrients and will be returned to the surrounding plantation during the planting of tree seedlings. Boiler ash, on removal from the boiler, will be quenched with boiler blow-down water and effluent stream from demineralization plant (to maximize the re-use and recycling of the available water). It is expected that most of the water will evaporate during the process of quenching. Ash will be stored in hoppers on site before removal to a central storage facility (associated with existing forestry operations) for the purposes of land application as fertilizer.

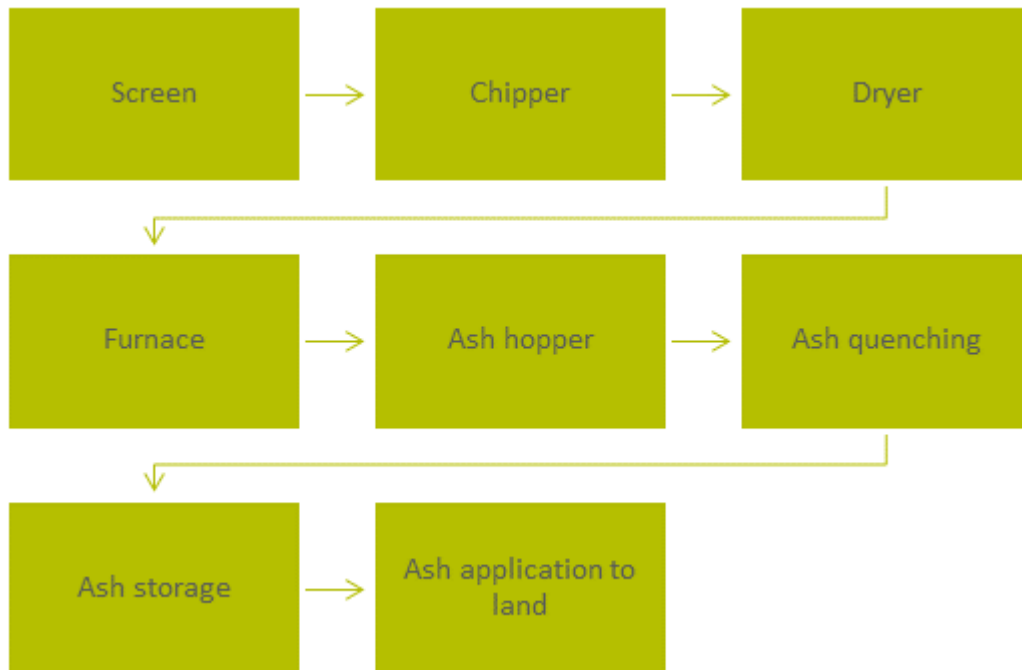


Figure 7: The biomass cycle

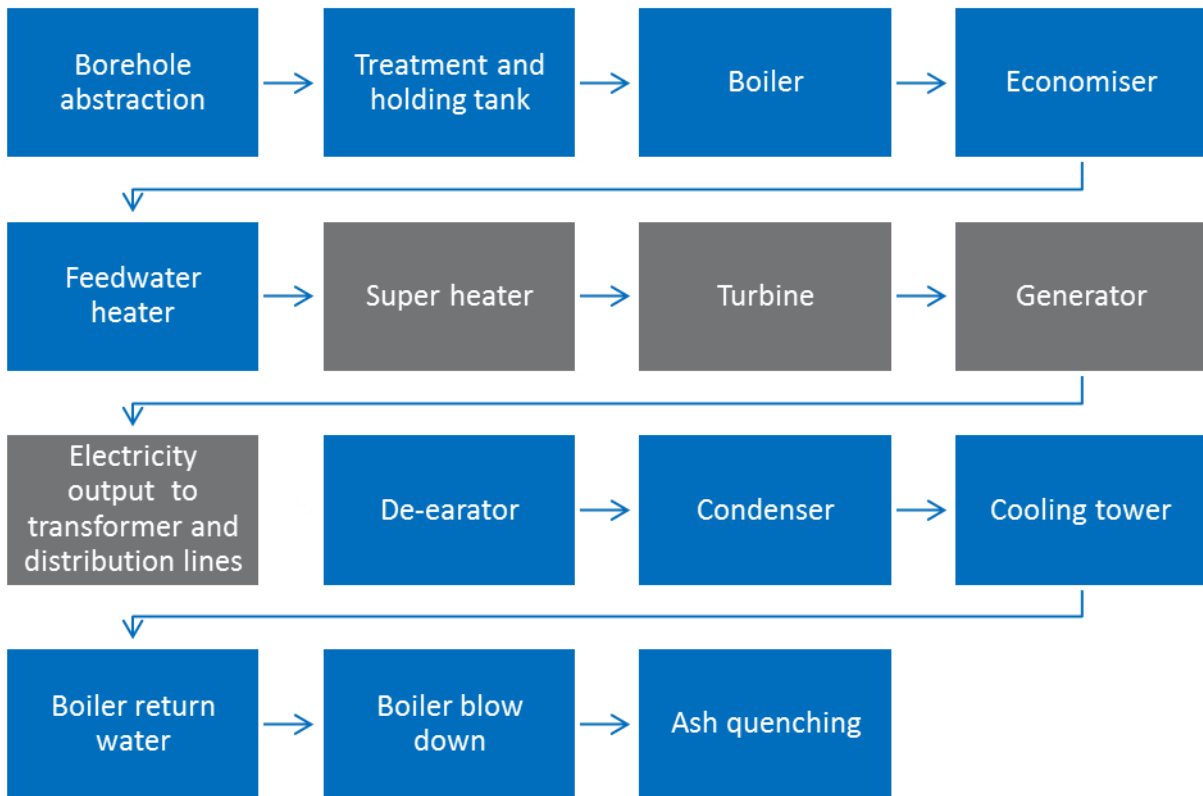


Figure 8: The water (blue blocks) and electricity (blue/grey blocks) process

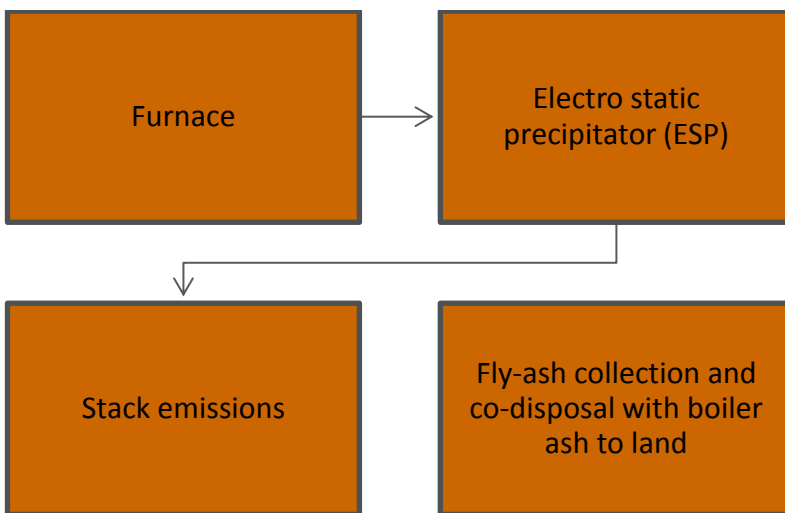


Figure 9: The stack emission cycle

3.2 Related Infrastructure

- I. Water – All the water will be supplied via the boreholes. From the boreholes, the power plant as well as drinkable and sanitation water will be sourced from there.
- II. Sanitation –A final layout and design yet so the ablution facilities have not yet been designed. However, the planning is for a septic tank that will be emptied by a vacuum pump tanker that will dispose of the sewage at a registered waste water treatment works.
- III. Electricity – We will have a loop-in-loop-out from the overhead lines meaning that we will use power off the grid if need be and export power to the overhead lines. The existing sawmill has a transformer but we will not be using this for the power plant at all (very small transformer). The Single Line Diagram of the power plant and facility will also only follow detailed design stage.
- IV. Roads – Please see the attached layout plot plan for the site layout.

3.3 Material Quantities

The following quantities are summarised:

Description	Quantities stored on site	Quantities used/generated per day	Quantities used/generated per annum
Ash from the boiler to be used as fertilizer in local plantations	10m ³	3.6tons	1200 tons generated per annum (91.32% uptime)
Biomass: Sawmill dust/offcuts and plantation offcuts	20 000 tons storage at any one time	750 tons delivered to site per day	274 500 tons delivered per annum
Water Use for electricity	Storage for 7560m ³	3960m ³ water used per day	356,400m ³ water used per annum
Waste Water Effluent	The demin plant produces an effluent stream of 7.5 m ³ /h	90 m ³ per day	32850m ³
Hazardous material (diesel/oil, water treatment additives)	This will only be available after detailed design has been completed.		
Water Use for domestic use	Included in the 7560 m ³ storage above	12m ³ domestic use	3180 m ³

Items	Available Biomass (m ³)	Available Biomass (ton)	Required Biomass for 10 MW Power Plant (ton)
Sawdust & Wood Chips	138435	31 148	98 852
Woodpiles	21734	4 890	31148
Total	160169	36 038	130 000

4 Legislation and guidelines that have been considered in the preparation of the scoping report

4.1 Overarching/Framework legislation

4.1.1 Constitution of the Republic of South Africa (Act No 108 of 1996)

According to Section 24 of the Constitution: "Everyone has the right to an environment that is not harmful to their health or well-being; and (b) 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 proposed development can be considered as sustainable use of renewable natural resources whilst providing employment opportunities and promoting economic development.

4.1.2 National Environmental Management Act (Act No 107 of 1998)

The National Environmental Management Act 107 of 1998 (NEMA) established a set of principles, which all authorities have to consider when exercising their powers during the granting of permits. The principles underpinning environmental management contained in the NEMA, as stated in Section 2 are that sustainable development requires the consideration of all relevant factors including the following:

- That the disturbance of ecosystems and loss of biological diversity are avoided, or where they cannot be altogether avoided, are minimised and remedied;
- That pollution and degradation of the environment are avoided, or, where they cannot be altogether avoided, are minimised and remedied;
- That the development, use and exploitation of renewable resources and the ecosystems of which they are a part do not exceed the level beyond which their integrity is jeopardised;
- That negative impacts on the environment and on people's environmental rights be anticipated and prevented, and where they cannot be altogether prevented, are minimised and remedied.
- Development must be socially, environmentally and economically sustainable.

- Environmental management must be integrated and acknowledge that all elements of the environment are linked and interrelated, and it must pursue the best practicable environmental option.
- People and their needs must be placed at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

Section 28(1) states that “every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring”. If such degradation/pollution cannot be prevented, then appropriate measures must be taken to rectify or minimise such pollution. These measures may include, but are not limited to:

- Assessing the impact of the project or development on the environment;
- Informing and educating employees about the environmental risks of their work and possible ways of minimising such risks;
- Ceasing, adapting or controlling actions which cause pollution/degradation;
- Preventing movement of pollutants;
- Eliminating the pollution source; and
- Remedying the effects of the pollution.

For this reason Regulations have been published which lists activities for which environmental impact assessments are required. The Environmental Impact Assessment Regulations in terms of Chapter 5 of the National Environmental Management Act (NEMA) (Act no. 107 of 1998) were promulgated on 4 December 2014 and include Regulations R983, R984 and 985.

- **Regulation GN R982:** Environmental Impact Assessment Regulations: provides for activities that may impact detrimentally on the environment to require prior environmental authorisation. The Regulations describes the procedures that are to be followed in order to obtain an environmental authorisation.
- **Regulation GN R983 and R984:** sets out lists of identified activities which may not commence without environmental authorisation from the competent authority and which must follow the basic assessment or full scoping EIA procedure as provided for in the NEMA EIA Regulations.
- **Regulations GN 985:** sets out activities in specified regions of the country, for which an environmental authorization will be required.

Details		Attributes	
Field Name	Field Value		
OBJECTID	29427		
Shape	Polygon		
UNIQUE_ID	22832		
VMID	243		
SANBITYPE	Gs 10		
SAVEGTYPEN	Drakensberg Foothill Moist Grassland		
SAVEGBIOME	Grassland		
SAVEGGRP	Sub-Escarpment Grassland		
KZNVGT_TXT	4		
KZNEGTYPE	4		
KZNEGNAME	Drakensberg Foothill Moist Grassland		
KZNEGBIOM	Grassland		
VEG_TYPE	Drakensberg Foothill Moist Grassland		
VEG_STYPE	Drakensberg Foothill Moist Grassland		
PRIORITY_W	0		
AREA	2529562363.348		
PERIMETER	3527640.939		
ACRES	625065.972		
HECTARES	252956.236		
Target_in_	No		
KZN_Con_St	Least Threatened		
CNSRVTNSTT	Least threatened		
Shape_Length	4076892.224769		
Shape_Area	3380253737.87145		

The proposed site does not contain protected or sensitive areas. Listing Notice 3 is therefore not relevant in terms of this application. The proposed project requires a full scoping EIA in terms of R984.

4.2 Biodiversity

4.2.1 National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004)

This Act gives effect to ratified international agreements affecting biodiversity to which South Africa is a party, and which bind the Republic. Furthermore, the Minister may list ecosystems and species that are threatened or in need of protection. The Minister may also list threatening processes and activities in listed ecosystems and related to protected species. The Act also makes provision for the rehabilitation of ecosystems. The Minister may also promulgate a list of invasive species and the required measures associated with these.

Given the location of the proposed project on the existing footprint of a brownfield site, zoned for agricultural use, it is not foreseen that any protected species will be affected.

In terms of Regulation 507 of 19 July 2014 (Publication of National List of Invasive Species) invader species are categorised as follows:

Category 1a Listed Invasive Species

- Take immediate steps to combat, or eradicate where possible.

Category 1b Listed Invasive Species

- Control the listed invasive species.

Category 2 Listed Invasive Species

- Utilization allowed under Permit conditions.
- Control outside of the Permit conditions.

Category 3 Listed Invasive Species

- Subject to certain prohibitions (e.g. sell)
- Category 3 plant specimens in riparian areas are treated as Category 1b.

The Environmental management programme (EMPr) will make provision for the control of all listed invasive species.

4.2.2 National Environmental Management: Protected Areas Act (Act 57 of 2003)

The intention of the Act is to protect and conserve ecologically viable areas as well as their natural landscapes.

The proposed site is not within or close to a formally protected area. The nearest protected area is just over 5km away.

4.2.3 National Veld and Forest Fires Act (Act No 101 of 1998)

The purpose of this Act is to prevent and combat veld, forest and mountain fires throughout the Republic and provides for a variety of institutions, methods and practices for achieving the purpose. Chapter 4 places a duty on owners to prepare and maintain firebreaks. The procedure in this regard and the role of adjoining owners and the fire protection association are dealt with. Chapter 5 places a duty on all owners to acquire equipment and have available personnel to fight fires.

The location of the proposed plant amidst plantations will require specific measures that will be included in the environmental management programme (EMPr) to prevent fires.

4.2.4 Conservation of Agricultural Resources Act, 1983 (Act No 43 of 1983)

The Act sets out measures to prevent the spread of alien vegetation. The legislation includes a list of alien and invasive species and the required measures to be taken in relation to these. The Act also provides for the regulation of control over the utilisation of agricultural resources in SA in order to promote the conservation of soil, water and vegetation (including wetlands). In accordance with the Act, authorisation is required to:

- I. drain or cultivate any vlei, marsh or water sponge;
- II. cultivate any land within the flood area of a water course or within 10 m outside the flood-area of a water course;
- III. divert run-off from a water course; or
- IV. burn veld, including wetland vegetation.

Regulation GNR 1048 of 24 May 1984 (as amended): makes provision of land through various measures, such as the prevention of soil erosion, the prevention of the disturbance of natural flow patterns and run-off, prevention of bush encroachment and makes provision for the restoration of land resources.

Measures will be included in the EMPr to curb the spread of declared weeds and to prevent soil erosion.

4.3 Water

4.3.1 National Water Act (Act No 36 of 1998)

Water use is controlled by the National Water Act (Act no 36 of 1998)(NWA) and the enforcing authority is Department of Water Affairs (DWA). The NWA recognises that water is a scarce resource in South Africa and its provisions are aimed at achieving sustainable use of water to the benefit of all users. The provisions of the Act are thus aimed at discouraging pollution and waste of water resources.

Water use is defined broadly in terms of Section 21, and includes:

- a. Taking water from a water resource;
- b. Storing water;
- c. Impeding or diverting the flow of water in a water course;
- d. Engaging in a stream flow reduction activity reduce stream flow;
- e. Engaging in a controlled activity identified as such in section 37 (1) or declared under section 38 (1);
- f. Discharging waste or water containing waste into a water resource through pipe, canal, sewer, sea outfall or other conduit;
- g. Disposing of waste in a manner which may detrimentally impact on a water resource;
- h. Disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process;
- i. Altering the beds, banks, course or characteristics of a watercourse;
- j. Removing, discharge or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

A water use must be licensed unless it is listed in Schedule I as an existing lawful use, is permissible under a general authorisation, or if a responsible authority waives the need for a license.

The Act also makes amongst others, provision for the prevention and remediation of pollution, the handling and emergency incidences and the registration of dams with a safety risk.

The proposed project requires a water use licence because ground water will be abstracted (Section 21(a)). No water will be disposed of into the environment and no wetlands or water courses will be affected during construction or operation. Measures will however be included in the EMPr related to the prevention of the pollution of storm water run-off, the prevention of water resource pollution and the handling of emergency incidences.

4.4 Waste

4.4.1 National Environmental Management Waste Act (Act 59 of 2008) and amendment R449 dated 2 June 2014.

In July 2009, the National Environmental Management Waste Act (Act 59 of 2008) came into effect. This Act requires that any holder of waste must take all reasonable measures to –

- avoid the generation of waste and where such generation cannot be avoided, to minimise the toxicity and amounts of waste that are generated;
- re-use, recycle or recover waste;
- where waste must be disposed of, to ensure that the waste is treated and disposed of in an environmentally sound manner;
- manage the waste in such a manner that it does not endanger health or the environment or cause a nuisance through noise, odour or visual impacts;
- within that person's power, prevent any other person from contravening a provision of this Act in respect of the waste; and
- take reasonable measures to prevent the waste from being used for an unauthorised purpose.

The Minister published a list of waste management activities which require authorization under the Act. Government Notice R921 of 29 November 2013 lists Category A and Category B waste activities which requires any person undertaking such activities to perform a Basic Assessment Process or Scoping / EIA Process respectively. No person may commence, undertake or conduct a waste management activity listed in the GN R718 unless a license is issued in respect of that activity.

Activities associated with the proposed project that requires a Waste Management License Application for the use of sawmill dust/offcuts and the disposal of ash as fertilizer into surrounding plantations. No hazardous waste will be generated during construction and operation (unless an incident occurs where hydrocarbons are spilled).

4.5 Atmospheric emissions

4.5.1 National Environmental Management: Air Quality Act (Act No 39 of 2004)

The Act provides for the protection of air quality in South Africa. Amongst others, no person may without a provisional atmospheric emission license or an atmospheric license conduct an activity that is listed in the Act. The Act also makes provision for ambient air quality standards related to criteria air pollutants in SA.

Table 1: Category 1: Combustion Installation

(1) Subcategory 1.1: Solid Fuel Combustion Installations

Category 1: Combustion Installations

(1) *Subcategory 1.1: Solid Fuel Combustion Installations*

Description:	Solid fuels combustion installations used primarily for steam raising or electricity generation.		
Application:	All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used.		
Substance or mixture of substances		Plant status	mg/Nm³ under normal conditions of 10% O₂, 273 Kelvin and 101.3 kPa.
Common name	Chemical symbol		
Particulate matter	N/A	New	50
		Existing	100
Sulphur dioxide	SO ₂	New	500
		Existing	3500
Oxides of nitrogen	NO _x expressed as NO ₂	New	750
		Existing	1100

The proposed project requires an air emission license given that activities as listed under the Act will be conducted – Subcategory 1.1. An air quality assessment has been done as part of the impact study associated with the application for environmental authorization.

4.5.2 National Dust Control Regulations, 2013: No R 827

The Regulations makes provision for the control of dust as well as to prescribe acceptable dust fall levels (as indicated in the table below).

Table 2: Dust Control Regulations

Restriction Areas	Dustfall rate (D) (mg/m ² /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.

Dust will be generated by the proposed activities during construction. Adequate dust control measures will have to be instituted to ensure that the fall-out rates do not exceed the standards. Dust control measures will be included in the EMPr.

4.6 National Ambient Air Quality Standards

In terms of R 1210 of 24 December 2009, National Ambient Air Quality Standards were promulgated. The standards include those for Nitrogen dioxides (NO₂), Sulphur Dioxide (SO₂), Ozone (O₃), lead, benzene and Particulate matter (PM 10) and Carbon Monoxide (CO).

In terms of R 486 of 29 June 2012, National; Ambient Air Quality standards for particulate matter with an aerodynamic diameter less than 2.5 micron (PM 2.5) were promulgated.

The EMPr will include measures to ensure that air quality in the region is not deteriorated and to ensure compliance with the National Ambient Air Quality Standards

4.7 Government Notice, R. 533 National Environmental Management: Air Quality Act (39/2004): Regulations regarding Air Dispersion Modelling, page 3 in Government Gazette 37804, 11 July 2014

The Regulations dictates the methodology for air dispersion modelling.

The air quality impact assessment modelling study will have to comply with the Regulations

4.8 Draft: National Environmental Management Air Quality Act, Act No. 39 of 39 of 2004, Declaration of Greenhouse Gases as Priority Air Pollutants, 14 March 2014

A person conducting an activity set out in Annexure I to this Notice which involves the emission of greenhouses declared as priority air pollutant in paragraph 2 in excess of 0.1 Megatonnes (109 kg) (Mt) or more annually or measured as CO₂-eq is required to submit a pollution prevention plan.

The following greenhouse gases or any other gases are declared priority air pollutants in terms of section 29(1)(a) of this Act: (a) Carbon dioxide (CO₂); (b) Methane (CH₄); (c) Nitrous oxide (N₂O); (d) Hydrofluorocarbons (HFCs); (e) Perfluorocarbons (PFCs); and (f) Sulphur hexafluoride (SF₆).

During the air quality assessment, the amount of CO₂ released during the operations, will have to be calculated in order to determine if a pollution prevention plan under this Regulations have to be submitted provided the draft regulations is formally promulgated during this time.

4.9 National Environmental Management Act: Air Quality Act, 2004 (Act No 39 of 2004): Declaration of small boilers as a controlled emitter and establishment of emission standards, 1 November 2013

In terms of these regulations, small boilers have to comply with specified emission standards Small boilers are those with a design capacity equal to 10MW but less than 50MW net heat input from any fuel type. Operators have to submit emission reports to the relevant authorities.

There are no small boiler onsite.

4.9.1 Environment Conservation Act, 1989 (Act No 73 of 1989) – Noise Control Regulations in terms of Section 25 of the Environment Conservation Act, 1989: GN 154 of January 1992

The Regulations makes provision for the control of disturbing and nuisance noise.

A noise disturbance or nuisance as defined in the national and provincial legislation means any sound which disturbs or impairs the convenience of any person. The Regulations describe a disturbing noise as noise that exceeds the ambient noise by more than 7 dB. This difference is usually measured at the location of the person experiencing the noise as disturbing. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7 dB, the noise can be construed as a disturbance.

The most applicable standard for use relevant to the proposed project is SANS 10103:2008 which provides typical rating levels for noise in various types of districts, as described in Table 1 below. SANS 10103:2008 defines daytime as between 06:00 to 22:00 hours and night time as between 22:00 to 06:00 hours. The rating levels in the table above indicate that in industrial districts the ambient noise.

Table 3: Typical rating levels for noise in various types of districts (SANS 10103:2008)

Type of District	Equivalent Continuous Rating Level, LReq.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

Noise levels in industrial areas should not exceed 60 dB(A) at night and 70 dB(A) outdoors during the day. The day / night (24hour) rating limit is 70 dB(A). These levels can thus be seen as the maximum target levels for any noise pollution sources.

The site is located within a rural area. It is not foreseen that the proposed project will contribute to the ambient noise levels in the area but noise control measures will be included in the EMP. Once the site is operational, a noise impact assessment will have to be done, and should noise levels exceed the relevant noise standards, engineering controls will have to be implemented to reduce noise impacts beyond the site boundaries.

4.10 Heritage resources

4.10.1 National Heritage Resources Act No 25 of 1999 (Act No 25 of 1999 as amended)

No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as—

- a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
- b. the construction of a bridge or similar structure exceeding 50 m in length;
- c. any development or other activity which will change the character of a site
 - I. exceeding 5 000 m² in extent; or
 - II. involving three or more existing erven or subdivisions thereof; or
 - III. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
 - IV. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
- d. the re-zoning of a site exceeding 10 000 m² in extent; or
- e. any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority,

A heritage impact assessment study will be required due to the size of the development and the construction of an access road and power line. The study has been done and no heritage objects have been found.

4.11 Municipal Biodiversity Summaries

(As per Sanbi: BGIS, 2015) Municipalities have a significant role to play in biodiversity conservation as part of their mandate to provide a safe and healthy environment for residents. In support of this role, the Department of Environmental Affairs (DEA) and the South African National Biodiversity Institute (SANBI) identified the need to provide municipalities with good quality biodiversity information that is easily accessible. The Municipal Biodiversity Summary project aims to make biodiversity information, including spatial data, available to municipalities to support them in their reporting responsibilities such as the drafting of State of Environment Reports. In addition, the project also provides municipalities with generic land-use planning and decision-making implications in terms of listed threatened ecosystems and other biodiversity features.

A municipal biodiversity summary has been developed for each municipality in South Africa. The summary provides a standard, national set of biodiversity information for each municipality which includes the following:

- Statistics for a selection of biodiversity features

- A terrestrial biodiversity summary map
- Shapefiles of biodiversity features for downloading
- Access to an interactive map to produce your own map of biodiversity features within a municipality
- A series of fact sheets related to the project

The main focus of the Municipal Biodiversity Summary Project is not as a land-use planning and decision-making tool as there are other tools, namely biodiversity sector plans and bioregional plans, which provide this role. Municipal biodiversity summaries are primarily a reporting tool providing biodiversity statistics, based on the best available national data, for municipalities. However, in those municipalities where there is no biodiversity sector plan or bioregional plan the municipal biodiversity summary for the municipality can provide some guidance in terms of land-use planning and decision-making as it provides information on the location of threatened ecosystems and other biodiversity features within the municipality.

The Municipal Biodiversity Summary Project used national data generated as of December 2009, unless otherwise indicated. Additional finer-scale biodiversity information is available on BGIS for some municipalities in the country. It is important to note that when this is the case, the finer-scale information should be used for land-use planning and decision-making purposes.

A BGIS Land Use Decision Support (LUDS) Report was compiled from the Sanbi website and is provided in the section below:



BGIS Land Use Decision Support (LUDS)

Report

Generated on the BGIS website: 8/28/2015

Disclaimer:

The Land-Use Decision Support (LUDS) Tool has been developed to facilitate and support biodiversity planning and land-use decision-making at a national and provincial level. Its primary objective is to serve as a guide for biodiversity planning and should not replace specialist ecological assessments.

While SANBI endeavours to keep the information on BGIS up-to-date and makes reasonable efforts to ensure that the data it publishes are accurate, SANBI makes no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information contained on the website for any purpose. SANBI will not be liable for any loss or damage; including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this tool.

Please note: that the spatial information incorporated into the LUDS Tool was mapped at various scales, with much of the spatial information mapped at a scale of 1:250 000 (i.e. 1 cm on the map = 2,5 km on the ground) or greater. To ensure maximum accuracy, always check the map against actual conditions on the ground when undertaking planning and decision-making, or contact the relevant conservation authority for additional assistance.

Information extracted from national datasets

The information below is extracted for the analysed area from national datasets available on BGIS. There is a short description of the dataset under each heading and the URLs to the webpage on BGIS with further information.

4.11.1 National terrestrial information

4.11.1.1 National list of threatened terrestrial ecosystems

BGIS source:

National list of threatened terrestrial ecosystems for South Africa (2011) – original extents

A list of all threatened ecosystem patches which original extent intersects the analysed area. Note: the data represents the **original extents** of the threatened ecosystems; in other words, natural areas which have been converted to agriculture, mining and urban areas have been **included**. Please view the area using the BGIS online map viewer Bing maps or Google maps tool in order to see whether any natural vegetation may still exist.

Please note that the number and names of these ecosystems may not be the same as those of the vegetation types because criterion F Priority areas for meeting explicit biodiversity targets as defined in a systematic biodiversity plan was used to develop the list for Gauteng.

BGIS project overview and report: <http://bgis.sanbi.org/ecosystems/project.asp>

BGIS download metadata and layer: <http://bgis.sanbi.org/ecosystems/map.asp>

Ecosystem name	Code	Status
#threatened system	0	

4.11.1.2 National vegetation types

BGIS source:

Vegetation Map of South Africa, Lesotho and Swaziland (Mucina & Rutherford 2006)

A list of all the national vegetation types the corresponding number of patches of each which original extents covered the analysed area. Note that this list is based on the estimated original extents of the vegetation types prior to any transformation. Please view the area using the BGIS online map viewer Bing maps or Google maps tool in order to see whether any natural vegetation may still exist.

BGIS project overview and report: <http://bgis.sanbi.org/vegmap/project.asp>

BGIS download metadata and layer: <http://bgis.sanbi.org/vegmap/map.asp>

Instructions on how to find Mucina & Rutherford (2006) vegetation type descriptions using BGIS online maps:

http://bgis.sanbi.org/vegmap/Veg_Map_Instructions.pdf

The **map code** below refers to the short code used on the wall map and BGIS interactive maps which helps to accurately identify a vegetation type given the complexity of the map's legend colours.

Vegetation Name	Map Code	Biome
Drakensberg Foothill Moist Grassland	GS10	Grassland Biome

4.11.1.3 Indigenous forest patches (DWAF)

BGIS source:

DWAF Indigenous Forest Patches (2005)

A list of all the indigenous forest patches found within the analysed area

BGIS project overview and report: <http://bgis.sanbi.org/indigenousforest/project.asp>

BGIS download metadata and layer: <http://bgis.sanbi.org/indigenousforest/map.asp>

Forest Name	Forest Group	Forest Patch
#Forest Patch	0	

4.11.1.4 National soil classes

BGIS source:

General soils and soil classes

A list of all the dominant soil classes the extents of which cover the analysed area. Please note that these soil classes were developed for agricultural use.

BGIS project overview and report: <http://bgis.sanbi.org/Soils/project.asp>

BGIS download metadata: <http://bgis.sanbi.org/Soils/project.asp>

(Please contact the data owner, the Agricultural Research Council, to obtain the GIS data).

Soil Class	Soil Class ID
Freely drained, structure less soils	S2

4.11.1.5 National aquatic information

4.11.1.5.1 Wetlands (NFEPAs Wetlands/National Wetlands Map 4)

BGIS source:

National Freshwater Ecosystem Priority Areas (NFEPAs) Wetland Map/National Wetlands Map 4 and NFEPAs wetland clusters.

A list of all Wetland units found within the analysed area, should these belong to a wetlands cluster its information is also included. Wetlands and wetland clusters which were selected as freshwater ecosystem priority areas (FEPAs) are indicated. A key to the information codes used is given below.

BGIS project overview and report (National Wetlands 4/Wetland clusters):

<http://bgis.sanbi.org/nfepa/project.asp>

BGIS download metadata and layer (National Wetlands 4/Wetland clusters):

<http://bgis.sanbi.org/nfepa/NFEPAmap.asp>

Wetlands

Wetland Types	Description	Condition	NFEPA Rank	FEPA Status
#wetland units	0			

Wetland Clusters

Wetland Cluster ID
#wetland clusters 0

4.11.1.6 Sub-quaternary catchments and rivers (NFEPA)

BGIS source:

National rivers and sub-quaternary catchment FEPA status (NFEPA)

A list of all NFEPA sub-quaternary catchments and their FEPA status followed by the river units they contain with various parameters and indicators. A sub-quaternary catchment and its river indicated as FEPA are fresh water ecosystem priority areas, A blank FEPA status indicates that NFEPA did not give the sub-quaternary catchment or river priority status. A key to the other information codes used is given below.

BGIS project overview and report (NFEPA River FEPAs and NFEPA rivers):

<http://bgis.sanbi.org/nfepa/project.asp>

BGIS download metadata and layer(NFEPA river FEPA and NFEPA rivers):

<http://bgis.sanbi.org/nfepa/NFEPAmap.asp>

Sub-quaternary catchments (river FEPAs)

NFEPA ID	FEBA Status
4560 # sub-quaternary catchments: 1	FishFSA

NFEPA river units

River Name	FEBA Status	Mainstream	Flagship
River Units: Condition: 0			

4.11.1.7 National protected area information

BGIS source:

Protected areas formal and informal (NBA 2011 and NPAES 2010)

A list of all protected areas the extents of which intersect with the analysed area. The formal protected areas were updated by the National Biodiversity Assessment (NBA 2011) whereas the informal protected areas were updated by the National Protected Areas Expansion Strategy (NPAES 2010).

Also included is a list of any NPAES 2010 focus areas that were intersected by the analysed area.

BGIS NBA 2011 project overview and report:

<http://bgis.sanbi.org/NBA/project.asp>

BGIS formal protected areas (NBA 2011) download metadata and layer:

http://bgis.sanbi.org/NBA/terrestrial_formalprotecedareas.asp

BGIS NPAES 2010 project overview and report:

<http://bgis.sanbi.org/protectedareas/NPAESinfo.asp>

BGIS informal protected areas (NPAES 2010) download metadata and layer:

<http://bgis.sanbi.org/protectedareas/ProtectedAreas.asp>

BGIS NPAES 2010 focus areas download metadata and layer:

<http://bgis.sanbi.org/protectedareas/NPAES.asp>

Protected Area Name

Formal Protected Area

Category Management Agent

#Formal Protected Areas: 0

Informal Protected Area

Category Management Agent

#Informal Protected Areas: 0

NPAES Focus Area Name

NPAES Focus Area

Category Management Agent

#NPAES Focus Area: 0

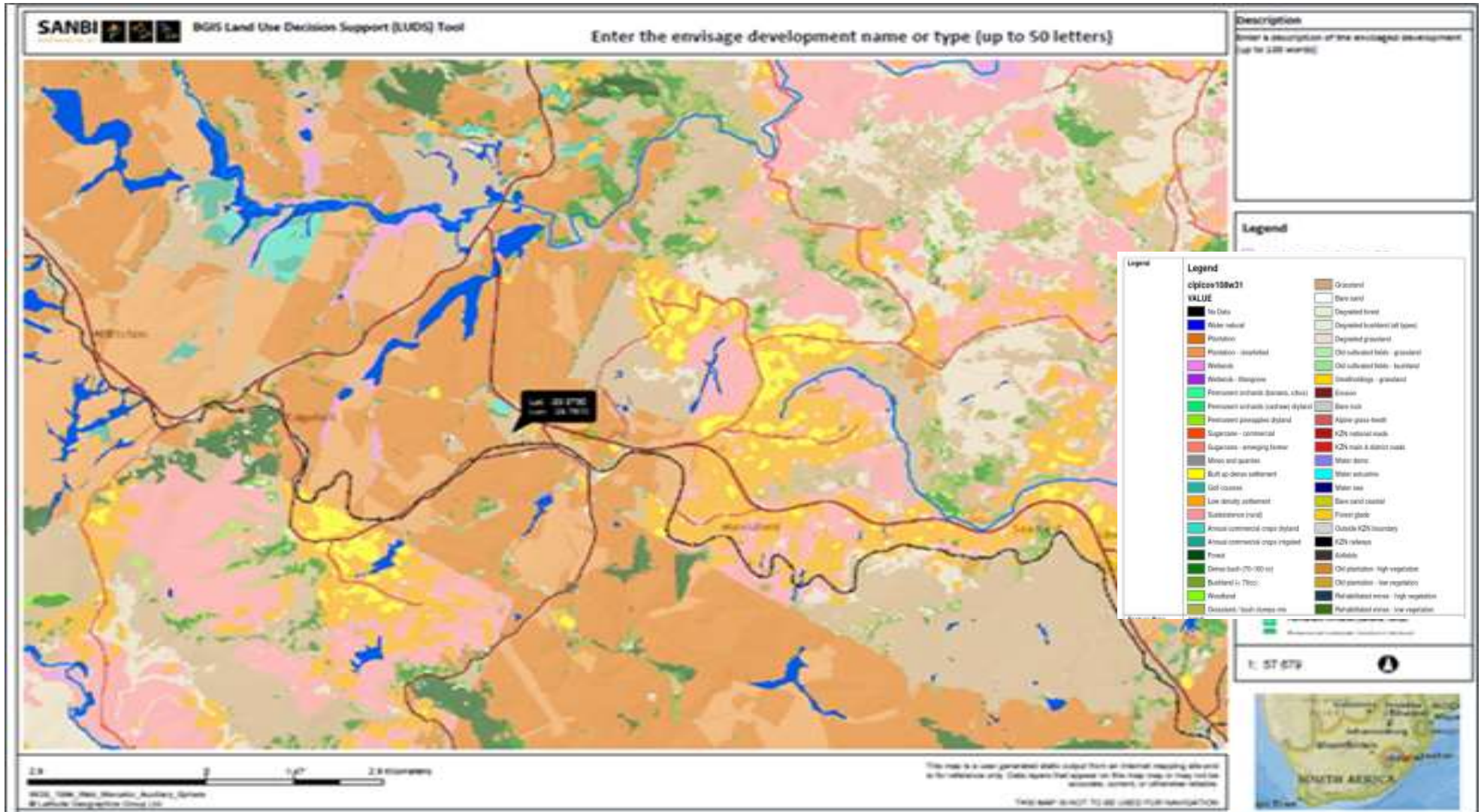


Figure 11: Map indicating grassland biomes

The project area is located within a degraded grassland area.

4.11.1.8 Information extracted from the most relevant biodiversity conservation plan for KwaZulu-Natal

The information below is extracted for the analysed area from the most relevant and up to date biodiversity conservation plan available on BGIS - the KZN Terrestrial Systematic Conservation Plan (SCP) and the KZN Aquatic SCP. There is a short description of the dataset under each heading and the URLs of the webpage on BGIS with further information.

Note on the conservation plan unit categories used in the KZN Terrestrial SCP and KZN Aquatic SCP

In order to better understand the KZN Terrestrial SCP and KZN Aquatic SCP please examine the tables below which briefly summarise the conservation plan categories they use.

Table 4: KZN Terrestrial SCP Category Descriptions (Legends and Definitions)

	Category	Legend field	Description
	Protected Area (PA)	Res	Reserves in the KwaZulu-Natal formal protected area network
	Critical Biodiversity Area 1 (CBA 1) Mandatory	R2	CBA2 units indicate the presence of one (or more) features with a very high irreplaceability score. In practical terms, this means that there are alternate sites within which the targets can be met, but
	Critical Biodiversity Area 2 (CBA 2) Mandatory	R1	CBA 3 units are optimal areas identified through systematic conservation planning software which represent the best localities out of a potentially larger selection of available planning units that are optimally located to meet both the conservation target but also the criteria defined within additional decision support layers
	Critical Biodiversity Area 3 (CBA 3) Optimal	R0	Units categorised as Biodiversity Areas (Bas) represent the natural and/or near natural environmental areas (i.e. non- transformed areas) not highlighted in the KZN SCP. It is important to note that their lack of selection for one of the CBA categories above should not be misinterpreted as reflecting areas of no biodiversity value. Whilst it is preferred that development be focused within these areas, this still has to be conducted in an informed and sustainable
	Biodiversity area	OCO	Areas that are 100% transformed according to KwaZulu-Natal landcover 2005
	100% transformed	IGN	These are areas which are 100% transformed according to the KwaZulu-Natal landcover 2005 coverage.
	Outside province	Out	Outside KwaZulu-Natal

Table 5: KZN Aquatic SCP category descriptions (Status field definitions)

	Status field	Description
	CONSERVED	Formal Protected Areas (PA)
	EARMARKED	Optimal biodiversity areas required to meet biodiversity targets
	AVAILABLE	Untransformed biodiversity areas
	EXCLUDED	Biodiversity transformed area

4.11.1.9 Terrestrial information for KwaZulu-Natal

BGIS source:

KwaZulu-Natal Systematic Conservation Plan (KZN SCP) – Terrestrial SCP (2011)

A list of all conservation plan units that intersect the analysed area. A short description of the conservation plan categories (legend definitions R0, R1 etc) used in the KZN Terrestrial SCP is given above. The top five biodiversity features with the highest irreplaceability scores are listed with each unit in descending order. Many units may have fewer features and some more, the plan makes provision for ten features.

BGIS project overview and report:

<http://bgis.sanbi.org/kzn/project.asp>

BGIS download metadata and layer:

<http://bgis.sanbi.org/kzn/terrestrialSCP.asp>

List of Plan Units

Other Areas

Unit ID: #51442

Top Five Irreplaceable Biodiversity Features	Unit Size (Ha): 55.988
--	------------------------

Feature 1: Mo_edolym_d- Euonyma Lymneaeformis

Feature 2: Drakensberg Foothills Moist Grassland

Feature 3: Mi_SPITRI_D – Spinotarsus Triangulosus

Feature 4: Mi_DORMON_D- Doratogonus Montanus

Feature 5: Mi_CENTRI_D- Centrobolus Tricolor

Other Areas

Unit ID: #51460

Top Five Irreplaceable Biodiversity Features	Unit Size (Ha): 95.126
--	------------------------

Feature 1: Mo_edolym_d- Euonyma Lymneaeformis

Feature 2: Drakensberg Foothills Moist Grassland

Feature 3: Mi_SPITRI_D – Spinotarsus Triangulosus

Feature 4: Gr_Tradra_d- Transvaaliana draconis

4.11.1.10 Aquatic Information for KwaZulu-Natal

BGIS source:

KwaZulu-Natal Conservation Plan (KZN SCP) – Freshwater SCP (2007)

A list of all conservation plan units that intersect the analysed area. A short description of the conservation plan categories (Status field definitions) used in the KZN Aquatic SCP is given above. The biodiversity features for each unit may be determined with the unit id and following the instructions for the linked files available at <http://bgis.sanbi.org/kzn/freshwaterSCP.asp>.

BGIS project overview and report:

<http://bgis.sanbi.org/kzn/project.asp>

BGIS download metadata and layer:

<http://bgis.sanbi.org/kzn/freshwaterSCP.asp>

Category (Status Field)	Unit ID	Unit Size (Ha)
Available	4417	3131.68
Available	4418	1052.16
#plan unit: 2		

In accordance with the LUD report, the site does not contain any sensitive ecological features.

4.12 Environmental Management Framework

<http://www.kzndae.gov.za/Portals/0/Environment/Planning/EMP%20map.pdf>

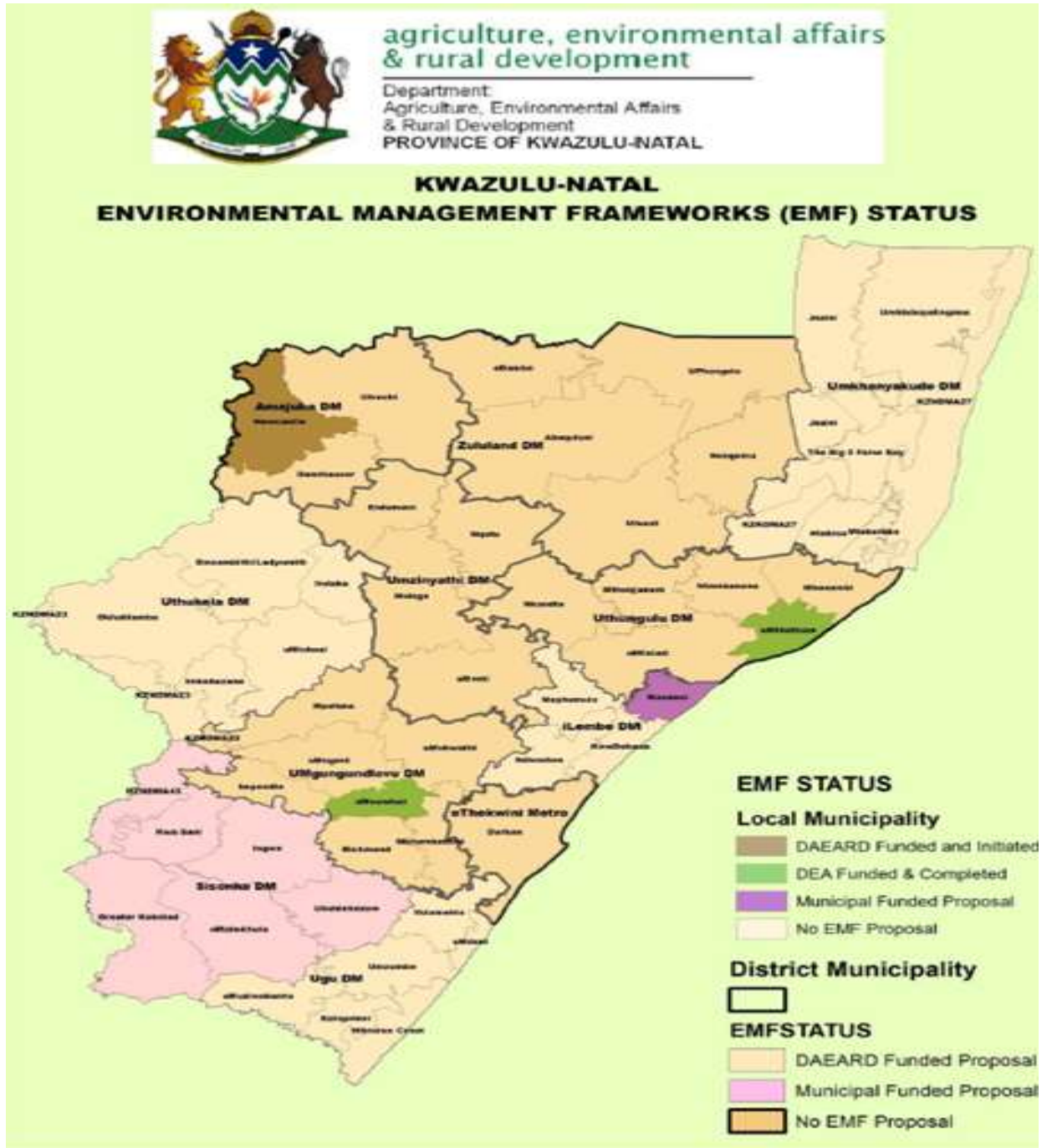


Figure 12: EMF Map









































According to the above map, the site area does not have an Environmental Management Framework (EMF).

5 A Description of the Environment that may be affected by the Proposed Activity

5.1 Geographical

The Land Cover map below (obtained from BGIS, SANBI, 2015) indicates the land uses associated with the project site are degraded grasslands.

Table 6: Grassland Biomes

Legend	Legend
clplcov108w31	
VALUE	
 No Data	 Grassland
 Water natural	 Bare sand
 Plantation	 Degraded forest
 Plantation - clearfelled	 Degraded bushland (all types)
 Wetlands	 Degraded grassland
 Wetlands - Mangrove	 Old cultivated fields - grassland
 Permanent orchards (banana, citrus)	 Old cultivated fields - bushland
 Permanent orchards (cashew) dryland	 Smallholdings - grassland
 Permanent pineapples dryland	 Erosion
 Sugarcane - commercial	 Bare rock
 Sugarcane - emerging farmer	 Alpine grass-heath
 Mines and quarries	 KZN national roads
 Built up dense settlement	 KZN main & district roads
 Golf courses	 Water dams
 Low density settlement	 Water estuarine
 Subsistence (rural)	 Water sea
 Annual commercial crops dryland	 Bare sand coastal
 Annual commercial crops irrigated	 Forest glade
 Forest	 Outside KZN boundary
 Dense bush (70-100 cc)	 KZN railways
 Bushland (< 70cc)	 Airfields
 Woodland	 Old plantation- high vegetation
 Grassland / bush clumps mix	 Old plantation - low vegetation
	 Rehabilitated mines - high vegetation
	 Rehabilitated mines - low vegetation

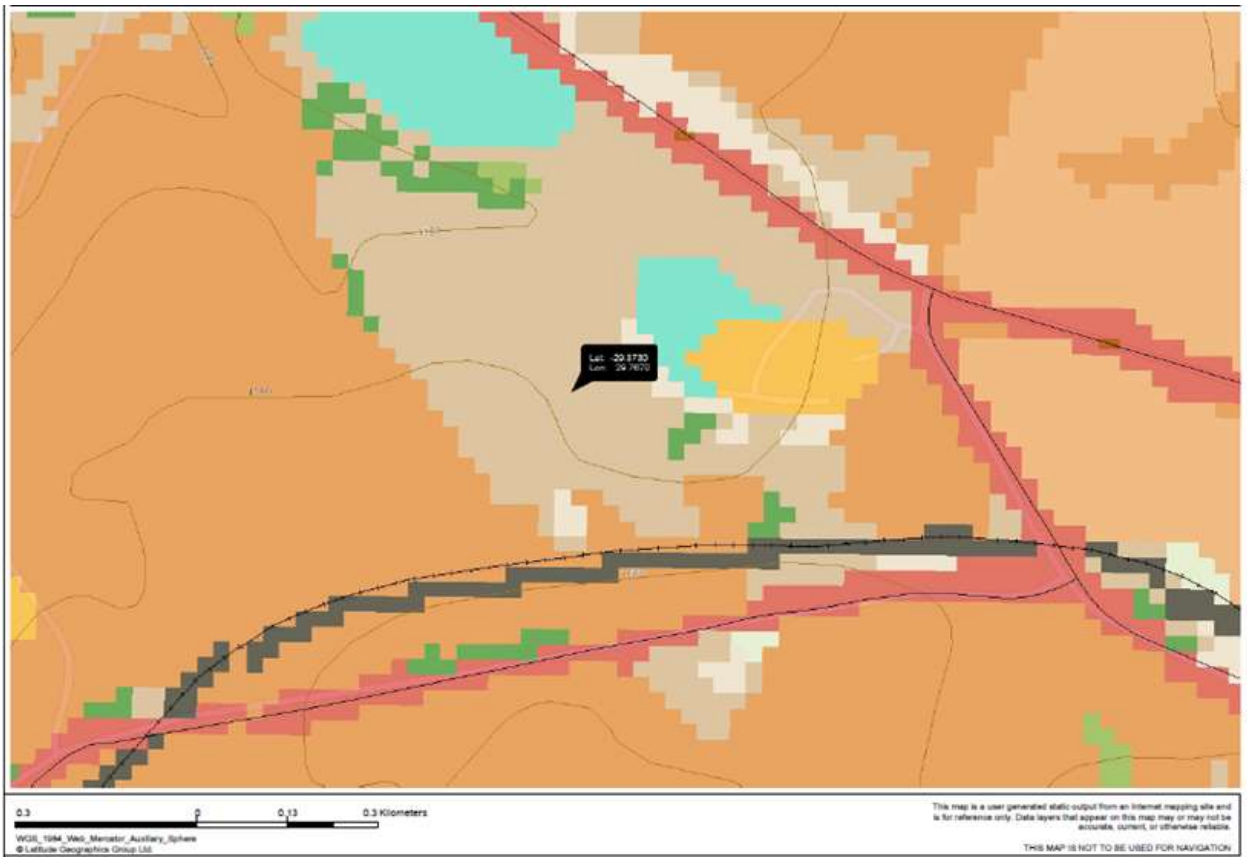


Figure 13: Land cover classes associated with the region (Data from SANBI, 2012)

5.2 Physical

Relief on the site varies around 1580 mamsl. The site is fairly flat with the highest point towards the eastern side of the site and a strong downward slope towards the northwestern side.

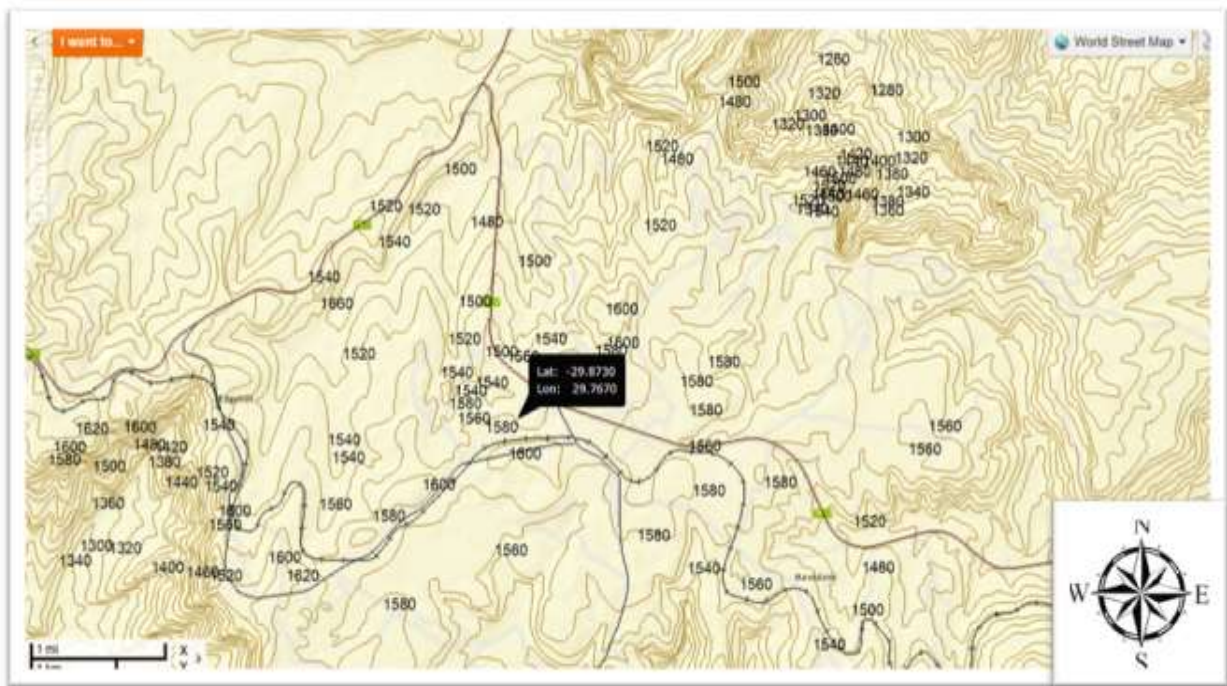


Figure 14: 20 meter contours associated with the project site, indicating the slope levels of the site (SANBI, 2016).

5.2.1 Climate

The site falls within the summer rainfall area of South Africa. Daily summer temperatures range between 14°C and 25°C. Winter temperatures range between 1°C and 20°C. Spring temperatures range between 5°C and 22°C, while autumn temperatures range between 6°C and 22°C. The site falls within a humid zone. Average rainfall for the area is between 801 and 1000mm per annum.



Figure 15: Temperature-Mean Maximum Annual

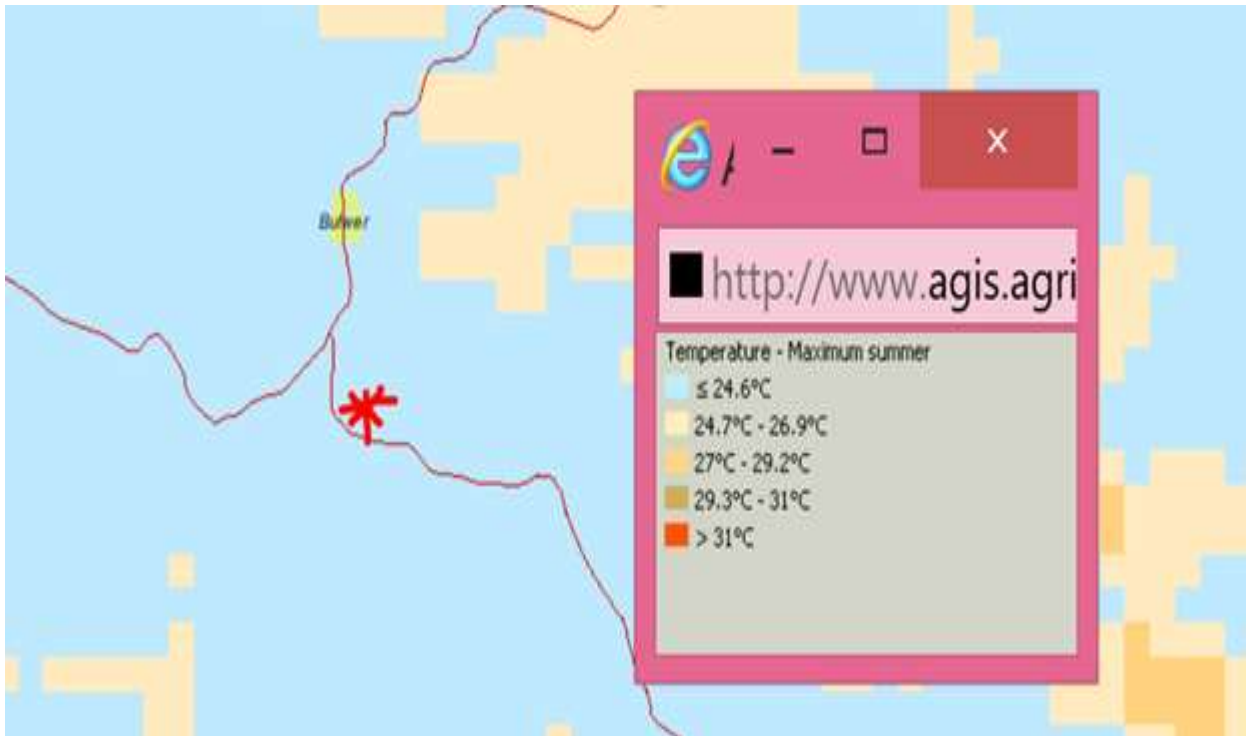


Figure 16: Temperature-Maximum Summer

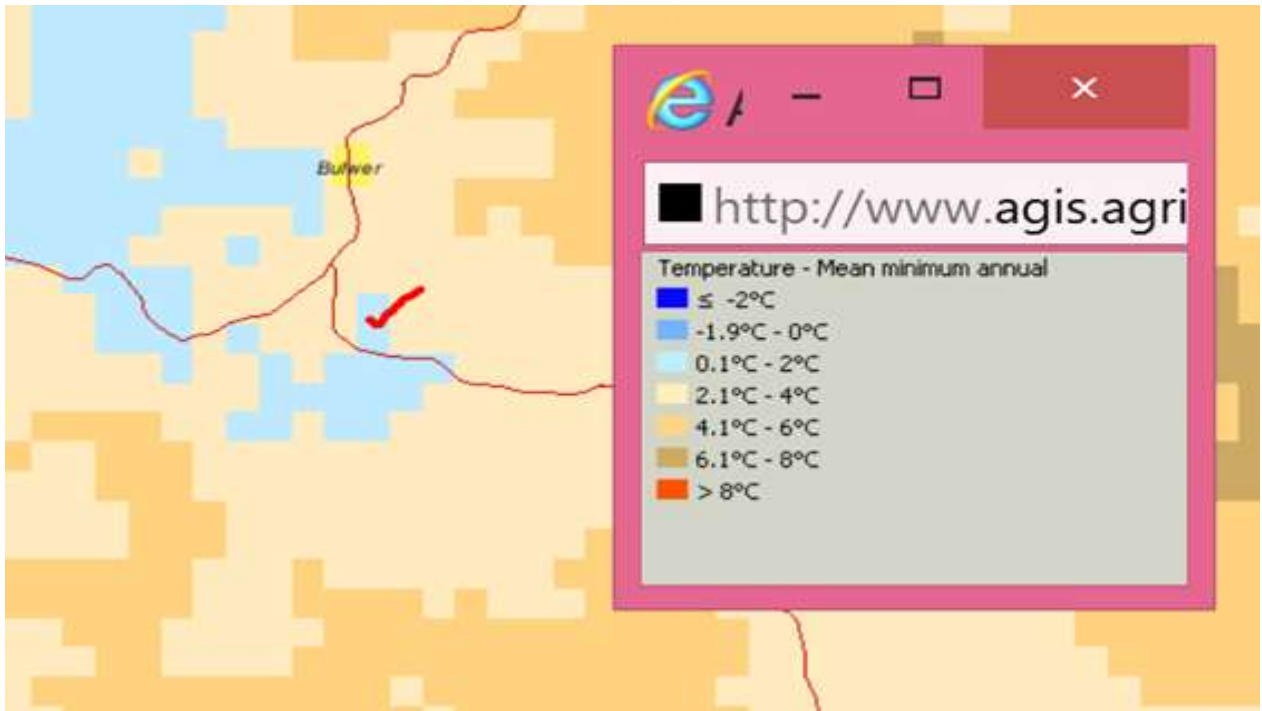


Figure 17: Temperature-Mean Minimum Annual

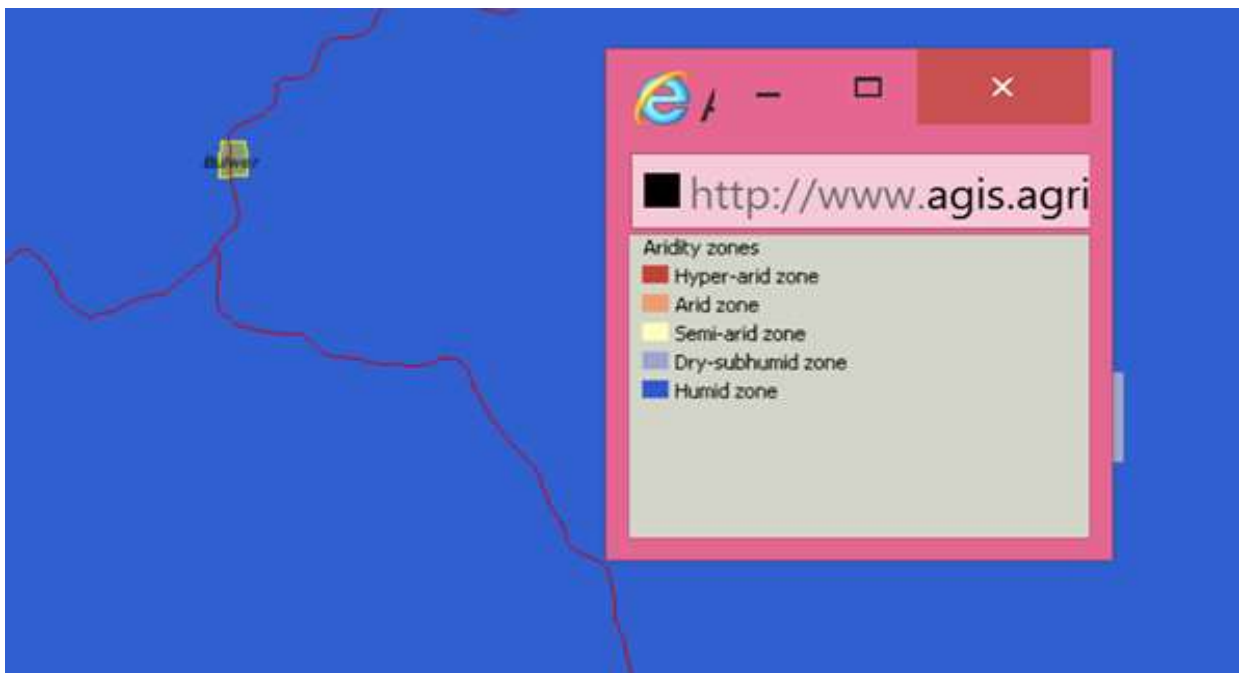


Figure 18: Aridity Zones

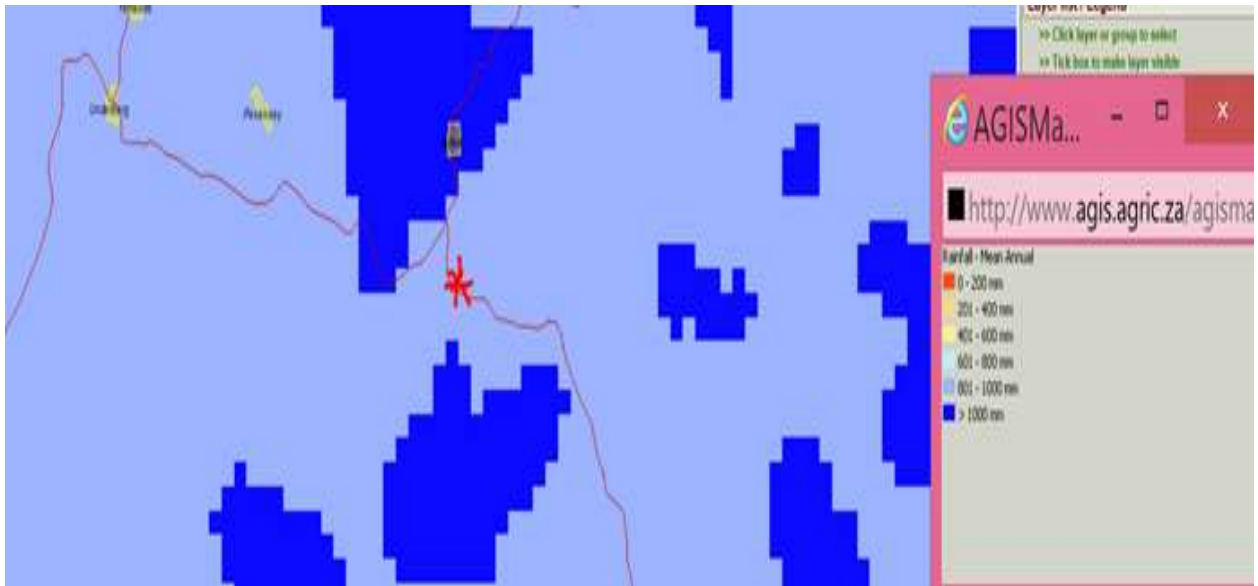


Figure 19: Average rainfall for the area between 801 and 1000mm per annum
<http://www.agis.agric.za/agisweb>

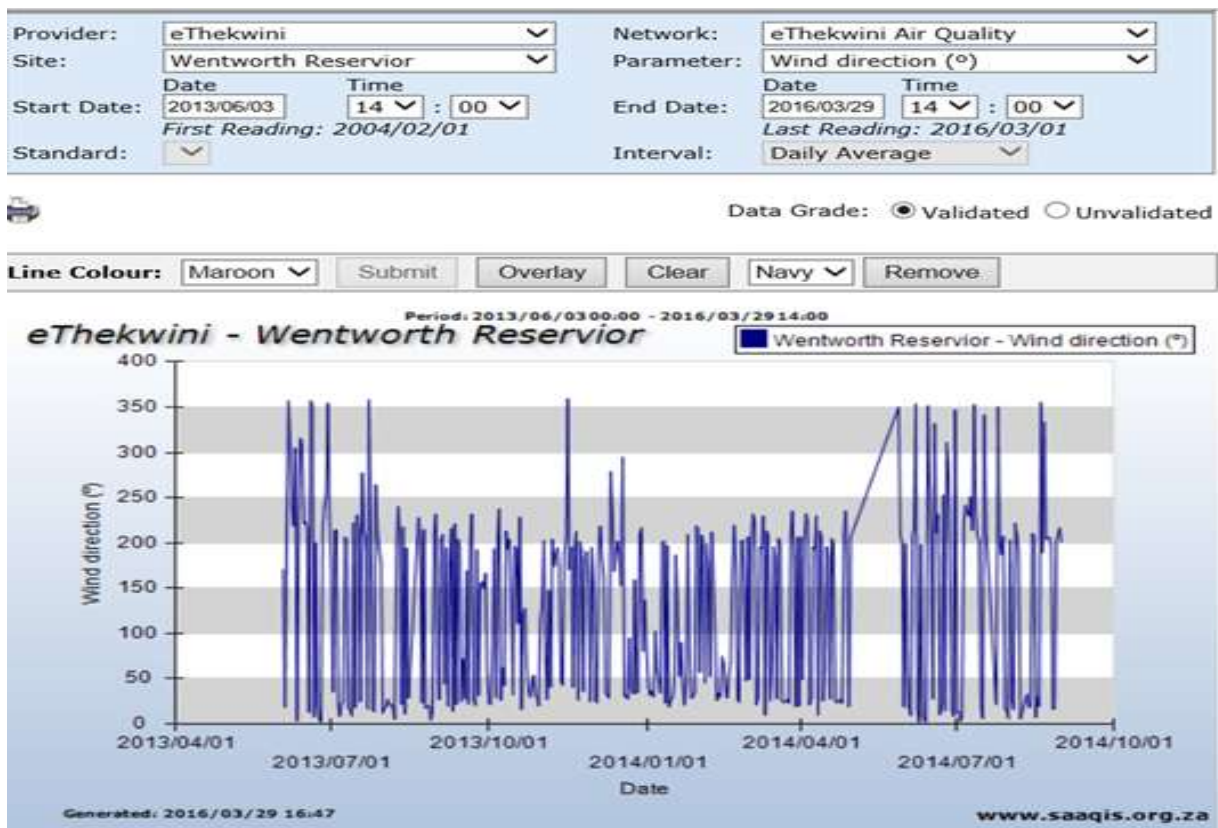


Figure 20: Wentworth Reservoir Wind Direction (*)

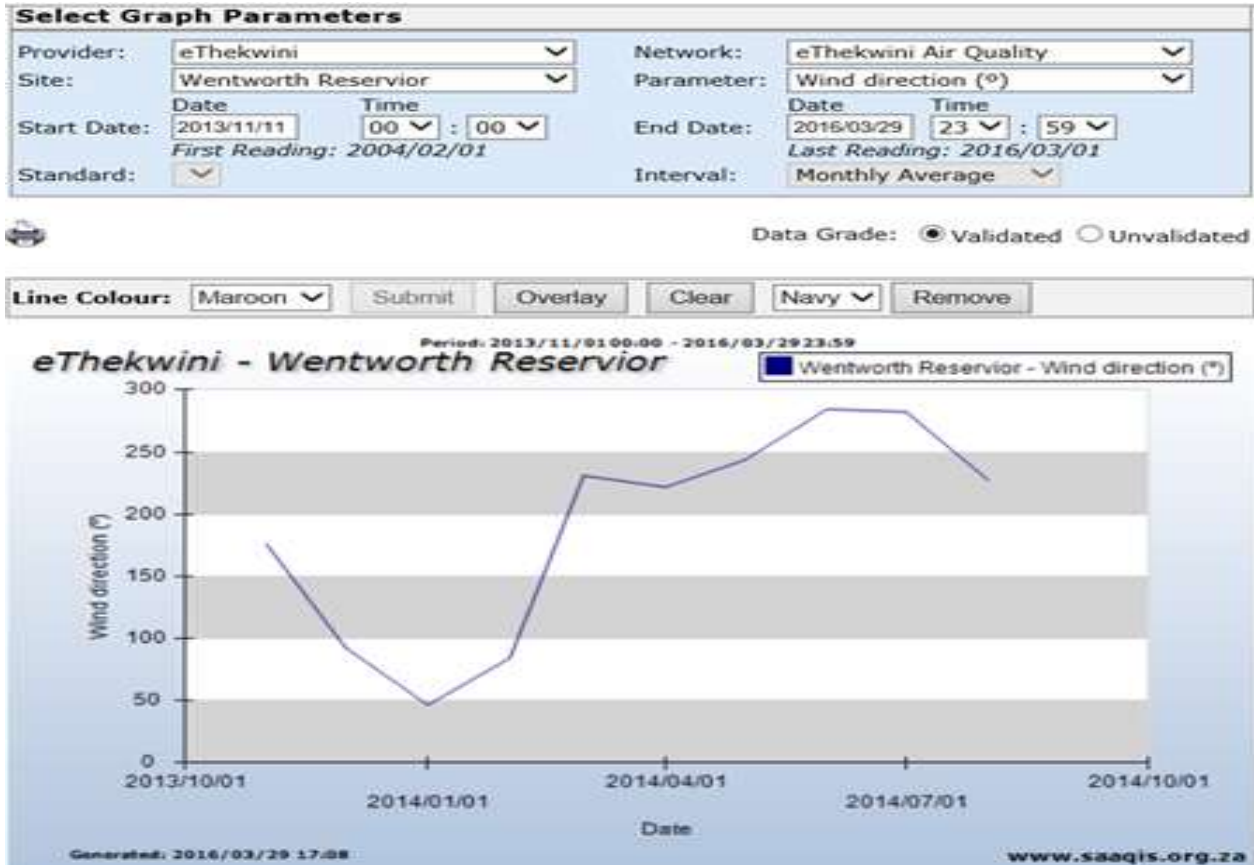


Figure 21: Average wind direction is North-westerly

South-180degrees

West-270degrees

North - 360 degrees

Winds are predominantly north westerly but changes during different seasons.

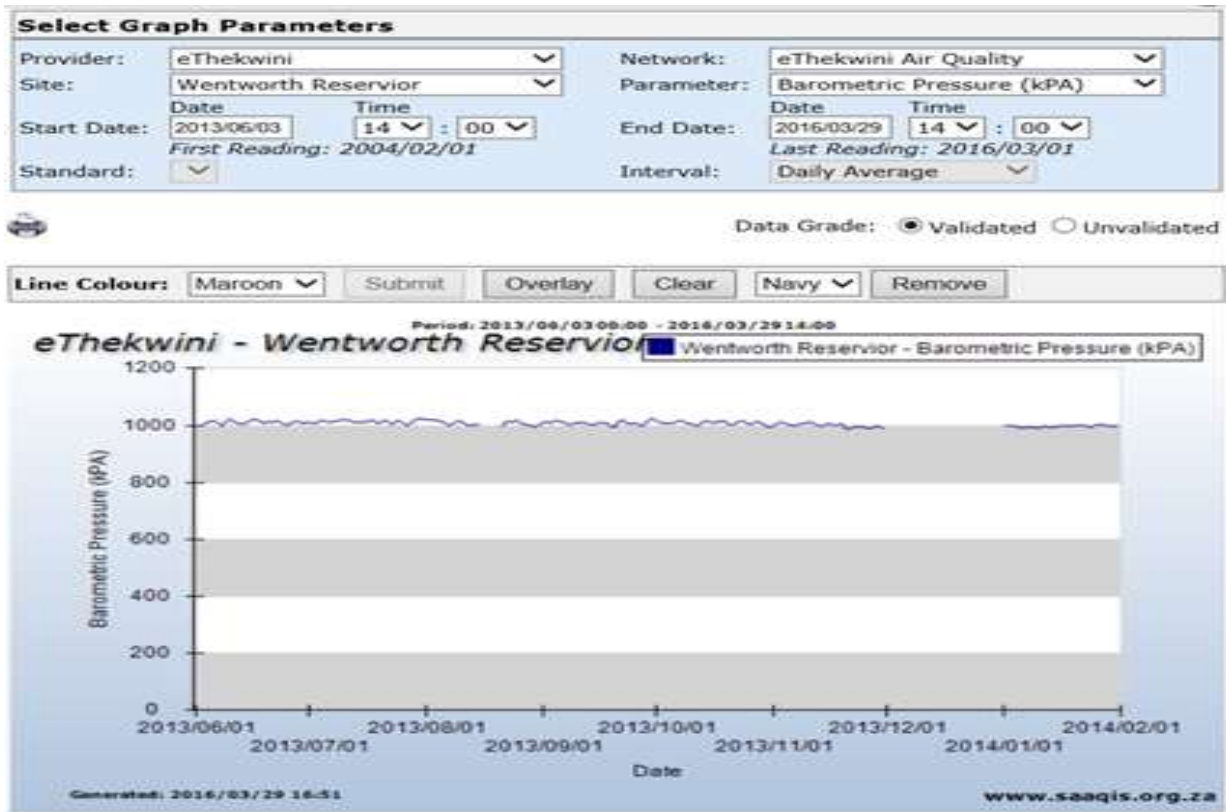


Figure 22: Wentworth Reservoir-Barometric Pressure (kPA)

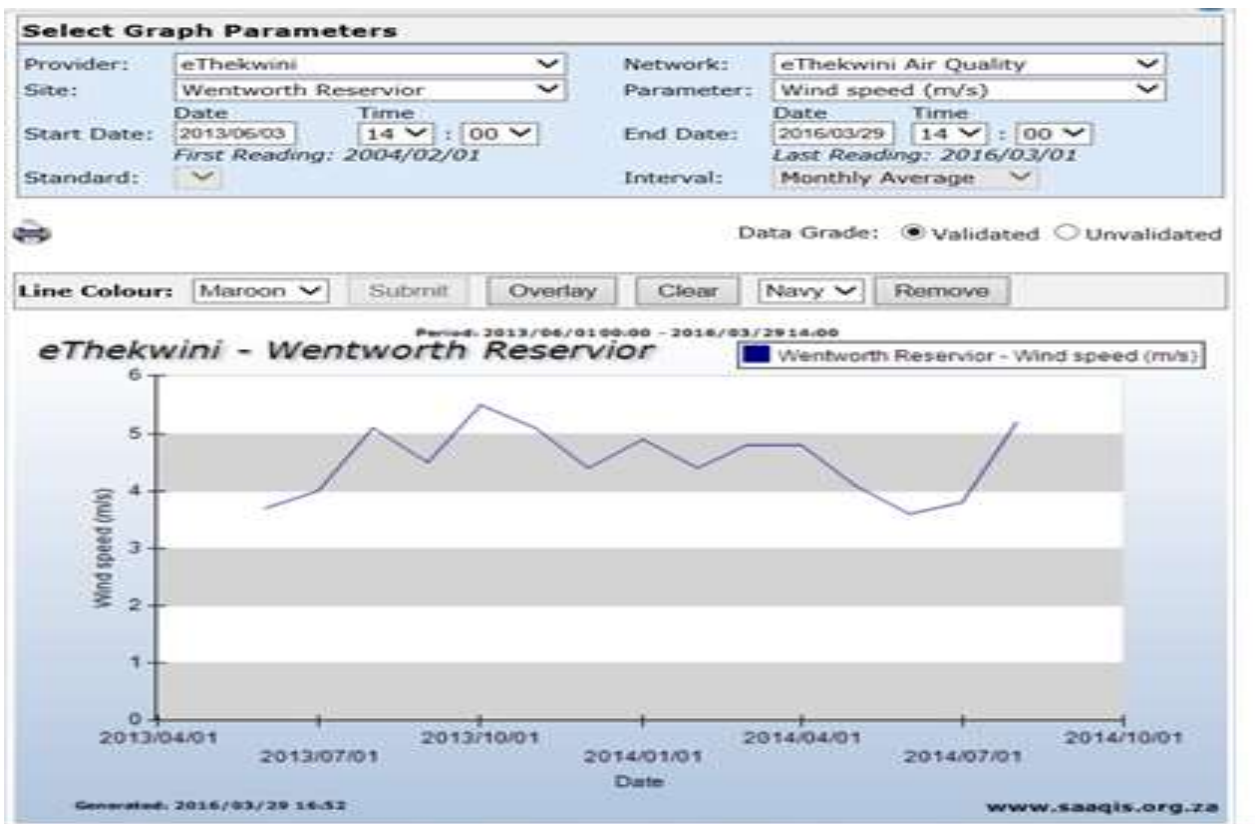


Figure 23: Wentworth Reservoir-Wind Speed



Figure 24: The wind direction in relation to sensitive receptors (pink circles)

5.2.2 Geology

The site is partially underlain by Karoo Dolerite (purple portion) which is a medium-grained igneous rock consisting of calcium aluminium silicate and pyroxene (calcium, magnesium and iron silicate) occurring as dykes or sills and Mudstone (yellow portion) which is a sedimentary rock as per the figure below.

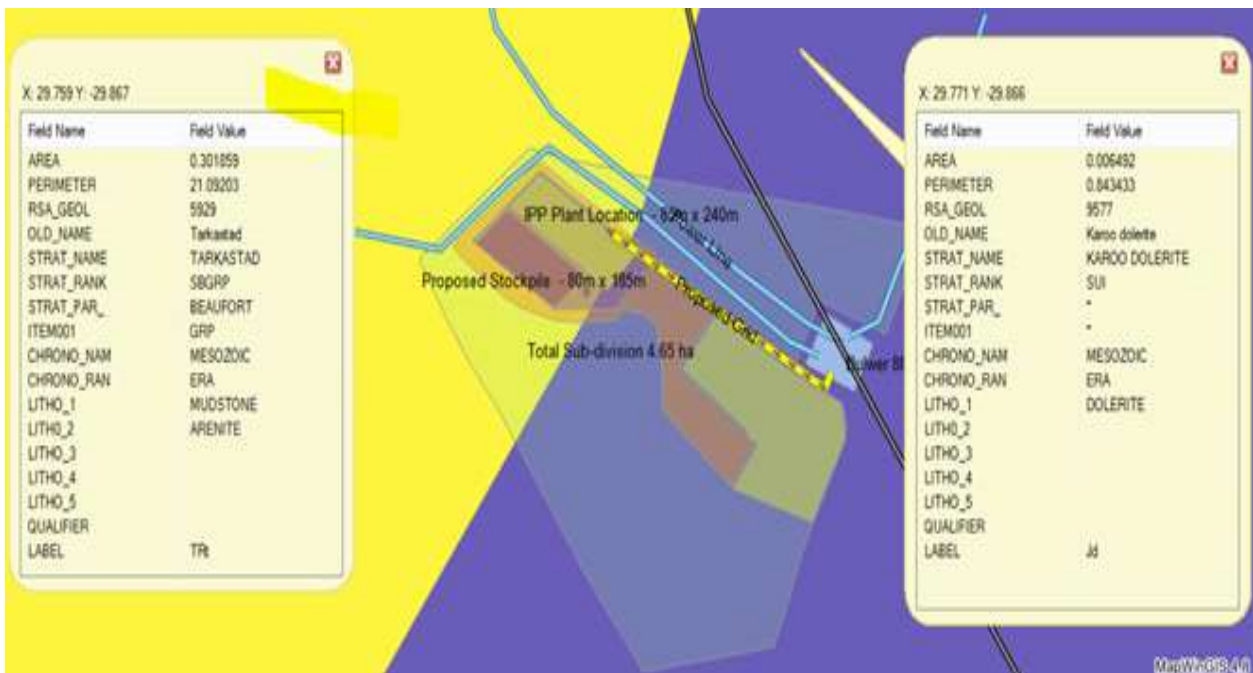


Figure 25: The geology associated with the Project Site

5.3 Soils

The soil on site is classified as soils with a restricted depth, excessive drainage, high erodibility and low natural fertility. The soils are categorised as red and yellow with a low to medium base status.

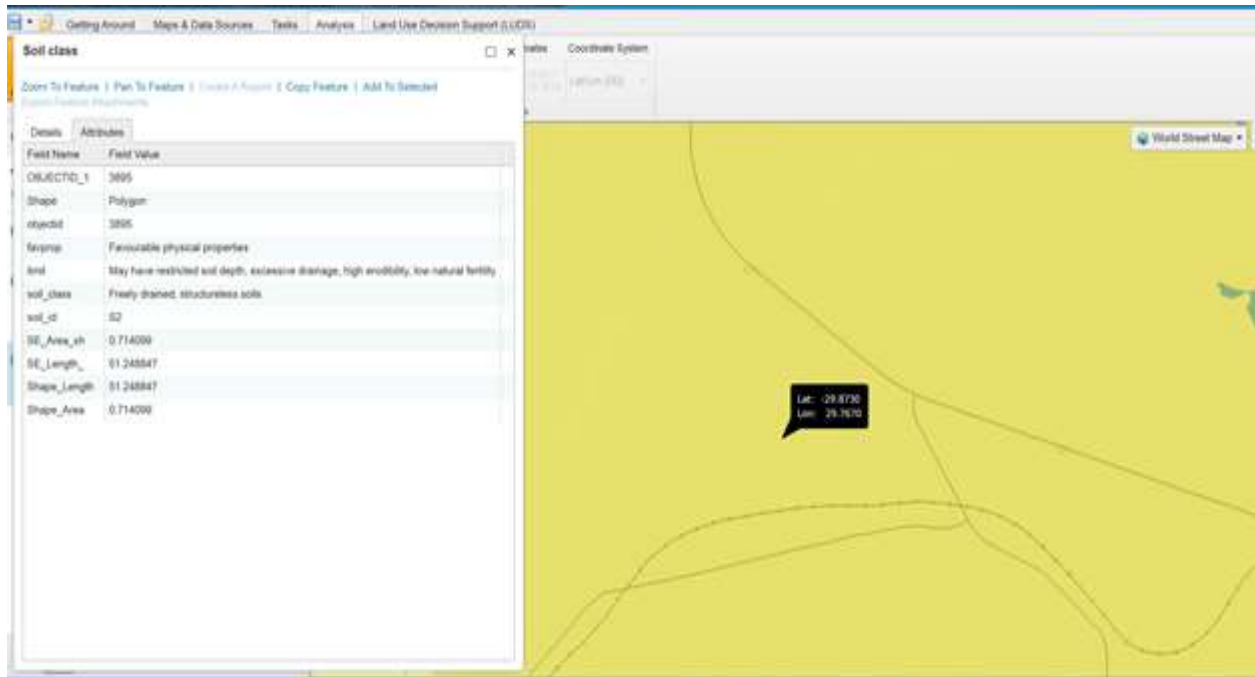


Figure 26: The soil onsite

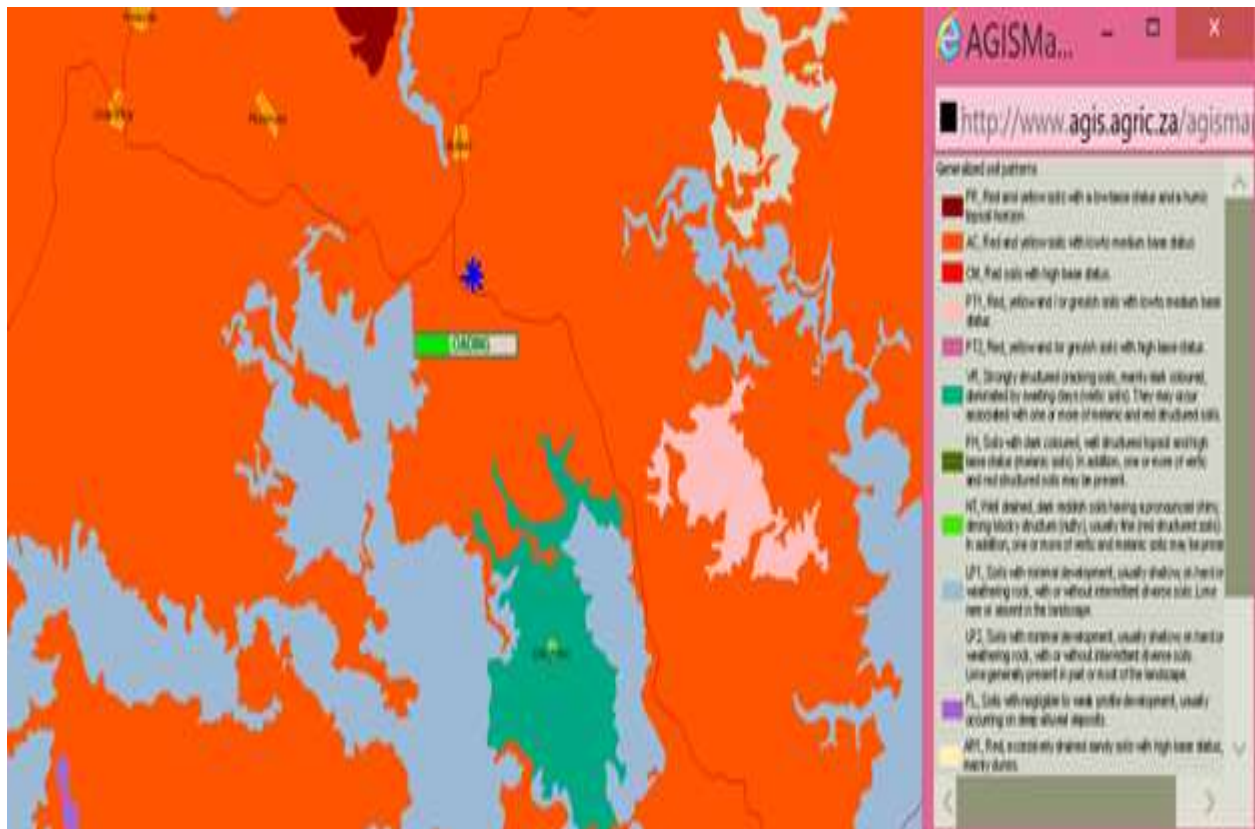


Figure 27: Generalized Soil Patterns

The site also has the following soil characteristics:

Freely Drained Structure Less Soils	May have restricted soil depth, excessive drainage, high erodibility, low natural fertility
--	--

Storm water control measures therefore have to be implemented to prevent erosion.

5.4 Water

5.4.1 Water Courses

The site falls within quaternary catchment U10F. The Luhane (a perennial river) forms the western/northern boundary of the site. No surface water will be abstracted and no effluent will be returned to the environment.



Figure 28: Quaternary catchments of the Project Site (data from DWS, 2013 and NFEPA, SANBI)

Within the U10F catchment Luhane is a first order perennial river.

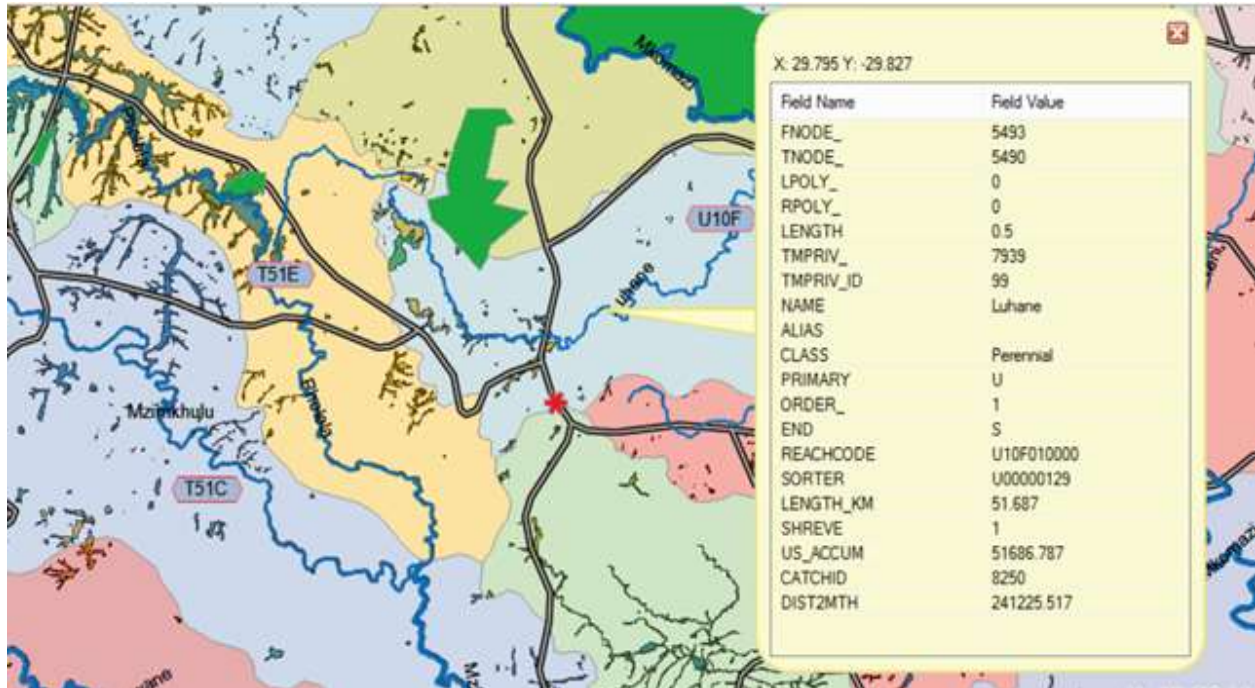


Figure 29: Details of the closest river in the relevant catchment



Figure 30: Ngudwini falls within the neighbouring catchment and is also a first order perennial river

The riparian area was delineated by a specialist and the findings of the report are: The edge of the riparian zone and adjacent seep zone is more than 32 m from the boundary of the site and so it will not influence the activities planned for the site. Given the proximity of the seep zone (closer than 500m from the site) a water use licence will be submitted.



A. View south-westwards from the north-western boundary of the site (altitude 1536 mamsl).



B. View westwards from the south-eastern boundary of the site (altitude 1539 mamsl).

5.5 Wetlands

No evidence of existing wetland vegetation could be found on site, especially since the site has been completely reformed due to sawmill activities on-site.

No activities will take place within the buffer zone of any wetland and as such no wetland delineation or assessment will be required for the purposes of the impact assessment. The figure below indicates the wetland distances from the project site.

A wetland seep has been identified on a neighbouring site. The distance of the project site is within 500m of this wetland – and therefore this will be included in the water use licence application.

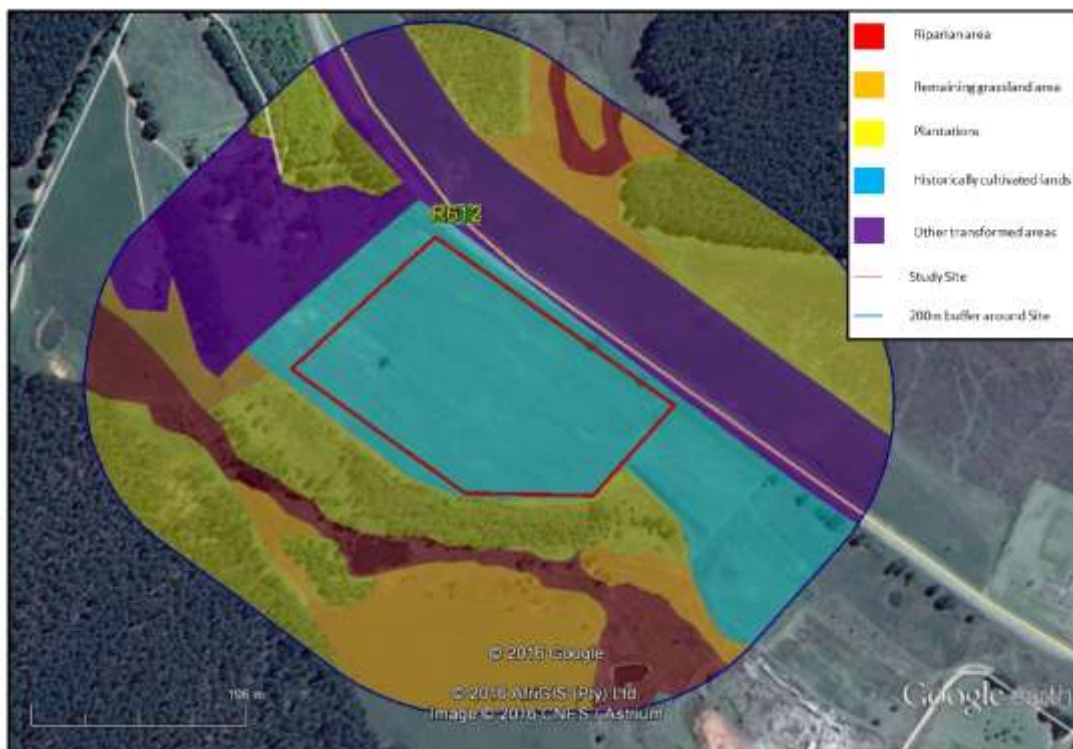


Figure 31: Wetlands in the area

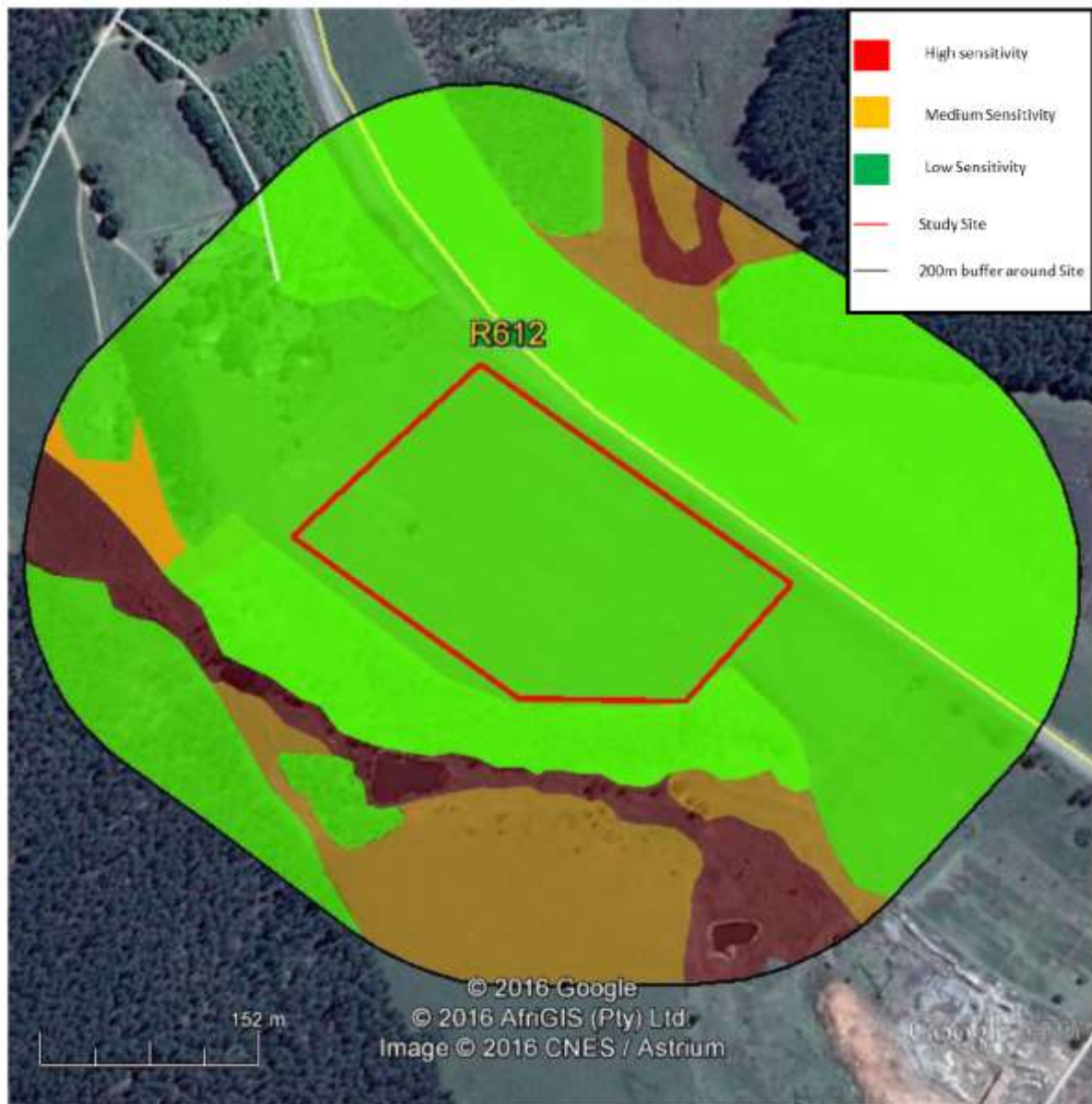
5.6 Biodiversity

A biodiversity assessment was undertaken by Arno van den Bergh (Msc:Pr.Sci.Nat). The specialist report is attached as an annexure. The following is the conclusion of the study:

The study area falls entirely within one main vegetation type, **Drakensberg Foothill Moist Grassland**, which falls into the Grassland Biome. The Drakensberg Foothill Moist Grassland vegetation zone has a conservation status of Least threatened.



The *Hyparrhenia hirta* and *Themeda triandra* grass species dominated the herbaceous layer across large parts of the grassland. However, large populations of different forbs/herbs, as well as Kikuyu grass (*Pennisetum clandestinum*) were interspersed within the grassland, especially in severely disturbed areas and on the borders of transformed areas. Various other grass species occurred in smaller populations within the grassland, such as *Eragrostis* spp. Most of the grassland appeared to be in a disturbed /degraded state.



After the site visits was conducted on the site, it was clear that a large part of the site has been degraded due to transformation. Information obtained from POSA checklist 3.0 and the South African National Biodiversity Institute (www.sanbi.org) indicated red and orange data plants species historically recorded within the 2929DD quarter degree grid cell.

Species of conservation concern that have historically been recorded from the area were evaluated to determine the likelihood of any of them occurring on site. Of the species that are considered to occur within the geographical area under consideration (within the quarter degree grid cell), there are one

vulnerable species that have a MEDIUM probability of occurring on site (see Appendix 1). The threatened species include the following:

- *Asclepias concinna*

For the site visits conducted, no orange or red data species were encountered on the study route and servitude. It should be noted that although this study was undertaken outside of the flowering season (summer months), a follow up study would not benefit any knowledge not yet obtained by this study, due to the site being totally transformed and most of the 200m buffer around the site being plantations and other transformed areas.

A **medium to low** sensitivity was awarded for the study site based on the methodology described in Section 2.5 of this report. A total of 10 plants were identified on and around the site that is listed in the Alien and Invasive Species

Regulations of 2014 (NEMBA) which is in need of management.

- 8 NEMBA Category 1b plants were identified and must be controlled.
- 2 NEMBA Category 2 plants were identified and must be controlled and if not eradicated, require a permit to carry out a restricted activity within an area, as specified in the act / regulations.

RECOMMENDATIONS

The following recommendations are made with regards to the proposed development:

- (i) An Environmental Control Officer must be appointed to oversee mitigation measures during construction and will be responsible for the monitoring and auditing of the contractor's compliance with the conditions of the Environmental Impact Management Plan/ Programme.
- (ii) All areas deemed of high sensitivity must be protected as far as possible and any activity within these areas needs to be restricted. Areas deemed of medium significance must be mitigated as far as possible by implementing the measures indicated in this report.
- (iii) Areas to be disturbed by construction activity as well as areas for ancillary activities such as stock piles, storage yards or site offices must be clearly demarcated in already disturbed areas or areas where they will cause minimal disturbance.
- (iv) The extent of the areas must be minimised and demarcated by preferably using steel droppers and nylon rope between the markers. Construction activities and materials must at all times be contained within the demarcated sites.
- (v) All alien invasive species have to be controlled before and after construction commences for the 10 recorded alien and invasive plant species recorded on site.
- (vi) All mitigation measures described in this report has to be adopted into a legal Environmental Management Programme to be used during construction of the planned project.

5.7 Noise

A noise disturbance or nuisance as defined in the national and provincial legislation means any sound which disturbs or impairs the convenience of any person. The Regulations describe a disturbing noise as noise that exceeds the ambient noise by more than 7 dB. This difference is usually measured at the location of the person experiencing the noise as disturbing. Therefore, if a new noise source is introduced into the environment, irrespective of the current noise levels, and the new source is louder than the existing ambient environmental noise by more than 7 dB, the noise can be construed as a disturbance.

The most applicable standard for use relevant to the proposed project is SANS 10103:2008 which provides typical rating levels for noise in various types of districts, as described in Table 7 below. SANS 10103:2008 defines daytime as between 06:00 to 22:00 hours and night time as between 22:00 to 06:00 hours. The rating levels in the table above indicate that in industrial districts the ambient noise.

Table 7: Typical rating levels for noise in various types of districts (SANS 10103:2008)

Type of District	Equivalent Continuous Rating Level, LReq.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

Noise levels in industrial areas should not exceed 60 dB(A) at night and 70 dB(A) outdoors during the day. The day / night (24hour) rating limit is 70 dB(A). These levels can thus be seen as the maximum target levels for any noise pollution sources.

Based on feedback from the equipment manufacturers, noise in the immediate vicinity of the plant will not exceed 85 dB(A). It will however be required to execute a noise assessment study once the plant is operational, to determine whether noise impact thresholds will be breached. A noise baseline survey will have to be carried out (by switching of noise sources associated with the new plant). In the case of a breach, noise generating equipment will have to be screened off to prevent a noise nuisance.

5.8 Air Quality

The graphs below obtained from SAAQIS (South African Air Quality Information System, March 2016) indicate the regional air quality. The Wentworth air quality station is the closest to the site and is mainly used for air dispersion modelling.

Table 8: Regional Air Quality

Wentworth Reservoir	
Site Id:	45
Site Code:	14
Site Name:	Wentworth Reservoir
Provider:	eThekwini
Network:	eThekwini Air Quality
Description:	The Wentworth air monitoring and meteorological stations are located at the Wentworth Reservoir. The air monitoring station measures pollutant concentration levels originating from the refinery flare and other stacks. The meteorological station measures meteorological parameters at a higher altitude than the other stations. This data is used mainly for dispersion modelling purposes.
Location:	45 Boston Drive, Wentworth
Longitude:	30,06592
Latitude:	-29.93408
Data Interval:	60
Height above sea level (m):	71
Monitoring Start Date:	1970/01/01
Province:	Kwazulu-Natal
Municipality:	eThekwini Municipality
Equipment Owner:	eThekwini Municipality
Land Owner:	eThekwini Municipality
Equipment Housing:	Shelter
Monitoring Objectives:	The air monitoring station measures pollutant concentration levels originating from the refinery flare and other stacks.
Site Topography:	The station is located at coastal area south of Durban at a height of about 71m above sea level.
Location and Description of Emission Sources:	Refineries on the south and north of the station and other industries to the west.
Site Classification:	Residential
Technician:	Lindokuhle Majavu
SANAS Accredited:	Yes

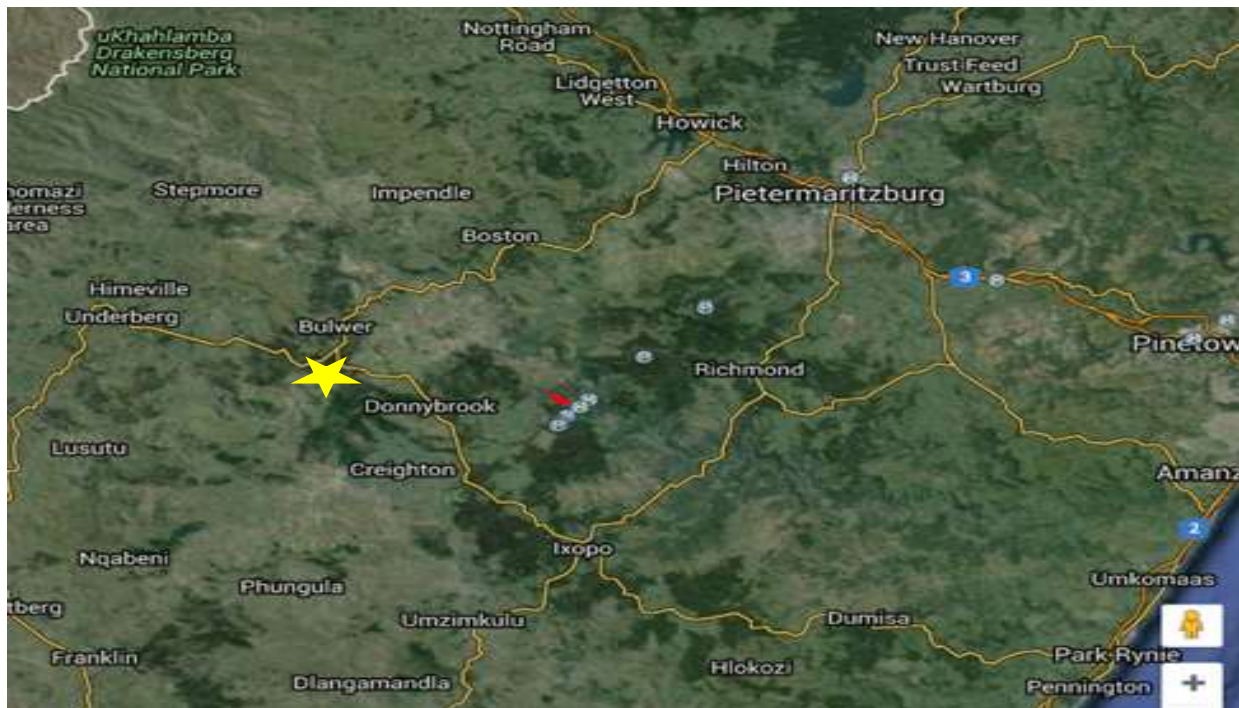


Figure 32: The location of the air quality monitoring station indicated by the red line and the project site indicated by the yellow star

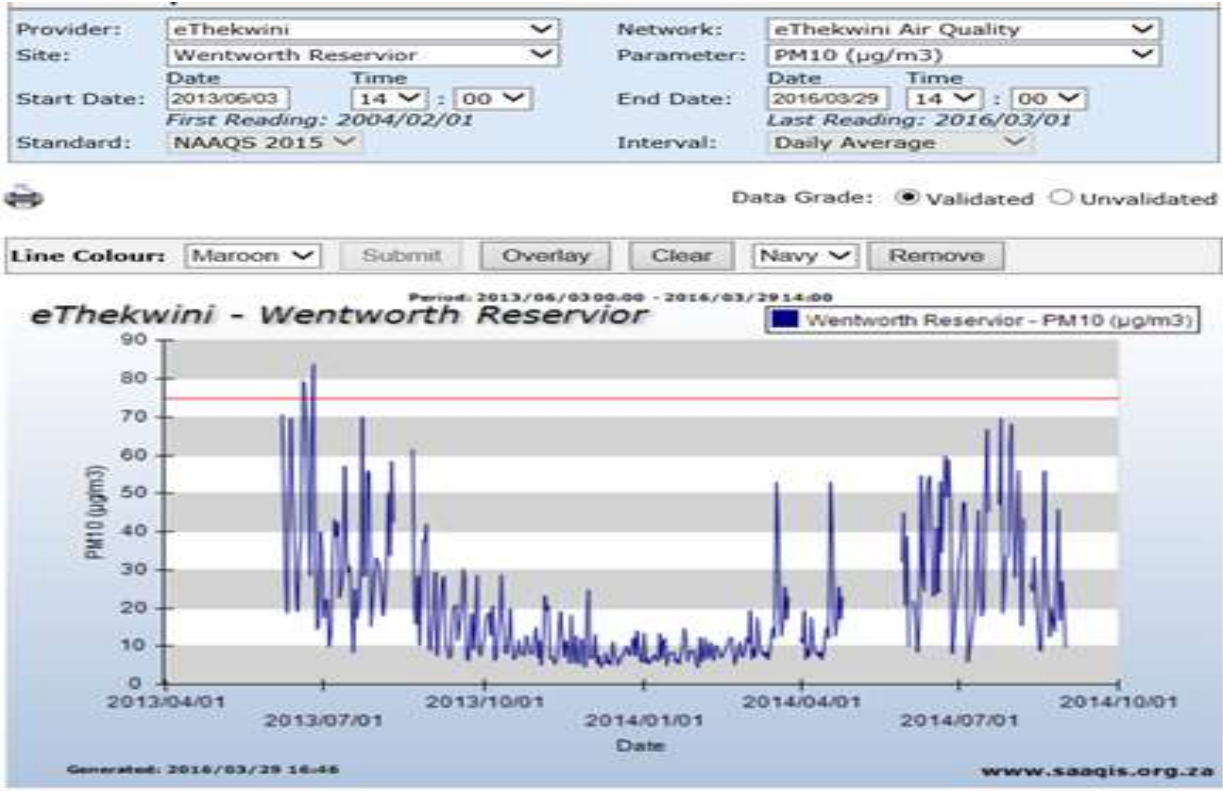


Figure 33: Wentworth Reservoir-PM10 µg/m³

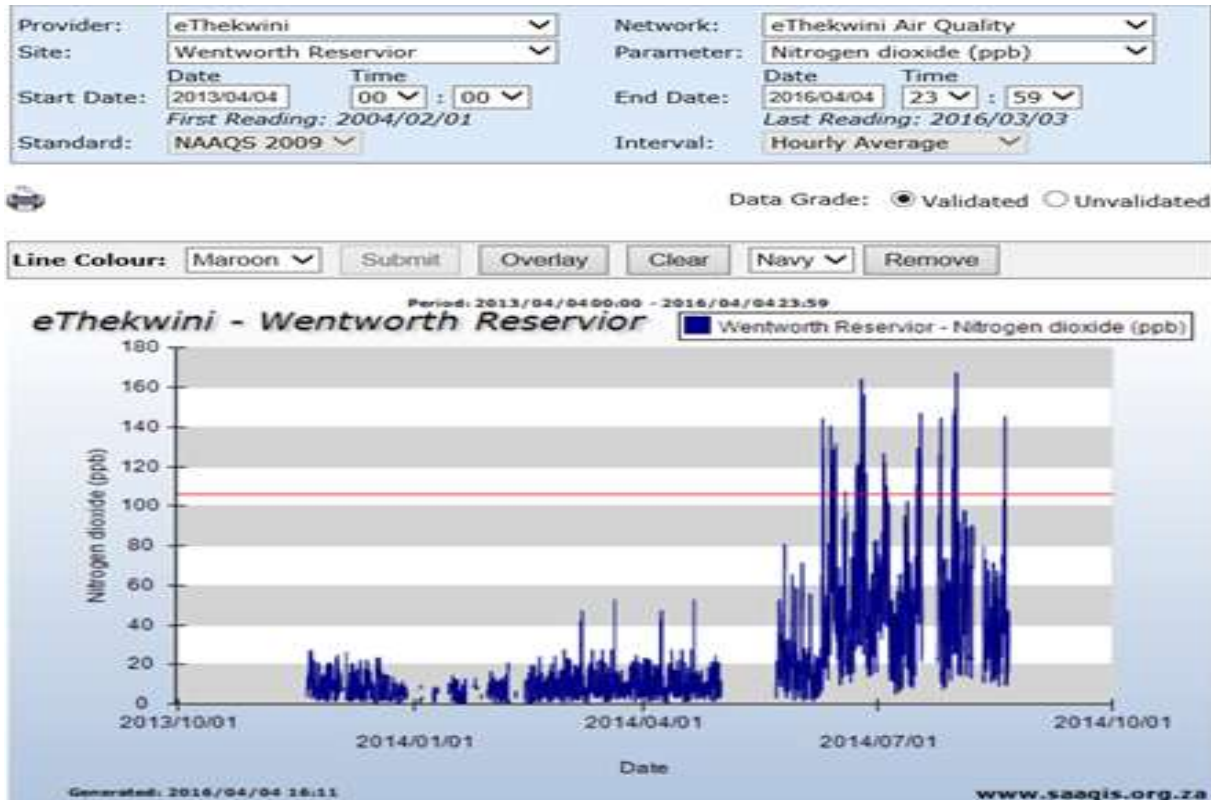


Figure 34: Wentworth Reservoir-Nitrogen Dioxide (ppb)

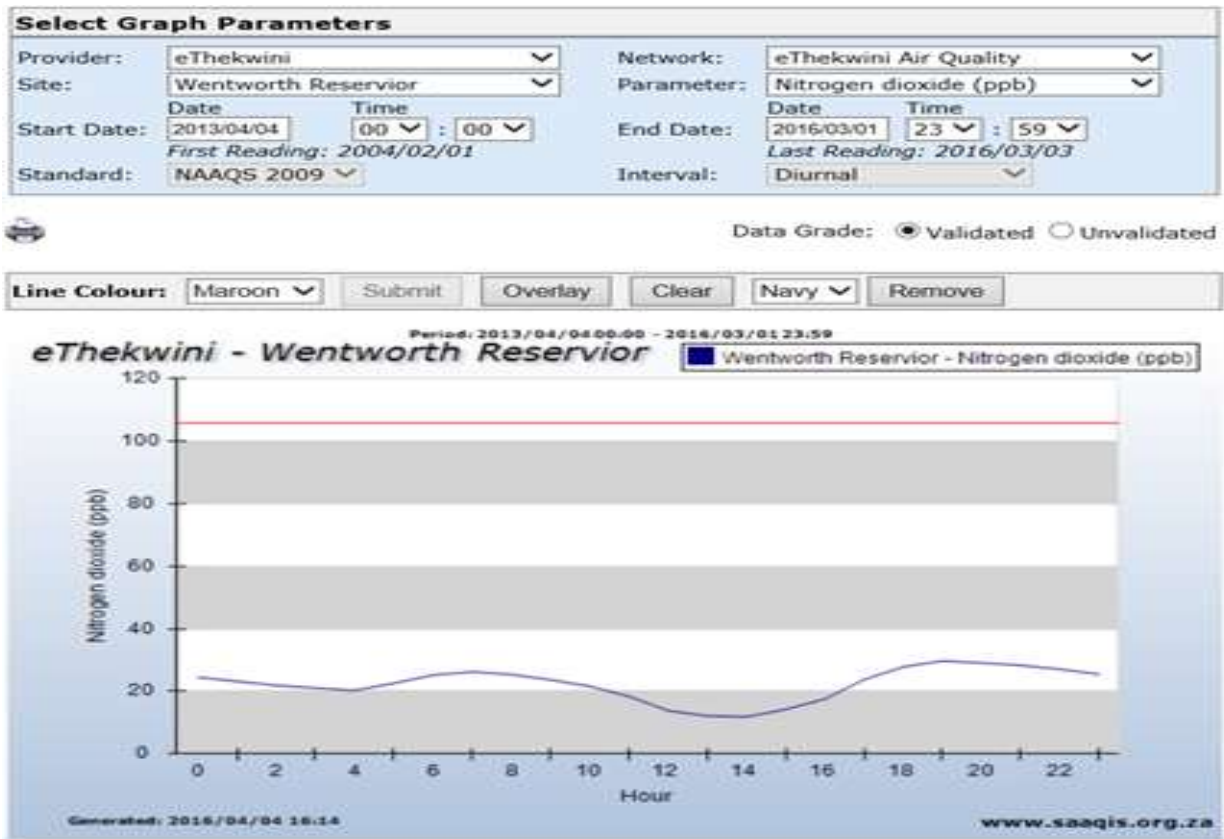


Figure 35: Wentworth Reservoir-Nitrogen Dioxide (ppb)

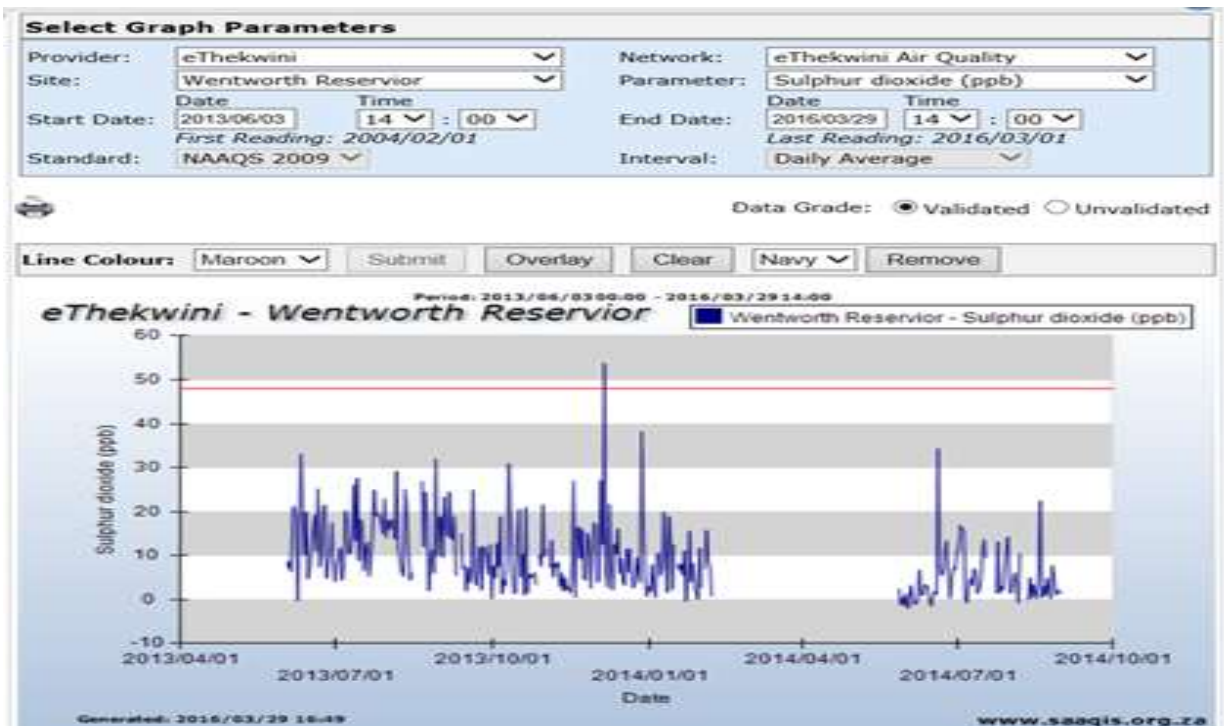


Figure 36: Wentworth Reservoir-Sulphur Dioxide (ppb)

The area does not have general air quality problems except for Oxides of Nitrogen (NO_2) – accordance to national ambient standards hourly limits may not exceed 106 ppb and 21ppb annual average

Rayten Engineering did the air quality assessment study (attached as an Annexure). The following findings from the report are summarised:

The proposed Ixopo renewable energy plant is located in the Ingwe Local Municipality near the town of Ixopo, Kwa-Zulu Natal, South Africa. The land use immediately surrounding the proposed project site consists of predominantly plantations/woodlots, woodlands/openbush, grassland and wetlands. Urban areas including urban villages and townships are concentrated further outwards towards the north-east and south-west quadrants. The nearest residential area/town to the project site is Senkwanzela which is located approximately 3km east of the proposed site. There are some dwellings/farm houses located less than 1km towards the west, south-east and at the north-western corner of the site boundary. Existing key sources of air pollution surrounding the project site have been identified to be:

- Industrial Activity (sawmills);
- Agricultural activity and biomass burning;
- Vehicle dust entrainment on unpaved roads;
- Wind erosion from exposed areas (e.g. opencast pits, stockpiles, open storage piles, cultivated land, etc.);
- Potentially Domestic fuel burning.

Based on the prevailing wind fields for the period January 2013 to December 2015, emissions from operations at the proposed Ixopo renewable energy plant will likely be transported towards the western quadrant during the evening and towards the eastern quadrant during the day time periods. Moderate to fast wind speeds observed may result in effective dispersion and dilution of emissions from the proposed operations. However, moderate to fast wind speeds may also facilitate dust emissions. Removal of pollutants via wet depositional processes would be evident during the spring and summer seasons, thus lower ambient concentrations of pollutants could be expected during these seasons. Elevated levels of pollutants would be expected during the autumn and winters seasons.

The existing air quality situation is usually evaluated using available monitoring data from permanent ambient air quality monitoring stations and dust fallout networks operated within close proximity to the project site. The Ganges air quality monitoring station is the second closest station to the project site where data is available on the SAAQIS. The Ganges station is located approximately 29km south-east of the Ixopo renewable energy plant and is operated by the eThekweni Municipality. Baseline concentrations for PM₁₀, NO₂ and SO₂ for the Ganges air quality monitoring station were assessed for the period January 2005 to August 2016. The data can be summarised as follows:

- Ambient PM₁₀ concentrations in the area are relatively high in relation to the 24-hour average PM₁₀ standard of 75µg/m³ with several exceedances observed.
- Hourly average nitrogen dioxide concentrations fall below the acceptable standard of 106 ppb for most of the period; with exceedances observed mostly in the autumn and winter seasons.
- Only a few exceedances of the sulphur dioxide hourly standard of 134ppb and no exceedances of the daily standard of 48ppb are observed for the monitoring period.
- Higher concentrations of pollutants are observed over the autumn and winter seasons compared to the summer and spring seasons.
- There is a lot of missing data throughout the monitoring period and little to no data available for the period October 2014 to August 2016.

Dust Fallout monitoring results for the project site was not available therefore the baseline dust fallout rates could not be determined. It is recommended that dust fallout monitoring for at least 12 months is conducted at the site using single dust buckets to determine the baseline dust fallout concentrations. Recommendations for potential dust fallout monitoring sites are provided under Section 6 of the report.

The main conclusions of the Impact Assessment for the project site can be summarised as follows for the construction and operational phases:

Dust and gaseous emissions are identified for activities at the proposed Ixopo renewable energy plant and will likely be emitted from the following key sources:

- Dust and Particulate Emissions:
 - o Construction activities;
 - o Boiler combustion stack emissions;
 - o Materials handling operations;
 - o Chipping and screening material;
 - o Wind erosion from exposed areas/storage pile;
 - o Vehicle-entrainment on paved roads due to hauling.
- Gaseous Emissions
 - o Boiler combustion stack emissions

The following main conclusions are made based on the dispersion modelling plots for the construction phase:

- Predicted incremental dust fallout rates:
 - o Do not exceed the allowable dust fallout limit of 1200 mg/m²/day for non-residential areas and 600 mg/m²/day for residential areas far beyond the boundary of the site;
 - o Exceedances of the standards are observed mostly within the site boundary towards the north-west corner and along a small portion beyond the north-western boundary;
 - o Predicted incremental dust fallout rates at identified surrounding sensitive receptors outside the site boundary, except for Receptor 1, are in compliance with the residential limit of 600 mg/m²/day. Receptor 1 is located directly adjacent to the site boundary and thus is likely going to be exposed to higher dust fallout rates compared to the other identified sensitive receptors.
- Predicted incremental PM₁₀ concentrations:
 - o Comply with the daily average standard of 75 µg/m³ and the annual average standard of 40 µg/m³ beyond all the site boundaries;
 - o Exceed the standards mostly within the site boundary and along the north-western boundary line near the proposed area of construction activity;
 - o Comply with the daily and annual average standards at all identified sensitive receptors.
- Predicted incremental PM_{2.5} concentrations:
 - o Comply with the daily average standard of 40 µg/m³ and the annual average standard of 20 µg/m³ beyond the site boundary and at all identified surrounding sensitive receptors;

o Exceed the standards within the site boundary near the area of proposed construction activity.

The following main conclusions are made based on the dispersion modelling plots for the operational phase:

□ Predicted incremental dust fallout rates:

o Comply with the allowable dust fallout limits of 1200 mg/m²/day for non-residential areas and 600 mg/m²/day for residential areas outside the site boundary;

o Exceedances of the non-residential and residential limits are observed within the site boundary at the proposed storage pile and plant area;

o Predicted incremental dust fallout rates over most of the site, beyond the site boundary and at the identified surrounding sensitive receptors are predicted to be low and fall within the residential limit.

□ Predicted incremental PM₁₀ concentrations:

o Comply with the daily average standard of 75 µg/m³ beyond all site boundaries, except over a small portion beyond the north-western boundary;

o Comply with the annual average standard of 40 µg/m³ beyond all site boundaries; with exceedances observed within the site boundary near the proposed area of activity;

o Comply with the daily and annual average standards at all identified sensitive receptors.

□ Predicted incremental PM_{2.5} concentrations:

o Comply with the daily average standard of 40 µg/m³ beyond all site boundaries, except over a small portion beyond the north-western boundary;

o Comply with the annual average standard of 20 µg/m³ beyond all site boundaries; with exceedances observed within the site boundary near the proposed plant area;

o Predicted incremental PM_{2.5} concentrations at identified surrounding sensitive receptors are predicted to be relatively low.

□ Predicted incremental SO₂ concentrations:

o Fall well within the allowable hourly, daily and annual standards of 350 µg/m³, 125 µg/m³ and 50 µg/m³; with no exceedances observed. Predicted to be very low to negligible both within and outside the site boundary and at all surrounding sensitive receptors.

□ Predicted incremental NO₂ concentrations:

o Comply with the hourly average standard of 200 µg/m³ and the annual average standard of 40 µg/m³ at all identified sensitive receptors. No exceedances of the hourly and annual standards are observed beyond the site boundary.

□ Predicted incremental CO concentrations:

o Fall well below the allowable hourly and 8-hourly standards of 30,000 µg/m³ and 10,000 µg/m³; with no exceedances observed. Low incremental concentrations are observed at all identified sensitive receptors surrounding the site.

□ Lead and Benzene:

o Predicted incremental lead and benzene concentrations associated with proposed biomass combustion activities at the Ixopo renewable energy plant site were shown to be negligible.

Aspects to note from the findings:

□ Predicted incremental concentrations due to proposed construction and operational activities associated with the Ixopo renewable energy plant are shown to be relatively low in relation to the standards outside the site boundary and over most portions of the site. Slightly higher concentrations and exceedances are observed over a small area located north-west of the site, along the north-western boundary and mostly within the site boundary in close proximity to or at the source.

□ Predicted incremental concentrations at all identified surrounding sensitive receptors comply with the acceptable limits; except for the dust fallout rate (620 mg/m²/day) at receptor 1 during the construction phase.

□ The background PM_{2.5} concentrations and the background dust fallout rates for the area could not be defined as data were not available. Furthermore, the Ganges ambient station is the nearest station

(~29 km) to the proposed project site that data were available for. Data from this station may not necessarily be representative of background concentrations at the Ixopo renewable energy plant site due to the distance between the sites. Ambient concentrations of pollutants may differ due to the difference in local emission sources, meteorological conditions and topography. However, predicted incremental concentrations for PM₁₀, PM_{2.5}, SO₂, NO₂ and CO are shown to be relatively low outside the site boundary and at surrounding sensitive receptors. Thus the cumulative impact on PM₁₀, PM_{2.5}, SO₂, NO₂ and CO is predicted to be minor.

□ Even though for the non-cumulative scenario low concentrations are observed outside the site boundary, the implementation of mitigation measures should be conducted where possible to reduce additional levels in background concentrations both within and outside the site.

□ Mitigation measures, except for the use of paved road surfaces and an ESP system for boiler stack emissions, were not modelled in this study. Other measures (provided in Table 6-1 & Table 6-2) that could be considered in light of the above findings and their control efficiencies (%) are listed below.

o Water sprays / misting at loading and offloading points (50% - 70%);

o Wind breaks at active stockpiles (up to 30%);

o Water spray with chemical binding agents (up to 90%);

o Enclosure of dust sources (up to 99%).

The choice of mitigation measures will depend on the availability of resources, practicality, effectiveness and affordability. Therefore, it is recommended that an air quality management plan is developed for the site, incorporating mitigation measures as discussed above, which can be integrated into the design stages of the project.

6 Cultural and Heritage

The project site is not located on an official heritage site but a heritage assessment has been undertaken.

A heritage assessment was undertaken by Dr. Anton van Vollenhoven (specialist study report attached as an Annexure). No heritage objects were found onsite. The conclusion of the study:

The surveyed area is almost completely disturbed and cleared from vegetation. Therefore it is no surprise that nothing of cultural heritage significance were located.

It is therefore recommended that the development may continue. This report is seen as ample mitigation and no further action is necessary.

It should nevertheless be noted that the subterranean presence of archaeological and/or historical sites, features or artefacts is always a distinct possibility. Care should therefore be taken when development commences that if any of these are discovered, a qualified archaeologist be called in to investigate the occurrence.

7 Socio-economic Overview of the Midvaal Region

The following information has been obtained from the Ingwe Local Municipality IDP for 2014/2015.

7.1 Social features

According to the 2011 population census there were 100 548 individual citizens of Ingwe living in approximately 23,073 households.

7.2 Socio-economic features

Information obtained from the Ingwe Municipality's IDP (2014/2015):

Fewer than 10% of people are employed in Ingwe. Around 5% are unemployed and around a further 4% are discouraged work seekers. Women are most obviously disadvantaged. Most children are economically inactive – further reflecting the youthful nature of the population. Income levels are possibly the most telling indicators of poverty. If the economically inactive section of the population is considered along with those potentially capable of earning below: 58% of the Total Population is categorised as having NO INCOME. After the income group earning up to R20 000 annually – the numbers of people earning more are statistically insignificant.

Approximately 36% of Ingwe's population have some primary education; around 20% have some secondary – while only less than 10% have matric. People with tertiary qualifications are an insignificant statistical category.

An overrepresentation of females in Ingwe LM remains from the previous to the 2011 Census, with females accounting for 54% of the municipal population.

The age structure of Ingwe Local Municipality reveals a youthful population profile with 57% of the population under the age of 20 and 71% under the age of 30. Around 36% of the population is within the working age category while 5% of the population is above 60.

The population is concentrated in traditional areas where the majority of the municipal population resides. The close proximity of dense rural settlements and their location on R617, a major road make Bulwer and Donnybrook accessible to a wider municipal population.

Electricity within Ingwe LM is supplied by Eskom. The table below illustrates the various energy sources used within Ingwe for lighting, cooking and heating. It is evident that the majority of households use wood for heating (75%), electricity for lighting (49,9%) and wood for cooking (70,2%). It cannot entirely be assumed that the use of wood as an alternative source of energy is due to the lack or limited access to electricity. It should be considered that this may be an energy saving mechanism.

Within Ingwe there is a backlog of approximately 3214 households without electricity.

The economic contribution of different sectors are indicated below:

- Agriculture 29%
- Farming 30%
- Social services 20.4%
- Informal trade 12.8%

Source of Energy	Heating	lighting	Cooking
Electricity	3514	11 511	4 834
Gas	449	92	932
Paraffin	558	427	849
Wood	17 300	0	16 189
Coal	91	0	53
Animal dung	48	0	43

Source of Energy	Heating	lighting	Cooking
Solar	19	83	31
Candle	0	10 782	0
Other	4	0	53
None	1 089	179	89

It is evident from the information above, that the area is in great need for the creation of additional job opportunities for unskilled and low level skilled workers to address the levels of unemployment. The area also has a lack of electricity. The proposed project will contribute to the creation of job opportunities and electricity availability in the region.

8 Need and Desirability of the Proposed Activity

The proposed project has several benefits that are aligned with local, regional, national and international initiatives. It will also impact positively on several key issues of concerns. The benefits and positive impacts are described below.

8.1 Improving Air Quality in the Region

Local and regional air quality in that burning of in-situ plantation residues will be replaced with controlled burning of which the flue gas emissions will be controlled by air quality control equipment. Emissions will comply with national air quality standards.

8.2 Accidental Fires

Fires: The in-situ burning of plantation residues may give rise to accidental fires. Controlled burning of these residues may impact positively on incidences of accidental fires.

8.3 Electricity Generation

The project will supply electricity to the National Grid. Through supporting the electricity supply in South Africa, the project will assist to relieve pressure on the National Grid. The project will also supply renewable energy, supporting the national targets for the generation of renewable energy.

8.4 Creating job opportunities

- This project will increase local employment for skilled labour during construction and implementation of the renewable energy plant
- The renewable energy plant will permanently employ the following skilled labour for the operation and maintenance of the plant (shift workers): 6 foreman, 6 millwrights and 12 operators. These people will be empowered with skills relating to the operation and maintenance renewable energy plants
- The renewable energy plant will also increase job opportunities for un-skilled labour as it is required for the harvesting and transportation of biomass to the renewable energy plant. This job opportunity consist of the following two levels:
 - Job opportunities to ensure biomass availability to the plant. This will consist of minimum 30 permanent employees, consisting of Bell drivers and their assistants, truck drivers and biomass packers.
 - There is also a community aspect to the biomass collection, where the community may collect plantation waste to weigh on a weighbridge and earn cash immediately. The prediction is that around 100 jobs will be created in this way. From a community uplifting perspective, the 100 wood collectors that can generate an income from selling wood to the plant, can influence the lives of ±500 people positively if their families and their own lives are taken into account.

8.5 Economic benefits

- The project will provide business opportunities for biomass suppliers, local labour contractors and equipment suppliers which will help increase the income of the people who are directly or indirectly connected with the project
- The project provides the potential for new sources of revenue from renewable energy, raises the economic benefits for the forestry industry, and promotes utilization of forestry waste, hence building a sustainable and circular economy.

8.6 Environmental benefits

Renewable energy reduces the reliance on non-renewable resources (coal) as well as the impact of coal mining on the environment.

Renewable energy created from biomass has a positive impact on the total reduction of greenhouse gasses and climate change.

9 Identified Alternatives to the Proposed Activity

9.1 Technology Alternatives

The developers of the proposed project have already chosen the following technologies to minimize environmental impacts associated with the project:

- Dry cooling technology as opposed to wet cooling: Dry cooling uses significantly less water than wet cooling. The use of dry cooling is however at a loss to the output generation capacity of the plant
- Water treatment technology: The proposed water treatment technology for the boiler feed water will avoid the generation of brine and promote the secondary use of water effluent for ash quenching. Effluent water quality from the water treatment plant will be comparable to drinking water standards
- The proposed project will incorporate rain water harvesting to supplement its water requirements.

9.2 Alternative Design

The proposed project have been designed to fit in with the existing sawmill infrastructure onsite. As such, no alternative designs can be considered. The site also does not contain any environmental sensitive areas (except the riparian zone which are already excluded from the lay-out) and as such no further design alternatives are available.

9.3 Scheduling Alternatives

No detailed information regarding the proposed time frame for the project is available yet, however it is anticipated that construction will start as soon as possible after all the necessary approvals have been obtained. Given that the project footprint will be placed on an existing brownfields site and that all associated infrastructure is required for the operation of the proposed plant, few viable scheduling alternatives is available.

9.4 Input Alternatives

Sawmill and plantation residues are the only viable source of renewable fuel on a large enough scale available in the area to ensure the viability of the project. The location of the project within the KZNa area is also specific in order to make use of the available biomass in the area. As such, no input alternatives can be considered.

The project developers have also chosen to supplement ground water with harvested rain water in order to reduce reliance on ground water abstraction.

9.5 No-go option

The no-go option will lead to opportunity losses for:

- Employment creation
- CDM credits
- Renewable energy generation
- Contribute to relieving pressure on the national electricity grid
- Control of accidental fires associated with the in-situ burning of plantation residue
- Improvement of air quality
- The optimisation of the use of sawmills residues and plantation residue.

No real benefits will be obtained from a no-go option, other than the conservation of ground water resources in the area.

10 Environmental Impact assessment

10.1 Methodology to Rate and Assess Significance

Significance is the product of probability and severity rating divided by the mitigation potential:

$$\text{Significance} = \frac{\text{Probability} \times \text{Severity}}{\text{Mitigation}}$$

Probability and Severity will be determined based on the following:

10.2 Determining the Severity of an Impact

Determination of the severity of an impact is a function of intensity, duration and extent, divided by the extent to which mitigation can successfully be applied:

$$\text{Severity} = \text{intensity} + \text{duration} + \text{extent}$$

Each of the 4 factors used to determine the severity of an impact, are described below:

10.2.1 Intensity factor

The level of intensity is the sum of volume, toxicity, social impact and ecological impacts.

Note that either Volume A or Volume B is used (refer to the description) but never both at the same time.

Table 9: Intensity factor rating and description

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
Volume (A) (refers to process input and output substances/ material or products)	Less than 80 m ³ at any one time (or low volumes relative to industry/commercial standards)	Between 80 and 300 m ³ at any one time (or medium volumes relative to industry/ commercial standards)	In excess of 300 m ³ at any one time (or high volumes relative to industry/ commercial standards)	
Volume (B) (refers to natural resources)	Relatively small	Medium	Large	
Toxicity	Toxicity is on par with everyday goods in wide-spread use and is biodegradable.	Toxicity can be compared to those that have to be handled with some caution and are non-biodegradable.	Toxicity is on par with toxic/dangerous/ flammable substances that are non-biodegradable.	
Social	No or very limited impact	Some impact on immediate communities, but cannot be considered as disruptive	Major disruptive impact on surrounding communities	

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
Ecological	Natural functions not affected or negligible.	Environment affected but natural functions and processes continue (Some damage or wildlife injury may occur). Impact is reversible or irreplaceable loss will not occur	Environment affected to the extent that natural functions are altered to the extent that it will permanently or over the long term cease (Major damage or wildlife injury could occur). Irreplaceable loss will occur.	
Total				

10.2.2 Duration

Duration is assessed and a factor awarded in accordance with the following:

Table 10: Duration factor rating and description

	Duration of Impact	Duration factor
Short term	The duration of the is impact is 1 Year or less	Factor 1
Medium term	The duration of the is impact is 1-5 Years	Factor 3
Long term	The duration of the is impact is 5 to 25 years	Factor 4
Permanent	The duration of the is impact is longer than 25 years and can be considered as permanent	Factor 5

10.2.3 Extent

Describes the physical extent the impact and factors are awarded according to the following:

Table 11: Extent factor rating and description

	Extent of the impact	Extent factor
Site	The impact only exists within the activity's footprint	Factor 1
Local	The impact could impact on the whole or a considerable portion of the properties on which the activity is undertaken as well as neighbouring properties	Factor 3
Regional	The impact could affect the area, neighbouring as well as other areas further away than the immediate neighbours	Factor 5

10.2.4 Probability

Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Table 12: Probability factor rating and description

	Possibility that impact will occur	Rating
--	------------------------------------	--------

Improbable	Low possibility of impact occurring due to design or history	1
Probable	Distinct possibility that impact will occur	2
Highly probable	Most likely that impact will occur	3
Definite	Impact will definitely occur	5

10.2.5 Significance Rating

Following from the above, the Significance rating can now be determined as follows:

Significance = severity x probability

The significance rating thus determined should influence the proposed project as described below:

Negligible (calculated Significance Rating < 25)

- Positive and negative impacts of negligible significance are unsubstantial and should have little or no influence on the proposed development project.

Low (calculated Significance Rating 25 < 50)

- The impact is limited and should not have a material effect on the decision to continue. Management intervention is required.

Moderate (calculated Significance Rating 50 < 90)

- Positive impact: Should weigh towards a decision to continue, should be enhanced in final design.
- Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to a low significance rating.

High (calculated Significance Rating > 90)

- Positive impact: Continue
- Negative impact: If mitigation cannot be implemented effectively (into the moderate category), proposal should be terminated.

The table below provides an example of how the unmitigated significance ratings are calculated:

Table 13: Calculating of Significance Ratings (Unmitigated)

Probability	Severity						Severity Rating	Significance Rating		
	Intensity	+	Duration	+	Extent	=		(Probability x Severity rating)		
Probable	2	Low	4	Short Term	1	Local	2	7	14	Negligible
Probable	2	Low	4	Medium Term	3	Regional	3	10	20	Low
Definite	5	Medium	12	Medium Term	3	Local	2	19	85	Moderate
Definite	5	High	20	Permanent	5	Site	1	26	180	High

10.2.6 Mitigation

Mitigation will be calculated as follows:

Description	Factor Allocated
Mitigation is not possible or positive impact of mitigation is negligible. Impact remains irreversible.	1
Mitigation is possible to some extent with moderate levels of positive impact. Impact is largely reversible with only a small portion that remains as irreversible.	2
Mitigation is possible with moderate to high levels of positive impact. Impact is reversible.	3
Mitigation is possible to such an extent that all negative impacts are reduced significantly or eliminated. Impact is completely reversible.	4

Significance = intensity + duration + extent

Mitigation potential

10.3 Description and Assessment of Impacts Associated with the Proposed Project

The following aspects associated with the proposed project have been identified and will be assessed for their respective impacts:

Aspect	Impacts to be considered	Pre-mitigation significance rating	Mitigation measures	After mitigation significance rating
Physical				
Hydrology	The increase in concrete and impermeable surfaces will increase runoff from the site and increase erosion	39	Storm water management plan	10
	Incorrect storm water management may lead to erosion due to the site geology and pedology	39	Storm water management plan	13
	Excavation and construction may lead to soil washing away and increasing sediment loads in surface runoff	20	Storm water management plan	7
	Ground water abstraction may deplete local aquifer and impact negatively on the availability of ground water by neighbouring properties	48	Hydro-geological study will be commissioned Implementation of relevant recommendations	24
	Increased sediment loads in surface run-off from residue stock piles and ash storage facilities	57	Storm water management plan	14
	Boiler ash application in plantations may increase sediment load in surface run-off	51	Boiler ash application plan	13
Noise	Increase in ambient noise levels in the area due to construction activities, increase in traffic and wood chipper operations	39	Construction times and delivery of materials to site is to be limited to day light hours Screening of high noise generation areas or equipment	13

Aspect	Impacts to be considered	Pre-mitigation significance rating	Mitigation measures	After mitigation significance rating
	Increase in instantaneous ambient noise levels associated with ash quenching.	26	Screening of high noise generation areas or equipment	9
Air Quality	Increase in dust emissions during construction	36	Dust suppression measures to be implemented	18
	Increase in localized emissions of particulate matter, NOx and SOx from flue gas emissions	115	Air quality control equipment will be installed with a 90% efficiency rating. Monitoring and maintenance plan to be developed and implemented. Boiler operation manual to be compiled to ensure optimum combustion temperatures and air flow is maintained, to minimize emissions related to incomplete combustion. Boiler operators are to be trained in the procedure.	29
	Increase in dust and diesel exhaust fumes from increased truck movement to and from the site, delivering biomass for use as fuel	75	Dust suppression measures to be implemented Maintenance of trucks to prevent inefficient combustion and high emission rates of exhaust gasses	38
	Increased levels of low level atmospheric particulate matter associated with biomass off-loading	39	Dust suppression measures to be implemented	13
	Decrease in air quality impacts due to wide-spread biomass burning associated with in-situ burning of plantation residues	115	Positive impact	115
	Increased atmospheric levels of particulate matter associated with boiler ash removal, storage and transport	45	Boiler ash application plan	11

Aspect	Impacts to be considered	Pre-mitigation significance rating	Mitigation measures	After mitigation significance rating
	Particulate matter dispersal from residue stock piles and chipper operations	45	Dust suppression measures to be implemented	23
	Reduced carbon emissions associated with energy from a renewable source	110	Positive impact	110
Solid and liquid Waste	Waste produced during construction, may impact on the surrounding land	30	Re-use of waste material to take place where viable. Waste management plan to be compiled and implemented.	8
	Increase in the volumes of general office waste generated on site due to the increased number of people present on site	39	Office waste will be managed with current waste generated on site	13
	Increase in the volumes of sewage generated on site due to the increased number of people present on site	51	Adequate sanitation facilities on-site to be ensured	17
	Poorly managed sanitation facilities may lead to contamination of soil and ground water	51	A sanitation management plan is to be compiled, that specifies inspection routines and frequency thereof related to all sanitation facilities. The plan must also include the management of the dry toilet waste to prevent any pollution or nuisances as well as the safe disposal thereof. The sanitation management plan must include the management of the re-use of grey water for dust suppression.	17
Soil	Over application of boiler ash may lead to deterioration of soil quality in the plantations	51	Boiler ash application plan	17

Aspect	Impacts to be considered	Pre-mitigation significance rating	Mitigation measures	After mitigation significance rating
	Compaction of soil by heavy machinery during delivery of boiler ash for the purposes of application in plantations	45	Boiler ash application plan	15
BIOLOGICAL				
Flora	Alien species may establish due to disturbance during construction	33	Quarterly inspection of the site Rehabilitation and re-vegetation of disturbed areas with a suitable specie	8
	Boiler ash application in plantations may impact on undisturbed/natural areas	32	Boiler ash application plan	11
Fauna	Boiler ash application in plantations may disturb fauna in natural patches on route to the site of application	20	Boiler ash application plan	10
SOCIO-ECONOMIC				
Employment	Increase in local employment opportunities.	80	Positive impact	80
Economic	Positive impacts on local economic development through the increase in regional domestic product	64	Positive impact	64
Electricity supply	Positive impact on the amount of electricity available in SA	65	Positive impact	65
Renewable energy	Positive impact on the availability of renewable energy	85	Positive impact	85
RESOURCE USE				
Use of non-renewable resources	The use of non-renewable resources during construction	40	Use of recyclable material and locally obtained materials where feasible	40
SPILLAGES AND FIRE HAZARDS				
Spills	Pollutants such diesel fuel may lead to soil pollution and	26	Spill management plan	9

Aspect	Impacts to be considered	Pre-mitigation significance rating	Mitigation measures	After mitigation significance rating
	infiltrate groundwater.			
Fires	Accidental or spontaneous combustion of the biomass stock piles on site leading to fire hazards in the surrounding plantations and deteriorating air quality	50	Fire management plan	17
Biodiversity	Impacts on sensitive areas	70	Sensitive areas will be cordoned off and access prevented	18

Table 14: Significance ratings of aspects as identified

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
Hydrology	The increase in concrete and impermeable surfaces will increase runoff from the site and increase erosion	3	1	1	1	6	4	3	13	3	39	4	10
	Incorrect storm water management may lead erosion	3	1	1	1	6	4	3	13	3	39	3	13
	Excavation and construction may lead to soil washing	1	3	1	1	6	1	3	10	2	20	3	7

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
	away and increasing sediment loads in surface runoff												
Hydrology	Ground water abstraction may deplete local aquifer and impact negatively on the availability of ground water by neighbouring properties	3	1	3	1	8	4	4	16	3	48	2	24
	Increased sediment loads in surface runoff from residue stock piles and ash storage facilities	3	3	3	3	12	4	3	19	3	57	4	14
	Boiler ash application in plantations may increase sediment load in surface runoff	3	3	1	3	10	4	3	17	3	51	4	13
Noise	Increase in ambient noise levels in the area due to construction activities, increase in traffic and wood	1	1	3	1	6	4	3	13	3	39	3	13

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
	chipper operations												
Noise	Increase in instantaneous ambient noise levels associated with ash quenching.	1	1	3	1	6	4	3	13	2	26	3	9
Air Quality	Increase in dust emissions during construction	3	1	3	1	8	1	3	12	3	36	2	18
	Increase in localized emissions of particulate matter, NOx and SOx from flue gas emissions	3	3	5	3	14	4	5	23	5	115	4	29
	Increase in dust and diesel exhaust fumes from increased truck movement to and from the site, delivering biomass for use as fuel	1	3	3	1	8	4	3	15	5	75	2	38
	Increased levels of low level atmospheric particulate matter	3	1	3	1	8	4	1	13	3	39	3	13

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
	associated with biomass off-loading												
Positive impact	Decrease in air quality impacts due to wide-spread biomass burning associated with in-situ burning of plantation residues	5	3	5	1	14	4	5	23	5	115	1	115
Air quality	Increased atmospheric levels of particulate matter associated with boiler ash removal, storage and transport	3	1	3	1	8	4	3	15	3	45	4	11
	Particulate matter dispersal from residue stock piles and chipper operations	3	1	3	1	8	4	3	15	3	45	2	23
Positive impact	Reduced carbon emissions associated with energy from a renewable source	3	3	3	3	12	5	5	22	5	110	1	110

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
Waste generation	Waste produced during construction, especially during demolition of the existing boiler may impact on the surrounding land	3	1	1	1	6	3	1	10	3	30	4	8
	Increase in the volumes of general office waste generated on site due to the increased number of people present on site	1	3	3	1	8	4	1	13	3	39	3	13
	Increase in the volumes of sewage generated on site due to the increased number of people present on site in conjunction with poorly managed sanitation facilities with potential soil and ground water pollution, as well as odour nuisances	1	5	3	1	10	4	3	17	3	51	3	17
Soil pollution	Over application of boiler ash may lead	3	3	1	3	10	4	3	17	3	51	3	17

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
	to deterioration of soil quality in the plantations												
Erosion	Compaction of soil by heavy machinery during delivery of boiler ash for the purposes of application in plantations	3	1	1	3	8	4	3	15	3	45	3	15
Ecological impacts	Alien species may establish due to disturbance during construction	1	1	1	3	6	4	1	11	3	33	4	8
	Boiler ash application in plantations may impact on undisturbed/natural areas	3	3	1	3	10	3	3	16	2	32	3	11
	Boiler ash application in plantations may disturb fauna in natural patches on route to the site of application	1	1	1	1	4	3	3	10	2	20	2	10

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
Positive impact	Increase in local employment opportunities.	1	1	5	1	8	4	4	16	5	80	1	80
Positive impact	Positive impacts on local economic development through the increase in regional domestic product	1	1	5	1	8	4	4	16	4	64	1	64
Positive impact	Positive impact on the amount of electricity available in SA	1	1	3	1	6	4	3	13	5	65	1	65
Positive impact	Positive impact on the availability of renewable energy	1	1	3	3	8	4	5	17	5	85	1	85
Sustainability	The use of non-renewable resources during construction	1	1	1	3	6	1	3	10	4	40	1	40
Pollution	Pollutants such diesel fuel may lead to soil pollution and infiltrate groundwater.	1	3	1	1	6	4	3	13	2	26	3	9

	Description of impact	Volume	Toxicity	Social	Ecological	Intensity	Duration	Extent	SEVERITY	PROBABILITY	Pre-mitigation significance	Mitigation Rating	Post mitigation and final significance rating
Fire	Accidental or spontaneous combustion of the biomass stock piles on site leading to fire hazards in the surrounding plantations and deteriorating air quality	3	5	5	3	16	4	5	25	2	50	3	17
Biodiversity	Impacts on fauna and flora and sensitive environment	3	1	3	1	8	3	3	14	5	70	4	18

After mitigation measures have been applied, it is evident that none of the identified negative impacts are of a high or even moderate significant rating. Several positive impacts have been identified.

10.4 Combustion of biomass and Disposal of ash in surrounding plantations

10.4.1 RESULTS FROM VARIOUS SAWMILLS

The results of various tests that were conducted to verify different constituents of biomass received from different sawmills are tabled below. These results were further analysed as indicated in the figures shown below each table of results.

Table 15: Biomass Lab Results Sun Pallets (Old Wood Chip)

Sun Pallets (Old Wood Chip)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	14.60	31.98	33.81
2	Gross Calorific Value	kcal/kg	18.85	32.53	34.81
3	Net Calorific Value at Constant Volume	MJ/kg	3488	7638	8074
4	Net Calorific Value at Constant Volume	kcal/kg	3110	7769	8212
5	Total Moisture	%	56.8		
6	Moisture in Analysis Sample	%		5.4	
7	Ash (ISO)	%	0.2	0.4	0.4
8	Volatile Matter (ISO)	%	37.1	81.2	85.8
9	Fixed Carbon (ISO)	%	5.9	13.0	13.7
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.06	0.14	0.15
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					

SiO ₂	%		39.58
Al ₂ O ₃	%		28.60
Fe ₂ O ₃	%		7.40
P ₂ O ₅	%		5.03
TiO ₂	%		2.24
CaO	%		3.52
MgO	%		0.72
K ₂ O	%		5.20
Na ₂ O			2.69
SO ₃			0.35
MnO ₂			0.09

Table 16: Biomass Lab Results Long Tom Lumber (New Sawdust)

Long Tom Lumber (New Sawdust)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	21.79	31.21	32.92
2	Gross Calorific Value	kcal/kg	22.12	31.68	33.42
3	Net Calorific Value at Constant Volume	MJ/kg	5205	7454	7863
4	Net Calorific Value at Constant Volume	kcal/kg	4919	7566	7981
5	Total Moisture	%	33.8		
6	Moisture in Analysis Sample	%		5.2	

7	Ash (ISO)	%	2.0	2.8	3.0
8	Volatile Matter (ISO)	%	53.7	76.9	81.1
9	Fixed Carbon (ISO)	%	10.5	15.1	15.9
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.13	0.18	0.19
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%	35.22		
	Al ₂ O ₃	%	27.53		
	Fe ₂ O ₃	%	7.38		
	P ₂ O ₅	%	5.30		
	TiO ₂	%	2.50		
	CaO	%	2.07		
	MgO	%	0.70		
	K ₂ O	%	4.82		
	Na ₂ O	%	3.44		
	SO ₃	%	0.45		
	MnO ₂	%	0.11		

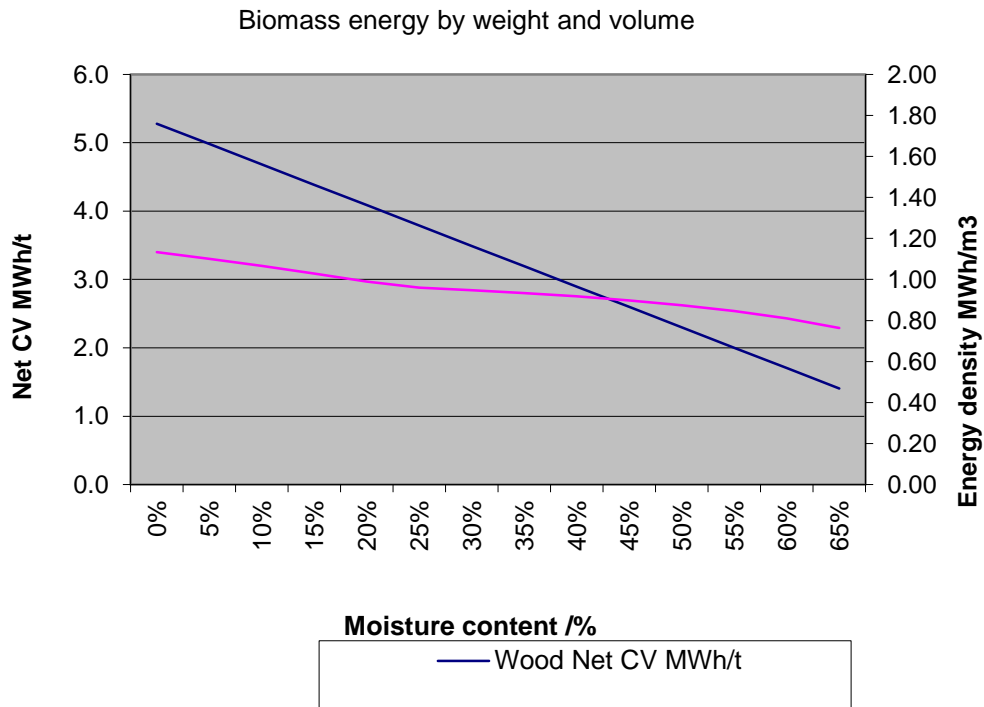


Figure 37: Net Calorific Value vs Moisture Content & Energy Density

The calorific value is a function of moisture content, it has been indicated above that for thermal conversion, a biomass fuel with low moisture content is preferred because its calorific value is higher. According to van Loo and Koppejan (2008), the GCV of biomass fuels usually varies between 18 to 22 MJ/kg dry basis (d.b.).

The characteristics of the biomass found at these sawmills indicates higher calorific values and low ash content, however, the moisture content of biomass was also found to be below 44% which is the limiting value for biomass fuel for energy production. The biomass to be used as fuel have a direct impact on the biomass power plant design, operation, and performance, including the fuel feed system, boiler technology, and emission control. Less homogeneous and /or low quality fuels need more sophisticated combustion systems

Table 17: Biomass Lab Results Long Tom Lumber (New Wood Chip)

Long Tom Lumber (New Wood Chip)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	17.88	32.42	34.38
2	Gross Calorific Value	kcal/kg	18.24	33.08	35.08
3	Net Calorific Value at Constant Volume	MJ/kg	4270	7743	8211
4	Net Calorific Value at Constant Volume	kcal/kg	3926	7901	8378
5	Total Moisture	%	48.0		
6	Moisture in Analysis Sample	%		5.7	
7	Ash (ISO)	%	0.4	0.8	0.8
8	Volatile Matter (ISO)	%	42.7	77.4	82.1
9	Fixed Carbon (ISO)	%	8.9	16.1	17.1
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.13	0.23	0.24
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%			37.99
	Al ₂ O ₃	%			29.02
	Fe ₂ O ₃	%			7.15
	P ₂ O ₅	%			5.74
	TiO ₂	%			2.07

CaO	%		3.40
MgO	%		0.67
K ₂ O	%		5.04
Na ₂ O	%		3.14
SO ₃	%		0.58
MnO ₂	%		0.08

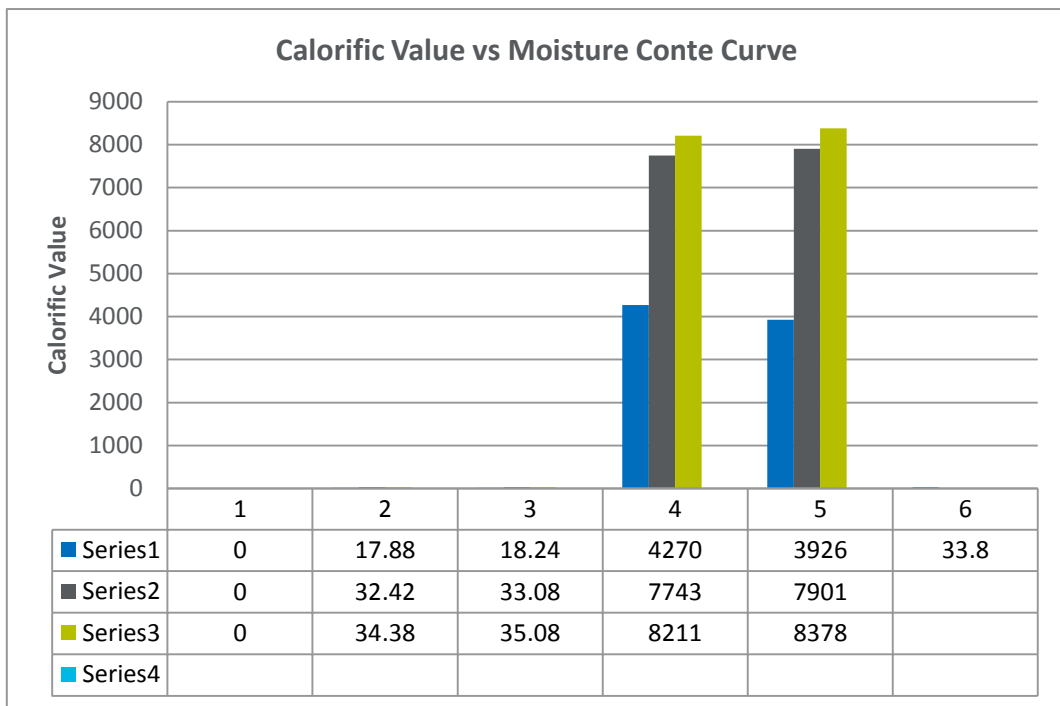


Figure 38: Net Calorific Value vs Moisture Content Curve

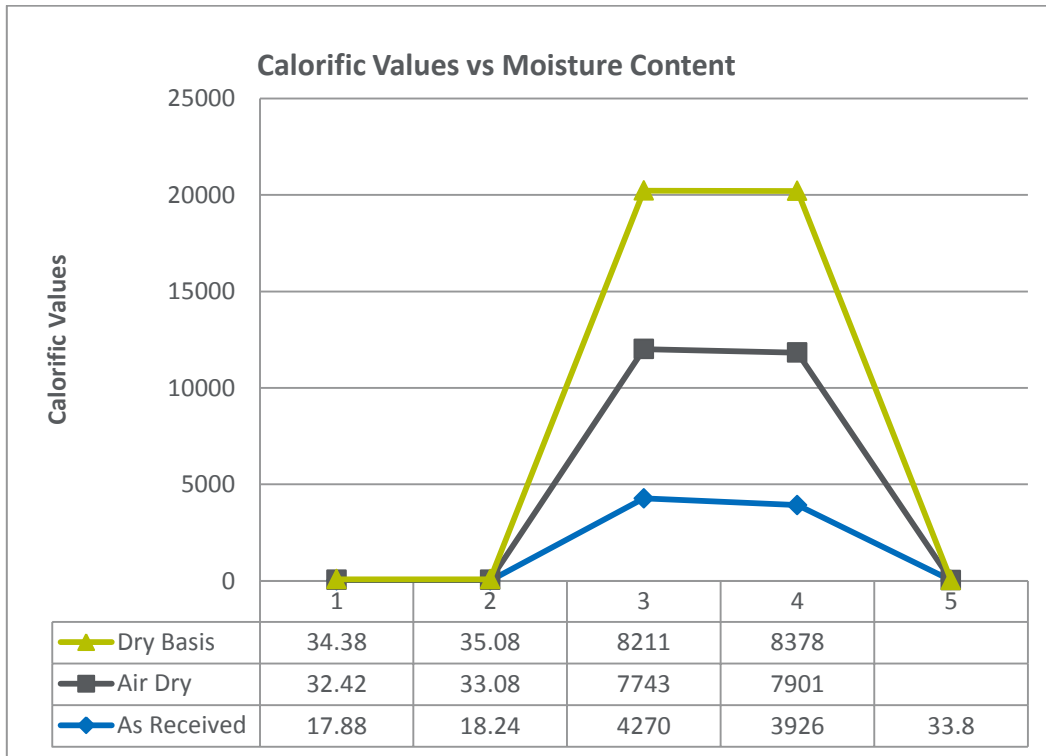


Figure 39: Net Calorific Value vs Moisture Content Curve

The net calorific value of the wet sample is less than that of the dry sample.

Table 18: Biomass Lab Results CRS Timbers (Old Wood Chip)

CRS Timbers (Old Wood Chip)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	15.05	30.41	31.94
2	Gross Calorific Value	kcal/kg	15.21	30.74	32.29
3	Net Calorific Value at Constant Volume	MJ/kg	3593	7263	7629
4	Net Calorific Value at Constant Volume	kcal/kg	3231	7341	7711
5	Total Moisture	%	52.9		
6	Moisture in Analysis Sample	%		4.8	

7	Ash (ISO)	%	2.3	4.7	4.9
8	Volatile Matter (ISO)	%	35.3	71.3	74.9
9	Fixed Carbon (ISO)	%	9.5	19.2	20.20
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.08	0.16	0.17
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%	35.76		
	Al ₂ O ₃	%	28.93		
	Fe ₂ O ₃	%	7.05		
	P ₂ O ₅	%	5.13		
	TiO ₂	%	2.11		
	CaO	%	4.06		
	MgO	%	0.48		
	K ₂ O	%	5.22		
	Na ₂ O	%	3.36		
	SO ₃	%	0.40		
	MnO ₂	%	0.10		

10.4.2

10.4.3

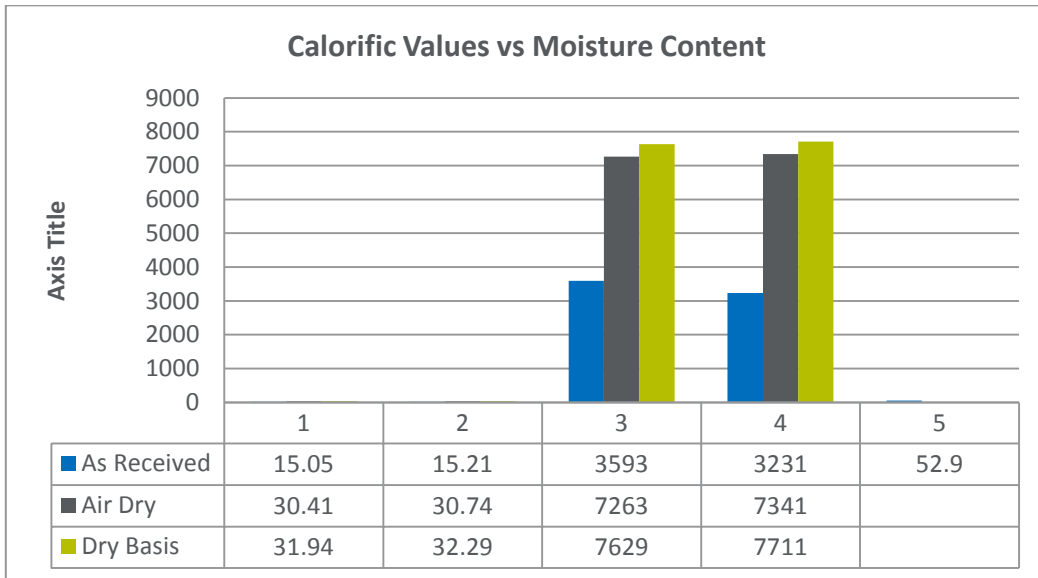


Figure 40: Net Calorific Value vs Moisture Content Curve

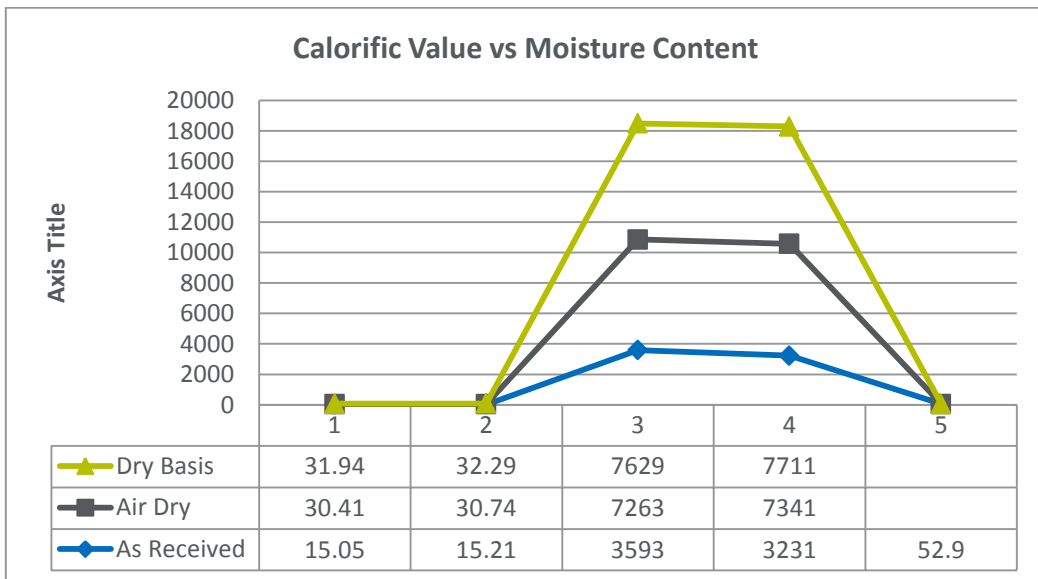


Figure 41: Net Calorific Value vs Moisture Content Curve

Table 19: Biomass Lab Results CRS Timbers (New Wood Chip)

CRS Timbers (New Wood Chip)						
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis	
1	Gross Calorific Value	MJ/kg	18.74	31.24	32.82	
2	Gross Calorific Value	kcal/kg	18.94	31.57	33.17	
3	Net Calorific Value at Constant Volume	MJ/kg	4475	7461	7837	
4	Net Calorific Value at Constant Volume	kcal/kg	4153	7541	7921	
5	Total Moisture	%	42.9			
6	Moisture in Analysis Sample	%		4.8		
7	Ash (ISO)	%	2.3	4.7	4.9	
8	Volatile Matter (ISO)	%	45.3	75.5	79.3	
9	Fixed Carbon (ISO)	%	9.7	16.1	16.9	
10	Total	%	100.0	100.0	100.0	
11	Sulphur (Total)	%	0.08	0.14	0.15	
12	Hydrogen in coal	%	0.00		0.00	
Ash Constituents						
	SiO ₂	%				40.04
	Al ₂ O ₃	%				27.35
	Fe ₂ O ₃	%				6.94

P ₂ O ₅	%		4.62
TiO ₂	%		1.80
CaO	%		2.85
MgO	%		0.60
K ₂ O	%		4.83
Na ₂ O	%		3.00
SO ₃	%		0.35
MnO ₂	%		0.12

10.5

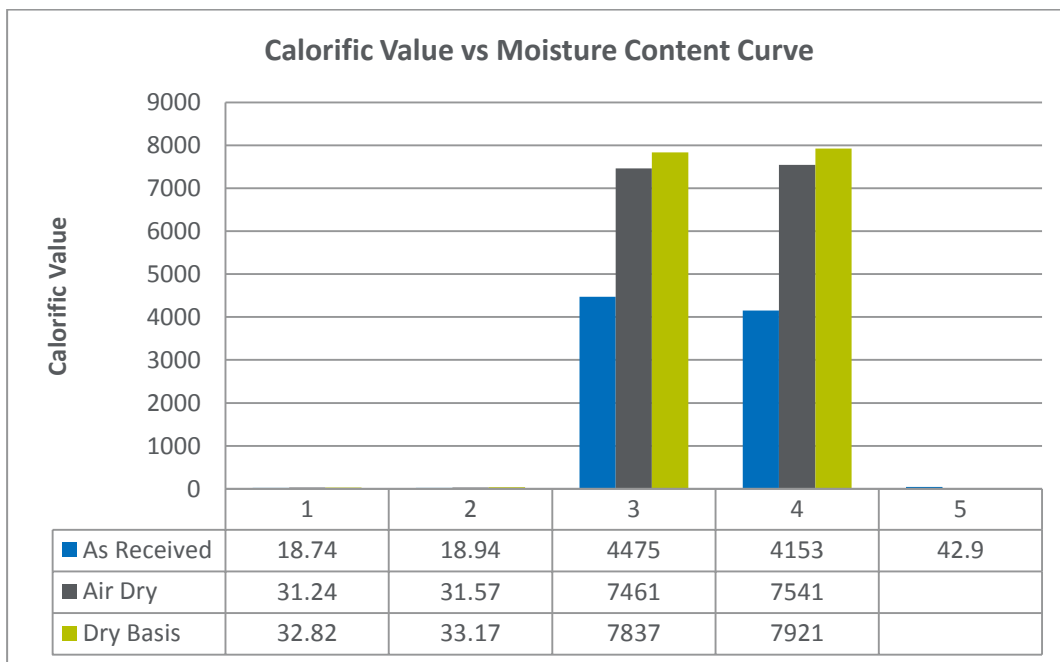


Figure 42: Net Calorific Value vs Moisture Content Curve

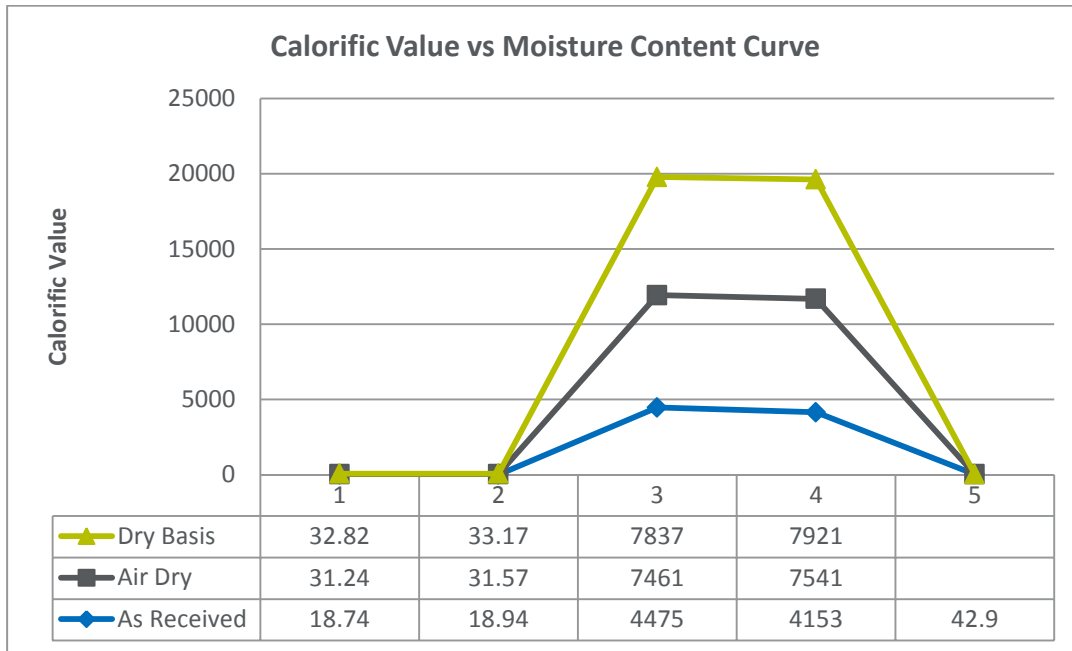


Figure 43: Net Calorific Value vs Moisture Content Curve

Table 20: Biomass Lab Results Pine Valley Timbers (New Wood Chip)

Pine Valley Timbers (New Wood Chip)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	20.20	31.27	32.95
2	Gross Calorific Value	kcal/kg	20.48	31.70	33.41
3	Net Calorific Value at Constant Volume	MJ/kg	4824	7468	7870
4	Net Calorific Value at Constant Volume	kcal/kg	4518	7572	7979
5	Total Moisture	%	38.7		
6	Moisture in Analysis Sample	%		5.1	
7	Ash (ISO)	%	1.7	2.7	3.8
8	Volatile Matter (ISO)	%	51.2	79.3	83.6
9	Fixed Carbon (ISO)	%	8.3	12.3	13.0

10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.12	0.18	0.19
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%			39.87
	Al ₂ O ₃	%			28.64
	Fe ₂ O ₃	%			6.99
	P ₂ O ₅	%			5.11
	TiO ₂	%			1.95
	CaO	%			3.55
	MgO	%			0.51
	K ₂ O	%			5.08
	Na ₂ O	%			3.40
	SO ₃	%			0.45
	MnO ₂	%			0.14

Table 21: Biomass Lab Results Pine Valley Timbers (New Sawdust Chip)

Pine Valley Timbers (New Wood Chip)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	16.63	32.22	33.81
2	Gross Calorific Value	kcal/kg	16.79	32.53	34.14
3	Net Calorific Value at Constant Volume	MJ/kg	3973	7695	8075
4	Net Calorific Value at Constant Volume	kcal/kg	3619	7770	8153
5	Total Moisture	%	50.8		
6	Moisture in Analysis Sample	%		4.7	
7	Ash (ISO)	%	0.7	0.13	1.0
8	Volatile Matter (ISO)	%	41.8	81.0	85.0
9	Fixed Carbon (ISO)	%	6.7	13.0	13.6
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.09	0.17	0.18
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%			40.05
	Al ₂ O ₃	%			26.18
	Fe ₂ O ₃	%			7.10
	P ₂ O ₅	%			5.32

TiO ₂	%		2.01
CaO	%		3.07
MgO	%		0.53
K ₂ O	%		4.44
Na ₂ O	%		2.92
SO ₃	%		0.43
MnO ₂	%		0.09

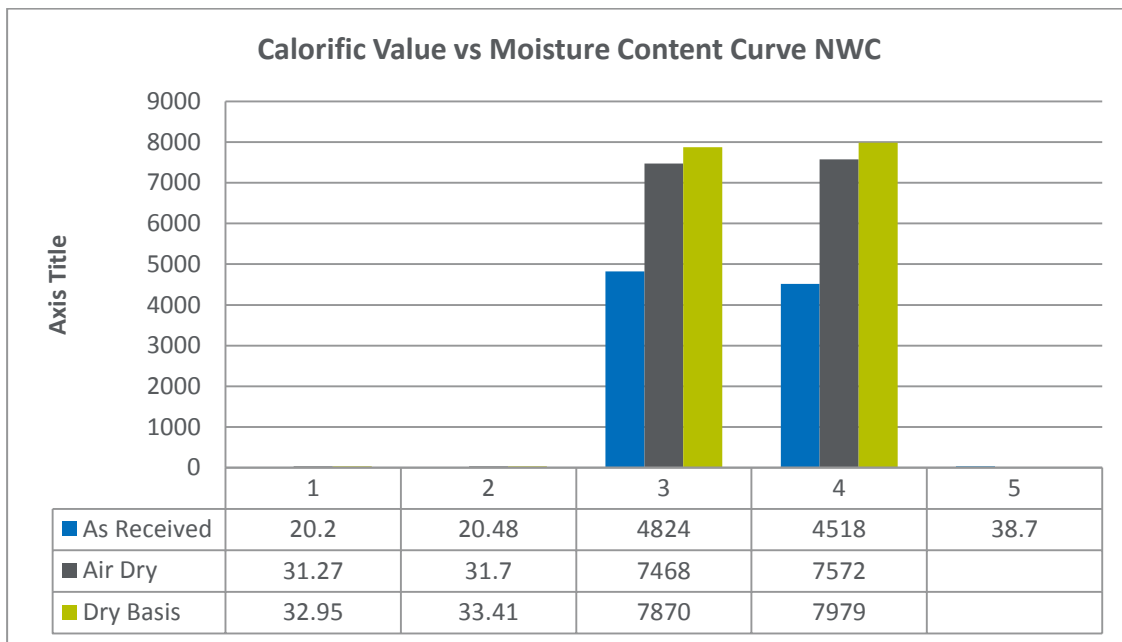


Figure 44: Net Calorific Value vs Moisture Content Curve

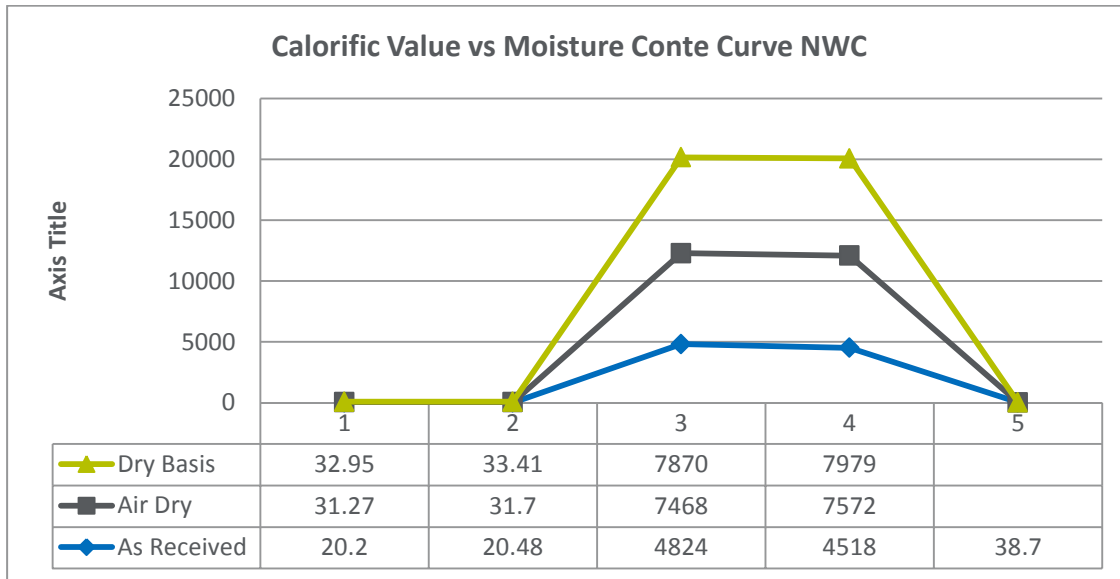


Figure 45: Net Calorific Value vs Moisture Content Curve

Table 22: Biomass Lab Results CRS Timbers (Old Sawdust)

CRS Timbers (Old Sawdust)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	20.57	32.13	33.71
2	Gross Calorific Value	kcal/kg	20.76	32.44	34.04
3	Net Calorific Value at Constant Volume	MJ/kg	4912	7674	8052
4	Net Calorific Value at Constant Volume	kcal/kg	4605	7748	8130
5	Total Moisture	%	39.0		
6	Moisture in Analysis Sample	%		4.7	
7	Ash (ISO)	%	1.1	1.7	1.8
8	Volatile Matter (ISO)	%	47.0	73.4	77.0
9	Fixed Carbon (ISO)	%	12.9	20.2	21.2
10	Total	%	100.0	100.0	100.0

11	Sulphur (Total)	%	0.10	0.16	0.17
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%			39.45
	Al ₂ O ₃	%			28.92
	Fe ₂ O ₃	%			7.26
	P ₂ O ₅	%			5.14
	TiO ₂	%			2.00
	CaO	%			3.28
	MgO	%			0.64
	K ₂ O	%			5.16
	Na ₂ O	%			2.88
	SO ₃	%			0.40
	MnO ₂	%			0.13

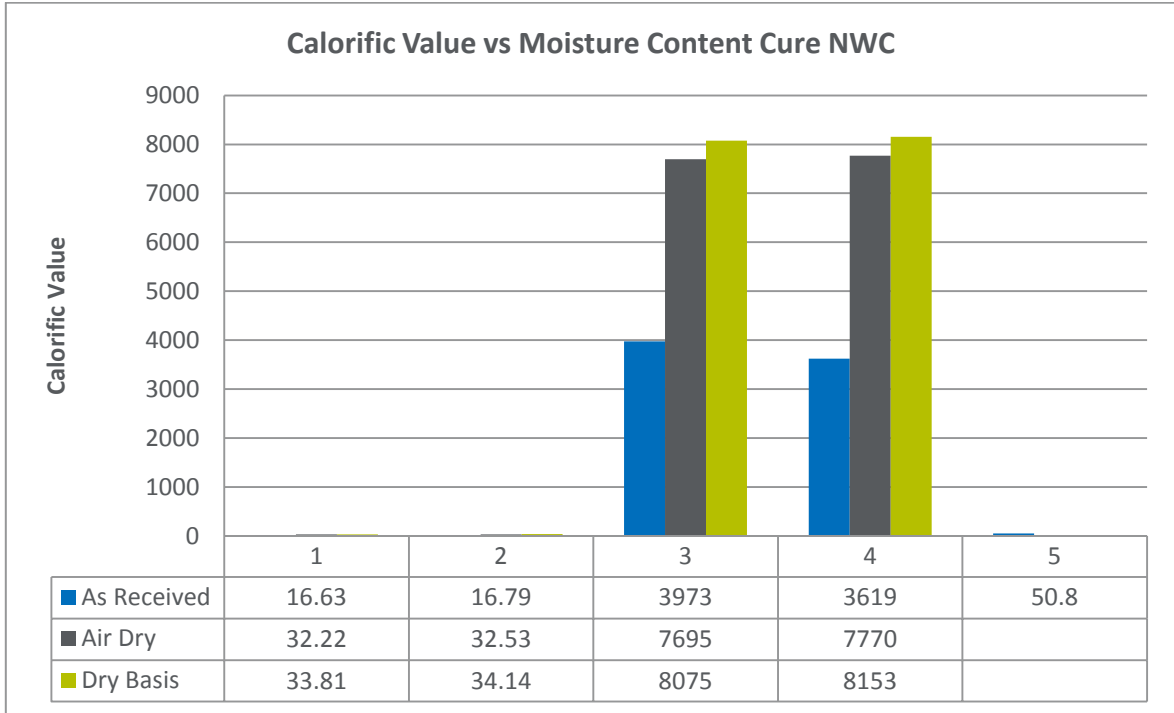


Figure 46: Net Calorific Value vs Moisture Content Curve

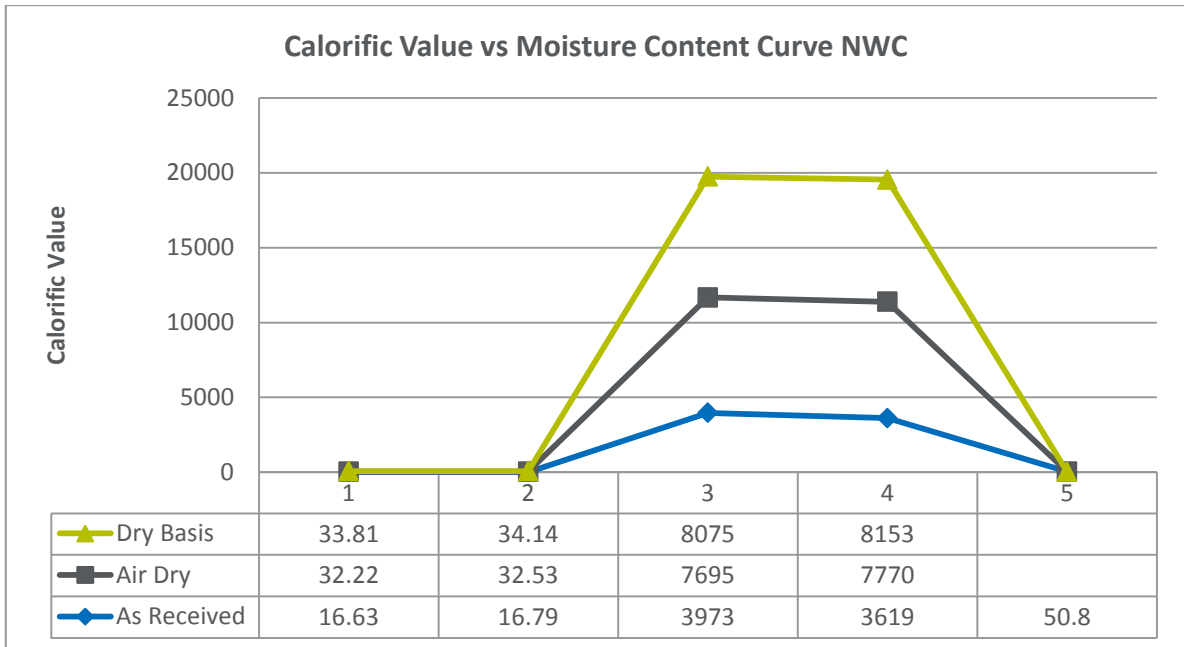


Figure 47: Net Calorific Value vs Moisture Content Curve

Table 23: Biomass Lab Results Lowpal Timbers (New Sawdust)



CRS Timbers (Old Sawdust)					
Item No	Sample Description	Units	As Received	Air Dry	Dry Basis
1	Gross Calorific Value	MJ/kg	17.09	32.41	33.90
2	Gross Calorific Value	kcal/kg	17.20	32.62	34.12
3	Net Calorific Value at Constant Volume	MJ/kg	4081	7741	8097
4	Net Calorific Value at Constant Volume	kcal/kg	3732	7791	8149
5	Total Moisture	%	49.6		
6	Moisture in Analysis Sample	%		4.4	
7	Ash (ISO)	%	0.5	1.0	1.0
8	Volatile Matter (ISO)	%	43.5	82.6	86.4
9	Fixed Carbon (ISO)	%	6.3	12.0	12.6
10	Total	%	100.0	100.0	100.0
11	Sulphur (Total)	%	0.09	0.18	0.19
12	Hydrogen in coal	%	0.00		0.00
Ash Constituents					
	SiO ₂	%			40.09
	Al ₂ O ₃	%			29.01
	Fe ₂ O ₃	%			6.87
	P ₂ O ₅	%			5.50
	TiO ₂	%			1.92
	CaO	%			3.45

MgO	%		0.69
K ₂ O	%		4.46
Na ₂ O	%		2.90
SO ₃	%		0.45
MnO ₂	%		0.18

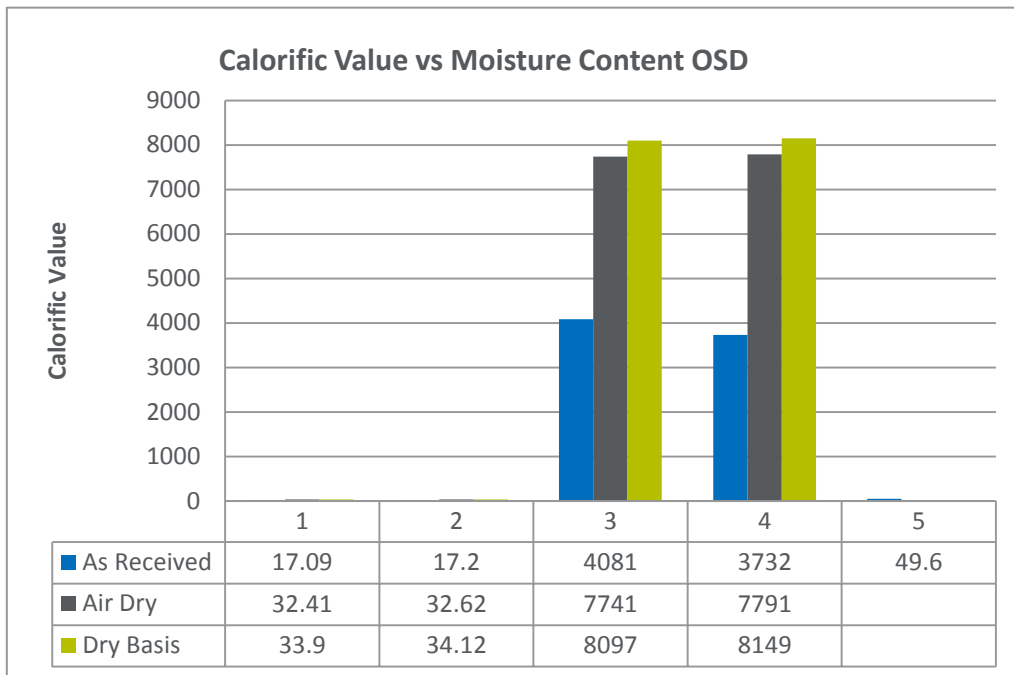


Figure 48: Net Calorific Value vs Moisture Content Curve

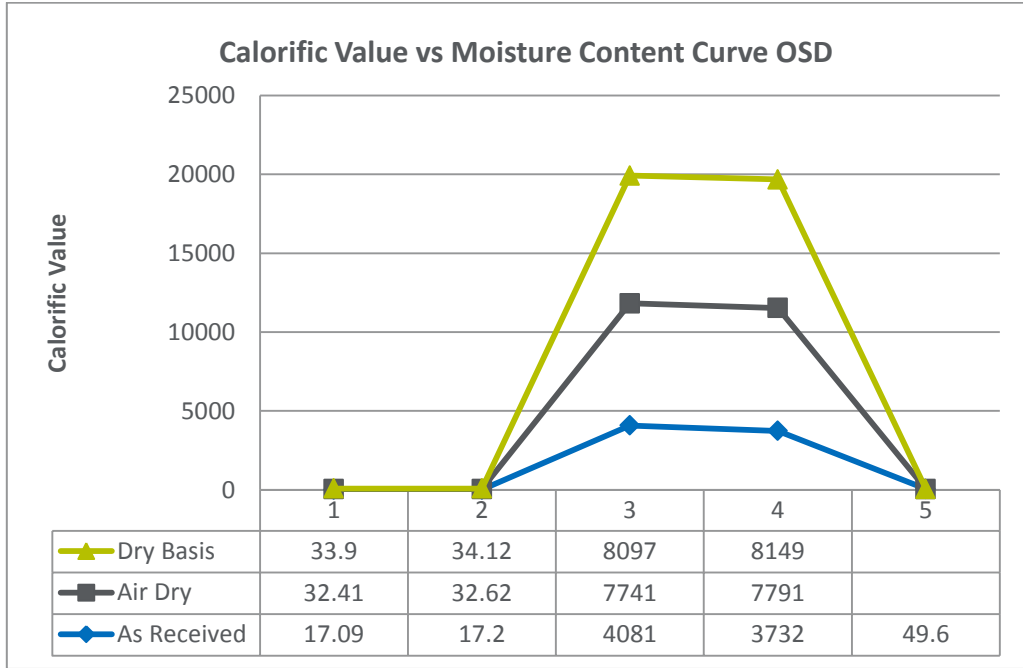


Figure 49: Net Calorific Value vs Moisture Content Curve

Legends:

NSD-New Sawdust; OSD-Old Sawdust; NWC-New Woodchip & OWC-Old Woodchip

10.6 Summary of Biomass Content

Table 24: Biomass Lab Results Analysis

Sawmill Plant	Biomass Content	New Sawdust	Old Sawdust	New Wood Chips	Old Wood Chips
Sun Pallets	GCV	0	0	0	33.81
	NCV	0	0	0	8074
	TM	0	0	0	56.8
	Ash	0	0	0	0.4
	VM	0	0	0	85.8
	C	0	0	0	13.7

Long Tom Timbers	GCV	32.9.2	0	34.38	0
	NCV	7863	0	0	0
	TM	33.8	0	48.0	0
	Ash	3.0	0	0.8	0
	VM	81.1	0	82.1	0
	C	15.9	0	17.1	0
CRS Timbers	GCV	0	33.71	32.82	31.94
	NCV	0	0	7837	7629
	TM	0	39.0	42.9	52.9
	Ash	0	1.8	3.8	4.9
	VM	0	77.0	79.3	74.9
	C	0	21.2	16.9	20.2
Pine Valley Timbers	GCV	33.81	0	32.95	0
	NCV	8075		7870	
	TM	50.8	0	38.7	0
	Ash	1.4	0	2.8	0
	VM	85.0	0	83.6	0
	C	13.6	0	13.0	0

Lowpal Timbers	GCV	33.90	0	0	0
	NCV	8097	0	0	0
	TM	49.6	0	0	0
	Ash	1.0	0	0	0
	VM	86.4	0	0	0
	C	12.6	0	0	0

Table 25: Fuel Characteristics per Sawmill Plant

Sawmill	Gross Calorific Value	Net Calorific Value	Volatile Matter	Moisture Content
Sun Pallets	33.81	8074	85.8	33.81
Long Tom Timbers	32.92	7863	81.1	33.8
CRS Timbers	31.94	7629	74.9	52.9
Pine Valley Timbers	32.95	7870	83.6	38.7
Lowpal Timbers	33.90	8097	86.4	49.6

10.7 Ash Content and Quality

After the thermal conversion of biomass, bottom ashes, fly ashes, and or slangs remain, depending on the fuel and technology used. Bottom ash is taken out at the bottom of the boiler. Fly ash can further be divided into cyclone light ash and fine particles from electrostatic and bag filters. The amount and quality of ash are important characteristics when selecting biomass fuel. Both are dependent on the biomass fuel that is used. According to Francescato and others (2008), debarked wood is the lowest ash-containing biomass, whereas forestry residues typically have a high ash content.

10.8 Chemical Composition

Biomass contains low levels of mineral, salts, and other material taken up from the soil or air during growth. According to Pastre (2002), the higher the concentration of the element nitrogen (N), sulphur (S), and chlorine (Cl) in biomass are as a result of the use of pesticides and fertilizer. The presence of these salts, mineral, and other elements are partly determining the level of gaseous and particulate emissions. Biomass fuel characteristic, such as the area of origin, ash content, chemical content, and to some extent, moisture content, affect the level and composition of emissions into air.

10.9 Contaminants

Besides contaminants within the biomass itself, which can result in harmful emissions to air and soil if not treated properly, biomass can be contaminated with material such as soil or stones, metals, and plastics. These contaminants may jam fuel feeding systems. Sand can result in glass formation during combustion (Carbon Trust 2005). To avoid this type of contamination, it is important to design a proper physical handling system handling mechanism for transferring fuel from where it is stored to where it is combusted (Carbon Trust 2005a).

10.10 Conclusion

Wood ash is commonly used as a liming agent because of its high calcium content. Liming agents are used to increase soil pH (pH is a measure of how acid a soil is).

Plants remove large amounts of phosphorus (P) and potassium (K) from the soil. Over time, P and K must be added to the soil to maintain crop yields.

Ash Application

The application of ash to surrounding plantation must comply with the following:

- a) Wood ash must be analysed for chemical composition before it is applied. The analysis must show that the ash have value as a soil ameliorant and acceptable levels of heavy metals.
- b) Wood ash may be spread in existing plantations or incorporated into the soil when plantations are replanted
- c) Wood ash must be applied according to generally accepted fertilizer guidelines and care must be taken to prevent over application.
- d) The ash should be processed (hardened) before application and the forming of dust during spreading must be minimized.
- e) Sensitive areas such as wetlands and key habitats should be avoided when applying ash.
- f) Ash application can be done any time of the year, but periods of heavy rainfalls and wind must be avoided, given that ash may be flushed or blown away.
- g) Erosion of soil in plantations due to damage and soil compaction caused by heavy machinery must be avoided. Consequences are reduced resistance to storms because of exposed roots, root rot and decreased growth. This can be avoided by planning appropriate routes, crossings and drop zones ahead of time.
- h) Avoid driving in low parts, where the soil is often wet with low buoyancy.
- i) Use forest residues to reinforce soil with low buoyancy in parts of the plantation frequented by heavy machinery
- j) Driving of heavy machinery and off-road vehicles along edges of streams, lakes and wetlands must be avoided. It is advised that as far as practically possible, a 30 meter buffer zone around water resources should be respected.
- k) The application of ash in natural and undisturbed areas is not allowed. This includes any wetland and riparian areas. Ash may also not be applied closer than the 1:100 year flood line or 50 meters from any

water course, whichever is the greatest.

- l) Wetlands are no-driving zones
 - m) Ash must be applied in such a manner to prevent wash-out by rains and entrainment in run-off.
 - n) The protection of workers during ash application must include measures to prevent skin, eye and respiratory exposure.
 - o) Temporary ash stockpiles:
 - i. The transport of ash from the point of origin to the point of use, must be done in such a manner that ash dust is not dispersed during transport. This can be accomplished for example by covering the ash with a tarpaulin, or transporting the ash in bags or bins with a lid.
 - ii. It is preferable to apply the ash to land directly from the vehicle used for transport to the point of use. If this is not practical, the location where the ash is temporarily stored must be selected by adhering to the criteria mentioned in this section.
 - iii. The temporary stockpile must be protected from wind liberating ash from the stockpile, to prevent a dust nuisance and pollution of surface water bodies.
 - iv. Temporary stockpile locations must be varied, to prevent localized over exposure of soil to high ash quantities.
- a) The application of ash in natural and undisturbed areas is not allowed. This includes any wetland and riparian areas. Ash may also not be applied closer than the 1:100 year flood line or 50 meters from any water course, whichever is the greatest.
 - b) Erosion of soil in plantations due to damage and soil compaction caused by heavy machinery must be avoided. Consequences are reduced resistance to storms because of exposed roots, root rot and decreased growth. This can be avoided by planning appropriate routes, crossings and drop zones ahead of time.

10.11 Cumulative Impacts

Two of the impacts identified could have cumulative impacts when considering impacts emanating from activities in the vicinity of the site and in the broader region. These are related to ground water abstraction and stack emissions.

With reference to ground water abstraction, a geo-hydrological study will incorporate the use of ground water by surrounding persons and organisations and a sustainable yield will be determined. If the sustainable yield is exceeded, it will have impacts on the availability of ground water for other users in the surrounding area. The project may also make active use of rain water harvesting to further lower ground water demands. A water management plan will be compiled in order to promote water conservation, limit accidental water losses and ensure that abstraction remains within the sustainable yield.

The cumulative impact related to air quality was assessed in terms of the Code of Practice for Air Dispersion Modelling in Air Quality Management in South Africa (DEA, 2014), which outlines the following for isolated sources that are not significantly influenced by background concentrations e.g. in isolated areas:

- For annual averages, the highest predicted concentration must be less than the National ambient air quality standards, no exceedances allowed;
- For short-term averages (24 hours or less), sum of the 99th percentile concentrations and background concentrations must be less than the National ambient air quality standards. Wherever one year is modelled, the highest concentrations shall be considered.

In the cumulative assessment for the Ixopo renewable energy plant, the maximum predicted incremental concentrations were added to the maximum background concentration for PM10, SO₂ and NO₂. Background data were obtained from the Ganges air quality monitoring station which is the second closest station to the site that data were available on the South African Air Quality Information System. No background data were available for dust fallout rates, PM_{2.5} and CO concentrations. Predicted incremental annual average concentrations for PM10 (0.12µg/m³), NO₂ (0.07µg/m³) and SO₂ (0.01µg/m³) fell well within the acceptable annual limits. However, PM10 and NO₂ exceed the acceptable annual limits when added to the maximum background annual concentrations. The sum of the approximate maximum background concentrations and the maximum predicted incremental concentrations for short term averages exceeded the acceptable limits for PM10, NO₂ and SO₂. However, it should be noted that the worst case scenario was assessed where the maximum background concentrations were used in the assessment as per the guidelines. In reality, when looking at the background air quality data in Section 4.2, exceedances of the background standards are mostly observed in the winter and autumn seasons. Furthermore, in the case of NO₂ and SO₂, ambient concentrations are within the acceptable limits for most of the time; with exceedances observed mostly within the autumn and winter seasons.

Predicted incremental concentrations for PM10, PM_{2.5}, SO₂, NO₂ and CO due to proposed operations at the Ixopo renewable energy plant are shown to be relatively low outside the site boundary and at surrounding sensitive receptors. Thus the cumulative impact is predicted to be medium; where the impact would result in minor cumulative effects.

After mitigation measures have been applied, it is evident that none of the identified negative impacts are of a high or even moderate significant rating. Several positive impacts have been identified.

11 Assumptions, Uncertainties and Gaps in Knowledge

This report has been compiled based on the following assumptions, uncertainties and gaps in knowledge:

- a. Due to noise generating equipment not being available on site to measure future noise levels, it is recommended that a study in this regard be executed during full operation and that the required engineering controls are instituted is required. Full mitigation of any noise impacts will be possible and as such it is recommended that environmental authorization not be declined based on the absence of this data
- b. In terms of air quality, the closest sampling site has been used. It might not be 100% representative of the site, but no other sampling records are readily available.
- c. The cumulative impact of air emissions, taking into account surrounding atmospheric emissions, such as those from roads, residential cooking and heating fires, have not been taken into account. This would require a full scale impact assessment, which would place an undue burden on the client, and is not commensurate with the extent of operations. The local Air Quality Management Plan however, should be viewed as the strategic initiative with respect to the management of cumulative impacts in this air shed.

12 Environmental Impact Statement and Recommendations by the EAP

The EAP confirms the following in relation to-

- I. the correctness of the information provided in the report;
- II. the inclusion of comments and inputs from stakeholders and interested and affected parties;
- III. 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;
- IV. an undertaking under oath or affirmation by the EAP in relation to the level of agreement between the EAP and interested and affected parties on the plan of study for undertaking the environmental impact assessment;

With adequate mitigation and management measures in place, the project can be expected to have a low negative impact during the construction phase on the surrounding social and natural environment.

The project will furthermore have a positive impact on the region in terms of job creation and economic stimulation during the construction phase. These positive impacts benefits can be maximised through preference in procurement processes for local firms and employment of local labourers where viable.

Due to a reduction in uncontrolled burning of plantation residue (being replaced by controlled burning at the site), it is also foreseen that the project will have a positive impact on air quality in the surrounding areas. The project will also have positive contribution to the reduction of greenhouse gas emissions.

Once in operation, the proposed project will continue to impact in a positive way on the local job creation and therefore indirectly, on the local economy.

Based on the outcomes of the environmental impact assessments as contained in the relevant sections of this document, the overall negative impact of the project is of Medium Significance, which can be reduced to a Low Significance though the implementation of cost-effective mitigation measures that are fairly easy to implement, maintain and monitor.

Based on the aforementioned, the EAP makes the following recommendations:

- The project should be approved and allowed to proceed.
- The mitigation measures proposed in the impact assessment section have been incorporated into the EMP in more detail and must be implemented during the final planning of and construction as well as operational phases of the project
- A communications pathway must be established that would allow a designated person to deal with any concerns and complaints that may arise during construction and operation.
- Strict monitoring and enforcement of the conditions and requirements of the EMP must be undertaken by the developer to ensure that all contractors and operators adhere to the requirements and that the monitoring regime is followed without fail.

13 Details of the Public Participation Process Conducted

The Public Participation Process (PPP) for this project is conducted by EON Consulting according to the guidelines as published in the Department of Environmental Affairs (2010), Public Participation 2010, Integrated Environmental Management Guideline Series 7, Department of Environmental Affairs, Pretoria, South Africa and the relevant regulations. This section of the document provides detail of the public participation process (PPP) undertaken up to this point in time. Note that the PPP is still in process.

13.1 Steps that were taken to notify potentially interested and affected parties of the proposed application, comments on the scoping report as well as comments on the draft EIAR

The following PPP was performed for the proposed project:

- Potential I&APs were identified by review of the site and consultation with the client
- These potential I&APs were informed of the process and invited by letter to be registered I&APs. The letter was accompanied by additional basic information and a registration form
- A notice in the local newspaper, The Witness, was printed on 11th April 2016, and informs the public of the public participation process
- Two site notices were displayed near the site
- The local Councillor was contacted telephonically and a copy of the scoping and Draft EIA report was e-mailed.
- The local municipality was contacted telephonically and information and reports were sent via e-mail
- The neighbouring land owners were served with hand delivered notices.
- Copies of the scoping and Draft EIA report was e-mailed to registered I&AP's
- A copy of the scoping and Draft EIA report was loaded on the EON website: www.eon.co.za

13.2 Proof of notice boards, advertisements and notices

13.2.1 Notification to I&AP

The municipal parties were contacted telephonically and it was agreed that they prefer to be e-mailed. Emails were sent which included a personal letter, Basic Information Document and registration form as attachments. If no reply is received as requested, the documents will be delivered by hand. Copies of the confirmation emails (or then signed hand delivery notices) is included in the **Annexure A**.

13.2.2 Notice in the newspaper

An advertisement, notifying the public of the EIA process, inviting I&AP's to participate in the process by registering their comments with EON Consulting (full contact details provided), was placed in The Witness on 11th April 2016 (**Refer to Appendix A: Public Participation Evidence**).

13.2.3 Registration of I&APs and Comments

No objections to the proposed project have been received to date following the Draft Scoping Phase public participation process. The following comments have been received to date from the I&AP's to date:

Issues and Comments Raised	I&AP/Stakeholder	Response
Comments Received During the Initial Public Participation		
Requested to be registered as an I&AP	Tyrone Hawkes Sappi Southern Africa Tyron. Hawkes@sappi.com Email: 14/04/2016	Noted.
Requested to be registered as an I&AP	Sean Brown Operation Manager North Sinbisi Forest Products Tel:039 553 8008 Mobile Number: 083 282 5288 Postal Address: P.O. Box 20 Weza 4685 Physical Address: Weza Road Main, Weza 4680	Noted.
Andre Kilian notified by Biomass regarding the project	Andre Kilian Email: andre@focuspoint.co.za	Noted.



<p>Hi Adri, hope you well.</p> <p>Please find the attached file.</p> <p>I have been trying for days now to get hold of Mr Mazibuko and Mrs Mkhize – and I get told they will be in the following day. So I phone the next day to be told no they will be at work in 2 days time. They don't answer their cell phones, so today I went to Ingwe in Creighton, and left both scoping reports for them to pick up when they decide to go to work. I got the Thanda (lady at the front desk) to sign both forms and to stamp them. Thanda got hold of both Mr Mazibuko and Mrs Mkhize for me – and I informed both that the scoping reports are at the front desk and that they need to read through it – to which they both agreed.</p> <p>Will this be sufficient?</p>	<p>Avril Shewan Hayters Forest Management P.O Box 91 Ixopo 3276 South Africa Tele: +2782 8201655 Tele: +2779 6959880 Fax: +2786 5770916 Mobile: +2772 6993406</p>	<p>Noted.</p> <p>Please find signed notification in Annexure A: Public Participation Evidence</p>
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Database

Sector	Name	Surname	Company/Organisation	Telephone	Cellphone	Email
Applicant	Albert	Janse van Rensburg	Biomass Investment (Pty) Ltd	011 486 0982	082 448 4263	albert@cleanenergy.co.za
Case Officer (DEA)	Sabelo	Malaza	Department of Environmental Affairs	012 399 900		
Local Municipality	Ingwe Municipality		Ingwe Municipality	039 833 1038		mailbox@ingwe.gov.za
I&AP	Sean	Brown	Sinbisi Forest Products	039 553 8008	083 282 5288	
I&AP	Avril	Shewan	Hayters Forest Management	082 8201655	072 699 3406	avril@hayters.co.za

14 Plan of Study for the Impact Assessment

14.1 Generation Alternatives to be considered

Based on Section 9 of the Scoping Report, no alternatives will be assessed. The chosen technology will render high quality products and is the most environmentally friendly methodology in comparison with other methods. The project applicant is the owner of the site and no other site is available (which belongs to the project proponent).

14.1.1 No-go alternative

South Africa currently relies almost completely on fossil fuels as a primary energy source (approximately 90%) with coal providing 75% of the fossil fuel based energy supply. Coal combustion in South Africa is the main contributor to carbon dioxide emissions, which is the main greenhouse gas that has been linked to climate change.

The White Paper on Renewable Energy (2003) has set a target of 10 000GWh of energy to be produced from renewable energy sources (mainly from biomass, wind, solar and small-scale hydro) by 2013. The White Paper's target of 10 000GWh renewable energy contribution to final energy consumption by 2013 was confirmed to be economically viable with subsidies and carbon financing. Achieving the target will add about 1.667MW new renewable energy capacity, with a net impact on GDP as high as R1.071-billion a year and contribute to water savings of 16.5-million kiloliters, which translates into a R26.6-million saving.

The no-go option is therefore not in line with the White Paper on Renewable Energy (2003) and will not contribute to the energy reserve in South Africa as well as water savings (when compared to coal fired energy generation)

14.2 Description of aspects to be assessed

The following aspects will be assessed:

14.2.1 Boiler

Emissions from the boiler will be routed through air quality control equipment. The effectiveness of the control equipment and the emissions from the stack will be modelled to determine the impact on ambient air quality.

14.2.2 Storage of biomass and ash

Dust and particulate matter from the storage of biomass and ash will be investigated to determine the impact on dust levels on the environment.

14.2.3 Clearing of vegetation for construction

Although the site is a brownfield site, the current levels of significant fauna and flora species will be determined.

14.2.4 Storm water run-off

Storm water run-off from paved areas has the potential to cause soil erosion and pick up pollutants from non-point sources on the site. This may lead to polluted run-off entering the nearby water courses.

The extent of storm water run-off and potential NPS pollution sources will be assessed based on a storm water management plan that will be compiled by the design engineers.

14.2.5 Electricity Generating and biomass chipping units

The noise levels from all units will be assessed based on the levels as certified by the manufacturers.

14.2.6 Waste water

Control and management of waste water emanating from the demineralisation plant, cooling equipment will be assessed in terms of pollutants, management of waste water and removal of sludge from waste water control equipment.

14.2.7 Access roads and vehicular movement

The above will be assessed in terms of dust generation during construction and operation.

14.2.8 Construction

The timing of construction, construction activities and control over no-go areas will be assessed to prevent accidental damage to no-go areas, dust nuisances, noise nuisances, oil spillages, storm water contamination, waste management, fire risks and sanitation services for workers. A complete EMPr will be compiled to control all construction related aspects.

14.2.9 Sanitation facilities

Once it has been confirmed that no sewage connection is available to a municipal waste water treatment plant, the safe disposal or onsite treatment of grey and black water will be assessed. Potential environmental impacts associated with onsite waste water treatment include surface and ground water and soil pollution as well as creating of nuisances by means of bad odours. The design and capacity of an onsite system will be assessed to determine whether a waste management and water use licence will be required.

14.3 Aspects to be assessed by specialists

The following aspects will be assessed by specialists:

- a) Air quality impacts from:
 - Boiler onsite
 - The storage of sawmill dust on site
 - Dust emissions during construction
- b) Ecological impacts as a result of the clearing of vegetation

Vegetation on site to determine if detailed fauna studies are required based on the presence of natural vegetation of high conservation value

Geohydrological assessment:

The impact on groundwater levels due to ground water abstraction for use by the project.

14.3.1 Site Lay-out

The final site lay-out plan will be assessed in terms of encroachment on sensitive areas: buffer zones around water courses as well as important patches of remnant natural vegetation.

14.3.2 Access roads and vehicular movement

The above will be assessed in terms of dust generation during construction and operation.

14.3.3 Hazardous waste generation

The storage and disposal of this waste will be assessed and management and mitigation measures will be compiled. The study must also address cumulative impacts.

14.3.4 Heritage impact assessment

A phase 1 archaeological assessment will be executed by a registered heritage practitioner:

The expected heritage impact assessment should identify all archaeological, spiritual and heritage sites via detailed site investigations and community consultation and to document and assess their importance within local, provincial and national context.

The Scope of Work will include the following:

- Identify all archaeological and heritage sites by physically surveying the area on foot or by vehicle and mapping the site for all identified heritage sites all the while ensuring that the correct protocol is adhered to regarding community consultation when associated with community grave locations;
- Identify all legislation and guidelines that should be considered;
- Describe the approach and methodology used for the assessment;
- Assess the following criteria:
 - I. site integrity (i.e. primary vs. secondary context),
 - II. amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
 - III. uniqueness
 - IV. potential to answer present research questions.
 - V. site significance
 - VI. assumptions and limitations of assessment
 - VII. Highlight potential impacts that should be investigated and assess their importance within local, provincial and national context;
 - VIII. Based on the above, provide possible mitigation measures to minimise negative impacts;

14.3.5 Riparian zone delineation

A riparian delineation is required in order to inform the proposed development layout of hydrologically, and ecologically sensitive areas associated with riparian systems on the site.

In 2005 the Department of Water Affairs and Forestry published a manual entitled “A practical field procedure for identification and delineation of wetland and riparian areas” (DWAFF, 2005). The “...manual describes field indicators and methods for determining whether an area is a wetland or riparian area, and for finding its boundaries.”

14.3.6 Cumulative impacts

The cumulative impacts will be assessed by considering impacts that the proposed facilities will have during construction, operational and decommissioning phases on the receiving environment consisting of the biophysical, heritage and socio-economic environment.

14.4 Proposed methodology to assess impacts

14.4.1 Air quality impacts

The Scope of Work will include the following:

- Identify all legislation and guidelines that should be considered;
- Describe the approach and methodology used for the assessment;
- Obtain all relevant data, including meteorological data and current air quality data
- An emissions inventory for dust, total suspended particulates, PM10 and emissions from all project-related activities are quantified (during construction and operational phase)
- A dispersion potential model of the area must be produced based on Government Notice, R. 533 National Environmental Management: Air Quality Act (39/2004): Regulations regarding Air Dispersion Modelling, page 3 in Government Gazette 37804, 11 July 2014

- Scenario modelling must be produced: The prediction of ambient air pollutant concentrations and dust fallout in terms of dispersion modelling
- The assessment of the impacts based on comparisons of the resulting concentration against the approximated pre-construction/construction/operational and rehabilitated ambient conditions, as well as against relevant standards and guidelines
- The identification of emission reduction opportunities and cost-effective emission abatement strategies
- Mitigation measures for worst case, most probable and best case scenarios must be identified
- Provision of recommendations regarding the optimum air quality monitoring positions and the establishment of an air quality monitoring programme
- The cumulative effect of existing air pollution levels must be clearly identified and measured against the approximated cumulative effect of the proposed operation.
- Highlight potential impacts that should be investigated and assess their importance within local, provincial and national context;
- Suggest feasible alternatives based on the above;

14.4.2 Ecological impacts

An ecologist will be appointed to do a site visit.

The aim of the Assessment is to provide an overview of the Ecological Sensitivity on site. During Scoping, the study will focus on fieldwork and culminate in the generation of a Baseline Site Sensitivity Map, aimed at identifying potential environmentally sensitive areas / red flags, in particular, to be avoided during site development. The Sensitivity Map will be accompanied by a Summary Report, containing the results of field investigations, providing recommendations in terms of site establishment and identifying additional studies that should be undertaken during Phase 2 of the project. This study may, for example, confirm the extent of wetland and aquatic ecological assessment required. Preliminary impacts will be identified however, detailed impact identification and identification of mitigation measures will occur during the EIA Phase of the project.

14.5 Methodology to assess significance and duration

Significance is the product of probability and severity rating divided by the mitigation potential:

$$\text{Significance} = \frac{\text{Probability} \times \text{Severity}}{\text{Mitigation}}$$

Probability and Severity will be determined based on the following:

14.5.1 Determining the Severity of an Impact

Determination of the severity of an impact is a function of intensity, duration and extent, divided by the extent to which mitigation can successfully be applied:

$$\text{Severity} = \text{intensity} + \text{duration} + \text{extent}$$

Each of the 4 factors used to determine the severity of an impact, are described below:

14.5.1.1 Intensity factor

The level of intensity is the sum of volume, toxicity, social impact and ecological impacts.

Note that either Volume A or Volume B is used (refer to the description) but never both at the same time.

Table 26: Intensity factor rating and description

	Low (1)	Medium (3)	High (5)	Sub Total (Sum)
Volume (A) (refers to process input and output substances/material or products)	Less than 80 m ³ at any one time (or low volumes relative to industry/commercial standards)	Between 80 and 300 m ³ at any one time (or medium volumes relative to industry/ commercial standards)	In excess of 300 m ³ at any one time (or high volumes relative to industry/ commercial standards)	
Volume (B) (refers to natural resources)	Relatively small	Medium	Large	
Toxicity	Toxicity is on par with everyday goods in wide-spread use and is biodegradable.	Toxicity can be compared to those that have to be handled with some caution and are non-biodegradable.	Toxicity is on par with toxic/dangerous/ flammable substances that are non-biodegradable.	
Social	No or very limited impact	Some impact on immediate communities, but cannot be considered as disruptive	Major disruptive impact on surrounding communities	
Ecological	Natural functions not affected or negligible.	Environment affected but natural functions and processes continue (Some damage or wildlife injury may occur). Impact is reversible or irreplaceable loss will not occur	Environment affected to the extent that natural functions are altered to the extent that it will permanently or over the long term cease (Major damage or wildlife injury could occur). Irreplaceable loss will occur.	
Total				

14.5.1.2 Duration

Duration is assessed and a factor awarded in accordance with the following:

Table 27: Duration factor rating and description

	Duration of Impact	Duration factor
Short term	The duration of the is impact is 1 Year or less	Factor 1
Medium term	The duration of the is impact is 1-5 Years	Factor 3
Long term	The duration of the is impact is 5 to 25 years	Factor 4
Permanent	The duration of the is impact is longer than 25 years and can be considered as permanent	Factor 5

14.5.1.3 Extent

Describes the physical extent the impact and factors are awarded according to the following:

Table 28: Extent factor rating and description

	Extent of the impact	Extent factor
Site	The impact only exists within the activity's footprint	Factor 1
Local	The impact could impact on the whole or a considerable portion of the properties on which the activity is undertaken as well as neighbouring properties	Factor 3
Regional	The impact could affect the area, neighbouring as well as other areas further away than the immediate neighbours	Factor 5

14.5.1.4 Probability

Probability describes the likelihood of the impact actually occurring, and is rated as follows:

Table 29: Probability factor rating and description

	Possibility that impact will occur	Rating
Improbable	Low possibility of impact occurring due to design or history	1
Probable	Distinct possibility that impact will occur	2
Highly probable	Most likely that impact will occur	3
Definite	Impact will definitely occur	5

14.5.2 Significance Rating

Following from the above, the Significance rating can now be determined as follows:

Significance = severity x probability

The significance rating thus determined should influence the proposed project as described below:

Negligible (calculated Significance Rating < 25)

- Positive and negative impacts of negligible significance are unsubstantial and should have little or no influence on the proposed development project.

Low (calculated Significance Rating 25 < 50)

- The impact is limited and should not have a material effect on the decision to continue. Management intervention is required.

Moderate (calculated Significance Rating 50 < 90)

- Positive impact: Should weigh towards a decision to continue, should be enhanced in final design.
- Negative impact: Should weigh towards a decision to terminate proposal, or mitigation should be performed to reduce significance to a low significance rating.

High (calculated Significance Rating > 90)

- Positive impact: Continue
- Negative impact: If mitigation cannot be implemented effectively (into the moderate category), proposal should be terminated.

The table below provides an example of how the unmitigated significance ratings are calculated:

Table 30: Calculating of Significance Ratings (Unmitigated)

Probability	Severity							Severity Rating	Significance Rating (Probability x Severity rating)	
	Intensity	+	Duration	+	Extent	=				
Probable	2	Low	4	Short Term	1	Local	2	7	14	Negligible
Probable	2	Low	4	Medium Term	3	Regional	3	10	20	Low
Definite	5	Medium	12	Medium Term	3	Local	2	19	85	Moderate
Definite	5	High	20	Permanent	5	Site	1	26	180	High

14.5.3 Mitigation

Mitigation will be calculated as follows:

Table 31: Mitigation factor rating and description

Description	Factor Allocated
Mitigation is not possible or positive impact of mitigation is negligible. Impact remains irreversible.	1
Mitigation is possible to some extent with moderate levels of positive impact. Impact is largely reversible with only a small portion that remains as irreversible.	2
Mitigation is possible with moderate to high levels of positive impact. Impact is reversible.	3
Mitigation is possible to such an extent that all negative impacts are reduced significantly or eliminated. Impact is completely reversible.	4

14.6 Public participation process

The Public Participation Process (PPP) is an integral and critical part of the environmental process and careful attention is given to fulfilling the legislated requirements, ensuring that all directly affected parties have access to information and the opportunity to participate meaningfully in the project. The second phase of the PPP would entail notification of the public review period of the draft Environmental Impact assessment Report (EIAR) by using the database of Interested and Affected Parties (I&APs). As per the first PP round, the draft EIAR will be e-mailed, made available on the EON website and a hard copy will be made available onsite. Review and commenting periods of I&AP's are prescribed in the legislation.

- Public Participation Report

The final Public Participation Report will be included into the Draft and Final Assessment Report. The issues and concerns that were obtained through the entire process will form the basis of this report. The report will inter alia consist of the following:

- A description of the PP process followed (with proof, e.g. copies of the newspaper advertisement, written correspondences with I&APs);
- List of registered I&APs;
- Proof of meeting proceedings;
- Public Participation map, indicating adjacent landowner consultation and

- Issues and Response Report.
- Authorisation notification letter

All registered stakeholders will be informed of the outcome of the authorisation and the right to appeal the decision.

14.7 Tasks that will be undertaken during the impact assessment process

The following tasks will be undertaken:

- I. Management of the public participation process
- II. Management of the appointed specialists
- III. Engagement with the competent authority, local government and Municipality who is responsible for the Air Emission License Process
- IV. Engagement with the Ward Councillor
- V. Review of specialist reports
- VI. Review of site lay-out plans
- VII. Review of engineering design reports
- VIII. Review of geotechnical assessment
- IX. Assessment of aspects and impacts in terms of the assessment methodology contained in this scoping report

14.8 Measures to avoid, reverse, mitigate or manage identified impacts and the determination of residual risks that need management and monitoring

All aspects and impacts will be assessed against the proposed mitigation measures. The risks associated with failures of the mitigation measures will be assessed and further mitigation and emergency procedures will be proposed.

The EMPr will include emergency procedures, monitoring and measurement of impacts.

No-go areas will be mapped by the EAP based on a site visit and specialist reports and the applicant will be advised to prevent accessing of no-go areas as defined.

14.9 Affirmation by the EAP in relation to the level of agreement between the EAP and I&AP's on the plan of study for undertaking the environmental impact assessment

The report will include a register of I&AP's, as well as their comments and inputs with the response of the EAP. The EAP hereby affirms that all comments and inputs from I&AP's will be objectively assessed, responded to and taken into account in terms of impact assessment, mitigation and management measures.

14.10 Specific information required by the competent authority

14.11 Matters in terms of Section 24(a) and (b) of the Act

The FSR has been submitted to the South African Heritage Resource Agency (SAHRA) for comments.

In terms of the Act, the following will be included in the assessment report:

- Investigation of the potential impacts, including cumulative effects, of the activity and its alternatives on the environment, socio-economic conditions and cultural heritage, and assessment of the significance of that potential impact;

- Investigation of mitigation measures to keep adverse impacts to a minimum, as well as the option of not implementing the activity;
- Public information and participation, independent review and conflict resolution in all phases of the investigation and assessment of impacts;
- Reporting on gaps in knowledge, the adequacy of predictive methods and underlying assumptions, and uncertainties encountered in compiling the required information;
- Investigation and formulation of arrangements for the monitoring and management of impacts, and the assessment of the effectiveness of such arrangements after their implementation.

14.12 Stages during which the competent authority will be consulted

The competent authority will be consulted:

- When the draft and final scoping report is submitted
- When comments are received from the competent authority on the draft scoping report
- During the compilation of the draft impact assessment report
- When the final impact assessment report is submitted
- When comments are received from the competent authority on the final impact assessment report
- Notification of the I&AP's regarding the final decision of the competent authority – evidence will be provided.
 - Authority communication schedule:
 - During the EIA process: Site visit by authorities, if required.
 - During preparation of Draft EIA Report and EMP: Communication with the DEA on the outcome of Specialist Studies and EMP.
- Submission of the Final EIA Report and EMP: Meetings with dedicated departments, if requested by the DEA, with jurisdiction over particular aspects of the project (e.g. Local Authority) and potentially including relevant specialists.

14.13 Authorities to be consulted during the EIA process:


- National Department of Environmental Affairs
- South African Heritage Resource Agency
- Department of Agriculture and Rural Development
- Department of Water Affairs
- Local Authorities (Municipalities)

15 Undertaking by the EAP

- (j) an undertaking under oath or affirmation by the EAP in relation to—
 - (i) the correctness of the information provided in the report;
 - (ii) the inclusion of comments and inputs from stakeholders and interested and affected parties;
and
 - (iii) 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;

Adri Venter, as the EAP, hereby confirms:

- i. The correctness of the information provided in this report
- ii. That all comments and inputs from stakeholders and I&AP's are included in this report
- iii. That all information provided by the EAP to I&AP's and responses by the EAP to comments or inputs are included in this report

Signature... Date.....16 August 2016.....

16 References

Department of Agriculture, 2013: Agricultural GIS. <http://www.agis.agric.za/agisweb/agis.html>

Department of Energy, 2015: www.DOE.gov.za

SANBI, 2013: Biodiversity Geographical Information System. www.sanbi.org

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

Ingwe local municipality Integrated development Plan (IDP) of 2014/2015.



17 Annexure A: Public Participation Evidence

Each neighbouring land owner received a notification regarding the EIA and providing them with detail regarding registering as an I&AP.

18 Annexure B: Site photos



Figure 50: South west: View towards the riparian zone



Figure 51: South west: View behind the riparian zone



Figure 52: North east: View towards the main road passing the site



Figure 53: North east – an overview of the nature of the brownfield site



Figure 54: View towards the North West



Figure 55: View towards the North West



Figure 56: View towards the South



Figure 57: Eragrostis onsite

1. Annexure C: EAP CV

Curriculum Vitae of Adri Venter

Position	Principal Consultant
Full Name	Adri Venter
Qualifications	MSc (Masters in Geography and Environmental Studies with specialization on Environmental Management, Air and Water Quality) B.Ed. (Adult Education) National and National Higher Diplomas in Public Health
Specialisation	Environmental Management, Environmental Health, Education and Training
Nationality	South African
Date of Birth	18 August 1964
Languages	English, Afrikaans
International Experience	Singapore and Algeria

18.1 Professional Associations

SACNASP: Professional Natural Scientist (Pr. Sc. Nat.:400062/14)

IAIA (International Association for Impact Assessors)

18.2 Education

Qualification:	MSc (Masters in Geography and Environmental Studies: Air and Water Quality)
Institution:	WITS
Year Completed:	2007
Certification:	Environmental Management Inspector (as defined in the National Environmental Management Act) - University of Pretoria. Obtained with Distinction
Year Obtained:	2007
Certification:	Wetland Training Course - University of Pretoria
Year Obtained:	2006
Certification:	Environmental Accounting - Tshwane University of Technology



Year Obtained: 2005
 Certification: Urban Environmental Management Singapore -Environmental Institute - Singapore

Year Obtained: 2003
 Certification: SABS ISO 14001: Environmental Management Systems: Environmental Law - SABS - Obtained with Distinction

Year Obtained: 2002
 Certification: SABS ISO 14001: Environmental Management Systems - South African Bureau of Standards (SABS) Obtained with Distinction

Year Obtained: 2002
 Certification: SABS ISO 14001: Environmental Management Systems Auditing - SABS - Obtained with Distinction

Year Obtained: 2002

Qualification: B.Ed. (Adult Education). Obtained with Distinction
 Institution: WITS
 Year Completed: 2001
 Certification: Certificate in Advanced Project Management - University of Pretoria

Year Obtained: 2000
 Certification: Certificate Senior Management - University of Stellenbosch - Directors Award for Best Student

Year Obtained: 1999
 Qualification: Certificate in Management of Change and Organisational Development:
 Institution: Louw du Toit and Associates in conjunction with University Of Pepperdine (USA) Obtained with Distinction

Year Completed: 1999
 Certification: Environmental Management Programmes - University of Johannesburg

Year Obtained: 1998
 Certification: People Centered Development - University of South Africa

Year Obtained: 1995
 Qualification: National Higher Diploma in Public Health
 Institution: Tshwane University of Technology

Year Completed: 1990
 Qualification: National Diploma in Public Health
 Institution: Tshwane University of Technology

Year Completed: 1987

18.3 Summarized Experience

Company	Sector / Industry	Position	Years of Experience
EON Consulting(Pty) Ltd	Consulting Services	Principal Consultant	4 years
MSA	Consulting Services	Operations	2 Years

		Manager: Environmental, Legal and Mining Services	
Arup	Consulting Services	Senior Environmental Manager	1 Year
City of Tshwane	Local Government	Acting Executive Director: Environmental Management	6 months
City of Tshwane	Local Government	Manager/Director: Environmental Policy and Resource Management	7 Years
City Council of Pretoria	Local Government	Director: Health Education and Training	4 Years
Tshwane University of Technology	Academic	Part time lecturer and moderator	8 Years
City Council of Pretoria	Local Government	Health Education and Training Officer	6 Years
City Council of Pretoria	Local Government	Senior Environmental Health Officer	5 Years

18.4 Key Knowledge and Competency Areas

Adri Venter has had a varied career across several sectors that have produced a multi-skilled individual able to identify and integrate multi-disciplinary aspects of large and complex environmental projects. Her knowledge and understanding of environmental impacts are broad ranging and include air and water quality as well as human health. Adri has undertaken environmental projects across several industries, which include mining, construction, government and large corporations. Adri has a Master of Science degree in Geography and Environmental Studies, with specific reference to environmental management, air and water quality. She also holds a B(Ed) Adult Education which has supported her career in environmental education, lecturer and Education and Training Development Practitioner.

Over 15 years' experience in a senior management position as well as in Environmental Management

Wide environmental management experience across several sectors.

Environmental Auditing and due diligence assessments (supported by formal training in environmental auditing, environmental law, environmental management programs and Environmental Management Inspector).

In-depth understanding and knowledge of all South African environmental legislation based on experience and relevant training.

Extensive experience in **Environmental Impact Assessments and Water Use License Applications**

Site Environmental Control Officer (ECO) experience

Extensive experience in the **policy and strategy environment**, especially in large corporations and government across a wide range of issues.

Extensive experience with the Mineral and Petroleum Resources Development Act, mining and large construction projects as well as **water use licensing**.

Implementation of **environmental management systems** (ISO 14001)

Multi-skilled individual ensuring an integrated and advanced understanding of companies and challenges (advanced degrees in Adult Education and Environmental Health).

Excellent presentation skills sharpened by years of formal lecturing and training.

Extensive experience in dealing with stakeholders, government departments, communities, NGOs and politicians.

18.5 Software Skills

Software	Skill Level	Years of Experience
MS Word	Advanced	20
MS Excel	Standard	20
MS PowerPoint	Advanced	20
MS Project	Advanced	12
MS Visio	Basic	7
SAP	Basic	7
MS Access	Basic	7
MS Outlook	Advanced	20
GIS	Basic	3

18.6 Key Achievements

Year	Achievement
2013	Adri was acknowledged by EON Consulting as one of the top performers in the company during the year 2013.
2012	Adri was one of 4 nominees for Principal Consultant of the year
2010	Received award for second best paper at the IAIA National Conference 2010 for a paper on Environmental Management.
2006	Adri was nominated as one of 3 individuals in the organisation in the individual category for the Innovation Award, in the Municipal Managers Service Excellence Awards for a project related to wetlands.
2004	The environmental section headed up by Adri received an award in the Municipal Managers Service Excellence Awards. The team was awarded in the category of Team service excellence for exceptional contribution to the goals of the organisation.
2000	The division headed up by Adri received the award for the best cooperative training institution from the Tshwane University of Technology on two consecutive years
1999	Adri received the Directors Award for Best Student in the Senior Management Programme at the University of Stellenbosch in 1999.

18.7 Employment History (Current first)

Employer:	EON Consulting(Pty) Ltd
Position:	Principal Consultant
Duties & Responsibilities:	<p>Provide technical expertise on water and environmental projects</p> <p>Business development and project management</p> <p>Waste water risk abatement plans</p> <p>Water Research</p> <p>Fatal Flaw Analysis and Due Diligence Assessments</p> <p>Water quality modeling</p> <p>Water use licensing</p> <p>Environmental Impact Assessments (EIAs)</p> <p>Supportive environmental frameworks and strategies</p>
Date From:	01 March 2011

Employer:	MSA
Position:	Operations Manager: Environmental, Legal and Mining Services
Duties & Responsibilities:	<p>Overview of various duties provided below</p> <p>Operational management of a team of environmental consultants in the Environmental Division. The MSA Group offered a full suite of environmental services, from legal compliance, environmental authorisations, and specialist services such as waste and water management as well as due diligence assessments across a range of industries.</p> <p>Duties include project management of complex projects, compilation of complex proposals (with budgets in excess of R 3million) providing technical advice to project teams, directing specialist studies and reviews of specialist studies and the review of environmental impact assessment reports. As the operations manager of the division I was responsible for financial management (including invoicing, debtor management, income forecasting), managing and tracking project budgets (which amounts in some cases to several million rand), human resource management and development, resource planning, business development, quality and risk management as well as client liaison. I am also responsible for maintenance of ISO 9000 and occupational health and safety within the division. I was also responsible for reporting on key business indicators to group management.</p> <p>Examples of large projects managed: Pre-feasibility and feasibility studies for iron, gold and platinum mines. Mining Right Applications and full suite of environmental authorisations for new mines, EIA for regional waste water treatment works, housing developments (50 000 houses), the compilation of the environmental component of Kumba's asset development management (ADM) system as well as the compilation of an Environmental Regulatory and Enforcement Strategy for the City of Johannesburg. I have also reviewed and updated the environmental risk registers of two shafts and executed a regulatory waste management audit for Impala Platinum. Mine water projects for Kumba and Mogale Gold.</p> <p>Several projects were successfully completed and environmental authorizations issued.</p>
Date From:	01 May 2009
Date To:	31 February 2011

Employer:	Arup
Position:	Senior Environmental Manager
Duties & Responsibilities:	Environmental consulting, environmental impact assessments, water use licensing, auditing,

Responsibilities: training and mentoring, environmental sustainability
Date From: July 2008
Date To: April 2009

Employer: City of Tshwane

Position: Director: Environmental Resource Management

Duties & Responsibilities: Responsible for the management of the environmental resource management section of the Metropolitan Municipality.

My role was focused on a) setting the sustainability agenda for the City by developing and implementing capacity building programs and through the development of integrated policies and strategies and b) ensuring corporate environmental responsibility and compliance.

With respect to a) above:

The development of environmental policy, strategies and frameworks as well as best practices. Linking environmental agendas with the City's Integrated Development Plan. The following policies and strategies were compiled:

Tshwane integrated Environmental Policy

Biodiversity Framework

Green Building guidelines

Water resource protection framework

Education and awareness strategy for employees

Community education and awareness strategy

Urban agriculture guidelines

Green construction guidelines

Generic EMP for construction projects

Best practice guidelines for water and energy use, waste management and green procurement

Compilation of a wetlands inventory for the City.

Training and Education. Development and implementation of employee and community environmental education programs was a critical aspect of my duties. Based on a strategic needs analysis, a training and development strategy was developed for municipal employees, councilors and the community of Tshwane. The strategy was implemented by the development of training programs and courses and the delivering of targeted training programs and courses. Several large community education events were managed through the involvement of community forums.

Inter-Governmental Liaison: Synchronisation of the City's policies and strategies with Provincial and National Government.

Management Information: Reporting on corporate environmental compliance and progress towards targets, environmental indicator development and environmental risk analysis was an integral part of my duties. The development of Management Information Systems (MIS) in support of evaluation, monitoring and reporting was required.

I was also responsible for environmental due diligence, legal compliance and the implementation of ISO 14001 related to the operations of the City. Examples of operations include: 2 coal fired power stations, several landfill sites, several waste water treatment works, the fresh produce market, several large workshops and the Bon Accord Quarry. All new infrastructure developments of the City were screened for legal implications pertaining to

all relevant environmental legislation. My division was also responsible for auditing of waste management service providers for the City.

Setting and management of compliance targets. Reviewing the City's capital projects for environmental implications and compliance requirements.

Environmental Risk Management: Implementation of Risk Assessment and Risk Management Plans for municipal operations

Date From: June 2001

Date To: June 2008

Employer: City of Tshwane

Position: Acting Executive Director: Environmental Management

Duties & Responsibilities: Responsible for the management of the Environmental Management Department of the Metropolitan Municipality. These included the City Waste Removal and Waste Management Services, Parks and Horticulture Services, Cemetery Services, Environmental Resource Management, Environmental Planning and Open Space Management as well as Nature Conservation and Resorts.

Date From: 01 October 2007

Date To: 30 December 2007

Employer City Council of Pretoria

Position: Acting Director: Health Education and Training

Duties & Responsibilities: Oversee the training department
Responsible for continued professional development of nursing and medical staff, Environmental Health Practitioners
Experiential learning of health professionals
Career development plans
Management training and development
Community education, training and awareness
Management of the activities of 3 regional Aids Information, Training and Counseling Centers

Date From: March 1999

Date To: September 2001

Employer: Tshwane University of Technology

Position: Part time lecturer and moderator

Duties & Responsibilities: Lecturing in various subjects in the department of Environmental Health and Occupational Health Nursing

Date From: 01 January 1994

Date To: 31 December 2002

Employer: City Council of Pretoria

Position: Health Education and Training Officer

Duties & Responsibilities: Health and environmental education, training and awareness programmes
Present training courses
Training needs analysis
Career development plans
Develop training courses

Aids Counseling and training

Date From: 01 January 1992

Date To: 31 December 2001

Employer: City Council of Pretoria

Position: Senior Environmental Health Officer

Duties & Responsibilities: Food safety, Environmental pollution control, education and awareness, law enforcement

Date From: 01 January 1986

Date To: 31 December 1992

18.8 Project History

Company: EON Consulting (Pty)Ltd

Project Name: Gautrain Independent Environmental Consultant (IEC)

Project Description: Review Gautrain environmental progress, express independent opinions, review EMP and annual reports, oversee expert consultants on behalf of Gautrain management

Project Duration: 2013 - 2015

Project Value: R 550 000

Designation on Project: SME and project manager

Responsibilities: Subject matter expert, auditing and assessment

Company: EON Consulting (Pty)Ltd

Project Name: R21/Pomona Environmental Control Officer (ECO)

Project Description: ECO for a water pipeline project

Project Duration: 2014 to 2015

Project Value: R 124 000

Designation on Project: ECO

Responsibilities: Review construction activities for legal compliance

Company: EON Consulting (Pty)Ltd

Project Name: Ekurhuleni EIA's

Project Description: Obtaining environmental authorisations and water use licenses for the Water and Sanitation department of the City of Ekurhuleni for a period of 3 years.
Screening studies to determine authorisations required.
Wetland studies.

Project Duration: 2014 to 2016

Project Value: R 4 000 000

Designation on Project: Principal Consultant and Environmental Assessment Practitioner (EAP)

Responsibilities: Screen all projects, apply and manage authorisations, act as site Environmental Control officer

Company: EON Consulting(Pty)Ltd

Project Name: Catchment Profiles

Project Description: Catchment risk profiles for 5 catchments in which Eskom operates for the



purposes of compiling a Water Safety Plan

Project Duration: 2013

Project Value: R 130 000

Designation on Project: Project leader and SME

Responsibilities: Catchment mapping, profile and risk assessment

Company: EON Consulting(Pty)Ltd

Project Name: Wynberg Dam

Project Description: Environmental Fatal Flaw Analysis of a proposed dam and hydro-electric scheme

Project Duration: 2013

Project Value: R 50 000

Designation on Project: Project leader and SME

Responsibilities: Pre-feasibility fatal flaw analysis

Company: EON Consulting(Pty)Ltd

Project Name: Arnot Power Station water use license audit

Project Description: Auditing of all conditions attached to the water use license of the Arnot Power Station

Project Duration: 2013

Project Value: R 60 000

Designation on Project: Project leader and SME

Responsibilities: Documentation review and site inspection

Company: EON Consulting(Pty)Ltd

Project Name: Sasol Water Quality Offsetting

Project Description: Determination of Secunda Complex mass loadings and investigating offsetting opportunities in the Waterval catchment

Project Duration: 2013

Project Value: R 1 000 0000

Designation on Project: Project leader

Responsibilities: Project management and SME

Company: EON Consulting(Pty)Ltd

Project Name: Busby EIA and WULA

Project Description: Obtaining a water use license and NEMA authorization for a renewable energy project

Project Duration: May 2012 – Present

Project Value: R 350 000

Designation on Project: Project leader and SME

Responsibilities: Advising the client and managing of the legal process to obtain the relevant environmental authorisations



Company: EON Consulting(Pty)Ltd
Project Name: Lazy Bend EIA and WULA
Project Description: Obtaining a water use license and NEMA authorization for a renewable energy project
Project Duration: May 2012 – Present
Project Value: R 350 000
Designation on Project: Project leader and SME
Responsibilities: Advising the client and managing of the legal process to obtain the relevant environmental authorisations

Company: EON Consulting(Pty)Ltd
Project Name: Ekurhuleni Environmental Authorisations
Project Description: Obtaining all environmental authorisations for the Water and Sanitation Division
Project Duration: April 2014 to April 2016
Project Value: R 4 000 000
Designation on Project: Project leader and SME
Responsibilities: Basic Assessments, Water use licensing, project screening, environmental amendments

Company: EON Consulting(Pty)Ltd
Project Name: Water Research Commission: Framework for the management of Eskom wetlands
Project Description: Research and pilot project on wetland management
Project Duration: January 2013 to June 2014
Project Value: R 1 000 000
Designation on Project: Project leader and SME
Responsibilities: Researcher and project lead

Company: EON Consulting
Project Name: CSIR Sediment Modeling
Project Description: Modeling of the land-water linkages related to bacterial and sediment loads
Project Duration: August 2012 to present
Project Value: R 120 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise

Company: EON Consulting
Project Name: Public Investment Company
Project Description: Environmental Due Diligence of a manufacturing plant
Project Duration: November 2012
Project Value: R87 000
Designation on Project: Project Leader and Subject Matter Expert
Responsibilities: The investigation of the status of environmental and occupational health and safety legal compliance, due diligence and compliance to the Equator principles



Company: EON Consulting
Project Name: Randfontein Local Municipality
Project Description: Waste Water Risk Abatement Plan (WWRAP).
Project Duration: 01 August 2012 – Present
Project Value: R87 000
Designation on Project: Project Leader and Subject Matter Expert
Responsibilities: The compilation of a WWRAP for the Randfontein waste water treatment works. All risks have been identified, rated and a management plan as well as incident management plan compiled
Project successfully completed in September 2012. Received high accolades (100% in satisfaction survey) from client

Company: EON Consulting(Pty)Ltd
Project Name: Tzaneen Waste Water Risk Abatement Plan
Project Description: Waste Water Risk Abatement Plan (WWRAP).
Project Duration: January 2013
Project Value: R 50 000
Designation on Project: Subject Matter Expert
Responsibilities: The update of the WWRAP for the Tzaneen waste water treatment works. All risks have been identified, rated and a management plan as well as incident management plan compiled. Once again this project scored 100% from a feedback survey from the client.

Company: EON Consulting
Project Name: Environmental Risk Assessment and environmental screening of Energy Crops and associated combustion and biogas installation for the generation of electricity
Project Description: Analyse water and environmental risks associated with the proposed planting and harvesting of biomass
Project Duration: August 2012 to present
Project Value: R 28 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise on legal environmental requirements

Company: EON Consulting(Pty)Ltd
Project Name: Water Conservation Water Demand Management (WCWDM) for Eskom
Project Description: Implementation of WC/WDM program
Project Duration: 01 March 2011 – Present
Project Value: R6 m
Designation on Project: Subject Matter Expert
Responsibilities: The compilation of a water trading study to investigate the feasibility of trading water through the promotion of improved agricultural efficiencies.

Strategic support related to strategic planning over a 5-year period, of key water and environmental initiatives in the Primary Energy Division.

Company: EON Consulting



Project Name: Environmental Risk Assessment and environmental screening of Energy Crops
Project Description: Analyse water and environmental risks associated with the proposed harvesting and generation of electricity from biomass by a local gold mine.
Project Duration: 1 month
Project Value: R 15 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise
Company: EON Consulting

Project Name: Water Sector Skills Inventory
Project Description: Analyse the skills levels in the water sector.
Project Duration: 01 March 2011 – Present
Project Value: R 60 000
Designation on Project: Subject Matter Expert
Responsibilities: Subject matter expertise
Company: MSA

Project Name: Environmental legal compliance of Sishen, Sishen South and Thabazimbi iron ore mines and beneficiation plant
Project Duration: 01 August 2009 - 31 August 2010
Project Value: R600 000
Designation on Project: Project Manager and Lead Auditor
Responsibilities: Lead site visits
Audit against legal requirements pertaining to air, water and other requirements as well as EMPR and various RoD's
Compile and present report on findings. Make rectification recommendations. Present report to top management.
Successfully completed. Completed August 2010
Company: MSA

Project Name: Environmental legal compliance of Mogale Gold Mine and beneficiation plant
Project Duration: February 2010 - 31 July 2010
Project Value: R200 000
Designation on Project: Project Manager and Lead Auditor
Responsibilities: Lead site visits
Audit against legal requirements pertaining to air, water and other requirements as well as EMPR and various RoD's. Investigate lawfulness of various historic activities.
Compile and present report on findings. Make rectification recommendations. Present report to top management.
Successfully completed. Completed August 2010
Company: MSA

Project Name: Feasibility Study of the Pan African Parliament in Salvokop, Pretoria
Project Duration: 01 April 2009 - Present
Project Value: R80 000



Designation on Project: Oversee the environmental feasibility study
Responsibilities: Ensure that all environmental risks are investigated and quantified. Make recommendations.
Successfully completed

Company: MSA
Project Name: Land-use management strategy for Kumba Iron Ore
Project Duration: 01 December 2008 - 31 December 2009
Project Value: R800 000
Designation on Project: Project Manager
Responsibilities: Develop a policy and strategy for Kumba Iron Ore to manage their land. Develop and apply assessment criteria to compile best management plans and practices for the respective pieces of land with reference to future use and rehabilitation requirements
Successfully completed and project accepted by the board.

Company: MSA
Project Name: Scoping study, mining right application and environmental impact assessment for Veremo Iron Ore Mine
Project Duration: 01 October 2008 - 31 January 2009
Project Value: R4 m
Designation on Project: Project Manager
Responsibilities: Oversee the impact studies, specialist studies and compilation of the environmental impact assessment report. Liaise with the mining engineers and interpret mining methods with respect to projected environmental impacts and legislative requirements

Company: MSA
Project Name: Due Diligence: Afrisam
Project Duration: September 2009
Project Value: R85 000
Designation on Project: Environmental Auditor
Responsibilities: Review of all plant operations and associated mining operations against legal requirements and the identification of environmental risks. Quantification of risks and corrective measures in financial terms
Successfully completed

Company: MSA
Project Name: Due Diligence: Kgalagadi Manganese Mine and beneficiation plant
Project Duration: June 2009
Project Value: R60 000
Designation on Project: Environmental Auditor
Responsibilities: Review proposed mining operations against legal requirements and current approvals obtained and the identification of environmental risks. Quantification of risks and corrective measures in financial terms



Successfully completed

Company: Arup (Pty)Ltd
Project Name: Water use license for Transnet's New Multi-purpose Pipeline
Project Description: Managing the water use authorizations associated with the 550km long petroleum pipeline.
Project Duration: 01 January 2008 - 31 December 2009
Project Value: R 800 000
Designation on Project: Senior Environmental Manager
Responsibilities: Assess water uses and water resource impacts on the 550 km long pipeline, which included in excess of 2000 river and wetland crossings.
Compile impact and significance tables, write technical reports, oversaw the compilation of GIS maps and data tables. Compile environmental management plans and emergency management plans
Water use license issued in record time

Company: Arup (Pty) Ltd
Project Name: Gautrain Construction
Project Description: Independent Environmental Certifier
Project Duration: 01 July 2008 - 31 July 2009
Project Value: R 10 billion (total value and not related to my role)
Designation on Project: Independent Certifier
Responsibilities: Environmental auditing of various construction sites to certify environmental compliance related to legislative requirements.

Company: Arup (Pty) Ltd
Project Name: Gauteng Freeway Improvement Project (SANRAL)
Project Description: Environmental legal compliance and ECO
Project Duration: 01 September 2008 - 31 July 2009
Project Value: R 1 million
Designation on Project: Oversee the Environmental Control Officer
Responsibilities: Environmental auditing of various construction sites to certify environmental compliance related to legislative requirements.
Quality control of the work of the ECO
Review audit reports as compiled by the ECO to the authorities

Company: City of Tshwane
Project Name: City Legal Compliance
Project Duration: 2002 - 2008
Project Value: N/a
Designation on Project: Project Leader
Responsibilities: Roll-out of a quarterly environmental audit program for all City operations. This included: Coal fired power stations, waste water treatment works, landfill sites, workshops, batching plants, Wonderboom Airport, stone quarries and asphalt plants etc.



Compilation of audit protocols and checklists

Verification of corrective measures

Reporting on legal compliance to the municipal manager and Council



19 Annexure D: Pre-application Consultation meeting with DEA



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