

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX N:

Risk Specialist Study

RISK ASSESSMENT OF THE PROPOSED POWER PLANT AT ATLANTIS IN THE WESTERN CAPE

Report prepared for:

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16rd of June 2016

SPECIALIST EXPERTISE

SPECIALIST COMPANY

This report was prepared by RISCOTM (Pty) Ltd, having head office in Johannesburg, South Africa. RISCOTM (Pty) Ltd is a consulting company that specialises in process safety. Further to this, RISCOTM¹ is an approved inspection authority (AIA) for conducting Major Hazard Installation (MHI) risk assessments in accordance with the OHS Act 85 of 1993 and its Major Hazard Installation regulations (July 2001). In order to maintain the status of approved inspection authority, RISCOTM is accredited by the South African National Accreditation System (SANAS) in accordance with the IEC/ISO 17020:2012 standard. The accreditation consists of a number of elements, including technical competence and third party independence.

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REPORT AUTHOR

The report was prepared by Mike Oberholzer, who performed the calculations in the report. The report was reviewed for quality checks in according to the IEC/ISO 17020:2012 standard by Lanie Smith.

Mike Oberholzer is a professional engineer, holds a Bachelor of Science in Chemical Engineering and is an approved signatory for MHI risk assessments, thereby meeting the competency requirements of SANAS for assessment of the risks of hazardous components, including fires, explosions and toxic releases

A short curriculum vitae of Mike Oberholzer is given in Appendix A with professional registration, given in Appendix B

¹

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SPECIALIST DECLARATION

I, Michael Paul Oberholzer as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that:

- I act as the independent specialist in this application;
- I perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I regard the information contained in this report as it relates to my specialist input or study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014, and any specific environmental management Act;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I have no vested interest in the proposed activity proceeding;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I have ensured that information containing all relevant facts in respect of the specialist input or study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input or study;
- I have ensured that the comments of all interested and affected parties on the specialist input or study were considered, recorded and submitted to the competent authority in respect of the application;
- I have ensured that all the particulars furnished by me in this specialist input or study are true and correct; and,
- I realise that a false declaration is an offence in terms of Regulation 48 and is punishable in terms of Section 24F of the Act.



Signature of the Specialist: _____

Name of Specialist: Michael Paul Oberholzer

Date: 16th of June 2016

LIST OF ABBREVIATIONS

AEGL	Acute exposure guideline levels
AIA	Approved inspection authority
AIHA	The American Industrial Hygiene Association
BLEVE	Boiling liquid expanding vapour explosions
BS	British Standard
CCGT	Combined cycle gas turbine
CNG	Compressed natural gas
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
EPA	Environmental Protection Agency
ERPG	Emergency response planning guidelines
HEL	Higher explosive limit
HSE	Health and Safety Executive
IDLH	Immediately dangerous to life or health
IEC	International Electrotechnical Commission
LC	Lethal concentration
LEL	Lower explosive limit
LFL	Lower flammable limit
LNG	Liquefied natural gas
LOC	Loss of containment
LPG	Liquefied petroleum gas
LUP	Land-use planning
MHI	Major Hazard Installation
MIR	Maximum individual risk (see individual risk)
MSDS	Material safety data sheet
NEMA	National Environmental Management Act
PAC	Protective action criteria
PADHI	Planning advice for developments near hazardous installations
QRA	Quantitative risk assessment
SANS	South African National Standard
SCAPA	The Subcommittee on Consequence Assessment and Protective Actions
TEEL	Temporary emergency exposure limit
TLV-STEL	Short-term exposure threshold limit values
TLV-TWA	Time weighted average threshold limit values
UFL	Upper flammable limit
VCE	Vapour cloud explosion

GLOSSARY

Definitions	
<i>Acute exposure guideline levels</i>	AEGL values are published by the EPA (USA). AEGL values represent threshold exposure limits for the general public applicable to five emergency exposure periods (10 minutes, 30 minutes, 1 hour, 4 hours and 8 hours) and are distinguished by varying degrees of severity of toxic effects. AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure. AEGL-2 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long lasting adverse health effects or an impaired ability to escape. AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL value.
<i>ALARP</i>	The HSE (UK) developed the risk ALARP triangle, in an attempt to account for risks in a manner similar to those used in everyday life. This involved deciding: • Whether a risk is so high that something must be done about it; • Whether the risk is or has been made so small that no further precautions are necessary; • Whether a risk falls between these two states and has been reduced to levels 'as low as reasonably practicable' (ALARP). Reasonable practicability involves weighing a risk against the trouble, time and money needed to control it.
<i>Approved Inspection Authority</i>	Defined in the MHI regulations (July 2001)
<i>Asphyxiant</i>	A gas that is nontoxic but may be fatal if it accumulates in a confined space and is breathed at high concentrations since it replaces oxygen containing air.
<i>Blast Overpressure</i>	A measure used in the multi-energy method to indicate the strength of the blast, indicated by a number ranging from 1 (for very low strengths) up to 10 (for detonative strength).
<i>Boiling liquid expanding vapour explosions</i>	Result from the sudden failure of a vessel containing liquid at a temperature above its boiling point. A BLEVE of flammables results in a large fireball.
<i>Detonation</i>	A release of energy caused by extremely rapid chemical reaction of a substance, in which the reaction front of a substance is determined by compression beyond the auto-ignition temperature.

Definitions	
<i>Emergency Plan</i>	A plan in writing that describes how potential incidents identified at the installation together with their consequences should be dealt with, both on site and off site.
<i>Emergency response planning guidelines</i>	ERPG values were developed by the American Industrial Hygiene Association. ERPG-1 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing anything other than mild transient adverse health effects or perceiving a clearly defined objectionable odour. ERPG-2 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. ERPG-3 is the maximum airborne concentration below which it is believed nearly all individuals could be exposed for up to 1 hour without experiencing or developing life-threatening health effects.
<i>Explosion</i>	A release of energy that causes a pressure discontinuity or blast wave.
<i>Flammable Limits</i>	A range of gas or vapour concentrations in the air that will burn or explode if a flame or other ignition source is present. The lower point of the range is called the LFL. Likewise, the upper point of the range is called the UFL.
<i>Flammable Liquid</i>	The Occupational Health and Safety Act 85 of 1993 defines a flammable liquid as any liquid which produces a vapour that forms an explosive mixture with air and includes any liquid with a closed cup flashpoint of less than 55°C. Flammable products have been classified according to their flashpoints and boiling points, which ultimately determine the propensity to ignite. Separation distances described in the various codes are dependent on the flammability classification. Class Description 0 Liquefied petroleum gas IA Liquids that have a closed cup flashpoint of below 23°C and a boiling point below 35°C IB Liquids that have a closed cup flashpoint of below 23°C and a boiling point of 35°C or above IC Liquids that have a closed cup flashpoint of 23°C and above but below 38°C II Liquids that have a closed cup flashpoint of 38°C and above but below 60.5°C IIA Liquids that have a closed cup flashpoint of 60.5°C and above but below 93°C
<i>Flash Fire</i>	Defined as combustion of a flammable vapour and air mixture in which the flame passes through the mixture at a rate less than sonic velocity so that negligible damaging overpressure is generated.
<i>Frequency</i>	The number of times an outcome is expected to occur in a given period of time.
<i>Ignition Source</i>	A source of temperature and energy sufficient to initiate combustion.

Definitions	
<i>Immediately dangerous to life or health</i>	IDLH values were developed by the National Institute of Occupational Safety and Health (NIOSH). IDLH value refers to a maximum concentration to which a healthy person may be exposed for 30 minutes and escape without suffering irreversible health effects or symptoms that impair escape (ranging from runny eyes that temporarily impair eyesight to a coma). IDLH values are intended to ensure that workers can escape from a given contaminated environment in the event of failure of the respiratory protection equipment.
<i>Individual Risk</i>	The probability that in one year a person will become a victim of an accident if the person remains permanently and unprotected in a certain location. Often the probability of occurrence in one year is replaced by the frequency of occurrence per year.
<i>Jet</i>	The outflow of material emerging from an orifice with significant momentum.
<i>Jet Fire or Flame</i>	Combusting material emerging from an orifice with a significant momentum.
<i>Lethal concentration</i>	The concentration by which a given percentage of the exposed population will be fatally injured. The LC ₅₀ refers to the concentration of airborne material the inhalation of which results in death of 50% of the test group. The period of inhalation exposure could be from 30 min to a few hours (up to 4 hours).
<i>Local Government</i>	Defined in Section 1 of the Local Government Transition Act, 1993 (Act No. 209 of 1993).
<i>Loss of Containment</i>	The event resulting in a release of material into the atmosphere.
<i>Major Hazard Installation</i>	An MHI installation is an installation: • Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily; • Where any substance is produced, used, handled or stored in such a form and quantity that it has the potential to cause a major incident (the potential of which will be determined by the risk assessment).
<i>Major Incident</i>	An occurrence of catastrophic proportions, resulting from the use of plant or machinery or from activities at a workplace. When the outcome of a risk assessment indicates that there is a possibility that the public will be involved in an incident, then the incident is catastrophic.
<i>Material Safety Data Sheet</i>	According to ISO-11014, an MSDS is a document that contains information on the potential health effects of exposure to chemicals or other potentially dangerous substances and on safe working procedures when handling chemical products. It is an essential starting point for the development of a complete health and safety program. It contains hazard evaluations on the use, storage, handling and emergency procedures related to that material. An MSDS contains much more information about the material than the label and it is prepared by the supplier. It is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure and what to do if such incidents occur.
<i>OHS Act</i>	Occupational Health and Safety Act, 1993 (Act No. 85 of 1993)

Definitions	
<i>PADHI</i>	The name given to a methodology and software decision support tool developed and used in the HSE (UK). It is used to give LUP advice on proposed developments near hazardous installations. PADHI uses two inputs into a decision matrix to generate either an 'advise against' or 'don't advise against' response: The zone in which the development is located of the three zones that HSE sets around the major hazard: • The inner zone ($> 1 \times 10^{-5}$ fatalities per person per year); • The middle zone (1×10^{-5} fatalities per person per year to 1×10^{-6} fatalities per person per year); • The outer zone (1×10^{-6} fatalities per person per year to 3×10^{-7} fatalities per person per year); The 'sensitivity level' of the proposed development which is derived from an HSE categorisation system of 'development types' (see the 'development type tables' in Appendix X).
<i>Protective Action Criteria</i>	Emergency planning of chemical release events are based on the following chemical exposure limit values: • AEGL values published by the EPA (USA); • ERPG values produced by AIHA; • TEEL values developed by SCAPA.
<i>Quantitative risk assessment</i>	The process of hazard identification, followed by a numerical evaluation of effects of incidents, both consequences and probabilities and their combination into the overall measure of risk.
<i>Risk</i>	The measure of the consequence of a hazard and the frequency at which it is likely to occur. Risk is expressed mathematically as: Risk = Consequence x Frequency of Occurrence
<i>Risk Assessment</i>	The process of collecting, organising, analysing, interpreting, communicating and implementing information in order to identify the probable frequency, magnitude and nature of any major incident which could occur at a major hazard installation and the measures required to remove, reduce or control potential causes of such an incident.
<i>Short-term exposure threshold limit</i>	TLV-STEL values are the concentrations to which workers can be exposed continuously for a short period (15 minutes) of time without suffering from irritation, chronic or irreversible tissue damage or narcosis to a sufficient degree to increase the likelihood of accidental injury, impair self-rescue or materially reduce work efficiency, provided that the daily TLV-TWA is not exceeded.
<i>Societal Risk</i>	Risk posed on a societal group who are exposed to a hazardous activity.
<i>Temporary Installation</i>	An installation that can travel independently between planned points of departure and arrival for the purpose of transporting any substance and which is only deemed to be an installation at the points of departure and arrival, respectively.
<i>Time weighted average threshold limit</i>	TLV-TWA values are the concentrations for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed day after day, without adverse effects.
<i>Vapour Cloud Explosion</i>	VCEs result from ignition of a premixed cloud of a flammable vapour, gas or spray with air, in which flames accelerate to sufficiently high velocities to produce significant overpressure.

COMPLIANCE WITH THE APPENDIX 6 OF THE 2014 EIA REGULATIONS

Requirements of Appendix 6 – GN R982	Addressed in the Specialist Report
1. (1) A specialist report prepared in terms of these Regulations must contain-	
a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vita;	*Yes
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	*Yes
c) an indication of the scope of, and the purpose for which, the report was prepared;	*Yes
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	N/A
e) a description of the methodology adopted in preparing the report or carrying out the specialised process;	*Yes
f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;	*Yes
g) an identification of any areas to be avoided, including buffers;	*To be finalised from MHI risk assessment
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	*Yes
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	*Yes
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment;	*Yes
k) any mitigation measures for inclusion in the EMPr;	*N/A
l) any conditions for inclusion in the environmental authorisation;	*Yes
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	*N/A
n) a reasoned opinion- i. as to whether the proposed activity or portions thereof should be authorised; and ii. if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	*Yes
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	*N/A
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	*N/A
q) any other information requested by the competent authority.	*N/A

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RISK ASSESSMENT OF THE PROPOSED POWER PLANT AT ATLANTIS IN THE WESTERN CAPE

1.1. INTRODUCTION AND METHODOLOGY

1.1.1. *Introduction*

1.1.1.1. **Scope**

This report forms part of an environmental impact assessment (EIA) for a power plant to be situated in Atlantis in the Western Cape. The EIA is being undertaken without a specific technology provider in mind; and therefore the authorisations will need to be for a range of gas to power technologies and emission profiles. The EIA will be based on a project 'envelope' approach whereby a range of potential project inputs and outputs will be specified (in terms of maximum project footprint, range of NOx emissions, bulk and scale of structures, maximum noise emissions and so forth), and the impact assessment provided for this project envelope. Provided that the detailed project design is within this envelope, the assessment would then remain valid.

The proposed power plant would consist of a combined cycle gas turbine (CCGT) plant that uses a cycle configuration of combustion turbines, heat recovery steam generators (HRSG) and steam turbines to generate electricity. This type of power plant is being installed in increasing numbers round the world where there is access to natural gas.

The envelope approach for the power plant would be required at two proposed sites within the Atlantis area.

1.1.1.2. **Study Objectives**

The main objective of the study was to provide a detailed assessment of the proposed project to:

- Determine the current conditions and landscape in sufficient detail so that there is a baseline against which impacts can be identified and measured;
- Identify potential impacts (both positive and negative) that may occur during the operation of the proposed development as well as effects associated with future environmental changes if a no-go option is implemented;
- Assess impact in terms of direct and indirect cumulative impacts;
- Provide recommendations with regards to potential monitoring programs;
- Determine mitigation or management measures that may be implemented to reduce the effect of negative impacts and enhance the effect of positive impact as much as possible;
- Incorporate and address all issues and concerns raised relevant to the area of expertise.

1.1.1.3. **Purpose and Main Activities**

The main activity at the proposed power plant would be the production of electricity from gas or other liquid fuels.

1.1.1.4. Main Hazard Due to Substance and Process

The main hazards that would occur with a loss of containment of hazardous components at a proposed power plant include:

- Thermal radiation from fires;
- Overpressure from explosions.
- Formation of toxic clouds from process chemical stored on site.

1.1.1.5. Approach to the Study

As an approved inspection authority (AIA), RISCOT uses the methodologies and criteria described in the subsection of methodology. The quantitative risk assessment (QRA) process is also summarised in that introduction.

It is important to know the difference between hazard and risk. A hazard is anything that has the potential to cause damage to life, property and the environment. Furthermore, it has constant parameters (related to a particular component such as petrol, chlorine, ammonia and so forth) that pose the same hazard wherever they are present. Risk on the other hand is the probability that a hazard will actually cause damage at a particular degree of severity. Risk is therefore the probability that a hazard will manifest itself. For instance, the risk presented by a chemical depends upon the amount present, the process it is used in, the design and safety features of the equipment involved, exposure, prevailing environmental and weather conditions and so on.

1.1.1.6. Information Sources

The project scope and design information, with layouts, were supplied by the CSIR, while the meteorological conditions were supplied by the South African Weather Service.

The remaining sources of information can be found in the study references.

1.1.2. Methodology

The Major Hazard Installation (MHI) regulations give instruction to the owner regarding the requirements of the risk assessment but stop short on giving the methodologies and criteria that must be used for such studies.

As an AIA, RISCOM uses the methodologies and criteria described in the internationally recognised CPR 18E (Purple Book) and RIVM (2009) as documentation with which conformance can be measured. This is a requirement of accreditation and implies that similar results should be obtained by independent risk assessors compliant to the aforementioned documents. Furthermore, CPR 18E (Purple Book) and RIVM (2009) are legal requirements for conducting quantitative risk assessments (QRAs) in the Netherlands and forms the basis of the commercially available software.

The evaluation of the acceptability of the risks is extended to the ALARP criteria of the UK Health and Safety Executive (HSE) that covers land use based on the determined risks (see the subsection on determining risks). The QRA process is summarised with the following steps:

1. The identification of components that are flammable, toxic, reactive or corrosive and that have the potential to result in a major incident from fires, explosions or toxic releases;
2. The development of accidental loss-of-containment scenarios for equipment containing hazardous components (including the release rate, location and orientation of release);
3. For each incident developed in Step 2, the determination of the consequences (thermal radiation, domino effects, toxic-cloud formation, etc.);
4. For scenarios with off-site consequences (i.e. greater than 1% fatality off-site), the calculation of the maximum individual risk (MIR), taking into account all generic failure rates, initiating events (such as ignition), meteorological conditions and lethality.

1.1.2.1. Hazard Identification

The first step in any risk assessment is to identify all hazards. This is applied under the subsection dealing with the identification of key issues. The merit of including a hazard for further investigation is then determined by how significant it is, normally by using a cut-off or threshold value.

Once a hazard has been identified, it is necessary to assess it in terms of the risk it presents to the employees and the neighbouring community. In principle, both probability and consequence should be considered but there are occasions where, if either the probability or the consequence can be shown to be sufficiently low or sufficiently high, decisions can be made based on just one factor. During the hazard identification component of the report, the following considerations are taken into account:

- Chemical identities;
- Location of on-site installations that use, produce, process, transport or store hazardous components;
- The type and design of containers, vessels or pipelines;
- The quantity of material that could be involved in an airborne release;
- The nature of the hazard most likely to accompany hazardous materials spills or releases, e.g. airborne toxic vapours or mists, fires or explosions, large quantities in storage and certain handling conditions of processed components.

The evaluation methodology assumes that the facility will perform as designed in the absence of unintended events such as component and material failures of equipment, human errors, external events and process unknowns.

1.1.2.1.1. Notifiable Substances

The General Machinery Regulation 8 and its Schedule A on notifiable substances requires any employer who has a substance equal to or exceeding the quantity as listed in the regulation to notify the divisional director. A site is classified as a Major Hazard Installation if it contains one or more notifiable substances or if the off-site risk is sufficiently high. The latter can only be determined from a quantitative risk assessment.

1.1.2.1.2. Substances Hazards

1.1.2.1.2.1. Chemical Properties

A short description of bulk hazardous components that may be stored on, produced at or delivered to site is given. The material safety data sheets (MSDSs) of the respective materials are attached in Appendix I.

1.1.2.1.2.2. Corrosive Liquids

Corrosive liquids considered under this subsection are those components that have a low or high pH and that may cause burns if they come into contact with people or may attack and cause failure of equipment.

1.1.2.1.2.3. Reactive Components

Reactive components are components that when mixed or exposed to one another react in a way that may cause a fire, explosion or release a toxic component.

1.1.2.1.2.4. Flammable and Combustible Components

Flammable and combustible components are those that can ignite and give a number of hazardous effects, depending on the nature of the component and conditions. These effects may include pool fires, jet fires and flash fires as well as explosions and fireballs.

1.1.2.1.2.5. Toxic and Asphyxiant Components

Toxic or asphyxiant components of interest to this study are those that could produce dispersing vapour clouds upon release into the atmosphere. These could subsequently cause harm through inhalation or absorption through the skin. Typically, the hazard posed by toxic or asphyxiant components will depend on both concentration of the material in the air and the exposure duration.

1.1.2.1.3. Physical Properties

Physical properties are used in simulations and were based on the DIPPR² data base.

1.1.2.2. Physical and Consequence Modelling

In order to establish the impacts following an accident, it is necessary first to estimate: the physical process of the spill (i.e. rate and size); the spreading of the spill; the evaporation from the spill; the subsequent atmospheric dispersion of the airborne cloud; and, in the case of ignition, the burning rate and resulting thermal radiation from a fire and the overpressures from an explosion.

The second step is then to estimate the consequences of a release on humans, fauna, flora and structures. This merely illustrates the significance and the extent of the impact in the event of a release. The consequences would be due to toxic and asphyxiant vapours, thermal radiation or explosion overpressures. The consequences may be described in various formats. The simplest methodology follows a comparison of predicted concentrations (or thermal radiation or overpressures) to short-term guideline values. In a different, but more realistic fashion, the consequences may be determined by using a dose-response analysis. Dose-response analysis aims to relate the intensity of the phenomenon that constitutes the hazard to the degree of injury or damage that it can cause. Probit analysis is possibly the method mostly used to estimate probability of death, hospitalisation or structural damage. The probit is a lognormal distribution and represents a measure of the percentage of the vulnerable resource that sustains injury or damage. The probability of injury or death (i.e. risk level) is in turn estimated from this probit (risk characterisation).

The consequence modelling gives an indication of the extent of the impact for selected events and is used primarily for emergency planning. A consequence that would not cause irreversible injuries would be considered insignificant, and no further analysis would be required. The effects from major incidents are summarised in the following subsections.

1.1.2.2.1. Multiple Consequence Scenarios

A particular scenario may produce more than one major consequence. In such cases, the consequences are evaluated separately and assigned failure frequencies in the risk analysis. Some of these phenomena are described in the subsections that follow.

1.1.2.2.1.1. Scenarios for Release of a Pressurised Liquefied Gas

The nature of the release of a liquefied gas from a pressurised vessel is dependent on the position of the hole.

A hole above the liquid level will result in a vapour release only, and the release rate would be related to the size of the hole and internal pressure of the tank. Over a period of time, the bulk temperature reduces, with an associated decrease in the vapour release rate.

A hole below the liquid level will result in a release of a liquid stream. With the reduced pressure of the atmosphere, a portion of the liquid will vaporise at the normal boiling point. This phenomenon is called flashing, as shown in Figure 1.1. The pool, formed after flashing, then evaporates at a rate proportional to the pool area, surrounding temperature and wind velocity.

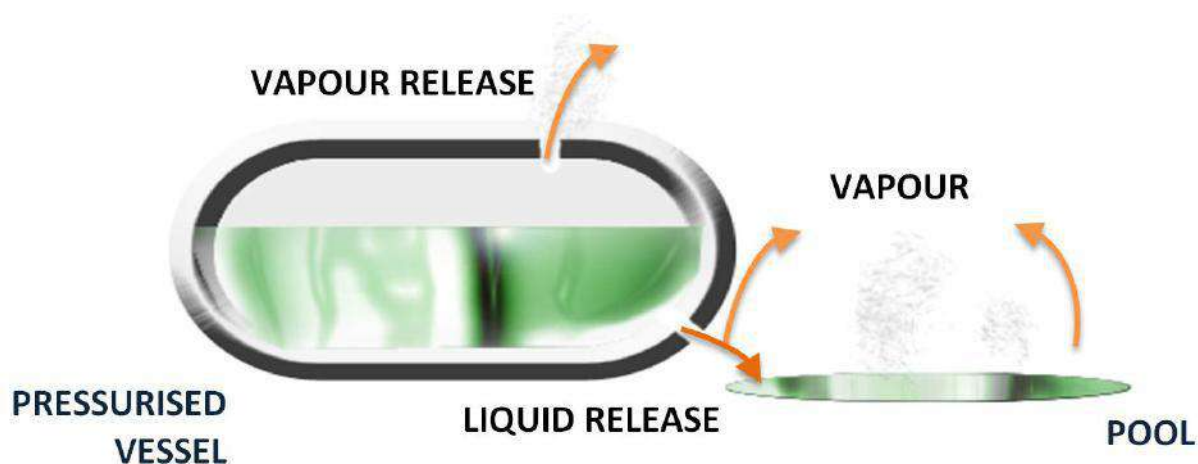


Figure 1.1 Airborne vapours from a loss of containment of liquefied gas stored in a pressurised vessel

1.1.2.2.1.2. Instantaneous Release of a Liquefied Flammable Gas

An instantaneous loss of containment of a liquefied flammable gas could result in the consequences given in the event tree of Figure 1.2. The probabilities of the events occurring are dependent on a number of factors and are determined accordingly. All the scenarios shown in the figure are determined separately and reported in the relevant subsections of the report.

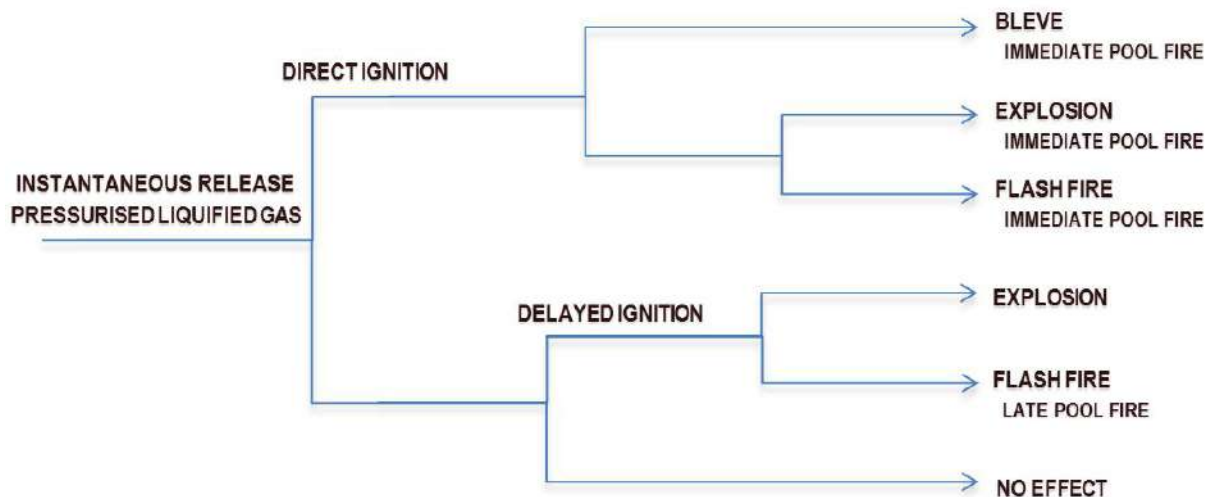


Figure 1.2 Event tree for an instantaneous release of a pressurised flammable gas

1.1.2.2.1.3. Continuous Release of a Pressurised Liquefied Flammable Gas

A continuous loss of containment of a liquefied flammable gas could result in the consequences given in the event tree of Figure 1.3. The probabilities of the events occurring are dependent on a number of factors and are determined accordingly. All the scenarios shown in the figure are determined separately and reported in the relevant subsections of the report.

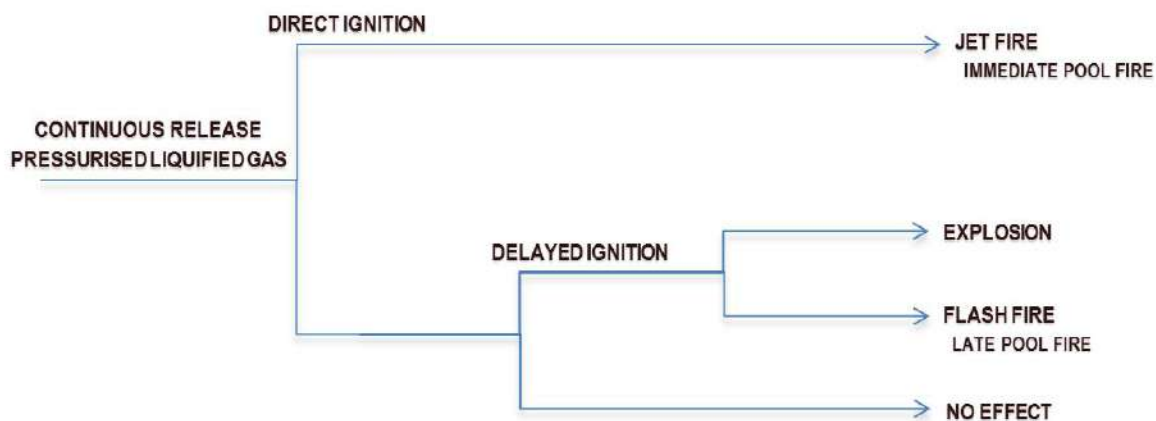


Figure 1.3 Event tree for a continuous release of a pressurised flammable gas

1.1.2.2.1.4. Continuous Release of a Flammable Liquid

A continuous loss of containment of flammable liquids could result in the consequences given in the event tree of Figure 1.4. The probabilities of the events occurring are dependent on a number of factors and are determined accordingly. All the scenarios shown in the figure are determined separately and reported in the relevant subsections of the report.

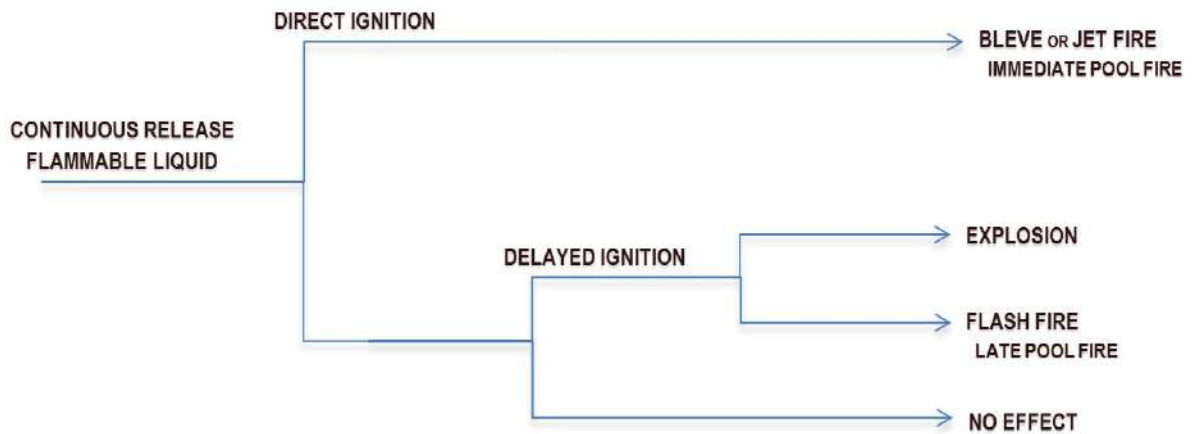


Figure 1.4 Event tree for a continuous release of a flammable liquid

1.1.2.2.2. Fires

Combustible materials within their flammable limits may ignite and burn if exposed to an ignition source of sufficient energy. On process plants this normally occurs as a result of a leakage or spillage. Depending on the physical properties of the material and the operating parameters, the combustion of material may take on a number of forms, i.e. pool fires, jet fires and flash fires.

1.1.2.2.2.1. Thermal Radiation

The effect of thermal radiation is very dependent on the type of fire and duration of exposure. Certain codes, such as the American Petroleum Institute API 520 and API 2000 codes, suggest values for the maximum heat absorbed by vessels to facilitate adequate relief designs in order to prevent failure of the vessel. Other codes, such as API 510 and the British Standards BS 5980 code, give guidelines for the maximum thermal radiation intensity and act as a guide to equipment layout, as shown in Table 1.1.

The effect of thermal radiation on human health has been widely studied, relating injuries to the time and intensity of the radiation exposure.

Table 1.1 Thermal radiation guidelines (BS 5980, 1990)

Thermal Radiation Intensity (kW/m ²)	Limit
1.5	Will cause no discomfort for long exposure
2.1	Sufficient to cause pain if unable to reach cover within 40 seconds
4.5	Sufficient to cause pain if unable to reach cover within 20 seconds
12.5	Minimum energy required for piloted ignition of wood and melting of plastic tubing
25	Minimum energy required to ignite wood at indefinitely long exposures
37.5	Sufficient to cause serious damage to process equipment

For pool fires, jet fires and flash fires CPR 18E suggests the following thermal radiation levels be reported:

- 4 kW/m², the level that glass can withstand, preventing the fire entering a building, and that should be used for emergency planning;
- 10 kW/m², the level that represents the 1% fatality for 20 seconds of unprotected exposure and at which plastic and wood may start to burn, transferring the fire to other areas;
- 35 kW/m², the level at which spontaneous ignition of hair and clothing occurs, with an assumed 100% fatality, and at which initial damage to steel may occur.

Thermal radiation guideline levels for continuous and emergency flaring is given in the API 521 (2007) standard. More specifically, the acceptable radiation at ground level for LNG flaring can be found in BS EN 1473 (2007) and NFPA 59A (2013). The BS EN 1473 (2007) standard is slightly more conservative and more detailed and was adopted for this study. These values are given in Table 1.2 and Table 1.3.

**Table 1.2 Allowable thermal radiation flux excluding solar radiation inside the boundary
(BS EN 1473 2007)**

Equipment Inside Boundary	Maximum Thermal Radiation Flux (kW/m ²)	
	Normal	Accidental
Flow rate (defined in the standard)		
Peak within the sterile area (defined in the standard)	5	9
Outer edges of the restricted (sterile) area	N/A	5
Roads and open areas	3	5
Tanks and process areas	1.5	5
Control rooms, maintenance workshops, laboratories, warehouses, etc.	1.5	5
Administrative buildings	1.5	5

**Table 1.3 Allowable thermal radiation flux excluding solar radiation outside the boundary
(BS EN 1473 2007)**

Outside Boundary	Maximum Thermal Radiation Flux (kW/m ²)	
	Normal	Accidental
Flow rate (defined in the standard)		
Remote area ³	3	5
Critical area ⁴	1.5	1.5
Other areas ⁵	1.5	3

3 As defined in BS EN 1473 (2007), an area only infrequently occupied by small numbers of persons, e.g. moor land, farmland, desert.

4 As defined in BS EN 1473 (2007), this is either an unshielded area of critical importance where people without protective clothing can be required at all times, including during emergencies, or a place difficult or dangerous to evaluate at short notice, e.g. hospitals, retirement houses, sports stadiums, schools, outdoor theatres).

5 As defined in BS EN 1473 (2007), other areas typically include urban and industrial areas not under control of the operator or occupier of the LNG facility.

1.1.2.2.2. Bund and Pool Fires

Pool fires, either tank or bund fires, consist of large volumes of liquid flammable material at atmospheric pressure burning in an open space. The flammable material will be consumed at the burning rate, depending on factors including the prevailing winds. During combustion heat will be released in the form of thermal radiation. Temperatures close to the flame centre will be high but will reduce rapidly to tolerable temperatures over a relatively short distance. Any building or persons close to the fire or within the intolerable zone will experience burn damage with the severity depending on the distance from the fire and the time exposed to the heat of the fire.

In the event of a pool fire, the flames will tilt according to the wind speed and direction. The flame length and tilt angle affect the distance of thermal radiation generated.

1.1.2.2.3. Jet Fires

Jet fires occur when flammable material of a high exit velocity ignites. In process industries this may be due to design (such as flares) or due to accidental releases. Ejection of flammable material from a vessel, pipe or pipe flange may give rise to a jet fire and in some instances the jet flame could have substantial 'reach'. Depending on wind speed, the flame may tilt and impinge on other pipelines, equipment or structures. The thermal radiation from these fires may cause injury to people or damage equipment some distance from the source of the flame.

1.1.2.2.4. Flash Fires

A loss of containment of flammable materials would mix with air and form a flammable mixture. The cloud of flammable material would be defined by the lower flammable limit (LFL) and the upper flammable limit (UFL). The extent of the flammable cloud would depend on the quantity of released material, physical properties of the released gas, wind speed and weather stability. An ignition within a flammable cloud can result in an explosion if the front is propagated by pressure. If the front is propagated by heat, then the fire moves across the flammable cloud at the flame velocity and is called a flash fire. Flash fires are characterised by low overpressure, with injuries caused by thermal radiation. The effects of overpressure due to an exploding cloud are covered in the subsection dealing with vapour cloud explosions (VCEs).

A flash fire would extend to the lower flammable limit; however, due to the formation of pockets, it could extend beyond this limit to the point defined as the $\frac{1}{2}$ LFL. It is assumed that people within the flash fire would experience lethal injuries while people outside of the flash fire would remain unharmed. The $\frac{1}{2}$ LFL is used for emergency planning to evacuate people to a safe distance in the event of a release.

1.1.2.2.3. Explosions

An explosion may give rise to any of the following effects:

- Blast damage;
- Thermal damage;
- Missile damage;
- Ground tremors;
- Crater formation;
- Personal injury.

Obviously, the nature of these effects depends on the pressure waves and the proximity to the actual explosion. Of concern in this investigation are the 'far distance' effects, such as limited structural damage and the breakage of windows, rather than crater formations.

Table 1.4 and Table 1.5 give a more detailed summary of the damage produced by an explosion due to various overpressures.

CPR 18E (1999) suggests the following overpressures be determined:

- 0.03 bar overpressure, corresponding to the critical overpressure causing windows to break;
- 0.1 bar overpressure, corresponding to 10% of the houses being severely damaged and a probability of death indoors equal to 0.025 (no lethal effects are expected below 0.1 bar overpressure on unprotected people in the open);
- 0.3 bar overpressure, corresponding to structures being severely damaged and a probability of death equal to 1.0 for unprotected people in the open;
- 0.7 bar overpressure, corresponding to an almost entire destruction of buildings and 100% fatality for people in the open.

1.1.2.2.3.1. Vapour Cloud Explosions (VCEs)

A release of flammable material into the atmosphere could result in the formation of a flash fire, as described in the subsection on flash fires, or a VCE.

The concentration of the combustible component would decrease from the point of release to below the LEL, at which concentration the component can no longer ignite. The material contained in the vapour cloud between the HEL and the LEL, if it ignites, could form a flash fire or a fireball. The sudden detonation of the explosive mass of material would cause overpressures that can result in injury or damage to property.

Table 1.4 Summary of consequences of blast overpressure (Clancey, 1972)

Pressure (Gauge)		Damage
Psi	kPa	
0.02	0.138	Annoying noise (137 dB), if of low frequency (10 – 15 Hz)
0.03	0.207	Occasional breaking of large glass windows already under strain
0.04	0.276	Loud noise (143 dB); sonic boom glass failure
0.1	0.69	Breakage of small under strain windows
0.15	1.035	Typical pressure for glass failure
0.3	2.07	‘Safe distance’ (probability 0.95; no serious damage beyond this value); missile limit; some damage to house ceilings; 10% window glass broken
0.4	2.76	Limited minor structural damage
0.5–1.0	3.45–6.9	Large and small windows usually shattered; occasional damage to window frames
0.7	4.83	Minor damage to house structures
1.0	6.9	Partial demolition of houses, made uninhabitable
1.0–2.0	6.9–13.8	Corrugated asbestos shattered; corrugated steel or aluminium panels, fastenings fail, followed by buckling; wood panels (standard housing) fastenings fail, panels blown in
1.3	8.97	Steel frame of clad building slightly distorted
2.0	13.8	Partial collapse of walls and roofs of houses
2.0–3.0	13.8–20.7	Concrete or cinderblock walls (not reinforced) shattered
2.3	15.87	Lower limit of serious structural damage
2.5	17.25	50% destruction of brickwork of house
3.0	20.7	Heavy machines (1.4 t) in industrial building suffered little damage; steel frame building distorted and pulled away from foundations
3.0–4.0	20.7–27.6	Frameless, self-framing steel panel building demolished
4.0	27.6	Cladding of light industrial buildings demolished
5.0	34.5	Wooden utilities poles (telegraph, etc.) snapped; tall hydraulic press (18 t) in building slightly damaged
5.0–7.0	34.5–48.3	Nearly complete destruction of houses
7.0	48.3	Loaded train wagons overturned
7.0–8.0	48.3–55.2	Brick panels (20 – 30 cm) not reinforced fail by shearing or flexure
9.0	62.1	Loaded train boxcars completely demolished
10.0	69.0	Probable total destruction buildings; heavy (3 t) machine tools moved and badly damaged; very heavy (12 000 lb. / 5443 kg) machine tools survived
300	2070	Limit of crater lip

Table 1.5 Damage caused by overpressure effects of an explosion (Stephens, 1970)

Equipment	Overpressure (psi)																									
	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10	12	14	16	18	20	
Control house steel roof	A	C	V				N																			
Control house concrete roof	A	E	P	D			N																			
Cooling tower	B			F			O																			
Tank: cone roof		D				K							U													
Instrument cubicle			A			LM						T														
Fire heater				G	I					T																
Reactor: chemical				A				I				P						T								
Filter				H					F									V			T					
Regenerator						I				IP					T											
Tank: floating roof						K							U												D	
Reactor: cracking							I							I							T					
Pine supports							P					SO														
Utilities: gas meter									Q																	
Utilities: electric transformer									H					I						T						
Electric motor										H								I							V	
Blower										Q										T						
Fractionation column											R			T												
Pressure vessel horizontal												PI						T								
Utilities: gas regulator												I								MQ						
Extraction column													I							V	T					
Steam turbine															I						M	S			V	
Heat exchanger															I			T								
Tank sphere																I						I	T			
Pressure vessel vertical																					I	T				
Pump																					I		Y			

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

Windows and gauges break

Louvers fall at 0.3–0.5 psi

Switchgear is damaged from roof collapse

Roof collapses

Instruments are damaged

Inner parts are damaged

Bracket cracks

Debris-missile damage occurs

Unit moves and pipes break

Bracing fails

Unit uplifts (half filled)

Power lines are severed

Controls are damaged

Block wall fails

Frame collapses

Frame deforms

Case is damaged

Frame cracks

Piping breaks

Unit overturns or is destroyed

Unit uplifts (0.9 filled)

Unit moves on foundations

- A Windows and gauges break
- B Louvers fall at 0.3–0.5 psi
- C Switchgear is damaged from roof collapse
- D Roof collapses
- E Instruments are damaged
- F Inner parts are damaged
- G Bracket cracks
- H Debris-missile damage occurs
- I Unit moves and pipes break
- J Bracing fails
- K Unit uplifts (half filled)
- L Power lines are severed
- M Controls are damaged
- N Block wall fails
- O Frame collapses
- P Frame deforms
- Q Case is damaged
- R Frame cracks
- S Piping breaks
- T Unit overturns or is destroyed
- U Unit uplifts (0.9 filled)
- V Unit moves on foundations

1.1.2.2.3.2. Boiling Liquid Expanding Vapour Explosions (BLEVEs)

A boiling liquid expanding vapour explosion (BLEVE) can occur when a flame impinges on a pressure cylinder, particularly in the vapour space region where cooling by evaporation of the contained material does not occur. The cylinder shell would weaken and rupture with a total loss of the contents, and the issuing mass of material would burn as a massive fireball.

The major consequences of a BLEVE are the intense thermal radiation from the fireball, a blast wave and fragments from the shattered vessel. These fragments may be projected to considerable distances. Analyses of the travel range of fragment missiles from a number of BLEVEs suggest that the majority land within 700 m from the incident. A blast wave from a BLEVE is fairly localised but can cause significant damage to immediate equipment.

A BLEVE occurs sometime after the vessel has been engulfed in flames. Should an incident occur that could result in a BLEVE, people should be evacuated to beyond the 1% fatality line.

1.1.2.3. Risk Analysis

1.1.2.3.1. Background

It is important to understand the difference between hazard and risk.

A hazard is anything that has the potential to cause damage to life, property and the environment. Furthermore, it has constant parameters (of petrol, chlorine, ammonia, etc.) that pose the same hazard wherever present.

Risk, on the other hand, is the probability that a hazard will actually cause damage along with how severe that damage will be (consequence). Risk is therefore the probability that a hazard will manifest itself. For instance, the risks of a chemical accident or spill depends upon the amount present, the process the chemical is used in, the design and safety features of its container, the exposure, the prevailing environmental and weather conditions and so on.

Risk analysis consists of a judgement of probability based on local atmospheric conditions, generic failure rates and the severity of consequences, based on the best available technological information.

Risks form an inherent part of modern life. Some risks are readily accepted on a day-to-day basis, while certain hazards attract headlines even when the risk is much smaller, particularly in the field of environmental protection and health. For instance, the risk of one-in-ten-thousand chance of death per year associated with driving a car is acceptable to most people, whereas the much lower risks associated with nuclear facilities (one-in-ten-million chance of death per year) are deemed unacceptable.

A report by the British Parliamentary Office of Science and Technology (POST), titled 'Safety in Numbers? Risk Assessment and Environmental Protection', explains how public perception of risk is influenced by a number of factors in addition to the actual size of the risk. These factors were summarised as follows in Table 1.6.

Table 1.6 The influence of public perception of risk on the acceptance of that risk, based on the POST report

Control	People are more willing to accept risks they impose upon themselves or they consider to be 'natural' than to have risks imposed upon them
Dread and Scale of Impact	Fear is greatest where the consequences of a risk are likely to be catastrophic rather than spread over time
Familiarity	People appear more willing to accept risks that are familiar rather than new risks
Timing	Risks seem to be more acceptable if the consequences are immediate or short term, rather than if they are delayed (especially if they might affect future generations)
Social Amplification and Attenuation	Concern can be increased because of media coverage, graphic depiction of events or reduced by economic hardship
Trust	A key factor is how far the public trusts regulators, policy makers or industry; if these bodies are open and accountable (being honest as well as admitting mistakes and limitations and taking account of differing views without disregarding them as emotive or irrational), then the public is more likely consider them credible

A risk assessment should be seen as an important component of ongoing preventative actions, aimed at minimising or hopefully avoiding accidents. Reassessments of risk should therefore follow at regular intervals and after any changes that could alter the nature of the hazard, so contributing to the overall prevention programme and emergency response plan of the plant. Risks should be ranked in decreasing severity and the top risks reduced to acceptable levels.

Procedures for predictive hazard evaluation have been developed for the analysis of processes when evaluating very low probability accidents with very high consequences (for which there is little or no experience) as well as more likely releases with fewer consequences (for which there may be more information available). These address both the probability of an accident as well as the magnitude and nature of undesirable consequences of that accident. Risk is usually defined as some simple function of both the probability and consequence.

1.1.2.3.2. Predicted Risk

The physical and consequence modelling (Section 5) addresses the impact of a release of hazardous materials without taking into account the probability of occurrence. This merely illustrates the significance and the extent of the impact in the event of a release. Section 5 also contains an analysis of the possibility of cascading or knock-on effects due to incidents in the facility and the surrounding industries and suburbs. In Section 6 the likelihood of various incidents is assessed, the consequences calculated and finally the risk for the facility is determined.

1.1.2.3.2.1. Generic Equipment Failure Scenarios

In order to characterise the various failure events and assign a failure frequency, fault trees were constructed starting with a final event and working from the top down to define all initiating events and frequencies. The analysis was completed using published failure rate data. Equipment failures can occur in tanks, pipelines and other items handling hazardous materials. These failures may result in:

- Release of combustible, flammable and explosive materials with fires or explosions upon ignition;
- Release of toxic or asphyxiant materials.

1.1.2.3.2.1.1. Storage Tanks

Incidents involving storage tanks include catastrophic failure leading to product leakage into the bund and a possible bund fire. A tank-roof failure could result in a possible tank fire. A fracture of the tank nozzle or the transfer pipeline could also result in product leakage into the bund and a possible bund fire.

Typical failure frequencies for atmospheric tanks and pressure vessels are listed, respectively, in Table 1.7 and Table 1.8.

Table 1.7 Failure frequencies for atmospheric tanks

Event	Leak Frequency (per item per year)
Small leaks	1×10^{-4}
Severe leaks	3×10^{-5}
Catastrophic failure	5×10^{-6}

Table 1.8 Failure frequencies for pressure vessels

Event	Failure Frequency (per item per year)
Small leaks	1×10^{-5}
Severe leaks	5×10^{-7}
Catastrophic failure	5×10^{-7}

1.1.2.3.2.1.2. Transport and Process Piping

Piping may fail as a result of corrosion, erosion, mechanical impact damage, pressure surge (water hammer) or operation outside the design limitations for pressure and temperature. Failures caused by corrosion and erosion usually result in small leaks, which are detected and corrected early. For significant failures, the leak duration may be from 10–30 minutes before detection.

The generic data for leak frequency for process piping is generally expressed in terms of the cumulative total failure rate per year for a 10 m section of pipe and each pipe diameter. Furthermore, the failure frequency normally decreases with increasing pipe diameter. The scenarios and failure frequencies for a pipeline apply to pipelines with connections, such as flanges, welds and valves.

Failure data given in Table 1.9 represents the total failure rate, incorporating all failures of whatever size and due to all probable causes. These frequencies are based on an environment where no excessive vibration, corrosion, erosion or thermal cyclic stresses are expected. For potential risk causing significant leaks (e.g. corrosion) the failure rate will be increased by a factor of 10.

Table 1.9 Failure frequencies for process pipes

Description	Frequencies of Loss of Containment for Process Pipes (per meter per year)	
	Full Bore Rupture	Leak
Nominal diameter < 75 mm	1×10^{-6}	5×10^{-6}
75 mm < nominal diameter < 150 mm	3×10^{-7}	2×10^{-6}
Nominal diameter > 150 mm	1×10^{-7}	5×10^{-7}

For scenarios and failure frequencies no distinction is made between process and transport pipes, materials from which a pipeline is made, presence of cladding, design pressure of a pipeline or its location on a pipe bridge. However, a distinction is made between aboveground and underground pipes. Scenarios for aboveground pipes are given in Table 1.10, and those for underground pipes are given in Table 1.11.

Transport pipelines aboveground can be compared, under certain conditions, with underground pipes in a pipe bay. The necessary conditions for this are external damage being excluded, few to no flanges and accessories present and the pipe is clearly marked. In very specific situations the use of a lower failure frequency for transport pipes aboveground can be justified.

Table 1.10 Failure frequencies for aboveground transport pipelines

Description	Frequency (per meter per annum)		
	Nominal Diameter < 75 mm	75 mm > Nominal Diameter > 150 mm	Nominal Diameter > 150 mm
Full bore rupture	1×10^{-6}	3×10^{-7}	1×10^{-7}
Leak with an effective diameter of 10% of the nominal diameter, up to a maximum of 50 mm	5×10^{-6}	2×10^{-6}	5×10^{-7}

Table 1.11 Failure frequencies for underground transport pipelines

Description	Frequency (per meter per annum)		
	Pipeline in Pipe Lane ⁶	Pipeline Complies with NEN 3650	Other Pipelines
Full bore rupture	7×10^{-9}	1.525×10^{-7}	5×10^{-7}
Leak with an effective diameter of 20 mm	6.3×10^{-8}	4.575×10^{-7}	1.5×10^{-6}

⁶ A pipeline located in a 'lane' is a pipeline located in a group of pipelines on a dedicated route. Losses of containment frequencies for this situation are lower because of extra preventive measures.

1.1.2.3.2.1.3. Ignition Probability of Flammable Gases and Liquids

The estimation of the probability of an ignition is a key step in the assessment of risk for installations where flammable liquids or gases are stored. There is a reasonable amount of data available relating to characteristics of ignition sources and the effects of release type and location.

The probability of ignition for stationary installations is given in Table 1.12 (along with the classification of flammable substances in Table 1.13). These can be replaced with ignition probabilities related to the surrounding activities. For example, the probability of a fire from a flammable release at an open flame would increase to a value of 1.

Table 1.12 The probability of direct ignition for stationary installations (RIVM, 2009)

Substance Category	Source-Term Continuous	Source-Term Instantaneous	Probability of Direct Ignition
Category 0 Average to high reactivity	< 10 kg/s	< 1000 kg	0.2
	10 – 100 kg/s	1000 – 10 000 kg	0.5
	> 100 kg/s	> 10 000 kg	0.7
Category 0 Low reactivity	< 10 kg/s	< 1000 kg	0.02
	10 – 100 kg/s	1000 – 10 000 kg	0.04
	> 100 kg/s	> 10 000 kg	0.09
Category 1	All flow rates	All quantities	0.065
Category 2	All flow rates	All quantities	0.0043 ⁷
Category 3 Category 4	All flow rates	All quantities	0

Table 1.13 Classification of flammable substances

Substance Category	Description	Limits
Category 0	Extremely flammable	Liquids, substances and preparations that have a flashpoint lower than 0°C and a boiling point (or the start of the boiling range) less than or equal to 35°C Gaseous substances and preparations that may ignite at normal temperature and pressure when exposed to air
Category 1	Highly flammable	Liquids, substances and preparations that have a flashpoint of below 21°C
Category 2	Flammable	Liquids, substances and preparations that have a flashpoint equal to 21°C and less than 55°C
Category 3		Liquids, substances and preparations that have a flashpoint greater than 55°C and less than or equal to 100°C
Category 4		Liquids, substances and preparations that have a flashpoint greater than 100°C

⁷ This value is taken from the CPR 18E (1999). RIVM (2009) gives the value of delayed ignition as zero. RISCUM believes the CPR 18E is more appropriate for warmer climates and is a conservative value.

1.1.2.3.3. Risk Calculations

1.1.2.3.3.1. Maximum Individual Risk Parameter

Standard individual risk parameters include: average individual risk; weighted individual risk; maximum individual risk; and, the fatal accident rate. The latter parameter is more applicable to occupational exposures. Only the maximum individual risk (MIR) parameter will be used in this assessment. For this parameter the frequency of fatality is calculated for an individual who is presumed to be present at a specified location. This parameter (defined as the consequence of the event multiplied by the likelihood of the event) is not dependent on knowledge of the population at risk. So, it is an easier parameter to use in the predictive mode than the average individual risk and weighted individual risk. The unit of measure is risk of fatality per person per year.

1.1.2.3.3.2. Acceptable Risks

The next step, after having characterised a risk and obtained a risk level, is to recommend whether the outcome is acceptable. In contrast to the employees in a plant, who may be assumed to be healthy, the adopted exposure assessment applies to an average population group that also includes sensitive subpopulations. Sensitive subpopulation groups are those people that for reasons of age or medical condition have a greater than normal response to contaminants. Health guidelines and standards used to establish risk normally incorporate safety factors that address this group.

Among the most difficult tasks of risk characterisation is the definition of acceptable risk. In an attempt to account for risks in a manner similar to those used in everyday life, the HSE (UK) developed the risk ALARP triangle. Applying the triangle involves deciding:

- Whether a risk is so high that something must be done about it;
- Whether the risk is or has been made so small that no further precautions are necessary;
- If a risk falls between these two states that it has been reduced to levels as low as reasonably practicable (ALARP).

This is illustrated in Figure 1.5.

ALARP stands for 'as low as reasonably practicable'. As used in the UK, it is the region between that which is intolerable, at 1×10^{-4} per year, and that which is broadly acceptable, at 1×10^{-6} per year/ A further lower level of risk of 3×10^{-7} per year is applied to either vulnerable or very large populations for land-use planning.

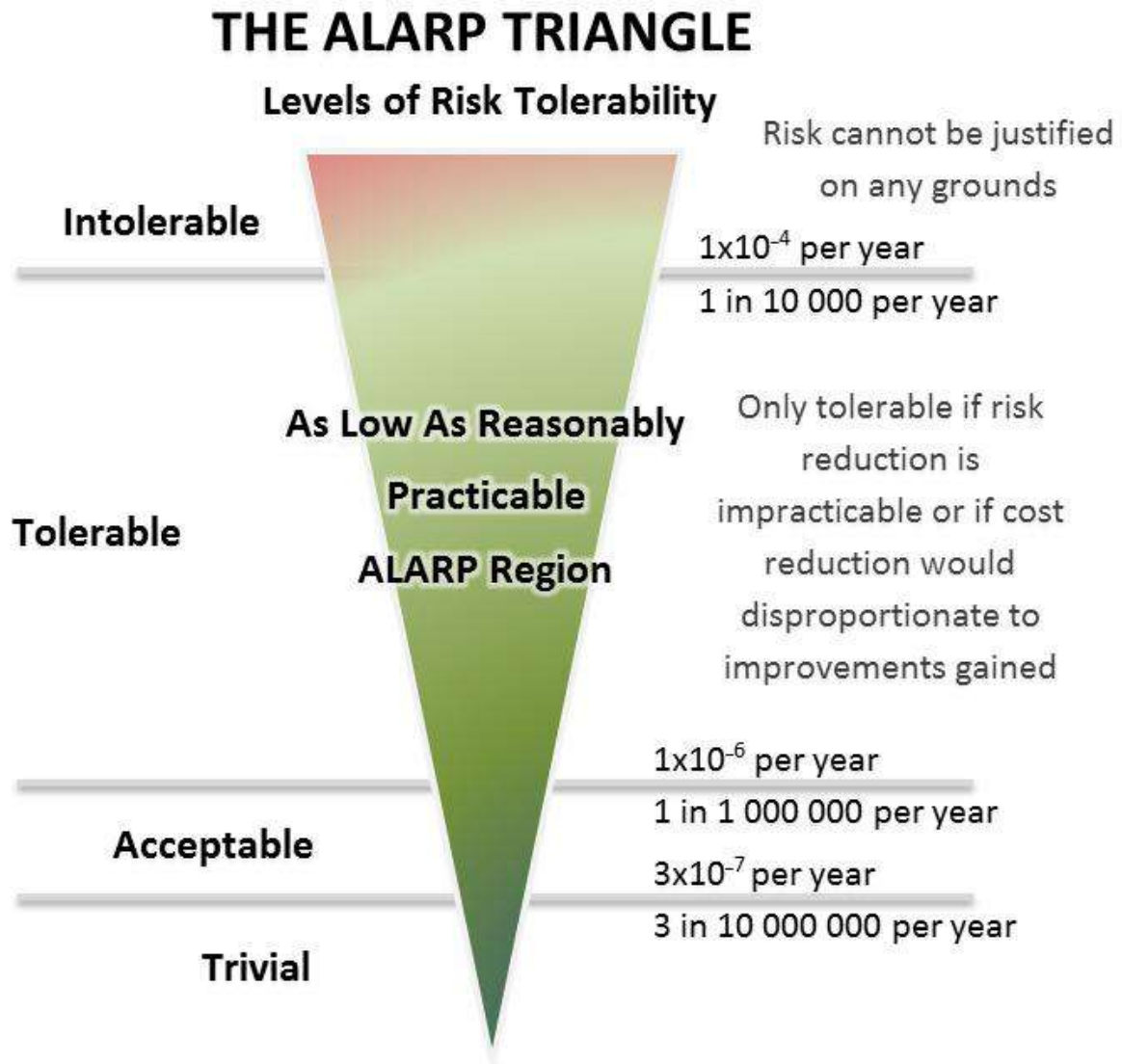


Figure 1.5 HSE (UK) decision-making framework

1.1.2.3.3.3. Land Use Planning

South Africa does not have specific land use planning (LUP) criteria applicable to major hazard installations. Therefore, in the absence of local LUP criteria, reference is made to the criteria adopted in the UK and the Netherlands. In this instance, RISCOP would only advise on applicable land planning and would require governmental authorities to make final decisions.

The objectives of LUP controls should be based on the potential risk posed by industry on sensitive land uses. Planning guidelines need therefore to have the following objectives in common:

- To discourage inappropriate developments near potentially hazardous installations;
- To attempt to structure growth so that developments with small numbers of less vulnerable members of the public nearby the site are encouraged, while the largest developments involving the most vulnerable and sensitive members of the public are kept further away.

Development categories must represent the full range of different possible developments. This approach would therefore categorise developments according to several factors, which determine the appropriate risk level, such as:

- The inherent vulnerability of the exposed population;
- The proportion of the time and individual spends at the development;
- The size of the facility, in terms of the number of people who may be present;
- Whether people are likely to be indoors or out of doors and, if out of doors, how easily they would be able to seek shelter;
- The ease of evacuation or other emergency measures;
- The construction of the building and the protection available to the harmful agent.

Land development restrictions can be seen as passive mitigation against unnecessary exposure to hazards. This includes the establishment of buffer zones (or separation distances), orientation of buildings and the use of suitable building materials. Land development planning policies must achieve a number of desired outcomes, including the protection of the amenity of residential areas (and other public areas) and the unhindered operation of businesses in industrial and commercial areas.

The land zoning applied in this study follows the HSE (UK) approach of defining the area into three zones, consistent to the ALARP approach (HSE, 2011).

The three zones are defined as follows: the inner zone (greater than 1×10^{-5} fatalities per person per year); the middle zone (1×10^{-5} fatalities per person per year to 1×10^{-6} fatalities per person per year); and, the outer zone (1×10^{-6} fatalities per person per year to 3×10^{-7} fatalities per person per year). The risks decrease from the inner zone to the outer zone as shown in Figure 1.6 and Figure 1.7.

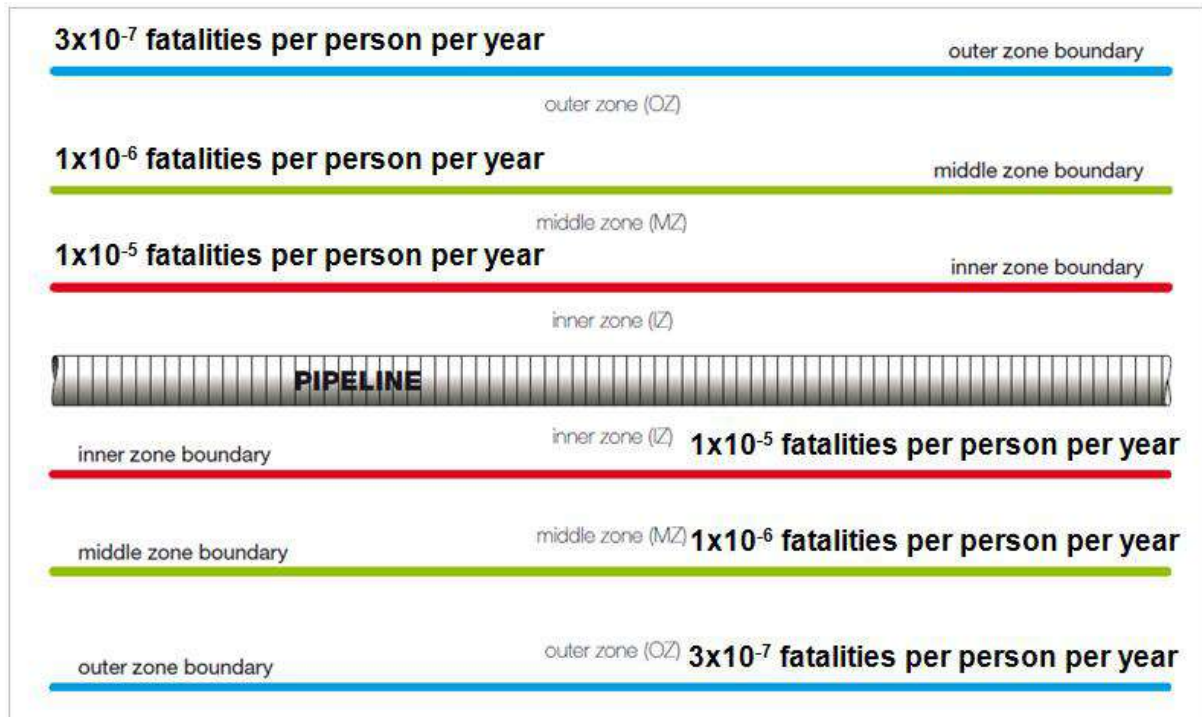


Figure 1.6 Town-planning zones for pipelines

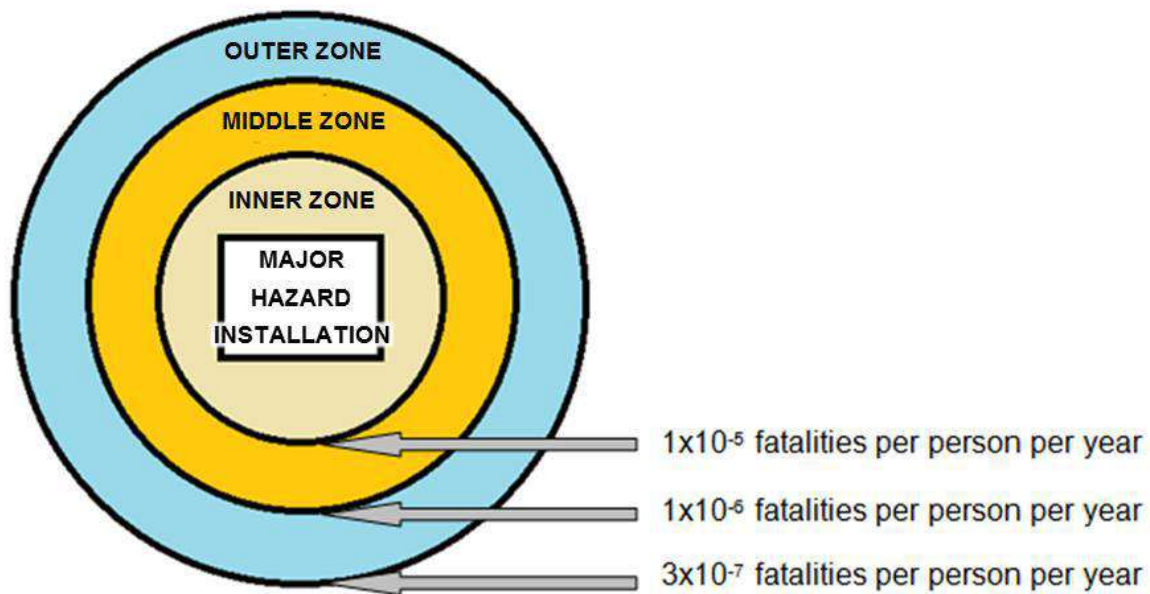


Figure 1.7 Town-planning zones

Once the zones are calculated, the HSE (UK) methodology then determines whether a development in a zone should be categorised as 'advised against' (AA) or as 'don't advise against' (DAA), depending on the sensitivity of the development, as indicated in Table 1.14. There are no land-planning restrictions beyond the outer zone.

Table 1.14 Land-use decision matrix

Level of Sensitivity	Development in Inner Zone	Development in Middle Zone	Development in Outer Zone
1	DAA	DAA	DAA
2	AA	DAA	DAA
3	AA	AA	DAA
4	AA	AA	AA

The sensitivity levels are based on a clear rationale; progressively more severe restrictions are to be imposed as the sensitivity of the proposed development increases.

There are four sensitivity levels, with the sensitivity for housing defined as follows:

- Level 1: based on workers who have been advised of the hazards and trained accordingly;
- Level 2: based on the general public at home and involved in normal activities;
- Level 3: based on the vulnerability of members of the public (e.g. children, those with mobility difficulties or those unable to recognise physical danger);
- Level 4: large examples of Level 2 and of Level 3.

Refer to Appendix G for detailed planning advice for developments near hazardous installations (PADHI) tables. These tables illustrate how the HSE land-use decision matrix, generated using the three zones and the four sensitivity levels, is applied to a variety of development types.

1.1.2.4. Software

The physical consequences were calculated with DNV's PHAST v. 6.7 and the data derived was entered into TNO's RISKCURVES v. 9.0.21. All calculations were performed by Mr M P Oberholzer.

1.1.2.5. Assessment of Potential Impacts

Assessment of impact significance should be based on the following conventions :

- Nature of impact including:
 - Review of the type of effect that a proposed activity will have on the environment:
 - “What will be affected and how”;
 - Direct impacts caused directly by the activity and generally occurring at the same time and at the place of the activity:
 - Usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable;
 - Indirect impacts of an activity including:
 - Indirect or induced changes that may occur as a result of the activity;
 - All potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity;
 - Cumulative impacts resulting from incremental impacts from the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities:
 - To be assessed by identifying other land use, human activity or projects in the local area;
- Status of the impact:
 - Describing whether the impact will be positive (with overall benefits to the environment), negative (with the environment adversely affected overall) or neutral (with the environment not affected overall);
- Potential intensity, as shown in Table 1.15:
 - Establishing whether the impact is potentially destructive or innocuous and should be described as:
 - Very high intensity or a fatal flaw (irreversible human health damage with morbidity or mortality or loss of species, fauna or flora);
 - High (severe impact on livelihood or quality of life or severe alteration of natural systems, patterns or processes such that they temporarily or permanently cease);
 - Medium (notable alteration of natural systems, patterns or processes where the environment continues to function but in a modified manner);
 - Low (negligible or no alteration of environmental functions, natural systems, patterns or processes);
- Spatial extent, as shown in Table 1.16:
 - Indicating the impact footprint i.e. whether the impact would be local and limited to the immediate area of development or whether the impact would be realised regionally, nationally or even internationally:
 - For example, if a species were to be lost, then the extent would be global because that species would be lost to the world);
- Duration, as shown in Table 1.17:
 - Reviewing the lifetime (timeframe) during which the impact will be experienced;
 - Where the concept of ‘reversibility’ is reflected in the duration scoring i.e. the longer the impact endures the less likely it will be reversible;
- Reversibility as follows:
 - Highly reversible:
 - As the most favourable assessment for the environment;

- For example, the noise impact caused by the desalination plant is a long-term impact but can be considered to be highly reversible at the end of the project life when the project is decommissioned;
- Moderate reversibility;
- Low reversibility;
- Irreversible:
 - As the least favourable assessment for the environment;
 - Where the impact is permanent;
 - For example, the loss of a paleontological resource on site caused by construction activities is permanent and could be irreversible;
- Irreplaceability of resource due to a loss caused by impacts, as follows:
 - High irreplaceability of resources (project will destroy unique resources that cannot be replaced);
 - Moderate irreplaceability of resources;
 - Low irreplaceability of resources;
 - Resources are replaceable (the affected resource is easy to replace or rehabilitate);
- Probability, as shown in Table 1.18:
 - Considering the likelihood of the impact occurring (and not the likelihood of the aspect to happen);
- Degree of confidence in predictions, based on the availability of information and specialist knowledge (assessed as high, medium or low);
- Significance, based on the above considerations, the specialist must provide an overall evaluation of the significance of the potential impact, as shown in Table 1.19 and according to the following:
 - Significance Rating = Impact Magnitude x Probability where
Impact Magnitude = Potential Intensity + Duration + Extent.

The concept of 'potential intensity', as shown in Table 1.15, is an acknowledgement at the outset of the potential significance of the impact. For example, emissions of sulphur dioxide have the potential to result in adverse human health effects, a significant potential impact, and that potential must be acknowledged in the significance rating; in that case, even a limited extent or duration would still be significant and the risk can only be reduced by reducing the likelihood of the impact occurring.

Table 1.15 Description, rating and score for potential intensity

Potential Intensity Description	Rating	Score ⁸
Negative		
Potential to severely impact human health (morbidity or mortality) or to lead to loss of species ⁹ (fauna or flora)	Very high Fatal flaw	16
Potential severe impact on quality of life ¹⁰ , individual economic status or loss of livelihoods or resulting in reduction of faunal or flora population or severe reduction or alteration of natural process	High	8
Potential to reduce environmental quality of air, soil or water, to result in loss of habitat or heritage or to reduce amenity	Medium	4
Nuisance	Medium-low	2
Negative change with no other consequence	Low	1
Positive		
Potential net improvement in human welfare	High	8
Potential to improve individual livelihoods or environmental quality of air, soil or water	Medium	4
Potential to lead to economic development	Medium-low	2
Potential positive change with no other consequence	Low	1

Table 1.16 Description and score for spatial extent

Extent Description	Score
Site specific	1
Local (< 2 km from site)	2
Regional (within 30 km of site)	3
National	4
International or global	5

⁸ The concept of the 'irreplaceable loss of a resource' is to be taken into account in the potential Intensity score of an impact.

⁹ Loss of species is a global issue and is differentiated from a loss of "flora or fauna" population.

¹⁰ A visual impact or air emissions (for example) could be considered as severely impacting on quality of life should it constitute more than a nuisance but not being life threatening.

Table 1.17 Description and score for duration

Duration Description	Score
Temporary (less than 2 years) or duration of the construction period Impact is fully reversible For example, construction noise Temporary impact that is highly reversible as it will stop at the end of the construction period	1
Short term (2–5 years) Impact is reversible	2
Medium term (5-15 years) Impact is reversible with implementation of appropriate mitigation and management actions	3
Long term (> 15 years but where the impact will cease after the operational life of the activity) Impact is reversible with implementation of appropriate mitigation and management actions For example, the noise impact caused by the desalination plant is a long term impact but can be considered to be highly reversible at the end of the project life, when the project is decommissioned	4
Permanent (mitigation will not occur in such a way or in such a timespan that the impact can be considered transient) Impact is irreversible. For example, loss of a paleontological resource on site caused by construction activities is permanent and would be irreversible	5

Table 1.18 Description and score for probability

Probability Description	Score
Improbable (little or no chance of occurring; < 10%)	0.1
Low probability (10-25% chance of occurring)	0.25
Probable (25-50% chance of occurring)	0.5
Highly probable (50-90% chance of occurring)	0.75
Definite (> 90% chance of occurring).	1

Table 1.19 Rating, description and score for significance

Significance Rating	Scoring	Description
Fatally flawed	18–26	The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating
High	10–17	The impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision making
Medium	5–9	The impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures and will only have an influence on decision making if not mitigated
Low	< 5	The impact may result in minor alterations to the environment, can easily be avoided by implementing appropriate mitigation measures and will not have an influence on decision making.

This type of assessment must be described in the text (with clear explanation provided for the rationale behind the allocation of significance ratings) and summarized in an impact assessment table.

Where relevant this assessment must also include an identification and description of scenarios (i.e. 'environmental' scenarios such as winter vs. summer or 'operational' scenarios such as normal vs. upset conditions, where relevant). The impact assessment table may be tailored according to scenarios (e.g. summer or winter); however, it **must** contain all the prescribed columns and impacts must be described separately for the construction, operational and decommissioning phases.

Furthermore, the following must be considered:

- Specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used:
 - Where appropriate national or international standards are to be used as a measure of the level of impact;
- Management actions:
 - Where negative impacts are identified specialists must specify practical mitigation objectives (i.e. ways to avoid or reduce negative impacts);
 - Where no mitigation is feasible this should be stated and the reasons given;
 - Where positive impacts are identified management actions to enhance the benefit must also be recommended;
 - Specialists should set quantifiable standards for measuring the effectiveness of mitigations and enhancement;
 - For each impact assessment or discussion, management actions should be listed under three categories as follows:
 - Mitigation measures or management actions inherent to the project design (to be implemented regardless of this study i.e. mitigation or management actions that the proponent had planned to implement as part of the project description);
 - Key management actions proposed by specialist (pertinent measures that will be written into and enforced through the EMP; these key management actions (to minimise negative impacts or enhance positive impacts) are not negotiable and have to be implemented to ensure that the significance of the associated impact is acceptable;

- Additional management actions (i.e. nice to have) proposed by the specialist (management actions to be considered by proponent and authority);
- Impacts should be described both before and after the proposed mitigation and management measures have been implemented:
 - Scenarios 'without mitigation' must consider all management actions already proposed by the proponent as part of the project description (i.e. management actions inherent to the project design);
 - Scenarios 'with mitigation' will assess the significance rating of the potential impact, taking into account any key management actions recommended by the specialist (i.e. not taking into account the additional 'nice to have' actions).

1.1.2.6. The History of Incidents in the Liquefied Natural Gas (LNG) Industry

In the early years of the LNG industry three incidents occurred at onshore facilities which resulted in fatalities. The outcome was the institutionalisation of more stringent operational and safety regulations in the industry.

The East Ohio Gas Company built the first commercial liquefaction LNG facility in Cleveland in 1941. As stainless steel alloys were scarce due to the Second World War, a large new tank was constructed out of steel with low nickel content. Shortly after going into service the tank failed and LNG spilled into the street and storm water system. 128 people were killed, 225 people were injured and about 30 acres were devastated due to the resultant fire.

Factors that were relevant to the incident developing was the incompatible nature of the material used to build the vessel, the absence of adequate bunding, the proximity of the facility to the residential area and the release from a second vessel due to the inadequate fire insulation of its support structure (US Bureau of Mines, 1946).

Within the United States, proper precautions have been common place in all the LNG facilities built and placed in service since the Cleveland incident.

In the second incident, one of the concrete LNG storage tanks the Texas Eastern Transmission Corporation (TETCO) collapsed killing 37 construction workers inside. This commonly misunderstood to be an LNG incident; however, the subsequent investigation by the New York City Fire Department (1973) concluded that it was a construction accident.

The third and final incident to produce a fatality in the US occurred in October 1979 at an electrical substation at Cove Point Terminal in Maryland. LNG leaked through an inadequately tightened pump seal and vaporised. The vapours travelled a distance through an underground electrical conduit and entered the substation where no gas detectors were installed. The subsequent explosion resulted in one fatality, one severe injury and very severe damages to the substation.

This incident resulted in three major design code changes which are applicable to entire industry (National Transportation Safety Board, 1980). As of 2014, no death or serious accident involving an LNG facility has occurred in the United States in 35 years.

Two other incidents are worth noting. In March 2014 an explosion and fire occurred at Northwest Pipeline LNG facility in Plymouth, Washington. One person was injured, the facility was damaged, including one of the LNG storage vessels, and the surrounding area was evacuated as a precaution to secondary incidents (The Williams Companies, 2014). There were no fatalities. The cause of the incident is still under investigation.

Another is the explosion at the LNG facility in Skikda, Algeria, in January 2004 that resulted in the death of 29 people, injured about 80 others and resulted in extensive damage to the facility and even to neighbouring facilities. A boiler exploded setting off a chain reaction. The ultimate cause of the incident is still under investigation, but there is some speculation that siting, design, operational and management aspects could have played significant roles (The Pipeline & Gas Journal, 2004). The LNG storage vessels themselves remained intact.

The LNG industry has an excellent safety record compared to refineries and other petrochemical plants (University of Houston Law Centre 2003). Worldwide there are 17 LNG liquefaction and export terminals, 40 import and regasification terminals and 136 LNG ships. The distribution of facilities in 2002 is illustrated in Figure 1.8. Approximately 120 million metric tons of LNG is handled every year. As of 2014, LNG has been safely delivered across the ocean for over 40 years. In that time there have been over 33 000 LNG carrier voyages, covering more than 60 million miles, without major accidents or safety problems either in port or on the high seas. Furthermore, LNG carriers frequently transit high traffic density areas.

Figure 1.8 Worldwide distribution of LNG production plants and receiving terminals (Powers, 2002)

In 2011 the largest earthquake and tsunami recorded in Japanese history, from the Great East Japan Earthquake, was the first seismic event to damage a Japanese LNG receiving facility, the Sendai City Gas Bureau Minato Works (Takei, 2012). The facility was constructed according to seismic design requirements and the actual earthquake did almost no damage. Flooding by the tsunami did most of the damage, but there were no fatalities, LNG leaks or secondary hazards due to LNG. As a result, new standards are being developed to safeguard LNG facilities against tsunami damage.

Due to the properties of LNG, explosions are highly unlikely. According to the US Federal Energy Regulatory Commission (FERC), although a large amount of energy is stored in LNG, it cannot be released rapidly enough to cause the overpressures associated with an explosion. LNG vapours consisting mainly of methane mixed with air are not explosive in an unconfined environment.

However, it should be noted that the safety of LNG facilities and marine transport vessels over the decades has been a product of advanced technology, well-trained professionals, a thorough understanding of LNG risks, virtually fail-safe safety systems and procedures and rigidly adhered to standards, codes and regulations.

1.2. DESCRIPTION OF THE AFFECTED ENVIRONMENT

1.2.1. Project Description

Electricity generated by the proposed power plant would be injected directly into the Eskom transmission system. It would flow from the point of injection to the relevant load centres via the transmission system.

The proposed project includes the construction of a CCGT plant using a cycle configuration of combustion turbines, HRSG units and steam turbines to generate electricity, as shown in Figure 1.9.

The station would include up to four gas turbine and generator sets producing about 400 MW each. The number of units required and exact output will depend on the specification of the equipment by the suppliers as well as the ambient operating conditions.

It is important to note that while the project has some conceptual designs, the final layout and detailed designs will be done by the owner or technology supplier.

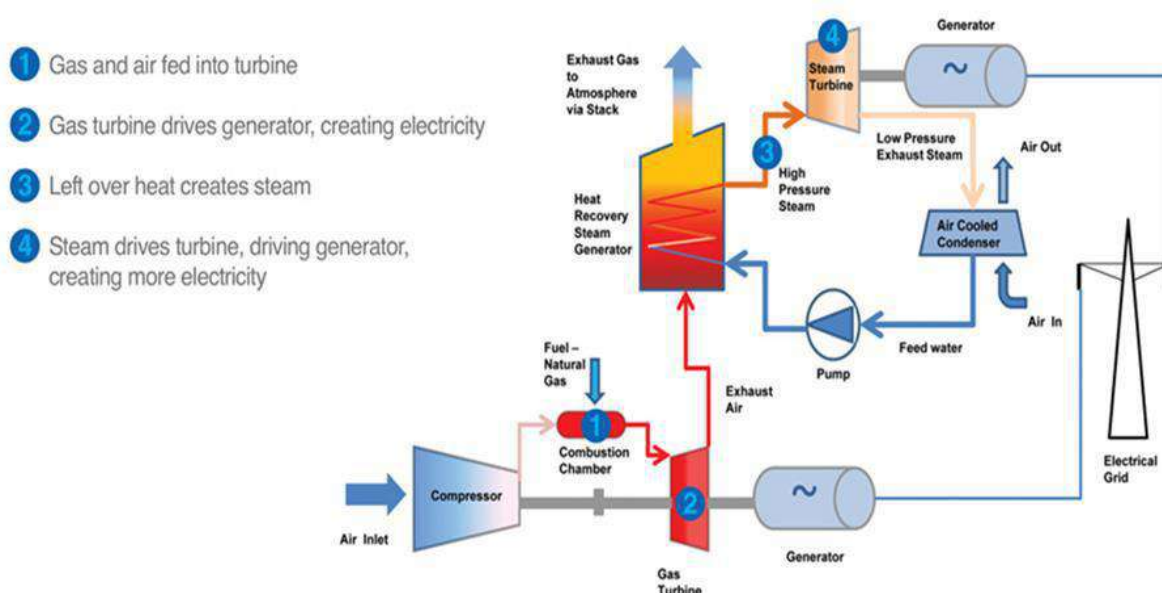


Figure 1.9 Schematic diagram of a typical CCGT (Meaford energy centre)

The power plant is intended to operate using natural gas received by pipeline or transported to site as LNG in rail cars. LNG could be stored on site (up to 5000 m³ in cryogenic vessels) and regasified into natural gas on site or at the railway offloading point. Should the natural gas pipeline or LNG supply not be ready at the start-up of the power plant diesel (up to 10 000 m³ stored) would be used to fuel the turbines. Diesel would also be used as a backup for natural gas in the event of outages.

The power plant would use either sea water or air for cooling. Should sea water be the choice of operation, a water treatment section would be required to remove biological growth and purify the water to the extent where it could be used in the process.

1.2.1.1. Utilities Expected at the Facility

The following utilities have been provided for in the study. Options using the most hazardous substances are assumed and inventories are estimated. The hazardous inventories assumed are conservative estimations and inventories should be less in the installed facility.

1.2.1.1.1. Seawater System

Seawater could be used in the vaporiser and for firefighting. It would be pumped using electric pumps or possibly diesel standby pumps for emergencies. It would have to be filtered and treated to remove any marine growth. Water would be returned to the sea after passing through the vaporisers.

It would be sanitised by either direct injection of chlorine or by the production of low concentration sodium hypochlorite.

This study assumes a common chlorine installation with chlorine being used for both seawater treatment and wastewater. It assumes three 925 kg chlorine drums would be kept on site with one drum connected to the seawater, one to the wastewater system and one spare.

Gaseous chlorine would be drawn through an eductor into the water at the required rate.

1.2.1.1.2. Sewage and Wastewater System

Provision has been made for a sewerage and wastewater system. Water would be cleaned prior to discharge.

This study assumes the use of chlorine and ammonia in a common facility as that for seawater.

1.2.1.1.3. Ammonia Installation

Anhydrous ammonia may be used to condition water for use in the boiler. It is assumed that it would be delivered to site in 8–10 t trucks and offloaded into a single 20 m³ storage vessel.

1.2.1.1.4. Hydrogen Installation

Hydrogen is expected to be used a coolant for the mechanical bearings and to be produced on site on by splitting water into hydrogen and oxygen in an electrolyser.

Oxygen would be vented to the atmosphere, while the hydrogen from the electrolyzers would be compressed and stored in three 10 m³ vessels at a maximum pressure of 25 bar.

1.2.1.1.5. Petrol and Diesel Filling Station

This study includes a fuel filling station used to fill company vehicles with diesel and petrol using commercial filling pumps.

The station would consist of underground storage vessels, including one 23 m³ petrol storage vessel and two 23 m³ diesel storage vessels.

The assumed frequency of delivery would be twelve deliveries of petrol and diesel per annum each.

1.2.1.1.6. Diesel Storage for Turbines

Provision has been made to provide 10 000 m³ of diesel as fuel for the turbines. In order to prevent dirt blocking the burners, the diesel would be required to stand in the storage vessel for

24 hours to allow particles to settle. To this end a minimum of three storage vessels would be required, one in use, one for settling and one being filled. The design assumes three 3500 m³ storage vessels with secondary containment equal to 110% of the largest vessel with a bund wall height limited to 1.8 m in height.

Diesel would be delivered to site via road or rail, offloaded in a dedicated area and pumped to the storage area.

1.2.1.1.7. Diesel Storage for Gensets

This study assumes an emergency genset would be provided for each boiler house. Gensets would operate on diesel stored in aboveground storage vessels of 10 m³.

Diesel would be delivered to site by road tankers and offloaded into the vessels. The vessels would have containment below them. The frequency of delivery would be 24 deliveries per year per aboveground vessel.

1.2.1.1.8. Nitrogen Installation

Nitrogen is an inert gas and would be used to purge lines and equipment prior to maintenance. It is expected that nitrogen would be stored in gas cylinders or a cryogenic storage vessel or would be produced on site by removing the nitrogen from the air.

1.2.1.1.9. Flare System

Vapours from vents, pressure safety valves, storage and compressors would be directed to the flare manifold where it would be released via the flare.

The flare would not always be in use but would require a small pilot flame fuelled by LPG. This would typically be stored as LPG in cylinders or a bulk storage vessel.

1.2.1.1.10. Potable Water

It is expected that potable water would be supplied by the municipality.

1.2.2. Project Location

The proposed power plant would be located in the Atlantis industrial area about 40 km north of Cape Town and 7 km from the Atlantic Ocean. The site is bounded by Neil Hare Road to the north and south, Gideon Basson Street to the west and the railway line to the east as shown in Figure 1.10.

The proposed power plant would be located in an industrially zoned area with the Ankerlig power station to the north and Atlantis Foundries to the east. The closest residential areas are Avondale, Witsand and Protea Park situated some 2.7 km from the proposed site.

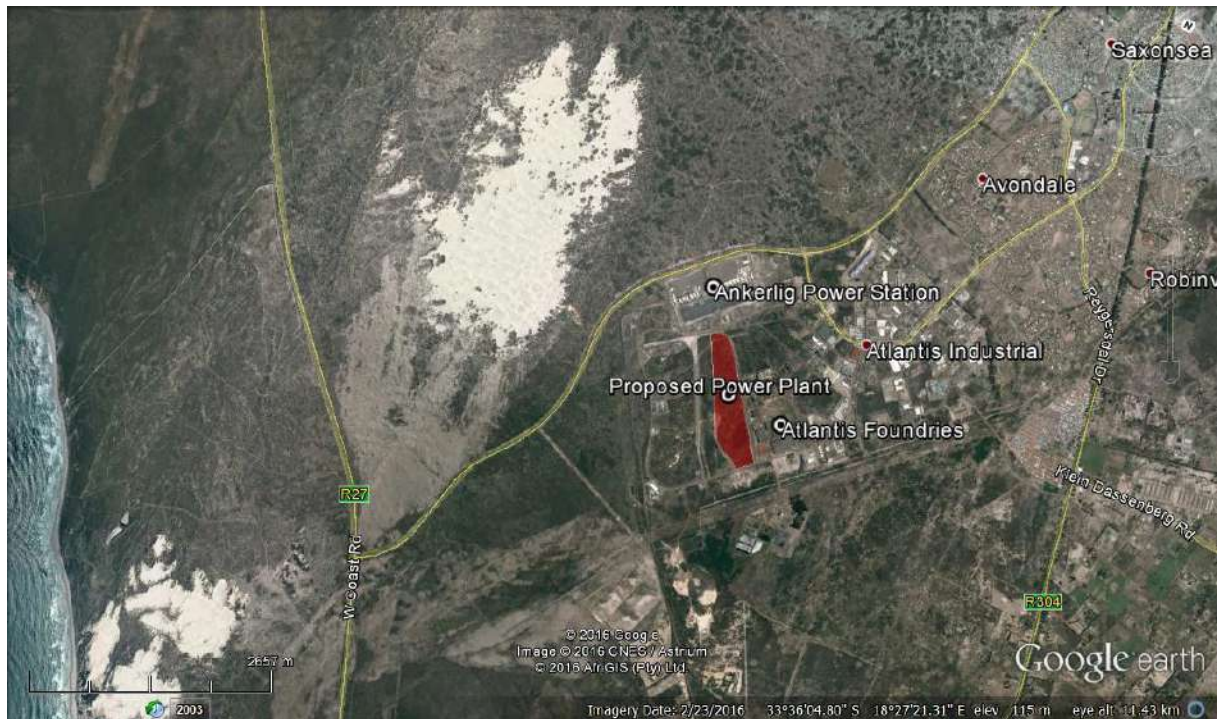


Figure 1.10 Location of the proposed power plant in Atlantis

Layout still has to be finalised. A typical facility would have a footprint of 157 m by 113 m without support buildings and structures, such as fuel storage, and would fit comfortably on the proposed site, as shown in Figure 1.11.

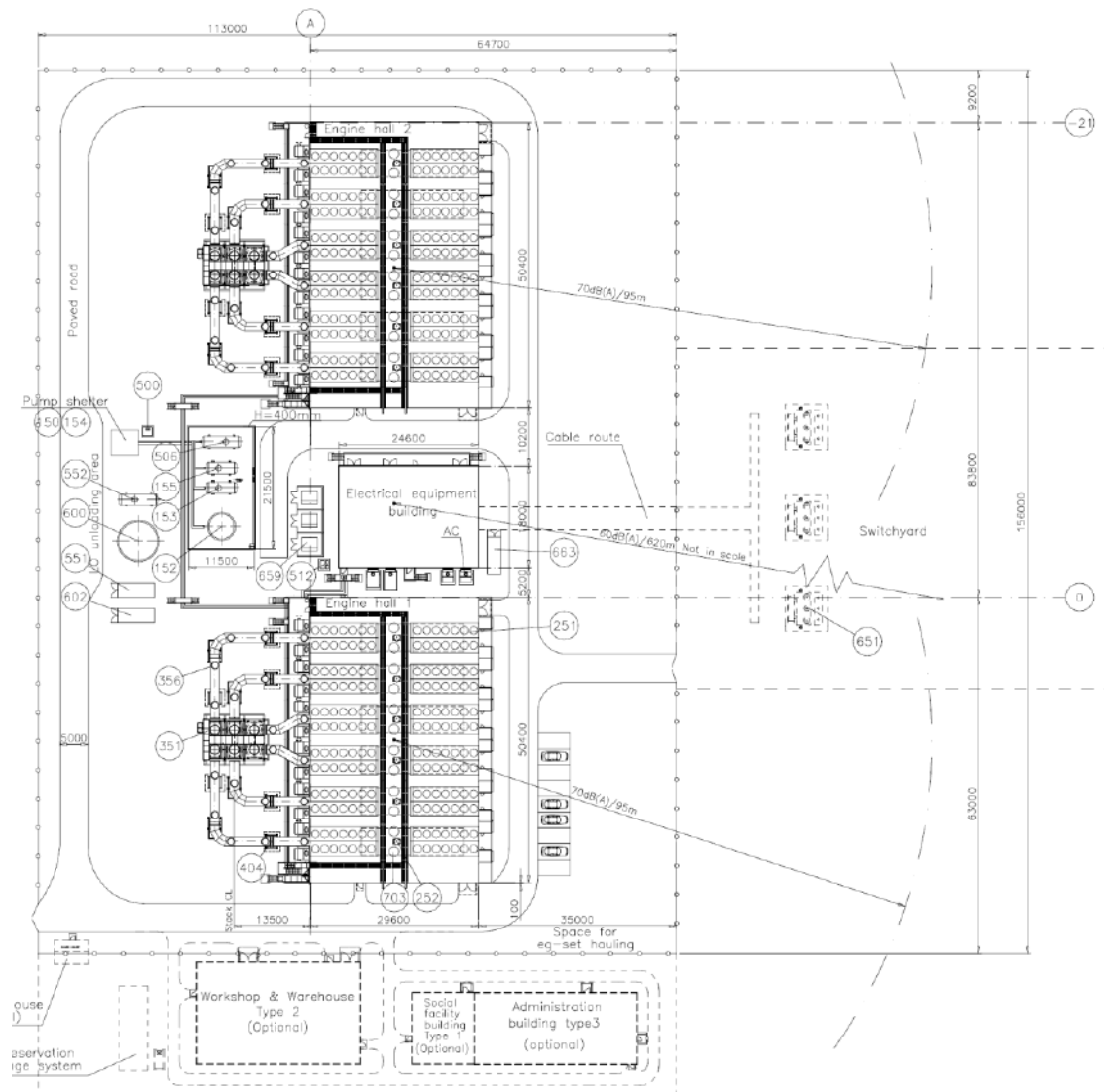


Figure 1.11 Typical power plant layout

1.2.3. Meteorology

Meteorological mechanisms govern the dispersion, transformation and eventual removal of hazardous vapours from the atmosphere. The extent to which hazardous vapours will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises of vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface, i.e. the mixing layer, define the vertical component. The horizontal dispersion of hazardous vapours in the boundary layer is primarily a function of wind field. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume stretching. Similarly, the generation of mechanical turbulence is a function of the wind speed in combination with surface roughness. Wind direction and variability in wind direction both determine the general path hazardous vapours will follow and the extent of crosswind spreading. Concentration levels of hazardous vapours therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth and to shifts in the wind field.

The meteorological conditions at Atlantis, as measured by the South African Weather Service, were used as the basis for wind speed, direction and atmospheric stability for the proposed project, unless otherwise stated.

1.2.3.1. Surface Winds

Surface meteorological data, including hourly average wind speed and wind direction recorded at Atlantis, was obtained by the South African Weather Service for the period from the 1st of January 2011 to the 31st of December 2015.

The wind roses in Figure 1.12 depict the seasonal variances of the measured wind speeds. In the summer months, the wind blows predominantly from the south-southeast, with wind speeds of over 10 m/s being common. During the winter months, the calm periods increase to 11.3%, with low to medium wind speeds predominantly from the northeasterly direction but with significant wind frequencies from the northwesterly and southeasterly directions.

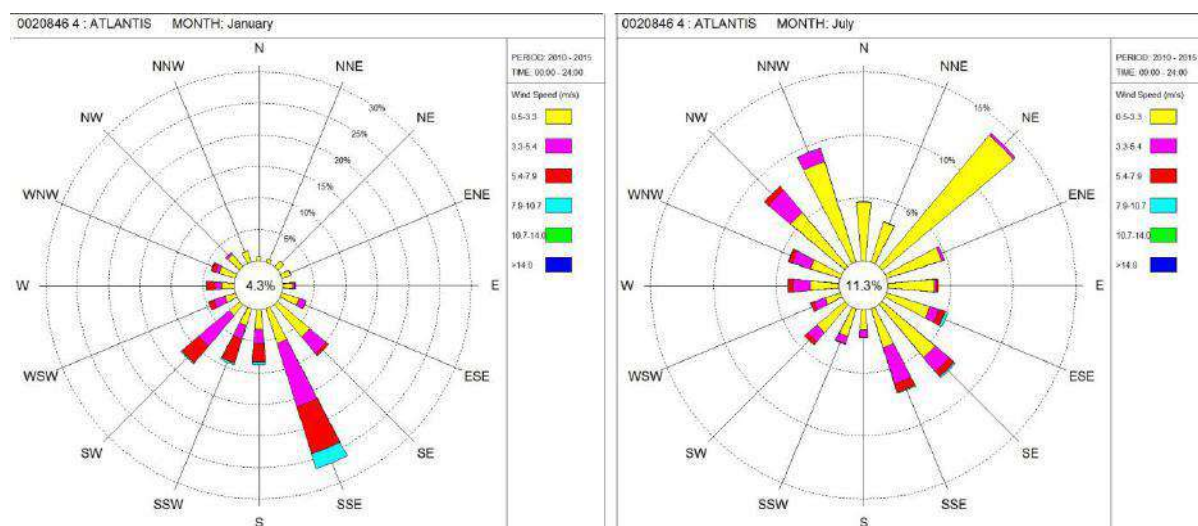


Figure 1.12 Seasonal wind speed as a function of wind direction at Atlantis for the period of 2010 to 2015

1.2.3.2. Precipitation and Relative Humidity

Cape Town International Airport is situated about 40 km from Atlantis. The long-term rainfall at the airport, as measured by the South African Weather Service, over the period between 1961 and 1990, is given in Table 1.20.

Cape Town is relatively dry, with an average annual rainfall of 515 mm and dry seasons ranging from November to March.

Table 1.20 Long-term rainfall at Cape Town International Airport

Month	Precipitation		
	Average Monthly (mm)	Average No. of Days with ≥ 1 mm	Highest 24 hour Rainfall (mm)
January	15	6	41
February	17	5	27
March	20	5	42
April	41	8	39
May	69	11	65
June	93	13	58
July	82	12	61
August	77	14	56
September	40	10	29
October	30	9	53
November	14	5	30
December	17	6	21
Year	515	103	65

The relative humidity for Atlantis, as measured by the South African Weather Services, for a period of 2010 to the end of 2015, is shown in Table 1.21.

The maximum humidity would be experienced during the night with lower temperatures.

Table 1.21 Average monthly maximum and minimum relative humidity measured for Atlantis

Month	Maximum Average Relative Humidity (%)	Maximum Average Relative Humidity (%)
January	87.6	36.0
February	88.2	36.8
March	89.8	40.3
April	89.0	37.7
May	93.3	48.0
June	94.5	51.5
July	93.5	48.7
August	93.2	48.5
September	92.2	44.7
October	90.8	39.2
November	88.7	37.2
December	86.7	36.8

1.2.3.3. Temperature

Air temperature, as shown in Table 1.22, is important for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), estimating evaporation rates and determining the development of the mixing and inversion layers.

Over the course of a year, temperatures typically vary from 6°C to 28°C and are rarely below 4°C or above 30°C.

Table 1.22 Long-term temperatures measured at Atlantis measured from 1980-2015

Month	Temperature (°C)			
	Highest Recorded	Lowest Recorded	Average Daily Maximum	Average Daily Minimum
January	41	5	28	15
February	41	5	28	15
March	43	4	27	13
April	39	2	24	11
May	34	1	21	9
June	31	-2	18	7
July	29	-3	18	6
August	32	-2	18	7
September	37	0	20	8
October	39	1	23	10
November	40	3	24	12
December	40	3	26	14
Year	37	1	23	10

1.2.3.4. Atmospheric Stability

Atmospheric stability is frequently categorised into one of six stability classes. These are briefly described in Table 1.23. Atmospheric stability, in combination with wind speed, is important in determining the extent of a particular hazardous vapour release.

A very stable atmospheric condition, typically at night, would have low wind speeds and produce the greatest endpoint for a dense gas. Conversely, a buoyant gas would have the greatest endpoint distance at high wind speeds.

Table 1.23 Classification scheme for atmospheric stability

Stability Class	Stability Classification	Description
A	Very unstable	Calm wind, clear skies, hot conditions during the day
B	Moderately unstable	Clear skies during the day
C	Unstable	Moderate wind, slightly overcast conditions during the day
D	Neutral	Strong winds or cloudy days and nights
E	Stable	Moderate wind, slightly overcast conditions at night
F	Very stable	Low winds, clear skies, cold conditions at night

The atmospheric stability for Atlantis as a function of the wind class, was calculated from hourly weather values supplied by the South African Weather Services from the 1st of January 2011 to the 31st of December 2015, as given in Figure 1.13.

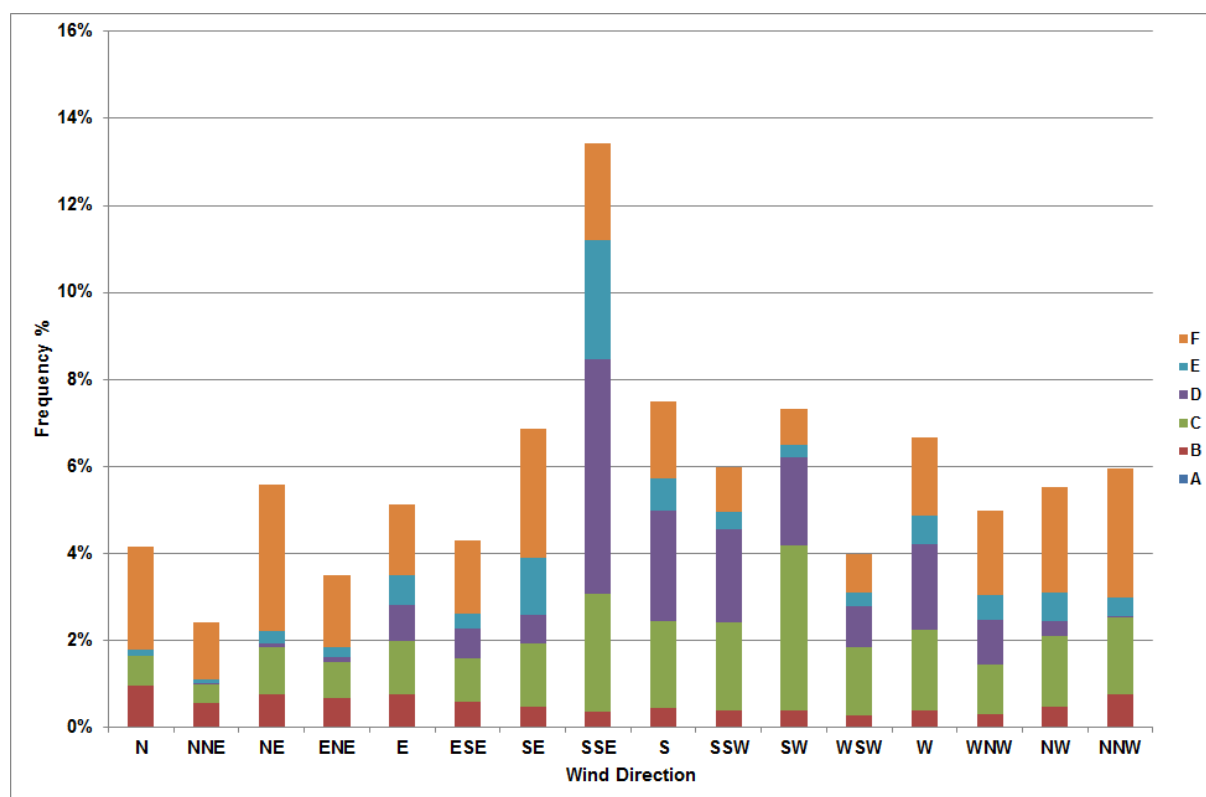


Figure 1.13 Atmospheric stability as a function of wind direction

Calculations for this risk assessment are based on six representative weather classes covering stability conditions of stable, neutral and unstable as well as low and high wind speeds. In terms of Pasquill classes, representative conditions are given in Table 1.24.

Table 1.24 Representative weather classes

Stability Class	Wind (m/s)
B	3
D	1.5
D	5
D	9
E	5
F	1.5

As wind velocities are vector quantities (having speed and direction) and blow preferentially in certain directions, it is mathematically incorrect to give an average wind speed over 360° of wind direction; the result would be incorrect risk calculations.

It would also be incorrect to base risk calculations on one wind category, such as 1.5/F for example. In order to obtain representative risk calculations, hourly weather data for wind speed and direction was analysed over a five-year period and categorised into the six wind classes for day and night conditions and sixteen wind directions. The risk was then determined using contributions from each wind class in various wind directions.

The allocation of observations into the six weather classes is summarised in Table 1.25 with the representative weather classes given in Figure 1.14.

Table 1.25 Allocation of observations into six weather classes

Wind Speed	A	B	B/C	C	C/D	D	E	F
< 2.5 m/s	B 3 m/s			D 1.5 m/s			F 1.5 m/s	
2.5–6 m/s				D 5 m/s			E 5 m/s	
> 6 m/s				D 9 m/s				

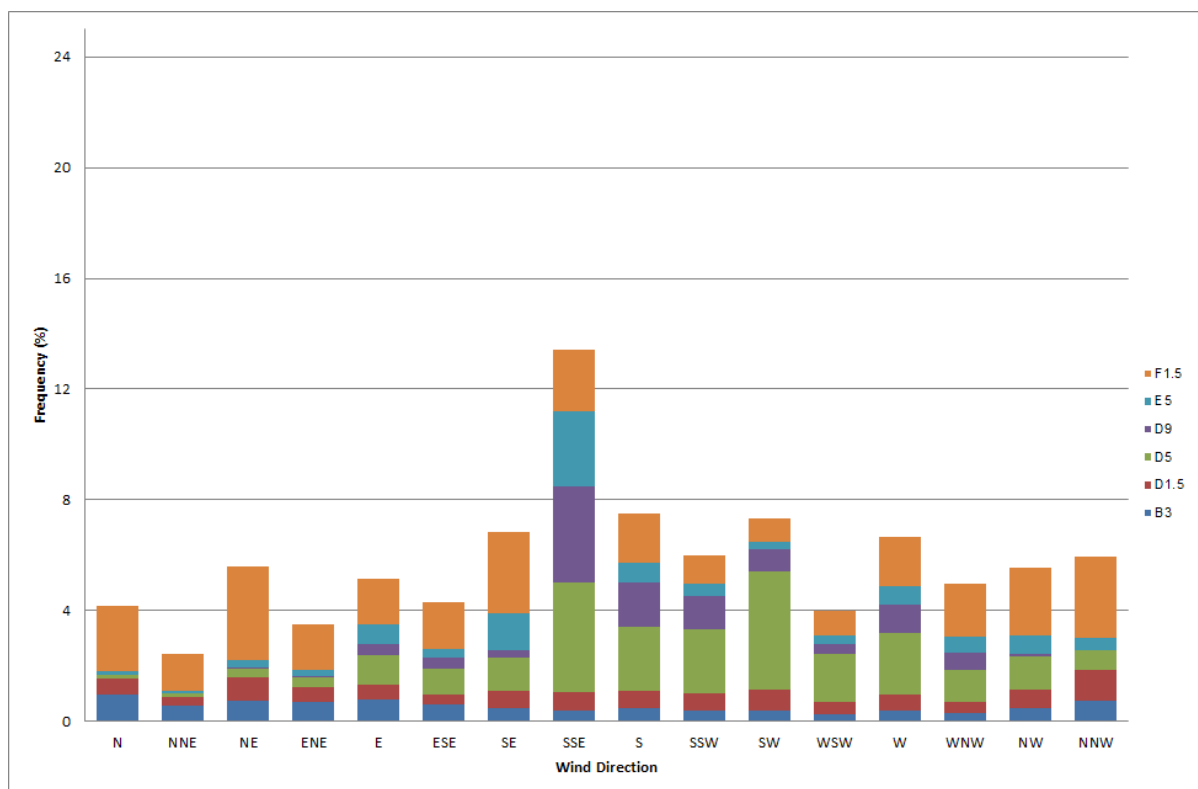


Figure 1.14 Representative weather classes for Atlantis

1.2.3.5. Meteorological Values

The meteorological values used in simulations, based on local conditions, are given in Table 1.26.

Table 1.26 Default meteorological values used in simulations, based on local conditions

Parameter	Default Value (Day)	Default Value (Night)
Ambient temperature (°C)	23	10
Substrate or bund temperature (°C)	17	17
Water temperature (°C)	17	17
Air pressure (bar)	1.013	1.013
Humidity (%)	42	91
Fraction of a 24-hour period	0.5	0.5
Mixing height	11	10

¹¹ The default values for the mixing height, which are included in the model, are: 1500 m for Weather Category B3; 300 m for Weather Category D1.5; 500 m for Weather Category D5 and Weather Category D9; 230 m for Weather Category E5; and, 50 m for Weather Category F1.5.

1.3. APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

1.3.1. Legislation

Legislation discussed in this subsection is limited to the health and safety of workers and the public.

Risk assessments are conducted when required to do so by law or by companies wishing to determine the risks of the facility for other reasons, such as insurance. In South Africa, risk assessments are carried out under the legislation of two separate acts, each with different requirements. These are discussed in the subsections that follow.

1.3.1.1. National Environmental Management Act (No. 107 of 1998; NEMA) and its Regulations

The National Environmental Management Act (NEMA) contains South Africa's principal environmental legislation. It has as its primary objective to make provision for cooperative governance by establishing principles for decision making on matters affecting the environment, on the formation of institutions that will promote cooperative governance and on establishing procedures for coordinating environmental functions exercised by organs of state as well as to provide for matters connected therewith (Government Gazette 1998).

Section 30 of the NEMA act deals with the control of emergency incidents where an "incident" is defined as an "unexpected sudden occurrence, including a major emission, fire or explosion leading to serious danger to the public or potentially serious pollution of or detriment to the environment, whether immediate or delayed".

The act defines "pollution" as "any change in the environment caused by:

- (i) Substances;
- (ii) Radioactive or other waves; or
- (iii) Noise, odours, dust or heat...

Emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or wellbeing or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future..."

"Serious" is not fully defined but would be accepted as having long lasting effects that could pose a risk to the environment or to the health of the public that is not immediately reversible.

This is similar to the definition of a Major Hazard Installation as defined in the Occupational Health and Safety Act (OHS Act) 85 of 1993 and its Major Hazard Installation (MHI) regulations.

Section 28 of NEMA makes provision for anyone who causes pollution or degradation of the environment being made responsible for the prevention of the occurrence, continuation or reoccurrence of related impacts and for the costs of repair of the environment. In terms of the provisions under Section 28 that are stated as:

“ 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, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped...”

1.3.1.2. The Occupational Health and Safety Act No. 85 of 1993

The Occupational Health and Safety Act 85 (1993) is primarily intended for the health and safety of the workers, whereas its MHI regulation is intended for the health and safety of the public.

The OHS Act shall not apply in respect of:

- “a) A mine, a mining area or any works as defined in the Minerals Act, 1991 (Act No. 50 of 1991), except in so far as that Act provides otherwise;
- b) Any load line ship (including a ship holding a load line exemption certificate), fishing boat, sealing boat and whaling boat as defined in Section 2 (1) of the Merchant Shipping Act, 1951 (Act No. 57 of 1951), or any floating crane, whether or not such ship, boat or crane is in or out of the water within any harbour in the Republic or within the territorial waters thereof, (date of commencement of paragraph (b) to be proclaimed.), or in respect of any person present on or in any such mine, mining area, works, ship, boat or crane.”

While the OHS Act has made provision for excluding the application of the act on shipping activities, Clause 78 (see below) of the Government Notice 255 Ports Rules (March 2009) requires compliance of the OHS Act and its regulations.

“ 78. Occupational health and safety legislation
All persons, including service providers, terminal operators, drivers of transport vehicles, employers, lessees and visitors within port limits, must comply with the provisions of any legislation relating to occupational health and safety matters, including the Merchant Shipping Act No. 57 of 1951, the Occupational Health and Safety Act No. 85 of 1993 and its regulations, the Maritime Safety Regulations of 1994, the IMDG Code and the National Road Traffic Act No. 93 of 1996.”

1.3.1.2.1. Major Hazard Installation Regulations

The Major Hazard Installation (MHI) regulations (July 2001) published under Section 43 of the Occupational Health and Safety Act (OHS Act) require employers, self-employed persons and users who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk (our emphasis) that could affect the health and safety of workers and the public to conduct a risk assessment in accordance with the legislation. In accordance with legislation, the risk assessment must be done by an AIA, which is registered with the Department of Labour and accredited by the South African Accreditation Systems (SANAS), prior to construction of the facility.

Similar to Section 30 of NEMA as it relates to the health and safety of the public, the MHI regulations are applicable to the health and safety of workers and the public in relation to the operation of a facility and specifically in relation to sudden or accidental major incidents involving substances that could pose a risk to the health and safety of workers and the public.

It is important to note that the MHI regulations are applicable to the risks posed and not merely the consequences. This implies that both the consequence and likelihood of an event need to be evaluated, with the classification of an installation being determined on the risk posed to the employees and the public.

The notification of the MHI is described in the regulations as an advertisement placement and specifies the timing of responses from the advertisement. It should be noted that the regulation does not require public participation.

The regulations, summarised in Appendix E, essentially consists of six parts, namely:

1. The duties for notification of a Major Hazard Installation (existing or proposed), including:
 - a. Fixed;
 - b. Temporary installations;
2. The minimum requirements for a quantitative risk assessment (QRA);
3. The requirements for an on-site emergency plan;
4. The reporting steps for risk and emergency occurrences;
5. The general duties required of suppliers;
6. The general duties required of local government.

1.3.1.3. Pressure Equipment Regulations

With a view to health and safety, these regulations apply to the design, manufacture, operation, repair, modification, maintenance, inspection and testing of pressure equipment with a design pressure equal to or greater than 50 kPa.

1.3.1.3.1. SANS 347 Categorisation and Conformity Assessment Criteria for all Pressure Equipment

This standard specifies criteria to be used for categorization and conformity assessment of pressure equipment (metallic and non-metallic) for use by but not limited to the manufacturer, users, certification bodies and approved inspection authorities. This standard is also applicable to the certification, recertification, modification or repair of pressure equipment (metallic and non-metallic), as defined by the relevant statutory regulations for pressure equipment. In Annex A of the South African National Standard SANS 347:2012 there is a schedule of health and safety standards approved by the Department of Labour. Application of the selected health and safety standards in their entirety becomes mandatory under the provisions of the preliminary environmental review (PER).

1.3.1.4. LNG Codes and Standards

The codes and standards proposed for this project are given in Appendix H. However, no codes or standards have been specifically related to LNG. European standards relating to LNG are listed as follows:

- EN 1160 outlines installations and equipment for liquefied natural gas (general characteristics of liquefied natural gas);
- EN 1473 installations and equipment for liquefied natural gas (design of onshore installations);
- EN 1474 outlines installations and equipment for liquefied natural gas, Part 1: design and testing of loading and unloading arms; Part 2: design and testing of LNG hoses; Part 3: design and testing of offshore LNG transfer systems;
- EN 1532 outlines installations and equipment for liquefied natural gas (ship to shore interface);
- EN 12065 outlines testing of foam concentrates designed for generation of medium and high expansion foam and of extinguishing powders used on LNG fires;
- EN 12066 outlines testing of insulating linings for LNG impounding areas;
- EN 12308 outlines suitability testing of gaskets designed for flanged joints used on -LNG piping;
- EN 12838 outlines suitability testing of LNG sampling systems;
- EN 13645 outlines design of onshore installations with a storage capacity between 5 t and 200 t.

EN 1473 is the most comprehensive of the European standards and is intended to be used for large onshore LNG installations. The purpose and application of this EN standard is to give guidelines for the design, construction and operation of all onshore liquefied LNG installations including those for the liquefaction, storage, vaporisation, transfer and handling of LNG.

The standard used in the US follows:

- NFPA 59A outline the standard for the production, storage and handling of liquefied natural gas (LNG).

1.4. IDENTIFICATION OF KEY ISSUES

1.4.1. Key Issues Identified During the Scoping Phase

1.4.1.1. Hazard Identification

Definitions and descriptions are provided under the subsection describing the methodology of hazard identification used in this report.

1.4.1.1.1. Notifiable Substances

Methane (compressed) is listed as a notifiable substance at a threshold value of 15 t. The schedule does not specifically mention liquefied natural gas (LNG). To this end LNG would not be classified as a notifiable substance.

However, if the design changes so that more than 15 t of compressed natural gas (CNG) would be contained in a single container, the CNG would be classified as a notifiable substance and the facility would automatically be classified as a Major Hazard Installation.

1.4.1.1.2. Substances Hazards

1.4.1.1.2.1. Chemical Properties

The material safety data sheets (MSDSs) of the respective materials are attached in Appendix I.

1.4.1.1.2.1.1. Natural Gas

The composition of natural gas is primarily methane ($\pm 95\%$ v/v), with other components including ethane, propane and nitrogen.

Given the flammable and potentially explosive nature of natural gas, fires and VCEs represent the primary hazards associated with transfer of the gas. The gas is a fire and explosion hazard when it is exposed to heat and flame. The lower explosive limit (LEL) is 5% v/v (meaning 5% gas to 95% air, measured by volume) and the higher explosive limit (HEL) is 15% v/v. In unconfined atmospheric conditions, the likelihood of an explosion is expected to be small.

It is not compatible with strong oxidants and could result in fires and explosions in the presence of such materials.

It is nontoxic and would be considered as an asphyxiant only. Chronic and long-term effects are low and are not listed.

It is in the gaseous state at atmospheric temperatures and pressures. Economical transportation would require either liquefying or compressing the gas so that it would occupy less volume per weight. LNG has a low temperature of -162°C (at atmospheric pressure). The critical pressure of methane is 46 bar; CNG would be above the critical pressure and would be a supercritical gas having a density similar to that of the liquid.

1.4.1.1.2.1.2. Chlorine

Chlorine is a greenish-yellow gas, with an irritating and suffocating odour. This gas is extremely toxic and a powerful oxidising agent. It has to be handled, stored and processed with caution.

It is very reactive and may cause ignition on contact with the following components: methane; oxygen; hydrazine; hydroxylamine; calcium nitride; diethyl ether; diethyl zinc; potassium, sodium and copper hydrides; boron; active carbon; silicon; phosphorus; arsenic powder; arsine; phosphine; silane; trialkylboranes (lower homologues); dicopper acetylide; zirconium dicarbide (at 250°C); arsenic disulphide; boron trisulphide; mercuric sulphide; boron diiodophosphide; phosphorus trioxide; and, trimercury tetraphosphide. Trimagnesium diphosphide and trimanganese diphosphide would ignite in warm chlorine. Metals such as tin, aluminium, brass, calcium, copper, iron, manganese, potassium, antimony, bismuth, magnesium, sodium, zinc, thorium, tin, uranium, nickel, mercury, aluminium-titanium alloys and niobium ignite in chlorine under various conditions. Titanium components would not be suitable for contact with dry chlorine gas or liquid. Steel ignites in chlorine under various conditions. Ignition has occurred during continuous chlorination of polyisobutene.

It may react explosively with amidosulphuric acid, antimony trichloride and tetramethylsilane (at 100°C), tert-butanol, butyl rubber, naphtha, carbon disulphide, 3-chloropropyne, dibutyl phthalate, dichloride (methyl) arsine, disilyl oxide, glycerol, white phosphorus (at -34°C), hexachlorodisilane (9), diborane, stibine, ethylphosphene; silicones, synthetic rubber, aluminium, oxygen difluoride (on warming), benzene, tetraselenium tetranitride, dimethyl phosphoramidate, methanol and tetrapyridine cobalt (II) chloride, methane (over yellow mercury oxide), ethylene, ethane and petrol. Explosive reactions with acetylene have occurred under a variety of conditions. Injection of liquid chlorine into a naphtha-sodium mixture may cause a violent explosion. Other incidents involving saturated hydrocarbons and chlorine have been reported, as have incidents involving organic auxiliary materials. Combination with hydrogen may be explosive over a wide range of conditions, and equimolar mixtures of chlorine and hydrogen containing 0.1-0.2% nitrogen trichloride explode in absence of light if the pressure is below a limiting value.

In humans, short-term (acute) exposure to high levels (> 30 ppm) results in chest pain, vomiting, toxic pneumonitis, pulmonary oedema and eventually death. At lower levels (< 3 ppm), it is a potent irritant to eyes, the upper respiratory tract and lungs.

Limited information is available on long-term (chronic) effects of exposure on humans. However, early literature shows that chronic exposure to concentrations of around 5 ppm causes respiratory complaints, corrosion of teeth, inflammation of mucous membranes of the nose and increased susceptibility to tuberculosis.

No information is available on developmental or reproductive effects on humans or animals via inhalation exposure. A study reported no adverse effects on growth, life span or fertility in rats exposed to 100 ppm in drinking water for their entire life span, over seven generations according to the US Environmental Protection Agency (EPA) Integrated Risk Information System (IRIS). Furthermore, no information is available for carcinogenic effects on humans from inhalation exposure, and it has not been found to be carcinogenic in oral studies with animals.

It is extremely irritating to skin and can cause severe burns. Acute tests on rats and mice have shown high acute toxicity. It is a potent irritant in humans to eyes, the upper respiratory tract and lungs. Several studies have reported the effects shown in **Error! Reference source not found.**

Table 1.27 Acute toxicological effects of chlorine

Concentrations		Effect
(ppm)	(mg/m ³)	
0.014–0.054	0.041–0.157	Tickling of the nose (odour threshold)
0.040–0.097	0.116–0.281	Tickling of the throat
0.060–0.3	0.174–0.870	Itching of the nose, coughing, stinging or dryness of the nose and throat
0.35–0.72	1.015–2.088	Burning of the conjunctiva and pain after 15 minutes
0.5	1.45	Temporary emergency exposure level TEEL-0
1.0	2.9	Threshold level value – time weighted average (TLV-TWA)
1.0	3	Emergency response planning guideline ERPG-1
> 1.0	> 2.9	Discomfort ranging from ocular and respiratory irritation to coughing, shortness of breath and headaches
1.0–3.0	2.9–8.7	Mild mucous membrane irritation
3.0	8.7	Short-term exposure level (STEL)
3.0	7.5	ERPG-2
14	40	Concentration which causes immediate irritation
34	98.9	Lowest reported median lethal concentration LC ₅₀ (human, 30 min)
20	60	ERPG-3
25	72.7	Immediately dangerous to life or health (IDLH)
30	87	Chest pain, vomiting, dyspnoea, coughing
46–60	133.4–174	Toxic pneumonitis and pulmonary oedema
430	1247	Highest reported LC ₅₀ (human, 30 min)
500	1454	Lowest recorded lethal concentration (mammal, 5 min)
873	2538	Lethal concentration (human, 30 min)
1000	2900	Lethal after a few breaths

Information on toxicity of chlorine was studied, and the relationship between toxicity and exposure were produced, as shown in Figure 1.15. Hazard categories were then defined more closely in terms of toxic effects, and the relationships shown in Figure 1.16 were derived. In assessing effects of toxic substances, consideration needs to be given to members of the public who may be more susceptible than the average adult worker, such as children and the elderly.

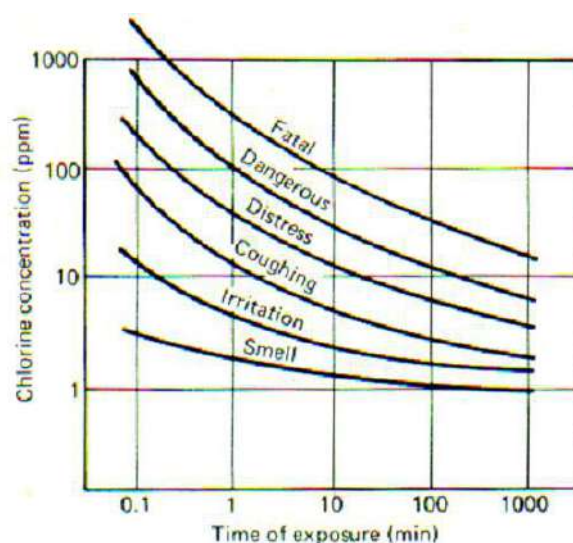


Figure 1.15 Effects of chronic exposure to different concentrations of chlorine vapour (Dicken 1974)

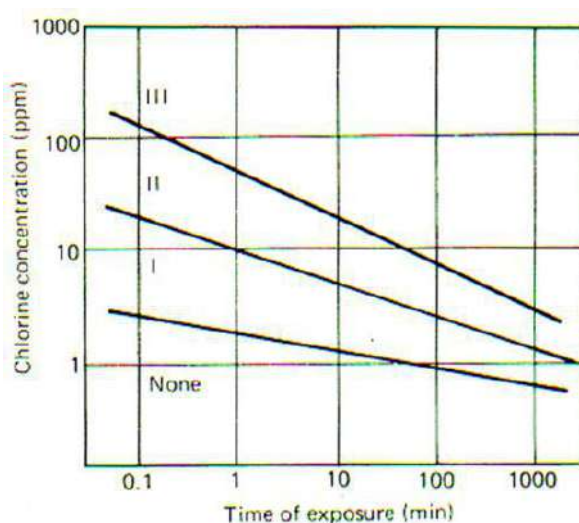


Figure 1.16 Categories of chronic releases (Dicken, 1974) with four categories of hazard defined: Category 0 involves no nuisance to the public; Category I could cause nuisance to the public (acceptable once per year); Category II could cause distress to people, damage to vegetation and could give rise to claim of compensation (acceptable once in 10 years); and, Category III could result in injury or loss of life (acceptable once in 100 years)

There have been a number of major accidents involving chlorine. Analysis has shown that, with one exception, fatalities occur within about 400 m of the release and generally within 250 m from the incident (Lees, 1994). Chlorine released from cylinders tends to have the highest mortality index (fatalities per tonnes released). In this event, the amount of gas released is small but often occurs within a building.

Accidents have involved storage tanks and portable cylinders as well as chlorine transported on trucks, railcars and ships. The worst incident occurred in 1939 at Zarnesti, Romania, where a failure of a chlorine tank killed about 60 people.

1.4.1.1.2.1.3. Ammonia

Ammonia is a colourless gas with a pungent and suffocating odour. It liquefies easily under pressure, with a normal boiling point of -33°C . Although classified as a non-flammable gas, it will burn in 16–25% vapour concentrations in air when exposed to open flames.

It is incompatible with certain materials. It is corrosive to copper, brass, silver, zinc and galvanized steel. Contact with strong oxidizers can result in fires and explosions. It forms explosive products when in contact with calcium hypochlorite (household) bleaches, halogens, gold, mercury and silver. Heat is generated when ammonia dissolves in water. At high temperatures, ammonia emits hydrogen and nitrogen. Products of combustion include nitrogen and water, which are harmless to life and the environment.

The effects of anhydrous ammonia upon the human body vary with the size and weight of the subject and to a lesser extent temperature and humidity.

Contact with liquid ammonia can cause frostbite. Ammonia is soluble in water, forming a corrosive liquid. It is toxic if swallowed or inhaled and can irritate or burn skin, eyes, the nose or the throat at levels as low as 35 ppm but normally at 100–125 ppm, through inhalation or direct contact. At 700 ppm it can cause serious and permanent injury with extreme rapidity.

Upon contact with moist mucosal membranes (such as those in the skin, eyes and respiratory tract), ammonia reacts with water to form a strong alkali, ammonium hydroxide. This causes severe damage to the surface of tissues, thereby exposing more tissue to the effects of the alkali. Symptoms are rapid on contact due to the high water solubility of ammonia and include immediate burning of the eyes, nose and throat and coughing and bronchospasm with wheezing and pulmonary oedema (fluid around the lungs).

Massive exposures can override the absorptive surface area of the upper respiratory tract and result in extensive injury to the lower airways and lung tissue.

There have been a number of major accidents involving ammonia involving storage tanks and pipelines as well as ammonia transported on trucks, railcars and ships.

The worst incident occurred in 1973 in Potchefstroom, South Africa, where a failure of an ammonia tank released approximately 39 t killing 18 people.

There have been a number of nonfatal releases of ammonia. A release of about 600 t of ammonia occurred from a pipeline in Floral, Arkansas, in 1971 and resulted in a fish kill but no injuries. In another incident, 230 t of ammonia was released from a pipeline at McPherson, Kansas, without fatalities.

1.4.1.1.2.1.4. Hydrogen

Hydrogen is a colourless odourless gas that is flammable over a wide range of air or vapour concentrations. The vapour forms an explosive mixture with air. Vapours or gases may travel considerable distances to an ignition source and flash back.

Leaking hydrogen may ignite in the absence of any normally apparent source of ignition and, if so, burns with a practically invisible flame that can instantly injure anyone coming in contact with it. Hydrogen gas is very light and rises rapidly in the air. Concentrations may collect in the upper portions of buildings. The liquid can solidify air and may create an explosion hazard.

The very cold gas, as it comes from the liquid, is slightly heavier than air and may remain near ground level until it warms up. Fog formed when the cold gas contacts atmospheric moisture indicates where the gas is spreading but flammable mixtures may exist beyond the visible fog. Explosive atmospheres may linger. Under prolonged exposure to fire or intense heat the containers may rupture violently and rocket.

It is incompatible with oxygen, oxidising agents, air, lithium and halogens. It may react explosively at elevated temperatures or with heating, alkali metals, halogens, oxygen, oxidizers, oxides, ozone, chlorides, dichlorides and trichlorides of nitrogen and unsaturated hydrocarbons. Divided platinum and some other metals will cause a mixture of hydrogen and oxygen to explode at ordinary temperatures. Embrittlement of steel and other metals such as nickel and copper-nickel alloys will occur at ambient temperatures on exposure to the gas at high pressures.

It is not toxic but is a simple asphyxiant by the displacement of oxygen in the air. Exposure to the liquid may result in frostbite.

1.4.1.1.2.1.5. Petrol (Gasoline)

Petrol is a hydrocarbon mixture with variable composition with a boiling point range of between 20°C and 215°C. It is a pale yellow liquid with strong petroleum odour. Due to the flashpoint of -40°C, it is considered highly flammable and will readily ignite under suitable conditions. The vapours are heavier than air and may travel some distance to an ignition source.

Petrol may contain up to 5% volume of benzene, a known animal carcinogen. It may also contain ethers and alcohols, as oxygenates, to a maximum concentration of 2%. It may also contain small quantities of multifunctional additives to enhance performance in a combustion engine.

It is stable under normal conditions but will react with strong oxidising agents and nitrate compounds. Such a reaction may cause fires and explosions.

Although it is of a low to moderate oral toxicity to adults, ingestion of small quantities may prove dangerous or fatal to small children.

Contact with vapours may result in a slight irritation of nose, eyes and skin. Vapours may cause headache, dizziness, loss of consciousness or suffocation; lung irritation with coughing, gagging, dyspnoea, substernal distress and rapidly developing pulmonary oedema.

If swallowed, it may cause nausea or vomiting, swelling of the abdomen, headache, central nervous system depression, coma and death.

The long-term effects of exposure have not been determined. However, it may affect lungs and may cause skin to dry out and become cracked.

Petrol floats on water and can result in environmental hazards with large spills into waterways. It is harmful to aquatic life in high concentrations.

1.4.1.1.2.1.6. Diesel

Diesel is a hydrocarbon mixture with variable composition and a boiling-point range between 252°C and 371°C. It is a pale yellow liquid with a petroleum odour. Due to a flashpoint between 38°C and 65°C, it is not considered highly flammable, but it will readily ignite under suitable conditions.

It is stable under normal conditions. It will react with strong oxidising agents and nitrate compounds. This reaction may cause fires and explosions.

Diesel is not considered a toxic material. Contact with vapours may result in slight irritation to nose, eyes and skin. Vapours may cause headache, dizziness, loss of consciousness or suffocation as well as lung irritation with coughing, gagging, dyspnoea, substernal distress and rapidly developing pulmonary oedema.

If swallowed, it may cause nausea or vomiting, swelling of the abdomen, headache, central nervous system depression, coma and death.

The long-term effects of exposure have not been determined. However, this may affect the lungs and may cause the skin to dry out and become cracked.

Diesel floats on water and can result in environmental hazards with large spills into waterways. It is harmful to aquatic life in high concentrations.

1.4.1.1.2.1.7. Caustic Soda (Sodium Hydroxide)

Sodium hydroxide is commonly known as caustic soda and is sold as a solid or a dark viscous aqueous liquid. It is non-flammable but may cause combustion on contact with flammable materials.

It is a strong base and reacts rapidly and exothermically with organic and inorganic acids, with organic and inorganic acid anhydrides (including oxides of non-metals such as sulphur dioxide, sulphur trioxide, phosphorus trioxide and phosphorus pentoxide) and with organic and inorganic acid chlorides. It may react explosively with maleic anhydride and other organic anhydrides. It attacks aluminium and zinc with evolution of hydrogen, a flammable gas. It may initiate violent polymerisation in polymerisable organic materials, including acetaldehyde and acrolein. It reacts when heated (above 84°C) with aqueous solutions of reducing sugars other than sucrose to evolve toxic levels of carbon monoxide.

Caustic soda is irritating and corrosive to all tissues. Most frequent exposures involve direct skin and eye contact, although inhalation of mist or dust can occur. Cases of ingestion are unlikely in industry but may occur accidentally in young children or intentionally.

It is extremely corrosive to the eyes and splashes are especially hazardous. Damage can range from severe irritation and mild corneal scarring to fluid accumulation, disintegration, ulceration and severe corneal scarring and clouding. Permanent blindness may result in severe cases and immediate first aid is vital to avoid permanent damage.

The solid and concentrated solutions are highly corrosive to the skin. Although skin contact may not lead to immediate pain, damage begins at once. Severe ulceration and scarring may result in serious cases.

The oral lethal dose LD₅₀ in rabbits is 500 mg/kg of a 10% solution. Ingestion will cause severe mouth burns. If swallowed, it may cause extensive damage to the oesophagus and may lead to vomiting, prostration, collapse and constrictive scarring.

Inhalation of the dust or concentrated mist may cause irritation and damage to the respiratory tract. Although prolonged exposure to high concentrations may cause discomfort and even ulceration of nasal passages, subjective symptoms are often relied upon as an indication of the need for control.

Sodium hydroxide has not been found to be carcinogenic or mutagenic.

1.4.1.1.2.1.8. Sulphuric Acid

Sulphuric acid is a colourless substance that may emit choking fumes when hot. It is non-flammable, but when it comes in contact with other flammable materials it may react resulting in fires.

It can have violent reactions with water and strong bases, generating heat. It is not compatible with organic materials, chlorates, carbides, fulminates and powdered metals. In contact with metal, it releases flammable hydrogen gas that will explode if ignited in enclosed spaces.

Sulphuric acid is hazardous for skin contact, inhalation, or ingestion. It is corrosive to the skin, eyes, nose, mucous membranes, respiratory and gastrointestinal tracts or any tissue with which it comes in contact. Severe burns can occur, with necrosis and scarring, and may result in death. Milder exposures can cause irritation of the eyes, skin, mucous membranes and respiratory as well as digestive tracts.

Chronic exposure may be associated with changes in pulmonary function, chronic bronchitis, conjunctivitis and overt symptoms resembling acute viral respiratory tract infection. Discoloration and erosion of dental enamel can occur. Long-term exposure may cause mutations in living cells, bronchitis, emphysema, erosion and pitting of teeth, running nose, upset stomach and tearing of the eyes.

1.4.1.1.2.1.9. Lime (Calcium Oxide)

Calcium oxide (CaO), commonly known as burnt lime, lime or quicklime, is a widely used chemical compound. It is a white caustic and alkaline crystalline solid at room temperature that is neither flammable nor toxic.

It is hygroscopic and reacts with water, generating energy sufficient to ignite combustible materials. With water it forms a medium strong base. Calcium oxide may react violently with acids, halogens and metals.

Calcium oxide is usually made by the thermal decomposition of materials, such as limestone, that contain calcium carbonate (CaCO₃), also known as calcite, in a lime kiln. This is accomplished by heating the material to above 825°C in a process called calcination or lime burning, to liberate a molecule of carbon dioxide (CO₂) thereby leaving CaO. This process is reversible, in that once the quicklime product has cooled, it immediately begins to absorb carbon dioxide from the air until, after enough time it is completely converted back to calcium carbonate.

1.4.1.1.2.1.10. *Ferric Chloride*

Ferric chloride is an orange to brown-black solid that is slightly soluble in water. It is noncombustible. It is corrosive to aluminium and most metals producing flammable hydrogen gas and toxic hydrogen chloride gas.

It reacts on contact with nylon, aluminium or aluminium alloys, carbon steel, stainless steel, and copper or copper alloys.

Exposure to the liquid and mist may severely irritate, damage or burn the eyes. The mist is extremely corrosive to the nose, throat and mucous membranes.

Ingestion may cause corrosive damage to the gastrointestinal tract. Repeated ingestion of sublethal doses can lead to excessive deposition of iron in the tissues with liver and pancreatic damage.

Higher ingestion exposures may lead to abnormal liver function with nausea or vomiting, reduced appetite or abdominal pain, lethargy, nausea, vomiting, tarry stools, diarrhoea, fast and weak pulse, hypotension, dehydration, acidosis and coma.

1.4.1.1.2.1.11. *Polyaluminium Hydrate*

Polyaluminium hydrate is a colourless odourless liquid and is not considered combustible or highly toxic.

It reacts with hydrogen chloride and corrodes aluminium.

Inhalation may irritate the respiratory tract. Ingestion may irritate the gastrointestinal tract. Contact: may cause moderate irritation to the eyes. It is non-irritating to the skin.

1.4.1.1.2.1.12. *Polyamine*

Polyamine is a straw-coloured liquid with a mild amine odour. It is not considered combustible or highly toxic.

Inhalation may irritate the respiratory tract. Ingestion may irritate the gastrointestinal tract. Contact may cause moderate irritation to the eyes. Skin contact is non-irritating to the skin.

It will react with strong oxidising agents and may produce carbon monoxide, carbon dioxide, oxides of nitrogen and hydrogen chloride as decomposition products.

1.4.1.1.2.1.13. *Sodium Hypochlorite (NaClO)*

Sodium hypochlorite (NaClO) in water solution is a yellow greenish fluid with a pungent odour and is commonly referred to as 'bleach'. It is not considered toxic or flammable.

It is a powerful oxidising agent and can react violently with possible ignition or explosion with organic materials. In the presence of water, it decomposes releasing oxygen and chlorine. Anhydrous sodium hypochlorite is very explosive. Primary amines and calcium hypochlorite or sodium hypochlorite react to form normal chloroamines, which are explosive.

It may be toxic to lungs, mucous membranes, skin and eyes. Repeated or prolonged exposure can produce target organ damage. Repeated or prolonged contact with a spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to a spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection.

1.4.1.1.2.2. Corrosive Liquids

Ammonia, chlorine, caustic soda and sulphuric acid would be considered highly corrosive.

Ammonia and chlorine were analysed as toxic components. It is assumed that caustic soda, sulphuric acid and sodium hypochlorite would be stored sufficiently far from the site boundary that a release would not affect the public.

1.4.1.1.2.3. Reactive Components

All components to be stored on, produced at or delivered to site are considered thermally stable in atmospheric conditions. The reaction with air is covered under the subsection dealing with ignition probabilities.

1.4.1.1.2.4. Flammable and Combustible Components

The flammable and combustible components to be stored on, produced at or delivered to site are listed in Table 1.28. These components have been analysed for fire and explosion risks.

Table 1.28. Flammable and combustible components to be stored on, produced at or delivered to site

Component	Flashpoint (°C)	Boiling Point (°C)	LFL (vol. %)	UFL (vol. %)
Natural gas	-188	-161	5	15
Hydrogen	N/A	-253	4	75
LPG	-103.5	-42	2.1	9.5
Petrol	-40	87	1.4	7.6
Diesel or fuel oil	> 55	290	0.6	7.5

Ammonia will burn in 16–25% vapour concentrations in air when exposed to open flames. However, due to its low reactivity, it is classified as a non-flammable gas and is only assessed on toxicity (RIVM, 2009).

1.4.1.1.2.5. Toxic and Asphyxiant Components

Ammonia, chlorine and sulphuric acid are considered acutely toxic components.

The acute exposure guideline level (AEGl) values are given in Table 1.29.

Table 1.29 Guideline levels for toxic and asphyxiant components

Component	AEGl-1		AEGl-2		AEGl-3	
	mg/m ³	ppm	mg/m ³	ppm	mg/m ³	ppm
Sulphuric acid	0.2	0.06	8.7	2.7	160	50
Chlorine	1.45	0.5	5.8	2	58	20
Ammonia	20.9	30	111	160	766	1100

AEGl values correspond to a one-hour exposure.

Sulphuric acid has a very low vapour pressure and significant amounts of toxic vapour would not be released.

1.4.1.1.3. Physical Properties

For this study, liquid petroleum gas (LPG), petrol, diesel and fuel oil were modelled as pure components, as given in Table 1.30. See Appendix F for the physical and toxicological values used in the simulations.

Table 1.30 Representative components

Component	Modelled as
Natural gas, LNG, CNG	Modelled as methane
Petrol	Modelled as heptane
Diesel	Modelled as dodecane

1.5. HIGH LEVEL ASSESSMENT OF IMPACTS OR RISKS AND IDENTIFICATION OF MANAGEMENT ACTIONS

The risk assessment was done on each processing area by firstly selecting the scenario and completing the outflow and consequence modelling. Consequences with possible impacts beyond the site boundary were retained for the risk analysis of the area. The risk for each selection was completed and finally the risks of the facility are given as a combination of the respective risks for each area.

1.5.1. Installations Not Considered in This Study

The following installations were not considered in this study, as the site inventories would be very small in comparison to the relatively large LNG and diesel inventory:

- Diesel storage for gensets;
- Petrol and diesel filling station;
- Inert gases such as nitrogen;
- Workshop gases;
- Flammable store;
- Laboratory reagents.

Turbine oil, lube oils and greases were excluded from the study as they have very high flashpoints making ignition extremely remote.

It is assumed that corrosive liquids would be stored sufficiently far from the site boundary that a release would not affect the public. The toxic effects of vapours released from sulphuric acid were not considered due its low vapour pressure.

1.5.2. Diesel Storage for Turbines

1.5.2.1. The Purpose of the Processing Unit

Provision has been made to provide 10 000 m³ of diesel as fuel for the turbines. The design would assume three 3500 m³ storage vessels with secondary containment equal to 110% of the largest vessels with a bund wall height limited to 1.8 m in height.

1.5.2.2. Hazardous Components

1.5.2.2.1. Flammable or Combustible Components Stored, Delivered or Processed

Diesel is not flammable but will sustain combustion when ignited.

1.5.2.3. Consequence Modelling

1.5.2.3.1. Bund and Pool Fires

It is expected that a loss of containment from the diesel storage vessels would be contained within the bunded area. On loss of containment, a pool will form and the material will evaporate at a rate determined by the surface area of the pool, the temperature of the pool and wind conditions. In the event of an ignition, the evaporation rate would be replaced with the burning rate.

The maximum effect of a pool fire within the bunded area is shown in Figure 1.17, based on an arbitrary point north of the typical power plant layout.

The 4 kW/m² thermal radiation represents the endpoint of the emergency plan and could extend 78 m downwind from the centre of the bund. Depending on the location of the diesel storage vessels and bunds, emergency planning could be achieved without off-site evacuations.

The 10 kW/m² thermal radiation, representing the 1% fatality, could extend about 45 m downwind from the centre of the bund. Depending on the positioning of the tank farm, potential fatalities from a large bund fire could remain within the site boundary.

The 35 kW/m² thermal radiation, indicating a 100% fatality and initial damage to steel, was not reached limiting the damage to property.

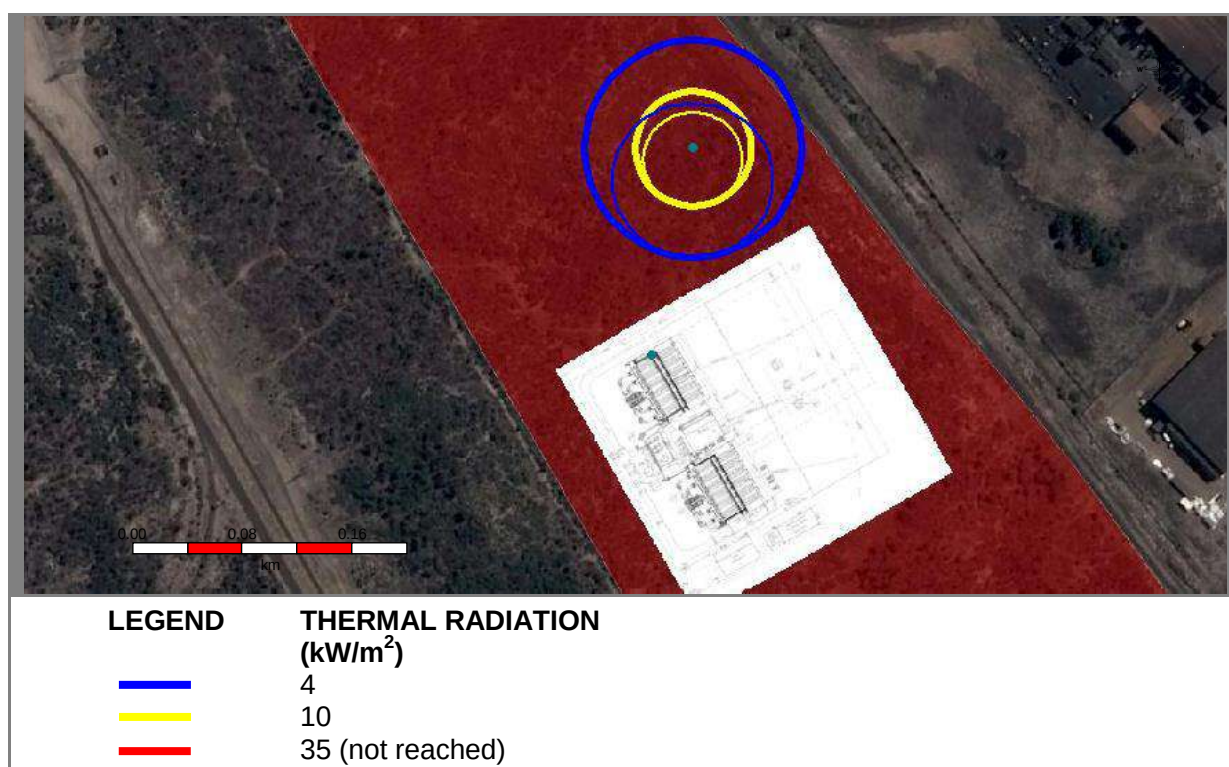


Figure 1.17 Thermal radiation from a large diesel pool fire in the bund

The distance from the diesel tank farm to the site boundary must also consider the values given in SANS 10089, as compliance with SANS 10089 is a requirement under the National Building Regulations and Building Standards Act (No. 103 of 1977).

1.5.2.4. NEMA Section 30 Scenarios

Section 30 scenarios are those that can impact onto the general public and environment and include:

- Tank failure with resulting bund fire;
- Pump failure with a large release of hydrocarbons that would be uncontained with potential ground contamination;
- Tank overfilling resulting bund fire.

The potential ground contamination can be prevented with suitable secondary containment.

1.5.2.5. MIR

Depending on the layout of the diesel tank farm, the risks could remain within the power station boundaries and that would result in acceptable risks. However, the designer must ensure that risks posed to the workers and public should be as low as reasonably practicable.

1.5.2.6. Reduction of Risks

From the simulations performed, a number of events have risks that extend beyond the point of release with potential to impact on future developments. Mitigation which could be considered to reduce this risk includes but is not limited to the points that follow. Mitigation suggested is for consideration only and is not mandatory.

1.5.2.6.1. Risk Ranking

This risk assessment considered numerous scenarios that could result in fires and explosions on site. Some of these scenarios have more serious consequences than other scenarios. The scenarios of particular interest are those with high-risk frequencies extending beyond the boundaries of the site.

Risk reduction starts with the identification of the scenarios with the highest contribution to the overall risk, after which the owner of the power station can determine appropriate mitigation.

The overriding contribution to the risk profile is the overfilling scenario followed by an ignition

1.5.2.6.2. Codes and Standards

The design has indicated that the applicable standard would be SANS 10089. This is an acceptable standard and full compliance with this standard would be expected. This standard also includes secondary containment requirements to prevent releases entering the ground. Full compliance with SANS 10108 covering the types of electrical instrumentation required for the process in order to reduce ignition sources would also be mandatory.

1.5.2.6.2.1. Safety Instrumented Systems

The International Electrotechnical Commission IEC 61508 and IEC 61511 (Safety Instrumented Systems) codes are specifically related to instrumentation requirements to ensure adequate protection from hazards in chemical facilities and are applicable to the life cycle of the plant. These codes are aimed at reducing to acceptable levels risks to surrounding populations.

The significance of these codes is that designs would be evaluated against the criteria of the code and instrumentation with specific failure rates would be specified as well as minimum periods of checking. Therefore, the selection of instrumentation is not based on price alone.

Further to this, instrumentation cannot be reduced or changed without reviewing the code. The specification of this code implies that designs presented at EIA and MHI evaluations cannot be altered at construction for the sole function of reducing costs. Moreover, the code ensures that the facility would continue to maintain safety functions for the life cycle of the plant, maintaining a safe working environment for both workers and the public.

The European standards body CENELEC has adopted this standard as EN 61511. This means that in each of the member states of the European Union, the standard is published as a national standard. For example, in Great Britain, it is published by the national standards body as British Standard BS EN 61511. The content of these national publications is identical with the IEC 61511 code. However, the code is not harmonized under any directive of the European Commission.

In the US American National Standards Institute ANSI/ISA 84.00.01-2004 was issued in September 2004. It mirrors the IEC 61511 code in content with the exception that it contains a grandfathering clause:

“ *Compliance with IEC 61508 and IEC 61511 (or ANSI/ISA 84.00.01-2004) would be a requirement in many countries around the world to achieve an acceptable risk to workers and public.* ”

Demonstrating compliance with the IEC 61508/11 codes can be achieved only once full-detail designs have been completed; it is premature at this stage in the project.

It should be noted that RISCOP would recommend compliance with the IEC 61508/11 codes.

1.5.2.6.2.2. Buncefield Recommendations

Due to the similarity of the diesel oil storage to the depot involved in the Buncefield incident, the recommendations from the Buncefield should be applied to the diesel storage vessels where applicable. Mitigation against overfilling is mentioned in more than one Buncefield recommendation and is applicable to the proposed diesel storage vessels.

1.5.2.7. Assessment of Potential Impacts during the Operational Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	=(f+c+d)*g	-	=(f+c+d)*g	-
Operational Phase										
Scenario: Loss of containment of diesel										
Formation of combustible liquids that could result in a fire which could destroy assets as well as injuring or killing people	Negative	Site specific (1) ¹² , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases
Hydrocarbons into the ground Not considered as proper engineering must be done to ensure that this is not a plausible scenario	-	-	-	-	-	-	-	-	-	-

¹² Scoring as per prior tables and criteria

1.5.3. LNG Storage

1.5.3.1. Purpose of the Processing Unit

LNG could be stored on site (up to 5000 m³ in cryogenic vessels) and regasified into natural gas on site or at the railway offloading point. The regasification unit would convert the liquid gas into a vapour which would be transported to the turbine boilers at a relatively low pressure. Note: storage of gas does not fall into the project description – but should this be necessary, the impacts have been identified below.

In the absence of detailed engineering design, the LNG tank design used in this study was assumed to be a storage vessel with secondary containment as shown in Figure 1.18.

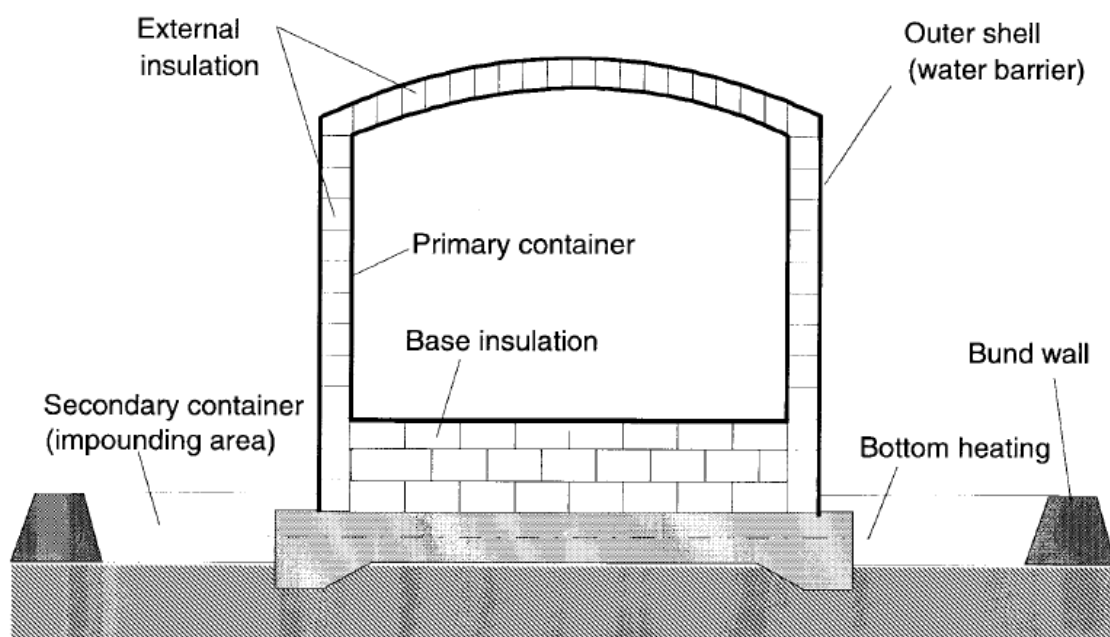


Figure 1.18 LNG storage vessel with secondary containment (Source EN 1473)

Regarding bund sizing, EN 1473 states:

“ When the edges of the bund wall are more than 15 m away from the tank, consideration shall be given to the installation of an impounding basin. “

Flammable liquid leaks can be conveyed in open channels to a remote impounding basin. These channels and the impounding basin can be covered with an insulating layer or built with special materials to limit evaporation (prEN 12066).

Design of impounding basins shall be such that flammable fluids cannot enter the surface water drainage system. Consideration shall be given to the installation of leak detection devices and means to control the evaporation rate in the impounding basin.

As the volume of the LNG vessel would be 5000 m³, the diameter was calculated to be 12 m (assuming the height equals the diameter in length) with the maximum diameter of the bund being 42 m. Therefore, this study assumes the bunded area would be 1500 m² with a diameter 43.7 m

Due to engineering designs not being available, this section concentrates on the loss of containment of the LNG storage only and has not considered auxiliary equipment including flaring of LNG from loading operations and emergency conditions.

1.5.3.2. Consequence Modelling

1.5.3.2.1. Pool Fires

Pool fires due to a loss of containment of the stored LNG would produce the only relevant scenarios. In this instance, the spilt material was assumed to be contained within a bunded area of 1500 m².

The maximum effect of a pool fire within the bunded area is shown in Figure 1.19, based on a strong wind speed at an arbitrary point north of the typical power plant layout.

The 4 kW/m² thermal radiation represents the endpoint of the emergency plan and could extend 160 m downwind from the centre of the bund with potential off-site impacts.

The 10 kW/m² thermal radiation, representing the 1% fatality, could extend about 45 m downwind from the centre of the bund. Depending on the positioning of the tank farm, potential fatalities from a large bund fire could extend beyond the site boundary into neighbouring properties but would not impact residential areas.

The 35 kW/m² thermal radiation, indicating a 100% fatality and initial damage to steel, could be limited to the site without significant damage to assets if located in a suitable area.

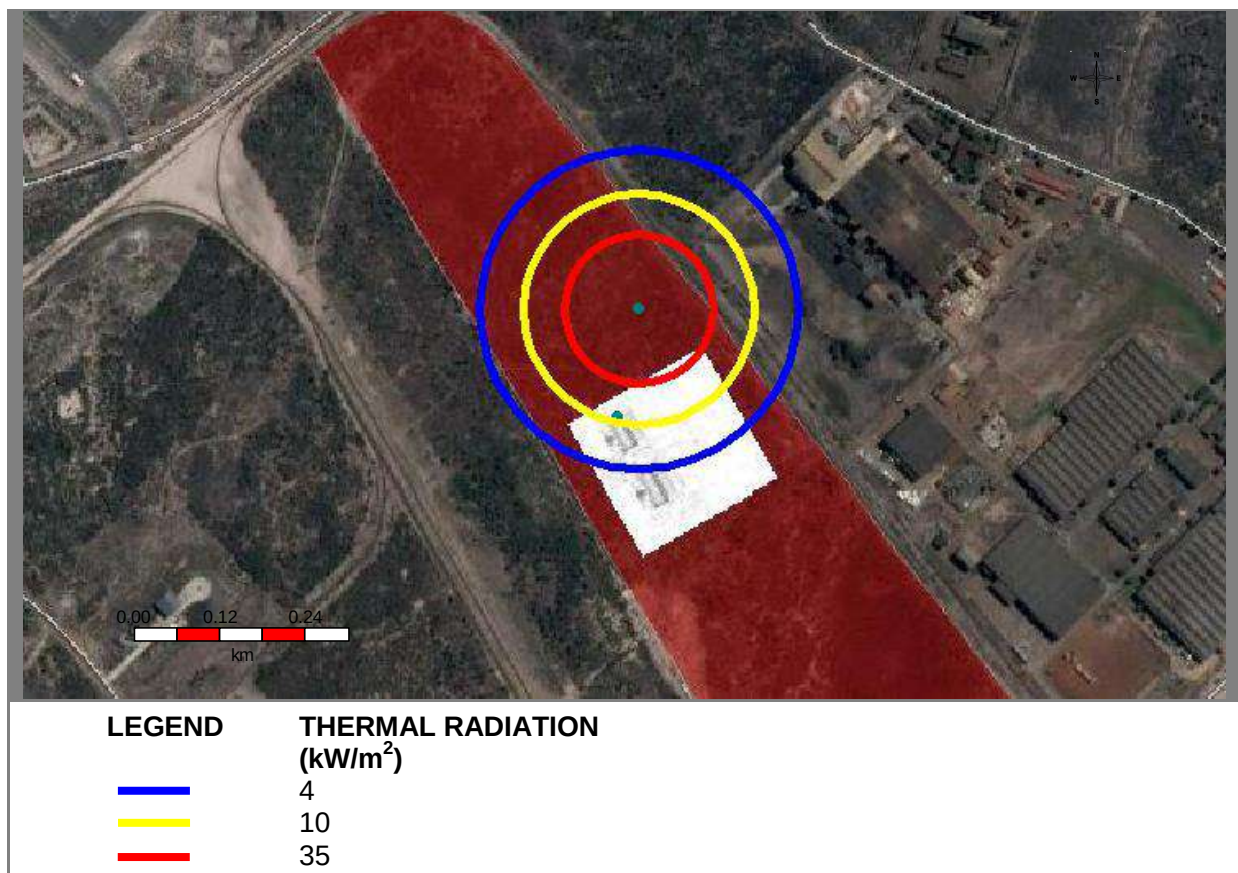


Figure 1.19 Thermal radiation from a large LNG pool fire within a bunded area

1.5.3.2.2. Jet Fires

Jet fires occur when material is released under pressure. The regasification unit is expected to operate under relatively low pressure as the distance to storage would be relatively short. As detail designs have not been completed, pressures have not been identified and are therefore not included.

1.5.3.2.3. Flash Fires

In the event of a large release of LNG, a flash fire could extend to the LFL reaching 730 m and 430 m downwind from a catastrophic release and loss of containment in 10 minutes, respectively. The extent of the flash fire, represented by the LFL, is shown in Figure 1.20. The thin lines indicate the extent of the flash fire from a northerly wind, while the thicker lines represent the extent from all wind directions.

While the impacts could extend beyond the site boundary into neighbouring properties, flash fires would not extend into residential areas.

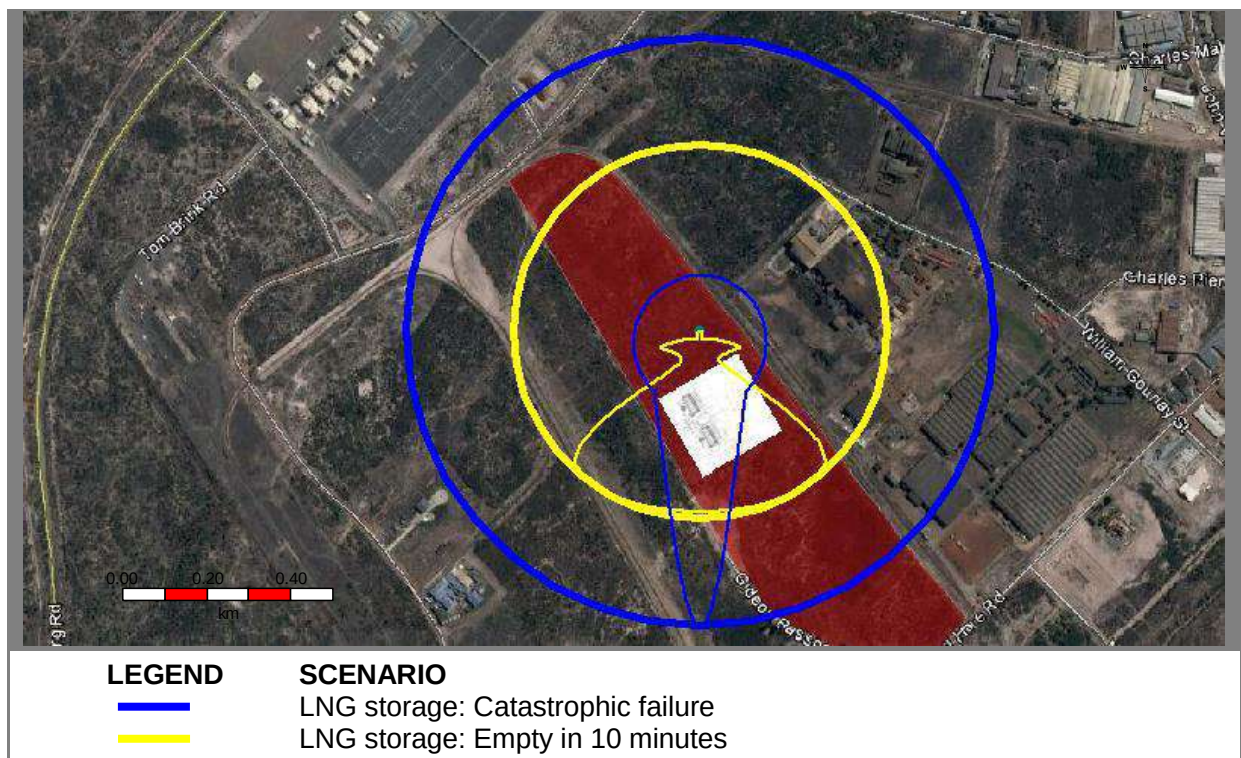


Figure 1.20 Extent of large LNG flash fires, represented by the LFL

1.5.3.2.4. VCEs

A loss of containment of LNG with an ignition source could form a flash fire or a VCE. On release, the vapours could drift to an ignition point before detonating forming a 'late explosion'.

The maximum distance predicted for a 1% fatality from a VCE is shown in Figure 1.21, estimated to be 662 m downwind of the release due to LNG storage failure.

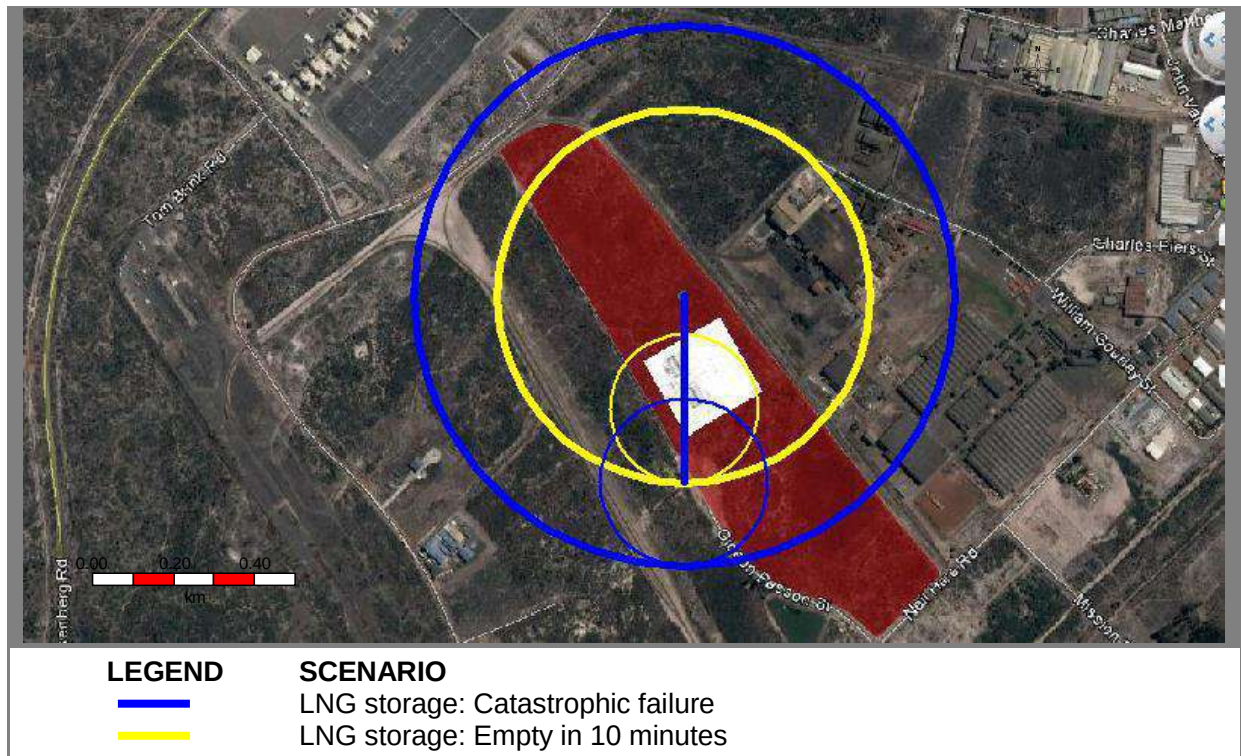


Figure 1.21 Blast overpressure 1% fatality from large VCEs due to releases at LNG storage

1.5.3.2.5. Flaring

The purpose of the flare is to safely remove the dangers of flammable material by combusting them at an elevated height.

The potential hazards from flares include:

- Thermal radiation from continuous flaring;
- Thermal radiation from emergency flaring;
- Flammable clouds in flame-out conditions.

As the flaring designs have not been completed, the thermal radiation from flaring cannot be assessed.

1.5.3.3. NEMA Section 30 Scenarios

Section 30 scenarios are those that can impact onto the general public and environment and include:

- Tank failure with resulting bund fire;
- Pump failure with a large release of hydrocarbons that would be uncontained with potential for ground contamination;
- Tank overfilling with resulting bund fire.

1.5.3.4. MIR

Failure rates and parameters used in the calculation of the MIR have been given in the subsection on the methodology for risk analysis. Explanation and exceptions to these parameters include:

- Storage vessel failure where:
 - It is expected that the LNG storage would be constructed of concrete and not steel:
 - As there are no failure rates available for concrete LNG structures, the failure rate was taken as that of a severe leak from an atmospheric tank i.e. 3×10^{-5} events per annum;
- Ignition probability where:
 - The direct ignition probability given in the subsection on the methodology for risk analysis is specific to the establishment;
 - Ignition outside the establishment would rely on a point source;
 - Probability of a delayed ignition from a process installation has been given as 0.5 (RIVM, 2009);
 - Direct ignition would be 0.5 to give a conservative value.

The risk isopleth of 1×10^{-6} fatalities per person per year extending beyond the site boundary would classify the site as a MHI, as shown in Figure 1.22. Providing the associated equipment of the LNG does not produce high pressure gases, the LNG storage can be located on the proposed premises to achieve acceptable risks to the public, without land planning restrictions.

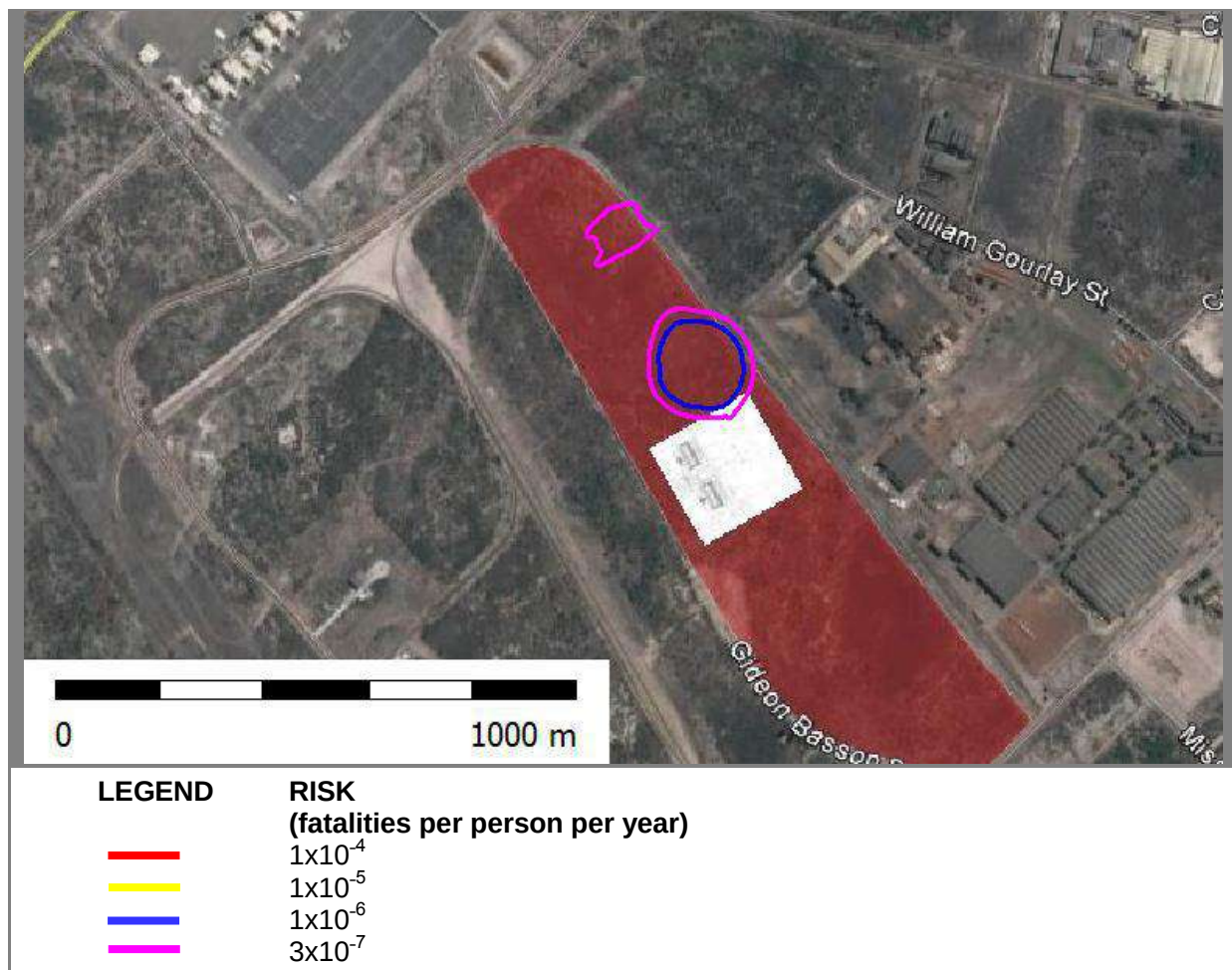


Figure 1.22 MIR for the proposed LNG storage

Appropriate land usage between the risk isopleths of 1×10^{-4} fatalities per person per year and 3×10^{-7} fatalities per person per year can be determined with use of the PADHI tables, given in Appendix G, should the built facility have off-site risks within this range.

Should the designer be able to demonstrate that the storage vessel has been designed to the equivalent of a pressure vessel code, the risk of failure can be reduced to 5×10^{-6} events per annum; this would result in an MIR below 3×10^{-7} fatalities per person per year and unrestricted land planning.

1.5.3.5. Assessment of Potential Impacts for the Operation Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	$=(f+c+d)*g$		$=(f+c+d)*g$	
Operational Phase										
Scenario: Loss of containment of LNG										
Formation of combustible liquids that could result in a fire which could destroy assets as well as injuring or killing people	Negative	Site specific (1) ¹³ , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases
Hydrocarbons into the ground Not considered as proper engineering must be done to ensure that this is not a plausible scenario	-	-	-	-	-	-	-	-	-	-

¹³ Scoring as per prior tables and criteria

1.5.4. Rail Gantry

1.5.4.1. Purpose of the Processing Unit

There is a possibility of transporting LNG to Atlantis by rail until a pipeline has been developed. This would involve unloading LNG into the storage area.

Typically, a train would consist of twelve 50 m³ rail cars; this study assumed that there would be twelve trains (24 rail cars) in a 24-hour period. Offloading would be done via a submersible pump in the tanker directly into the storage vessel at 30 m³/h.

1.5.4.2. Consequence Modelling

1.5.4.2.1. Bund and Pool Fires

Only pool fires from a loss of containment of LNG from the rail tanker would be relevant. In that instance, the spilt material was assumed to spread to a maximum distance of 1200 m² (RIVM, 2009). The maximum effect of a pool fire within the bunded area located at an arbitrary point north of the railway line during strong wind speeds is shown in Figure 1.23.

The 4 kW/m² thermal radiation represents the endpoint of the emergency plan and could extend 202 m downwind from the centre of the bund with potential off-site impacts.

The 10 kW/m² thermal radiation, representing the 1% fatality, could extend about 147 m downwind from the centre of the bund. Depending on the positioning of the tank farm, potential fatalities from a large bund fire could extend beyond the site boundary into neighbouring properties but would not impact residential areas.

The 35 kW/m² thermal radiation, indicating a 100% fatality and initial damage to steel, could extend beyond the site into adjacent property.

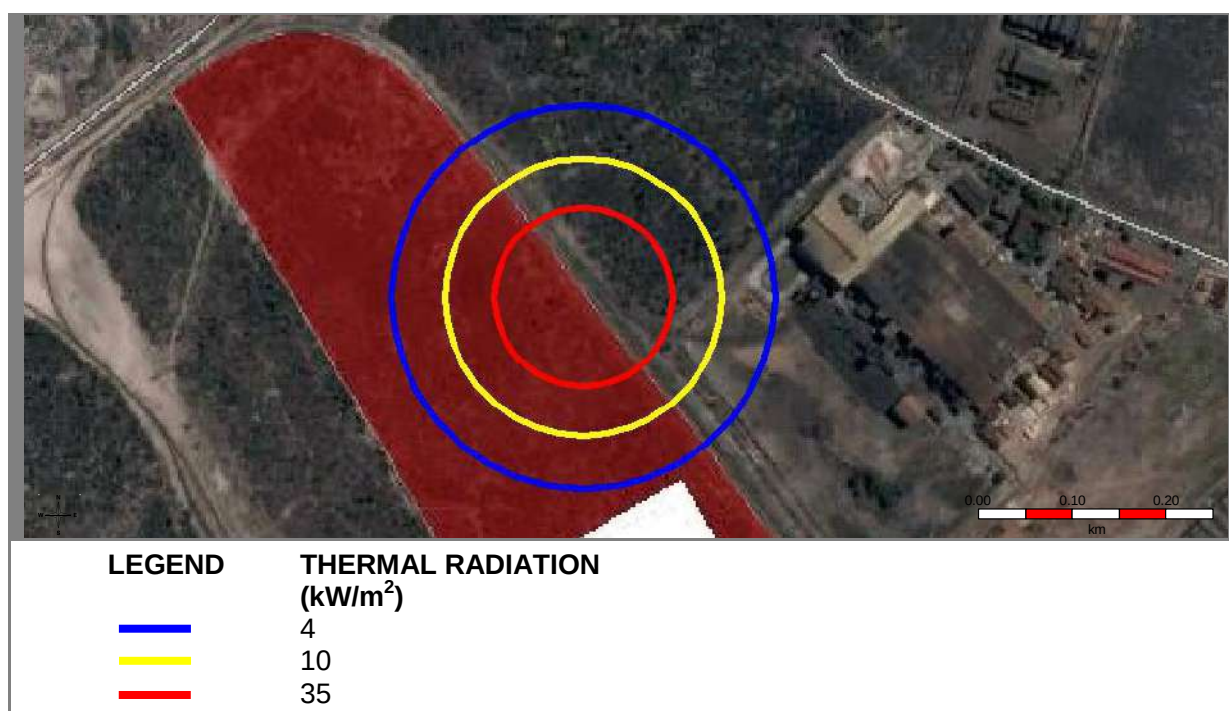


Figure 1.23 Thermal radiation from a large LNG pool fire from a rail tanker failure

1.5.4.2.2. Flash Fires

A loss of containment of LNG could form a flammable cloud that could drift to a point of ignition. On ignition, the flammable cloud could form either a flash fire or a VCE. The extent of the flammable cloud would depend on the released quantity, physical properties of the released gas, wind speed and weather stability.

A flash fire would extend to the LFL, but due to the formation of pockets could extend beyond this limit to the point defined as the $\frac{1}{2}$ LFL. It is assumed that people within the flash fire would experience lethal injuries, while people outside of the flash fire would remain unharmed.

Flash fires from a release of LNG at the rail offloading point are shown in Figure 1.24 and could extend a maximum of 683 m and 213 m downwind from a tanker failure and tanker hose release, respectively.

Potential flash fires could extend beyond the site boundary into neighbouring properties but would not extend into residential areas.

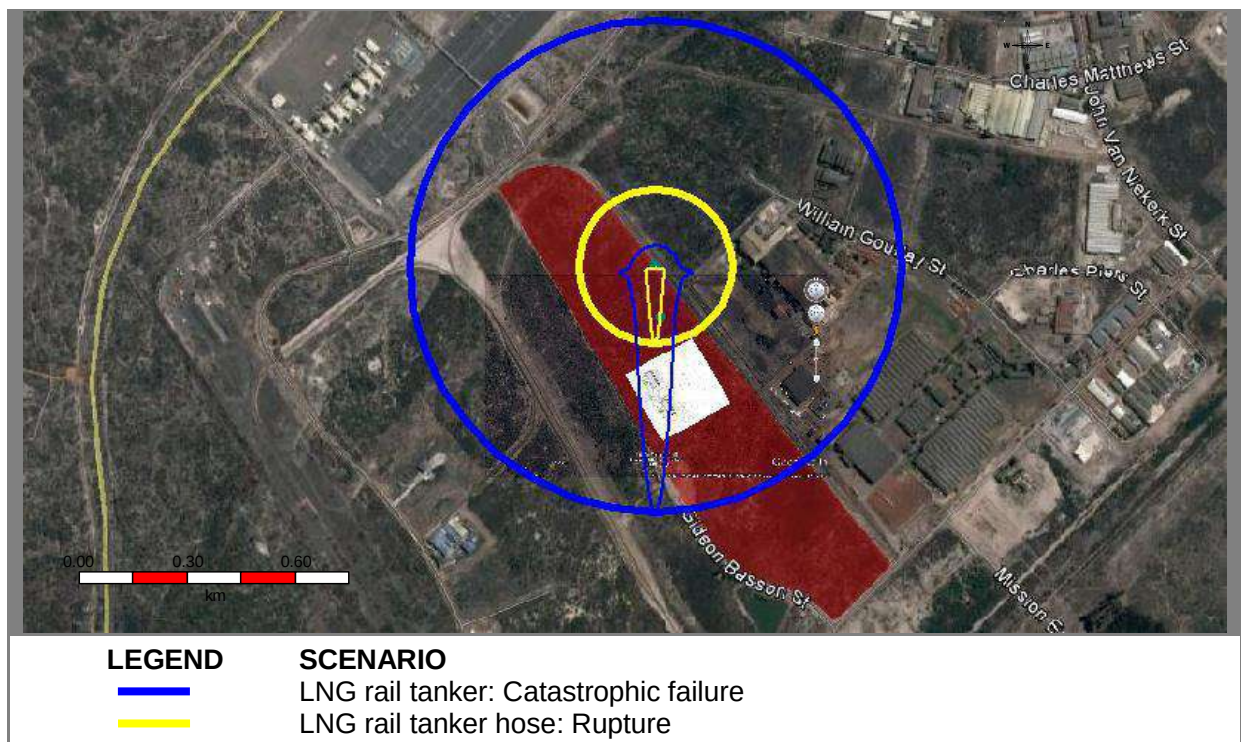


Figure 1.24 Extent of large LNG flash fires at rail tanker offloading, represented by the LFL

1.5.4.2.3. VCEs

A loss of containment of LNG with an ignition source could form a flash fire or a VCE. The maximum distance predicted for a 1% fatality from a VCE, as shown in Figure 1.25, are estimated to be 373 m and 316 m downwind due to releases at the tanker and tanker hose, respectively. While fatalities from VCEs could occur off site, people within the nearby residential areas would not be affected.

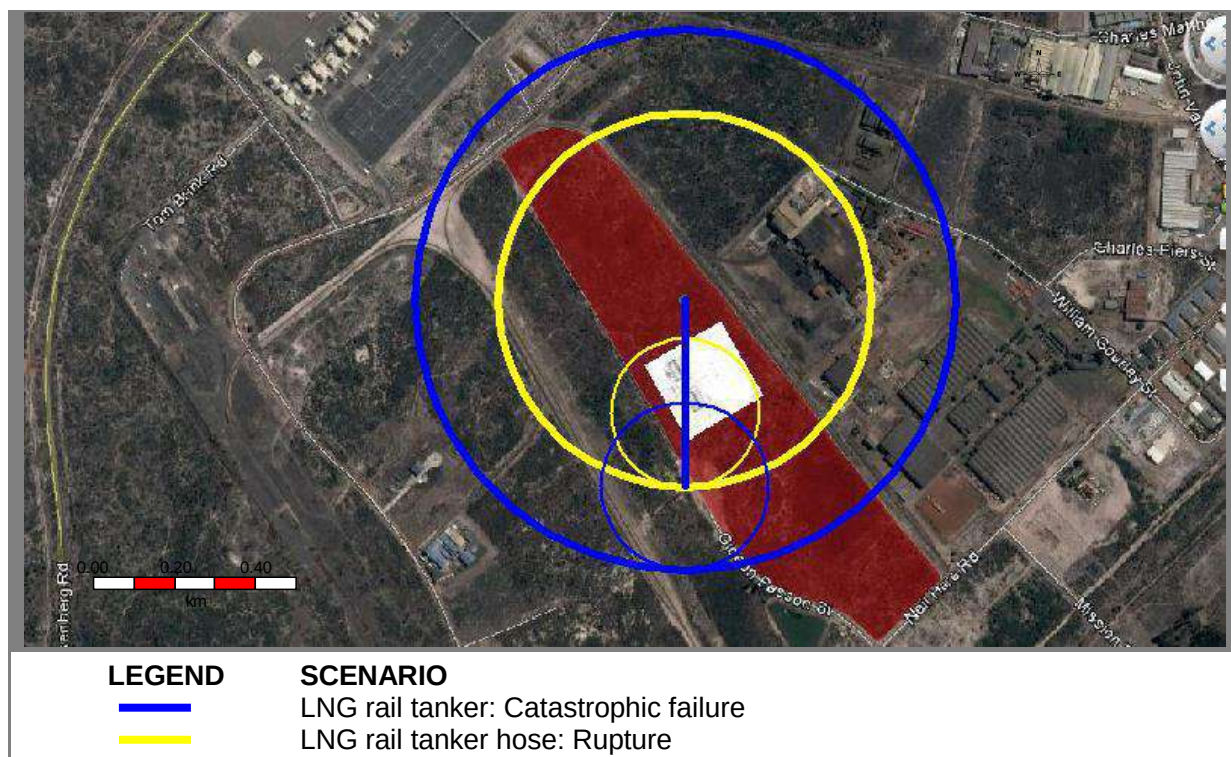


Figure 1.25 Blast overpressure 1% fatality from large VCEs from LNG rail tanker releases

1.5.4.2.4. BLEVEs

A boiling liquid expanding vapour explosion (BLEVE) can occur when a flame impinges on the rail tanker, particularly in the vapour space region where cooling by evaporation of the contained material does not occur. The shell weakens and ruptures (with a total loss of contents) and the ensuing flammable mass burns as a massive fireball.

A BLEVE formed from the 50 m³ rail tanker would assume an actual flammable mass of 21164 kg. On explosion the radius of the fireball was estimated to be 82.5 m, with duration of 11.35 seconds. The lift-off height was calculated to be 165 m.

Thermal radiation from the resulting fireball is shown in Figure 1.26. Due to the relatively short duration, the thermal-radiation consequence on health must be evaluated with respect to the duration time. The 1% lethality for the exposed duration equates to 15 kW/m² of thermal radiation, while the 10% fatality would be 20 kW/m² of thermal radiation.

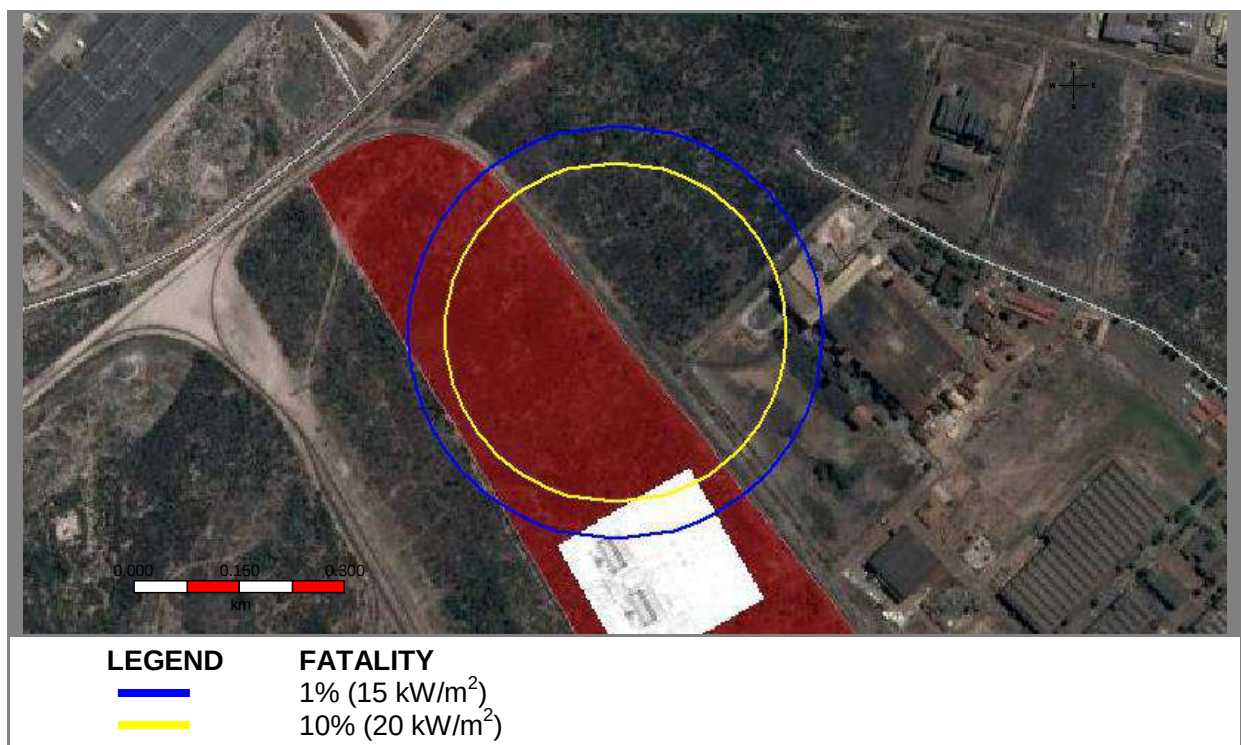


Figure 1.26 The 1% fatality and 10% fatality following a rail-tanker BLEVE

1.5.4.3. MIR

The risk calculations assumed a train of 12 cars each having a length of 15 m with the filling taking place at stationary points.

Depending on layout, MIR for the LNG rail facility, as shown in Figure 1.27, would be in the ALARP range and would be considered tolerable.

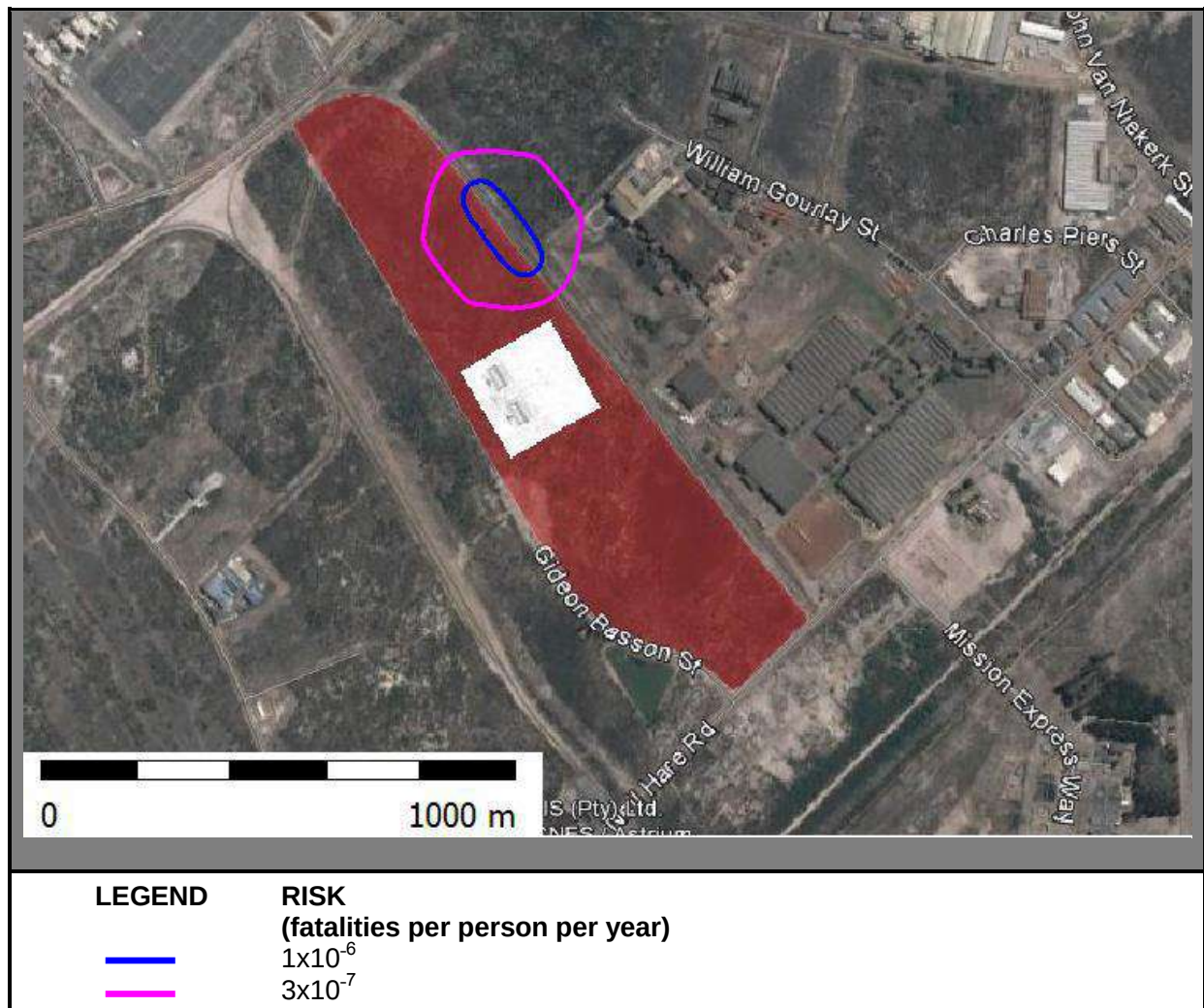


Figure 1.27 Risk isolines for the rail loading

1.5.4.4. Assessment of Potential Impacts for the Operation Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	$=(f+c+d)*g$		$=(f+c+d)*g$	
Operational Phase										
Scenario: Loss of containment of LNG										
Formation of flammable gases that could result in fires and explosions which could destroy assets as well as injuring or killing people	Negative	Site specific (1) ¹⁴ , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases

¹⁴ Scoring as per prior tables and criteria

1.5.5. Hydrogen Installation

1.5.5.1. The Purpose of the Processing Unit

Hydrogen is used as a coolant for the mechanical bearings. It could be manufactured on site by water vapour being split into hydrogen and oxygen in an electrolyser. It is assumed to be stored in three 10 m³ vessels at a maximum pressure of 25 bar.

1.5.5.2. Hazardous Components

1.5.5.2.1. Flammable or Combustible Components Stored, Delivered or Processed

Hydrogen is considered to be highly flammable and produces an almost invisible flame.

1.5.5.3. Consequence Modelling

1.5.5.3.1. Jet Fires

1.5.5.3.1.1. Storage Vessels

A large release of hydrogen from the storage vessels with an ignition could result in a jet fire. It is assumed that the storage vessels will have firewalls surrounding each tank, such that horizontal jet fires would be limited in distance from the respective point of release to the respective firewall. Therefore, injury to surrounding people or equipment beyond the firewall is not expected.

The thermal radiation from jet fires from a vertical release is shown in Figure 1.28. The thermal radiation remains below 4 kW/m² and would not result in lethalties or cascading effects.

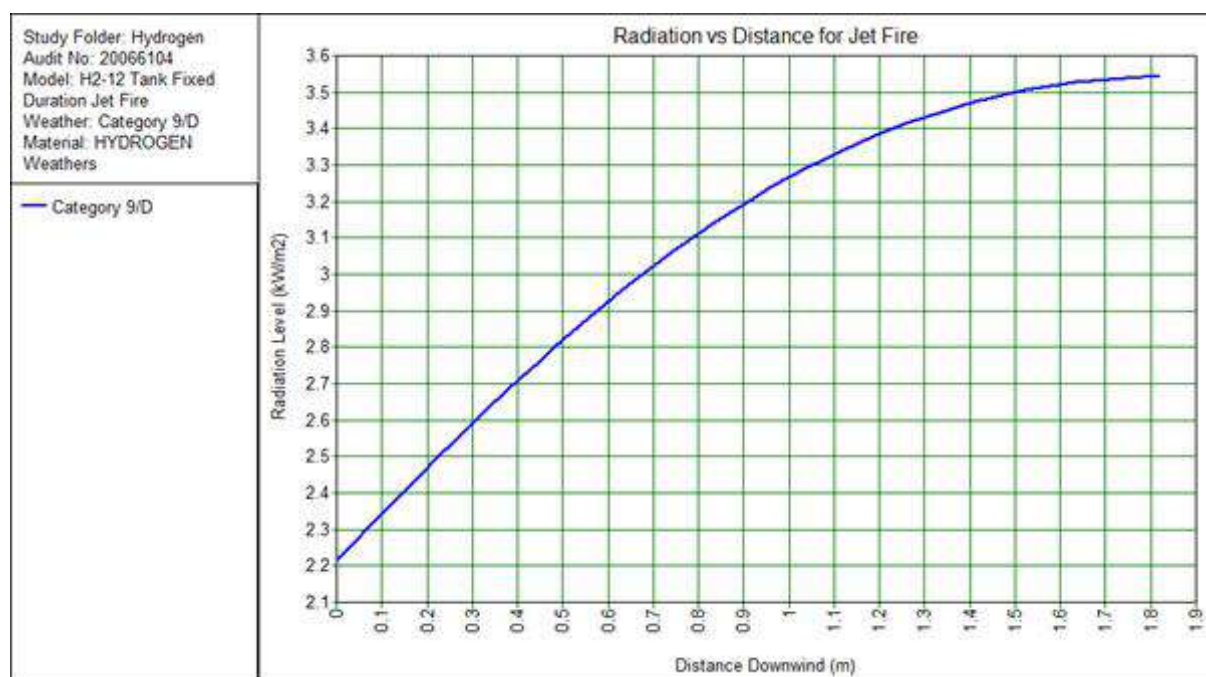


Figure 1.28 Thermal radiation effects from a vertical jet fire due to a release of hydrogen in high wind speeds

1.5.5.3.2. Flash Fires

1.5.5.3.2.1. Storage Vessels

With the exception of a catastrophic rupture, any release would be retained within the fire wall area. Due to the very buoyant nature of the hydrogen released material would rise rapidly limiting the extent of a flash fire.

The extent of flash fires from the point of release due to the worst-case scenario of a catastrophic failure of a storage vessel under strong wind conditions is shown in Figure 1.29.

Under worst case meteorological conditions of a strong wind, the LFL could extend 23 m from the point of release. Should the hydrogen storage be located at a suitable location on site, the impacts of flash fires could be restricted to the site.

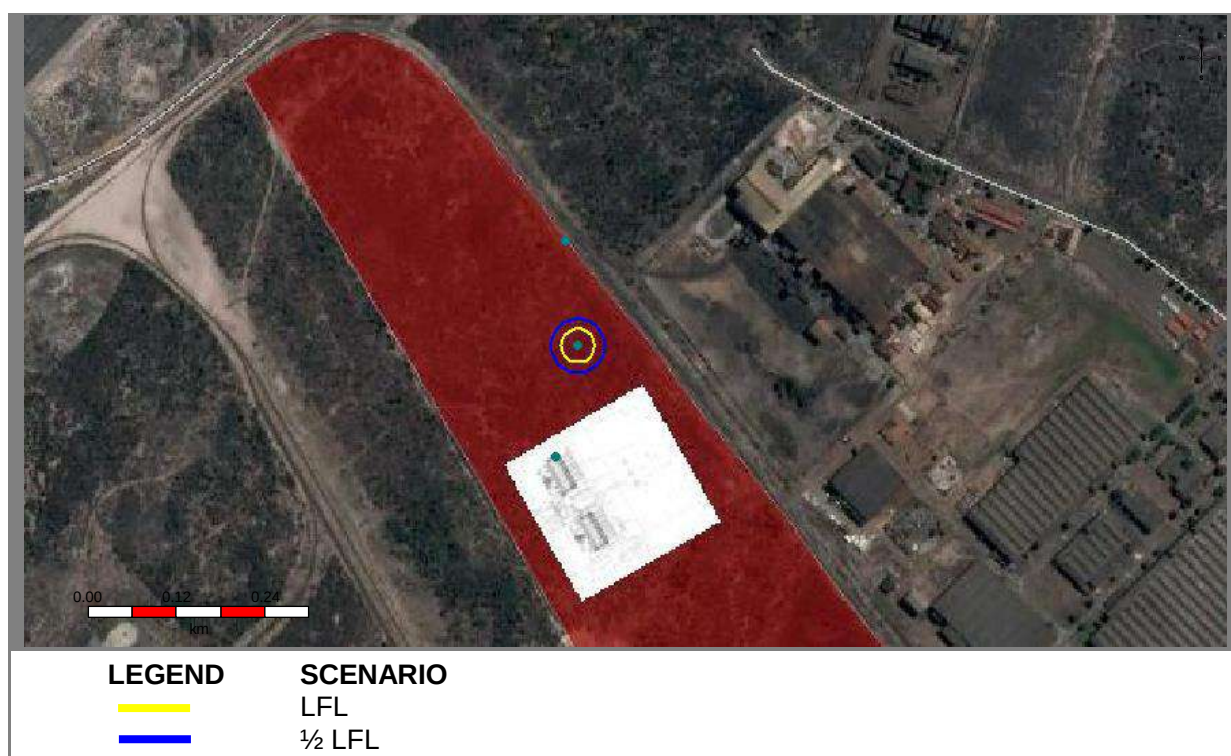


Figure 1.29 Flash fire limits due to a catastrophic failure of a hydrogen storage vessel

1.5.5.3.3. VCEs

1.5.5.3.3.1. Storage Vessels

Figure 1.30 shows blast overpressure isopleths due to a loss of containment in worst-case meteorological conditions. The thin lines indicate a northerly wind while the thicker lines indicate wind from all directions. No lethal effects are expected below 0.1 bar overpressure for people in the open.

In the worst case, hydrogen explosions of 0.1 bar overpressure could extend 55 m from the point of release. Should the hydrogen storage be located at a suitable location on site, the impacts of flash fires could be restricted to the site.

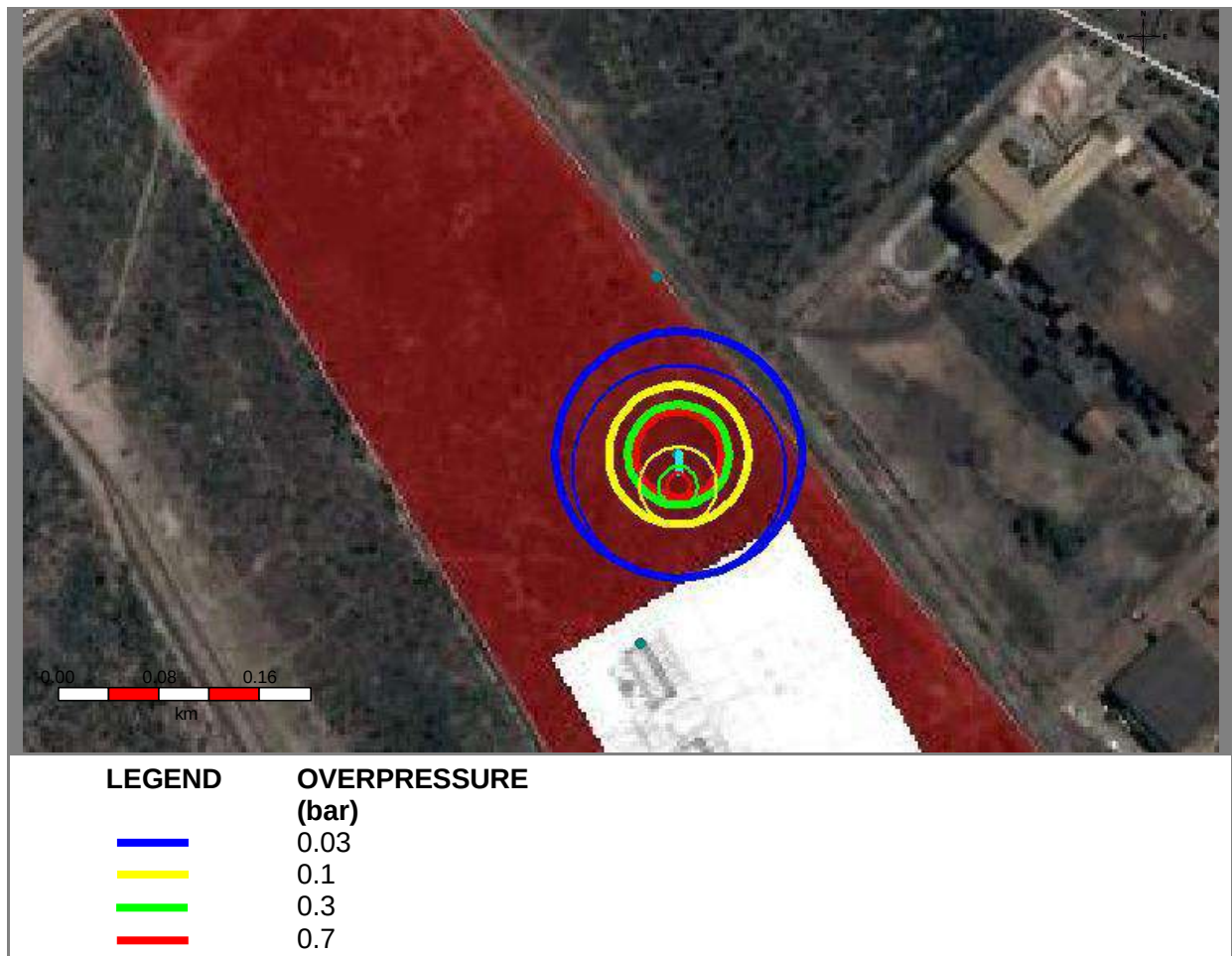


Figure 1.30 0.1 bar overpressures from a VCE from a hydrogen release at the storage vessels

1.5.5.3.3.2. BLEVE

A jet fire reaching the shell of a storage vessel could cause the vessel to weaken and release the entire contents, resulting in a fireball in a similar to a BLEVE.

Due to the relatively short duration, the thermal radiation consequence on health must be evaluated with respect to duration. The predicted fatality from fireballs is shown in Figure 1.31.

The 1% fatality for the exposure duration is represented by 58. kW/m², while the 10% fatality is represented by 78 kW/m². The 50% fatality was not reached.

In the worst case, the BLEVE fireball 13 m from the point of release. Should the hydrogen storage be located at a suitable location on site, the impacts of a BLEVE could be restricted to the site.



Figure 1.31 Fatality isopleths for fireballs at the hydrogen storage vessels

1.5.5.4. Assessment of Potential Impacts during the Operational Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	$=(f+c+d)*g$		$=(f+c+d)*g$	
Operational Phase										
Scenario: Loss of containment of hydrogen										
Formation of combustible liquids that could result in a fire which could destroy assets as well as injuring or killing people	Negative	Site specific (1) ¹⁵ , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases

¹⁵ Scoring as per prior tables and criteria

1.5.6. Ammonia Installation

1.5.6.1. The Purpose of the Processing Unit

Anhydrous ammonia used for water treatment is assumed to be delivered to site in 8–10 t trucks and to be offloaded into a single 20 m³ storage vessel.

1.5.6.2. Hazardous Components

1.5.6.2.1. Toxic and Asphyxiant Components Stored, Delivered or Processed

Ammonia is considered to be highly toxic.

1.5.6.2.2. Flammable or Combustible Components Stored, Delivered or Processed

Ammonia will burn in 16–25% vapour concentrations in air when exposed to open flames. However, due to its low reactivity, it is classified as a non-flammable gas and is only assessed on toxicity (RIVM, 2009).

1.5.6.3. Consequence Modelling

1.5.6.3.1. Toxic Vapour Clouds

The scenarios used in the modelling included:

- Catastrophic failure of the ammonia vessel;
- Ammonia vessel emptying contents in 10 minutes;
- Ammonia road tanker failure and hose.

AEGL-3 is the maximum air concentration below which it is believed that nearly all individuals could be exposed without experiencing or developing life-threatening health effects. The AEGL-2 concentration is the maximum air concentration below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or serious health effects or symptoms that could impair an individual's ability to take protective action. The AEGL-2 is used for emergency planning to indicate the furthest downwind distance to evacuation of nearby populations in the event of a release.

Downwind distances to the acute exposure guideline limits of AEGL-1, AEGL-2 and AEGL-3 are 7.4 km, 1.8 km and 940 m, respectively, for the largest release. Due to the scale of these releases, the AEGL values are not represented graphically.

The AEGL values give an indication of health effects from a one-hour exposure but do not give an indication of probability of fatality. The 1% fatality represents the endpoint for these risk assessment calculations. Scenarios producing a 1% fatality at the site boundary in worst-case meteorological conditions are assumed to have off-site impacts and are carried over to the risk calculations to evaluate the acceptability of the relative scenarios, based on likelihood of the incident occurring. Furthermore, the 1% fatality gives an indication of the extent of public liability in the event of a large release.

Figure 1.32 shows the scenarios with the largest distances to the 1% fatality. The thin lines indicate the cloud plume from a northerly wind direction, while the thicker lines represent the extent of the plume from all wind directions.

The 1% fatality for large ammonia releases could extend beyond the site boundary into neighbouring properties but would not enter nearby residential areas.

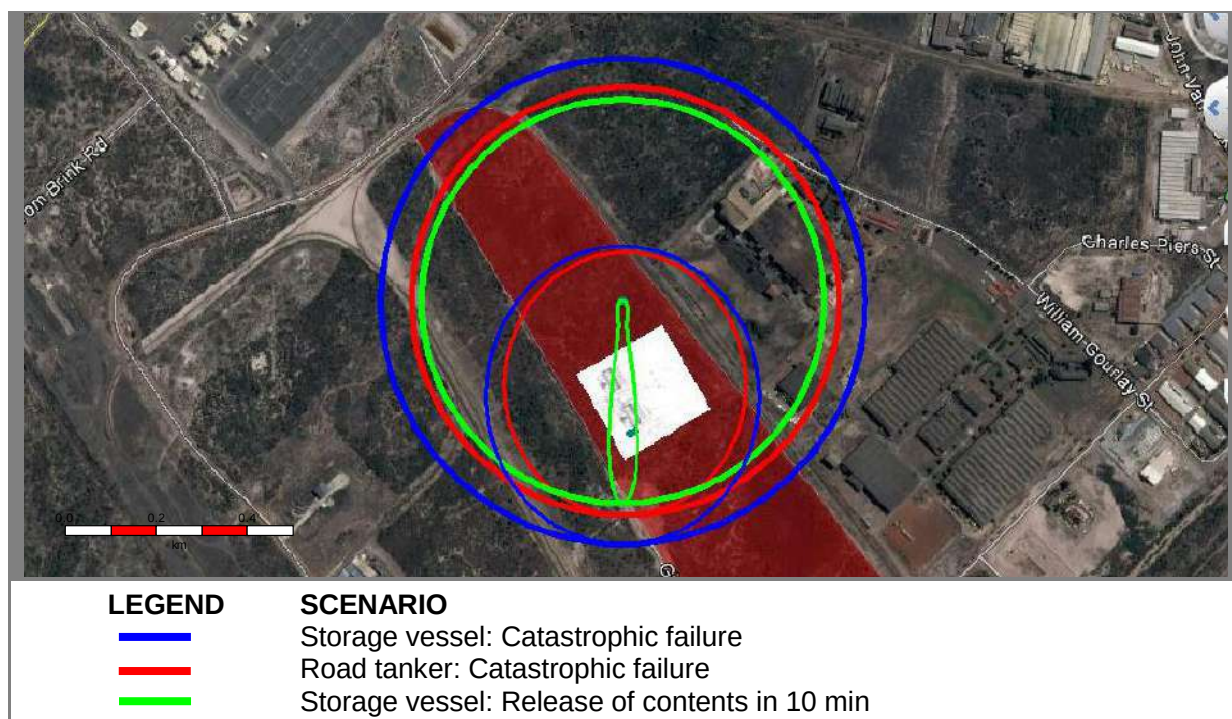


Figure 1.32 Maximum extent of the 1% fatality for major releases of ammonia

1.5.6.4. Maximum Individual Risk

The risk of 1×10^{-4} fatalities per person per year isopleth due to large releases of ammonia could extend beyond the site boundary, as shown in Figure 1.33, **classifying the site as a Major Hazardous Installation**.

Depending on layout, the risk to be the public would be in the ALARP range and considered acceptable for the surrounding industrial area.

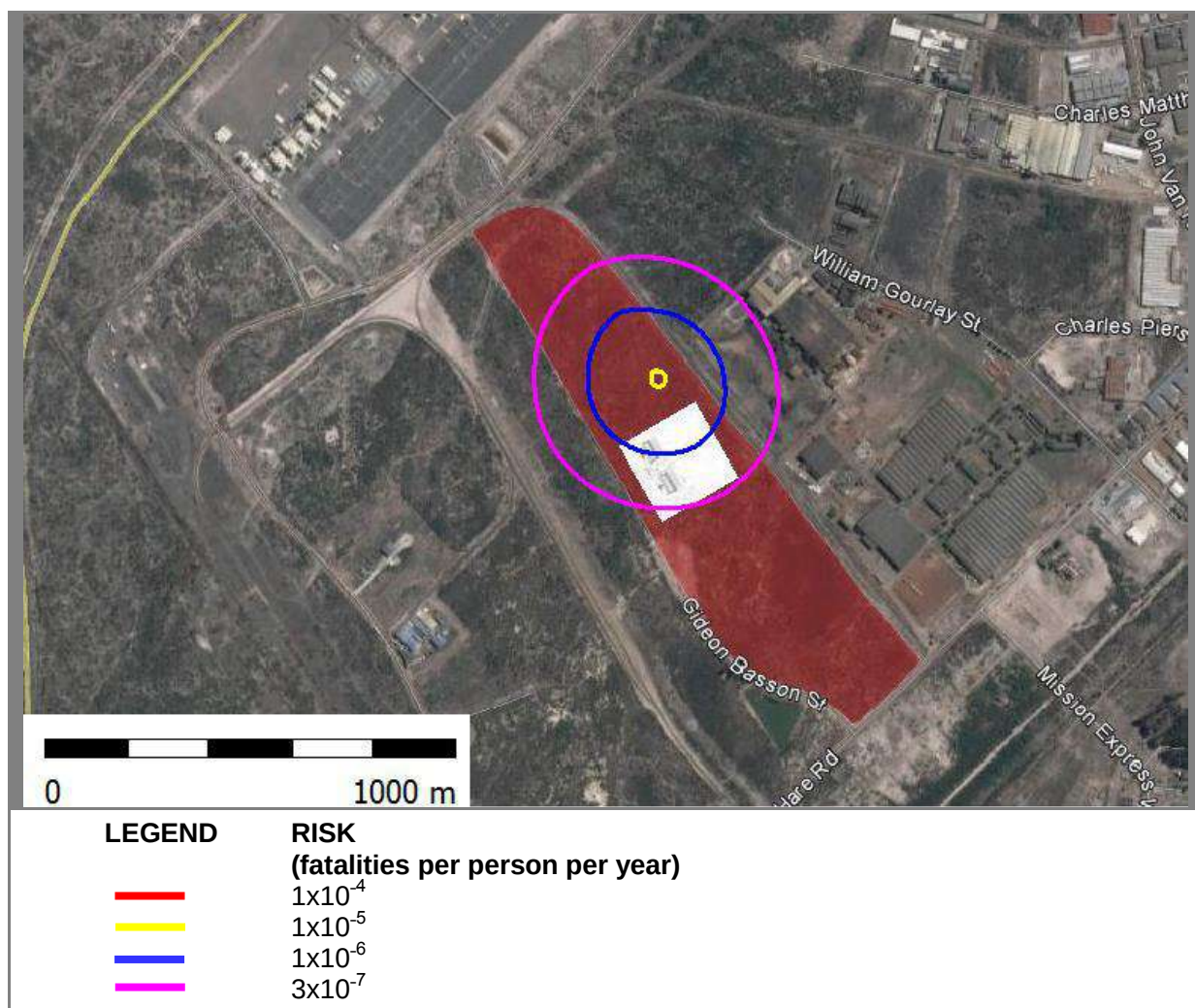


Figure 1.33 Lethal probability isolines associated with the ammonia installation

1.5.6.5. Reduction of Risks

From the simulations performed, a number of events have risks that extend beyond the point of release with potential to impact on future developments. Mitigation which could be considered to reduce this risk includes but is not limited to the subsections that follow. Mitigation listed is for consideration only and not mandatory.

1.5.6.5.1. Inventory

The reduction of ammonia inventory could reduce the impacts. However, the inventory would need to be optimised as not to limit the electricity production.

1.5.6.5.2. Component Replacement

Ammonia would be used for water pH adjustments. Alternatives to anhydrous ammonia could be investigated by considering the benefits versus costs and operational issues.

1.5.6.5.3. Codes and Standards

Codes, standards and engineering designs can be optimised to reduce the impacts of accidental ammonia releases.

1.5.6.5.3.1. Safety Instrumented Systems

The IEC 61508 and IEC 61511 (Safety Instrumented Systems) codes are specifically related to instrumentation requirements to ensure adequate protection from hazards in chemical facilities and are applicable to the life cycle of the plant. These codes are aimed at reducing to acceptable levels risks to surrounding populations.

The significance of these codes is that designs would be evaluated against the criteria of the code and instrumentation with specific failure rates would be specified as well as minimum periods of checking. Therefore, the selection of instrumentation is not based on price alone.

Further to this, instrumentation cannot be reduced or changed without reviewing the code. The specification of this code implies that designs presented at EIA and MHI evaluations cannot be altered at construction for the sole function of reducing costs. Moreover, the code ensures that the facility would continue to maintain safety functions for the life cycle of the plant, maintaining a safe working environment for both workers and the public.

The European standards body CENELEC has adopted this standard as EN 61511. This means that in each of the member states of the European Union, the standard is published as a national standard. For example, in Great Britain, it is published by the national standards body as BS EN 61511. The content of these national publications is identical with the IEC 61511 code. However, the code is not harmonized under any directive of the European Commission.

In the US American National Standards Institute ANSI/ISA 84.00.01-2004 was issued in September 2004. It mirrors the IEC 61511 code in content with the exception that it contains a grandfathering clause:

“ Compliance with IEC 61508 and IEC 61511 (or ANSI/ISA 84.00.01-2004) would be a requirement in many countries around the world to achieve an acceptable risk to workers and public. ”

Demonstrating compliance with the IEC 61508/11 codes can be achieved only once full-detail designs have been completed; it is premature at this stage in the project.

It should be noted that RISCUM would recommend compliance with the IEC 61508/11 codes.

1.5.6.6. Assessment of Potential Impacts during the Operational Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	=(f+c+d)*g		=(f+c+d)*g	
Operational Phase										
Scenario: Loss of containment of ammonia										
Formation of a toxic cloud which could result in people being injured or killed	Negative	Site specific (1) ¹⁶ , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases

¹⁶ Scoring as per prior tables and criteria

1.5.7. Chlorine Installations

1.5.7.1. The Purpose of the Processing Unit

Chlorine would be used for water and sewage treatment. Chlorine used for potable water treatment was assumed to be stored in a maximum of three 925 kg drums on site.

1.5.7.2. Hazardous Components

1.5.7.2.1. Toxic and Asphyxiant Components Stored, Delivered or Processed

Chlorine is considered to be highly toxic.

1.5.7.3. Consequence Modelling

1.5.7.3.1. Toxic Vapour Clouds

The scenarios used in the modelling included:

- Catastrophic failure of a single chlorine drum;
- Chlorine drum emptying contents in 10 minutes;
- Chlorine flexible hose connector failure.

The maximum downwind distances, for the worst case scenario, to the acute exposure guideline limits of AEGL-1, AEGL-2 and AEGL-3 were calculated at > 10 km, > 10 km and 2 km, respectively, for a failure of the chlorine drum emptying the entire contents in 10 minutes

AEGL-3 is the maximum air concentration below which it is believed that nearly all individuals could be exposed without experiencing or developing life-threatening health effects. The AEGL-2 concentration is the maximum air concentration below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or serious health effects or symptoms that could impair an individual's ability to take protective action. The AEGL-2 is used for emergency planning to indicate the furthest downwind distance to evacuation of nearby populations in the event of a release.

AEGL values give an indication of health effects from a one-hour exposure but do not give an indication of probability of fatality. The 1% fatality represents the endpoint for these risk assessment calculations. Scenarios producing a 1% fatality at the site boundary in worst-case meteorological conditions are assumed to have off-site impacts and are carried over to the risk calculations to evaluate the acceptability of the relative scenarios, based on likelihood of the incident occurring. Furthermore, the 1% fatality gives an indication of the extent of public liability in the event of a large release.

Figure 1.34 shows the scenarios with the largest distances to the 1% fatality. The thin lines indicate the cloud plume from a northerly wind direction, while the thicker lines represent the extent of the plume from all wind directions.

The 1% fatality could extend over the site boundary in more than one direction with potential consequences to neighbouring properties but not to residential areas.

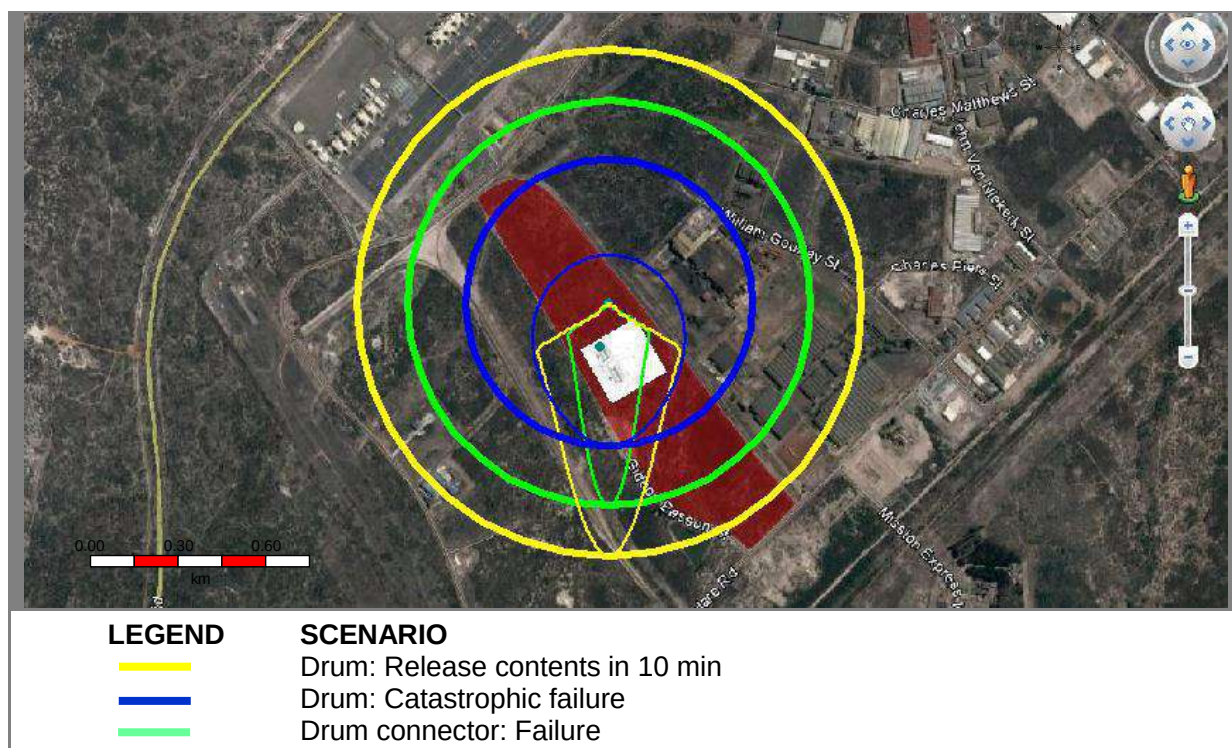


Figure 1.34 Maximum extent of the 1% fatality for major releases of chlorine

1.5.7.4. NEMA Section 30 Scenarios

Section 30 scenarios are those that can impact onto the general public and environment and include:

- Loss of containment from the chlorine drum, flexible connections or piping.

1.5.7.5. MIR

The risks were calculated assuming a failure of the chlorine drum as well as the failure of the flexible connecting hose. The study assumes a block valve would be fitted on the drum that would shut off the supply in the event of a release.

A large release of chlorine from the drums could have sufficient off site risks to classify the installation as a Major Hazardous Installation, as shown in Figure 1.35.

The risk of 1×10^{-4} fatalities per person per year, unacceptably high for the public, would remain on site. The risks would be in the ALARP range meaning that the risks would be tolerable for the surrounding environment.

It is uncertain if the proposed power plant would have chlorine, if so the facility would have to be designed to minimise the off-site impacts. If possible, the chlorine could be replaced with another oxidant, such as sodium hypochlorite, to reduce off-site impacts.

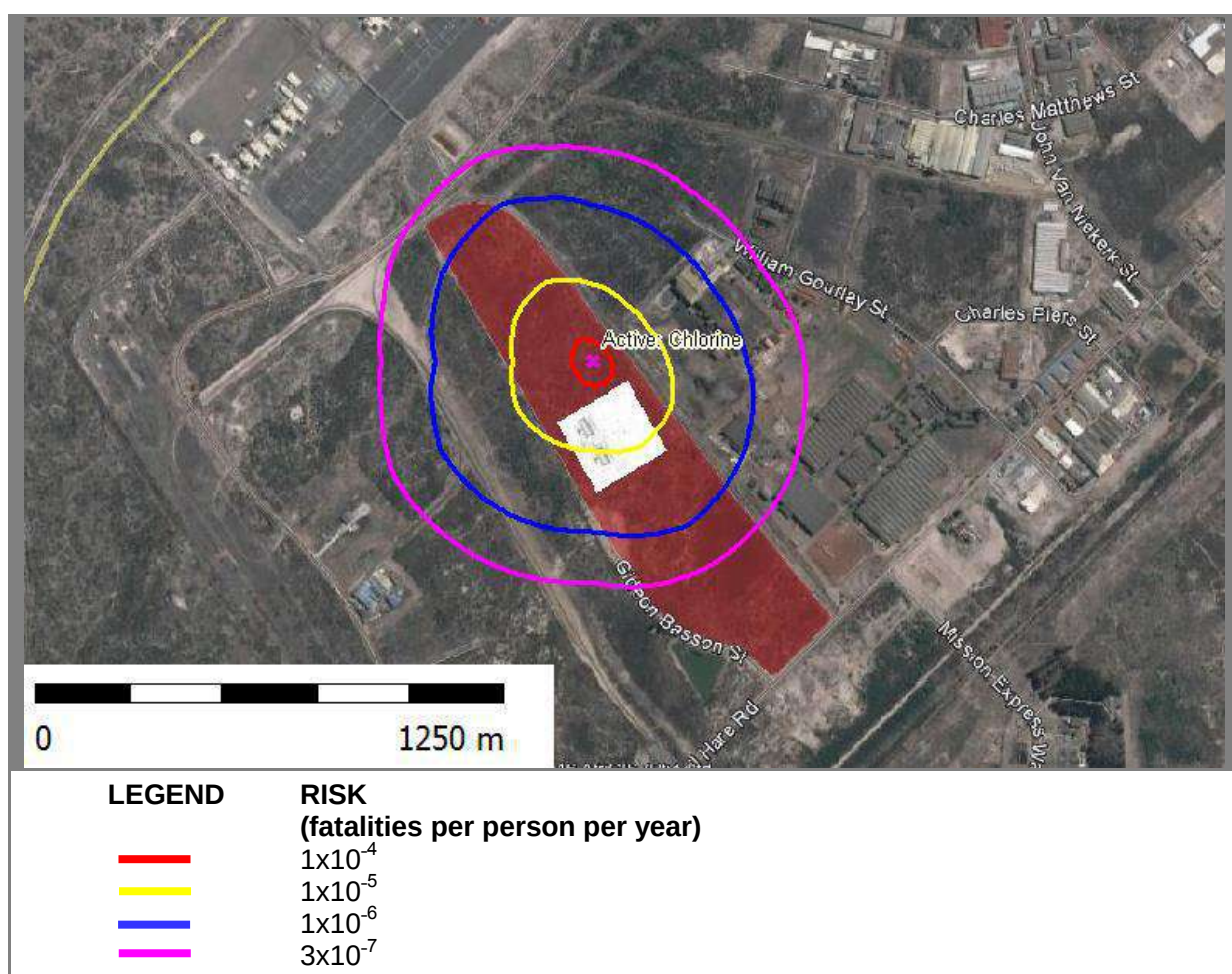


Figure 1.35 Lethal probability isolines associated with the chlorine installation

The distance to the risk isopleth of 3×10^{-7} fatalities per person per year was calculated to be 800 m from the centre of the release. This implies that sensitive receptors (such as schools, hospitals, etc.) should be located a minimum distance of 800 m from the facility.

Appropriate land usage between the risk isopleths of 1×10^{-4} fatalities per person per year and 3×10^{-7} fatalities per person per year can be determined with use of the PADHI tables, given in Appendix G, should the built facility have off-site risks within this range.

Should the designer be able to demonstrate that the storage vessel has been designed to the equivalent of a pressure vessel code, the risk of failure can be reduced to 5×10^{-6} events per annum; this would result in an MIR below 3×10^{-7} fatalities per person per year and unrestricted land planning.

1.5.7.6. Assessment of Potential Impacts during the Operational Phase

Impact Description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without Mitigation)	Mitigation	Significance (with Mitigation)	Confidence Level
a	b	c	d	e	f	g	=(f+c+d)*g		=(f+c+d)*g	
Operational Phase										
Scenario. Loss of containment of chlorine										
Formation of a toxic cloud which could result in people being injured or killed	Negative	Site specific (1) ¹⁷ , i.e. remains in the vicinity of the discharge point	Permanent (5) A permanent injury or loss of life	Irreversible	Very high (16) Potential injury	Improbable (0.1) Probability of a loss of containment with a fire is very much less than 10%	Low (2.1)	Proper engineering designs and layouts to minimise off-site impacts Spill containment is a legal requirement	Low (2.1) Proper engineering would reduce the off-site impacts and probability Reducing probability would not reduce the score as the probability is already very low	High Probability and risk calculated from well-known data bases

17 Scoring as per prior tables and criteria

1.6. TERMS OF REFERENCE FOR SPECIALIST STUDY (EIA PHASE)

The main aim of the investigation was to quantify the risks to the public and to determine potential fatal flaws. The terms of reference include:

1. The undertaking of a high level qualitative risk assessment for the various design options;
2. The giving of a brief description of the surrounding environment in terms of risks and safety;
3. The giving of recommendations (management actions) for future project phases, where applicable.

Furthermore, the terms of reference also include:

1. The review of the potential and anticipated designs, covering processing units, proposed inventories, proposed pipeline routing and transport conditions for selected alternatives;
2. The development of accidental loss of containment and fire or explosions scenarios for the facility including loss of containment from the storage vessels, compressors and pipelines;
3. For each incident developed in Step 2, the determination of the 1% fatality distance for fires and explosions:
 - a. As a 1% fatality beyond the site boundary should trigger a MHI risk assessment study;
4. Using generic failure rate data (tanks, pumps, valves, flanges, pipework, gantry, couplings, etc.), the determination of the probability of each major incident scenario;
5. The calculation of the MIR, taking into account all accidents, meteorological conditions and lethality:
 - a. Risk values of 1×10^{-4} fatalities per person per year, 1×10^{-5} fatalities per person per year, 1×10^{-6} fatalities per person per year and 3×10^{-7} fatalities per person per year would be plotted on a map for the major scenarios identified.

This risk assessment is not intended to replace a MHI risk assessment nor any other legal requirement.

1.7. CONCLUSIONS AND RECOMMENDATIONS

Risk calculations are not precise. The accuracy of predictions is determined by the quality of the base data and expert judgements. A number of well-known sources of incident data were consulted and applied to obtain the likelihood of an incident to occur. The risk assessment included the consequences of fires and explosions as well as toxic releases at the proposed facilities and related infrastructure.

The risk assessment was done on the assumption that proposed facilities and infrastructure would be maintained to an acceptable level and that all statutory regulations would be applied. It was also assumed that the detailed engineering designs would be done by competent people and would be correctly specified for the intended duty. For example, it is assumed that the tank wall thicknesses would be correctly calculated, that the vents would be sized for emergency conditions, that the instrumentation and electrical components would comply with the specified electrical area classification, that the material of construction would be compatible with the products, etc. It is the responsibility of the owner and their contractors to ensure that all engineering designs would be completed by competent persons and that all equipment would be installed correctly.

All designs should be in full compliance with (but not limited to) the relevant LNG codes and standards, the Occupational Health and Safety Act 85 of 1993 and its regulations, the National Environmental Management Act 107 of 1998 and its regulations, the National Buildings Regulations and the Buildings Standards Act 107 of 1977 as well as local bylaws.

A number of incident scenarios were simulated, taking into account the prevailing meteorological conditions, and described in the report.

Key findings and the related recommendations are described in the following subsections.

1.7.1. Notifiable Substance

Methane (compressed) is listed as a notifiable substance at a threshold value of 15 t. The schedule does not specifically mention liquefied natural gas (LNG). To this end LNG would not be classified as a notifiable substance.

However, if the design changes so that more than 15 t of compressed natural gas (CNG) would be contained in a single container, the CNG would be classified as a notifiable substance and the facility would automatically be classified as a Major Hazard Installation.

1.7.2. Major Hazard Installation

This investigation concluded that under typical design conditions, assuming conservative design options and inventories, the proposed power plant **could be considered as a Major Hazard Installation**, depending on the hazardous chemicals used on site as well as the layout of the power station

This study is not intended to replace the Major Hazard Installation risk assessment which should be completed prior to construction of the facility.

1.7.3. Land Planning

In accordance with Section 9 the MHI regulations, no facility within the 3×10^{-7} fatalities per person per year isopleths should be approved without first evaluating the impacts on the proposed development or potential land usage. Acceptable developments can be verified in the tables provided in the HSE Land Use Planning Methodology (UK; 2011), attached in Appendix G.

1.7.4. Recommendations

As a result of the risk assessment study conducted for the proposed power station at Atlantis a number of events were found to have risks beyond the site boundary. These risks could be mitigated to acceptable levels, as shown in the report.

RISCOM did not find any fatal flaws that would prevent the project proceeding to the detailed engineering phase of the project.

RISCOM would support the project with the following conditions:

1. Compliance with all statutory requirements, i.e. pressure vessel designs;
2. Compliance with applicable SANS codes, i.e. SANS 10087, SANS 10089, SANS 10108, etc.;
3. Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs;
4. Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place;
5. Compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm: Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility;
6. Demonstration by the owner or their contractor that the final designs would reduce the risks posed by the installation to internationally acceptable guidelines;
7. Signature of all terminal designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs;
8. Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities);
9. Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA;
10. Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations and that the risk assessment covers the entire facility.

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1.9. APPENDICES

1.9.1. Appendix A: Curriculum Vitae Michael Oberholzer

Proposed Position: Risk Assessor

Name of Firm: RISCUM (PTY) LTD

Name of Staff: Michael Paul Oberholzer

Profession: Chemical Engineer

Date of Birth: 20 August 1959

Years with Firm/Entity: 13

Nationality: South African

Membership in Professional Societies:

- Registered Professional Engineer (Registration No.: 910085) with the Engineering Council of South Africa
- Member of the South African Institute of Chemical Engineers
- Member of the Institute of Chemical Engineers (UK)
- Approved Inspection Authority for Major Hazard Installation (MHI) Risk Assessments, South Africa
- Technical Steering Committee for Risk Assessments

Key Qualifications:

Michael Oberholzer is currently director of RISCUM. He is a registered professional engineer and holds a BSc (Chemical Engineering) from the University of the Witwatersrand (1982). Mike has over 20 years of experience with Dow chemicals and Sentrachem in all aspects of project implementation. This includes Process Engineering Manager, Project Manager and Commissioning Manager. Since leaving Dow, Mike has concentrated on process safety and has completed a number of risk assessments studies and process hazard analyses in various industries, including assignments in the chemical, petrochemical, agrochemical, mining, offshore oil and gas and food industries.

Relevant projects are included in the following sections.

NUCLEAR

2008-present	Safety report for marine and land-based incidents for proposed nuclear sites
2008	Safety report for aircraft accidents into nuclear facility
2008	Appointed to conduct risk assessment of fuel plant, Pelindaba
2006	Risk assessment of tank farm, for PBNR
2005	Consequence analysis of fuel plant layout, Pelindaba
2003–2005	Chairman of HAZOP studies for PBNR

OIL AND GAS

Lead Process Engineer for quantitative risk assessment of:

2015	A natural gas pipeline for the Transnet in Durban North
2014	LNG facilities for the CSIR in the Western Cape
2014	LNG overland pipeline in Groutville, KwaZulu-Natal
2013	LPG installations for NGK, Cape Town
2013	LPG installations for Easigas (Port Shepstone)
2013	LPG installations for Sunrise Energy in Saldanha Bay
2012	LPG installations for Trelidor, Durban
2011	LPG installations for Afripak, Durban
2010–2011	LPG installations for Monsanto, Brits and Groblersdal
2010	LPG installations for Air Liquide
2009	A compressed natural gas plant, Gauteng
2004-2005	The Egoli Gas depots in Langlaagte and Cottesloe

Lead Process Engineer for:

2006	An emergency plan and oil spill contingency for Petronas, with regards to offshore drilling (Mozambique)
2006	Determination of hazardous areas from releases of H ₂ S from vents and pipelines
2005	Flare studies for Total facilities in Angola
	The studies consisted of calculating the radiation from flares at various locations and the subsequent evaluation of the safety distances from the flares
	The studies included air dispersion for H ₂ S in the event of flameout

TANK FARM AND FLAMMABLE STORAGE AND TRANSPORTATION

Lead Process Engineer for quantitative risk assessment of:

2015	A bulk crude-oil tank farm for Oiltanking MOGS in Saldanha Bay
2014	The First Rand Bank data centre facilities in Pretoria and Johannesburg
2014	The Vopak facility in the Island View Complex in Durban
2014	The Econ Oil facility in Marble Hall, Limpopo
2014	An occupied building risk assessment of BP facilities in Mozambique
2013	The Air BP facility in East London
2013	A crude storage facility at Saldanha Bay
2013	VSAD Terminal Lesedi at Heidelberg
2012	Kenmare Moma Mine in Mozambique
2012	Golder Africa study for tank farm (LPG and other fuels) near Heidelberg, Gauteng
2012	CSIR study for tank farm (LPG and other fuels) at Coega, Eastern Cape
2011-2012	BP fuel depots at Langlaagte and Pretoria
2010	Transnet Pipelines fuel depots around South Africa
2008	Multi-product tank farms in the Island View Complex in Durban
2007	Petroleum tank farm in the Western Cape
2005	An overland pipeline near Mossel Bay
2005	Holcim waste fuel blending
2004	Petroleum tank farms in Island View Complex in Durban and the Western Cape

Lead Process Engineer for:

- 2004 'Fatal flaw' analysis for PetroSA to determine the suitability of proposed design on an existing site
The study covered separation distances, domino effects and minimum instrumentation to meet acceptable risks using layer of protection analysis (LOPA)

POWER PLANTS

Lead Process Engineer for quantitative risk assessment of:

- 2015 An Eskom power plant in the Free State
2013 A refurbished power plant in Maputo, Mozambique
2012 Matla power station in the Witbank areas
2012 Energy recovery project for Anglo American
2010 Coal-based power plants in the Witbank areas
2009 Coal-based power plants in the Waterberg areas
2008 Proposed gas-fired power plants in Mozambique
2008 The conversion of the peaking power to a CCGT plant located at Atlantis, Western Cape
2006 Coal-based power plants near Witbank and Vaal South
2006 Proposed peaking power plants in KZN and Eastern Cape
2006 The expansion of the peaking power plant located at Atlantis, Western Cape
2005 The EcoElectrica Independent Power Generation Project at Mittal Steel in Vanderbijlpark
2004 Iscor Power Project at Vanderbijl Park

FOODS AND BEVERAGES

Lead Process Engineer for quantitative risk assessment of:

- 2015 A soya crushing facility for RussellStone Protein in Bronkhorstspuit
2014-2015 The Spar distribution centres in the South Rand, North Rand and Eastern Cape
2014 The Sasko Bakery facility in Bloemfontein
2014 The Peninsula Beverage Company facility in Cape Town
2014 The Chill Beverages International facility in Stellenbosch
2014 The Kynoch fertiliser facility in Endicott, Gauteng
2013-2014 The Coca-Cola Fortune facilities in Port Elizabeth, Port Shepstone and Polokwane
2013 The Quantum Food chicken processing plant at Hartesbeesfontein
2013 The ABI bottling facility in Johannesburg reviewed
2013 The new Unilever ice cream factory facilities at Chloorkop
2011 The Rainbow Chickens processing plant, Rustenburg
2010 The Famous Brands facility in Midrand
2010 The McCain Foods facility in George
2010 The Coca-Cola Canners facility in Germiston
2005 The ABI bottling facilities in Johannesburg, Midrand and Pretoria

CHEMICALS AND MANUFACTURING

Lead Process Engineer for quantitative risk assessment of:

2015	Two SA Calcium Carbide facilities in KwaZulu-Natal
2015	The Arch Wood Protection facility in Port Shepstone
2015	The Arengo ethanol plant in Cradock
2015	A water reclamation facility at the Optimum Colliery in Mpumalanga
2014	The Foskor facility in Richards Bay
2013	The Eagle Inks facility in Pinetown
2013	New bio-generation plants converting animal waste to electricity
2013	The Unilever facility in Phoenix, Durban
2013	A rapid wall facility in Richards Bay
2013	The Transnet Rail Engineering facilities in Germiston and Uitenhage
2012	The BAE Systems Land Systems facility in Alrode
2012	The Consol Glass facility in Nigel
2012	An ArcelorMittal polyurethane facility
2012	Isegen facilities at Durban and Germiston
2012	A MAP plant in Richards Bay
2012	An occupied building risk assessment and hazardous area classification for Synthomer, Durban
2012	New hydrogen fluoride and trialuminum fluoride plant in Richards Bay
2012	The Chevron lubricant manufacturing facility
2011	Steel plant in Witbank
2011	Steel plant in Saldanha Bay
2011	Platinum refinery in Springs
2011	New hydrogen fluoride and trialuminum fluoride plant in Gauteng
2010	Steel plant in Cato Ridge
2010	A bulk argon storage facility in Johannesburg
2009	An aluminium fluoride plant in KwaZulu-Natal
2009	Shell Chemicals, Durban
2009	The Unico facility in Durban
2008	The Revertex facility in Durban
2007	A new chlor-alkali facility in the Eastern Cape
2002–2008	Ammonia refrigeration plants throughout South Africa
2007	Alkylation plant in KwaZulu-Natal
2006	The Element Six facility in Springs
2006	The Singisi Forest Products wood product facility in Kokstad
2006	The Lanxess facility in Merebank, Durban
2006	A 900 t butane storage facility in Durban
	This study considered fires and explosions from an accidental loss of containment of material
2005	Impala Platinum BMR expansion
	This included the consequent modelling of fires and explosions of flammable liquid and gases as well as air dispersion of toxic gases
2005	NCP Chlorchem expansion
	This included the consequent modelling of fires and explosions of flammable liquid and gases as well as air dispersion of toxic gases
2005	The Dow Chemical Company facilities at Canelands, Chloorkop, Sasolburg and Berlin
	This included the consequent modelling of fires and explosions of large flammables and toxic gases
2004	The Magalies Water purification plant at Vaalkop
2003	PetroSA converting floating-roof tanks into MTBE storage tanks at the refinery and export terminal

REFINERIES

Lead Process Engineer for quantitative risk assessment of:

2009	A refinery expansion in Suriname
2006	Fire zoning classification of Saudi Aramco's Luberef facility, Saudi Arabia The study defined the fire zones as per the requirements of Saudi Aramco
2006	Building risk assessment of the Saudi Aramco Luberef facility, Saudi Aramco The study consisted of a full quantitative risk assessment as per API 752
2005	PetroSA refinery near Mossel Bay

HAZOP AND LOPA STUDIES

HAZOP Chairman for:

2010 to present	BP Southern Africa
2015	An ice-cream factory for Unilever at Chloorkop
2015	The national multi-product pipeline for Transnet in Durban
2015	Fuel transport pipelines for Oiltanking MOGS in Saldanha Bay
2014	The Enerwaste medical waste facility in Waltloo, Pretoria
2014	The Tongaat-Hulett Starch mill in Germiston
2014	The VTTI Burgan Oil facility in Cape Town
2013	The Sunrise Energy LPG terminal in Saldanha
2013	The SimsGas facility in Chamdor
2013	The Vanchem Vanadium Products facility in eMalahleni
2013	The ArcelorMittal facility in Newcastle
2013	The Proxa brine treatment facility in New Vaal
2010	Sasol projects at Secunda and Sasolburg
2009	A cogeneration plant, Rustenburg
2008	A new section of AngloGold Ashanti, Tanzania
2007–2010	A chrome chemical facility, KZN
2007	Chlorine expansion, Gauteng
2007	LOPA study for a large LPG installation and chemicals, Durban
2004–2004	Project upgrades at petroleum tank farms
2003–2005	Proposed nuclear installation at PBMR
2002–2004	Chevron on eight oil platforms off the coast of Cabinda

Education:

BSc (Chemical Engineering), University of the Witwatersrand, South Africa, 1982

Employment Record:

2002 to date	Director, RISCOP, South Africa Involved in process safety consulting including MHI risk assessments and facilitating process hazard analysis studies (HAZOP, SIL & LOPA)
2001–2002	Managing Member, Penoc Consulting, South Africa Involved in Process Engineering Project Management and Process Safety Consulting for various projects
1995–2001	Process Manager for Dow Chemicals, South Africa Managed the cost estimation, project approvals, process designs and commissioning of various plants within the group
1993–1995	Technical Manager for Sentrachem, Durban South Africa Managed the Technical Department of a facility conducting technical investigations, projects and continual plant improvements
1986–1993	Process Engineer for Sentrachem, Germiston, South Africa This involved conducting plant investigations, design of new plants, installing and commissioning new equipment

Languages:

	Speaking	Reading	Writing
English (first)	Excellent	Excellent	Excellent
Afrikaans	Good	Good	Average

Certification:

I, the undersigned, certify that to the best of my knowledge and belief, this data correctly describes me, my qualifications and my experience.

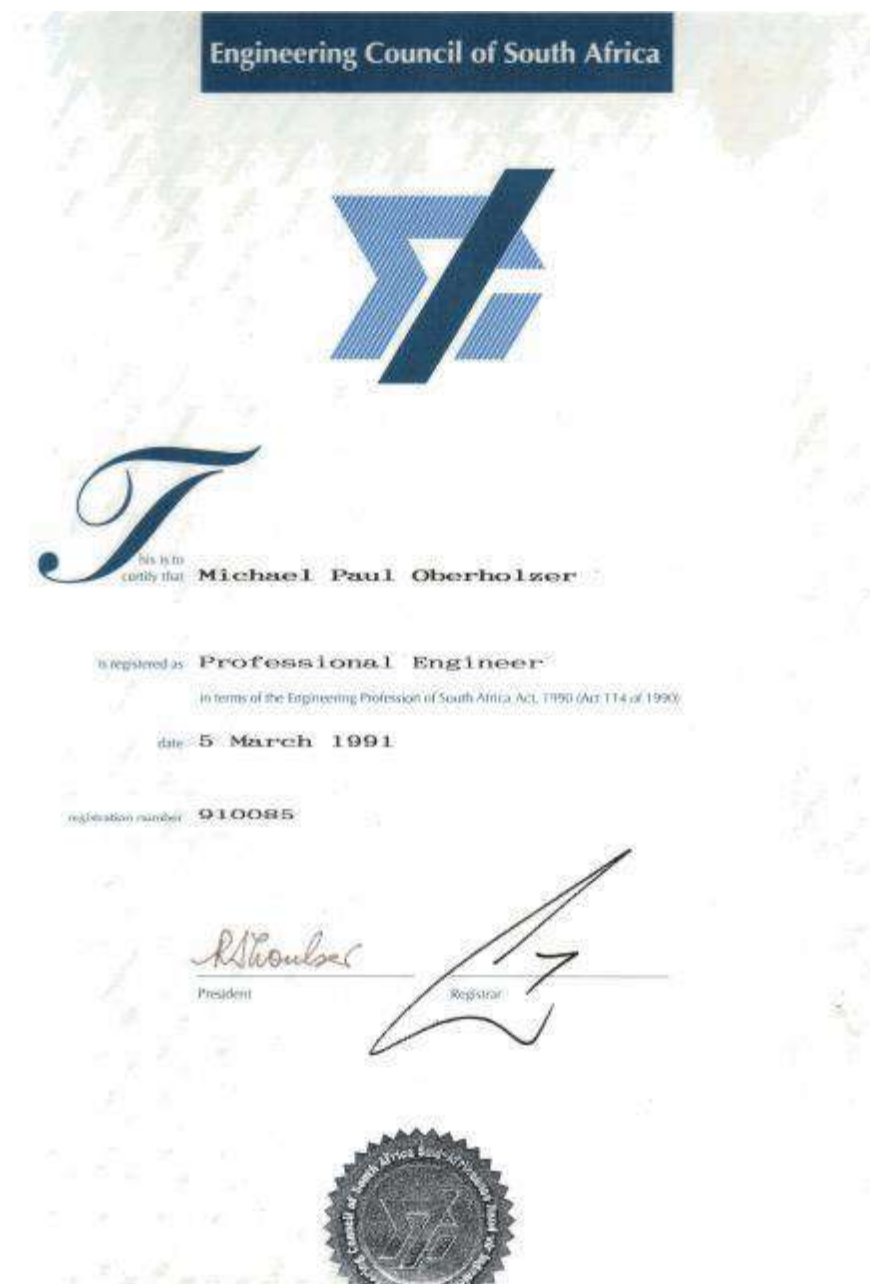


.....

Date: 31st of March 2016

Full name of staff member: Michael Paul Oberholzer

1.9.2. Appendix B: Professional Registration Michael Oberholzer



1.9.3. Appendix C: Department of Labour Certificate

Republic of South Africa



Department of Labour

Certificate

This is to certify that

RISCOM (PTY) LTD

Has been approved as an

APPROVED INSPECTION AUTHORITY

Type A; Explosive Chemicals, Gases, Flammable Gases, Non-Flammable, Non toxic gases (asphyxiants), Toxic gases and Flammable liquids, Flammable solids, Substances liable to spontaneous combustion,

Substances that on contact with water release flammable gasses, Oxidizing substances and organic peroxides, Toxic liquids and Solids.

In terms of the Occupational Health and Safety Act, 1993, read with the Major Hazard Installation Regulations 5(5) (a) regarding risk assessments


.....
Chief Inspector

Valid From: 27 May 2013

Expires: 26 May 2017

MHI 0005

.....
Certificate Number

1.9.4. Appendix D: SANAS Certificates



CERTIFICATE OF ACCREDITATION

In terms of section 22(2)(b) of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act, 2006 (Act 19 of 2006), read with sections 23(1), (2) and (3) of the said Act, I hereby certify that:-

RISCOM (PTY) LTD
Co. Reg. No.: 2002/019697/07
JOHANNESBURG

Facility Accreditation Number: **MHI0013**

is a South African National Accreditation System accredited Inspection Body to undertake
TYPE A inspection provided that all SANAS conditions and requirements are complied with

This certificate is valid as per the scope as stated in the accompanying schedule of accreditation,
Annexure "A", bearing the above accreditation number for

THE ASSESSMENT OF RISK ON MAJOR HAZARD INSTALLATIONS

The facility is accredited in accordance with the recognised International Standard

ISO/IEC 17020:2012

The accreditation demonstrates technical competency for a defined scope and the operation of a
quality management system

While this certificate remains valid, the Accredited Facility named above is authorised to use the
relevant SANAS accreditation symbol to issue facility reports and/or certificates



Mr R Josias
Chief Executive Officer

Effective Date: 27 May 2013
Certificate Expires: 26 May 2017


This certificate does not, on its own confer authority to act as an Approved Inspection Authority as contemplated in the Major Hazard Installation Regulations. Approval to inspect within the regulatory domain is granted by the Department of Labour.

ANNEXURE A

SCHEDULE OF ACCREDITATION

Facility Number: MHI0013

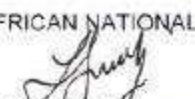
TYPE A

<u>Permanent Address:</u> Riscom (Pty) Ltd 33 Brighsh Dr Northcliff Johannesburg 2196 Tel: (011) 431-2198 Fax: 086 624 9423 Mobile: 082 457 3258 E-mail: mike@riscom.co.za	<u>Postal Address:</u> P O Box 2541 Cresta Johannesburg 2118 Issue No.: 12 Date of issue: 28 February 2013 Expiry date: 26 May 2017	
<u>Nominated Representative:</u> Mr M Oberholzer	<u>Quality Manager:</u> Mr M Oberholzer <u>Technical Manager:</u> Mr M Oberholzer	<u>Technical Signatory:</u> Mr M Oberholzer
Field of Inspection	Service Rendered	Codes and Regulations
<u>Regulatory:</u> 1) Explosive chemicals 2) Gases: i) Flammable Gases ii) Non-flammable, non toxic gases (asphyxiants) iii) Toxic gases 3) Flammable liquids 4) Flammable solids, substances liable to spontaneous combustion, substances that on contact with water release flammable gases 5) Oxidizing substances and organic peroxides 6) Toxic liquids and solids	<u>Specific Services:</u> i) Frequency/ Probability Analysis ii) Consequence Modelling iii) Hazard Identification and Analysis including HAZARD and Operability studies (HAZOP) iv) Emergency planning reviews	<u>Programmes, guidelines, regulations and codes:</u> MHI regulation par. 5 (5) (b) Reference Manual Bevi Risk Assessments version 3.2 (2009) CPR 18E (1999), Guideline for quantitative risk assessment ("Purple Book"), TNO Apeldoorn. CPR 14E (1997), Methods for the Calculation of Physical Effects ("Yellow Book"), 3 rd Edition, TNO, Apeldoorn. CPR 16E (1992), Methods for the Determination of Possible Damage ("Green Book"), 1 st Edition, TNO, Apeldoorn. Lees FP (2001), Loss Prevention in the Process Industries: Hazard Identification, Assessment and Control, 2 nd Edition, Butterworths, London, UK.

Original date of accreditation: 27 May 2005

Page 1 of 1

ISSUED BY THE SOUTH AFRICAN NATIONAL ACCREDITATION SYSTEM


 Field Manager

1.9.5. Appendix E: Notification of Major Hazard Installation

Prior to the assessment of the potential impact of the various accidental spills, reference needs to be made to the legislation, regulations and guidelines governing the operation of the development.

Section 1 of the Occupational Health and Safety Act (OHS Act; Act No. 85 of 1993) defines a "major hazard installation" to mean an installation:

- “
- (a) Where more than the prescribed quantity of any substance is or may be kept, whether permanently or temporarily;
 - (b) Where any substance is produced, processed, used, handled or stored in such a form and quantity that it has the potential to cause a major incident (*our emphasis*).
- “

It should be noted that if either (a) or (b) is satisfied, the Major Hazard Installation (MHI) regulations will apply. The prescribed quantity of a chemical can be found in Section 8(1) of the General Machinery Regulation 8.

A major incident is defined as: "an occurrence of catastrophic proportions, resulting from the use of plant and machinery or from activities at a workplace". Catastrophic in this context means loss of life and limbs or severe injury to employees or members of the public, particularly those who are in the immediate vicinity.

It is important to note that the definition refers to an occurrence, whereas Section 1b) refers to the potential to cause a major incident. If the potential to cause a major incident exists, then the OHS Act and the Major Hazard Installation regulations will apply (*our emphasis*).

On the 16th of January 1998, the MHI regulations were promulgated under the OHS Act (Act No. 85 of 1993), with a further amendment on the 30th of July 2001. The provisions of the regulations apply to installations that have on their premises a certain quantity of a substance that can pose a significant risk to the health and safety of employees and the public.

The scope of application given in Section 2 of the MHI regulations is as follows:

- “
- (1) Subject to the provisions of Subregulation (3) these regulations shall apply to employers, self-employed persons and users, who have on their premises, either permanently or temporarily, a major hazard installation or a quantity of a substance which may pose a risk that could affect the health and safety of employees and the public (*our emphasis*);
 - (2) These regulations shall apply to local governments, with specific reference to Regulation 9.
- “

It is important to note that the regulations refer to a substance, and furthermore the regulations are applicable to risks posed by the substance and NOT merely the potential consequences (*our emphasis*).

The regulations essentially consist of six parts, namely:

1. Duties for notification of a Major Hazard Installation (existing or proposed), including:
 - a. Fixed (see List 1);
 - b. Temporary installations;
2. The minimum requirements for a quantitative risk assessment (see List 2);
3. The requirements of an on-site emergency plan (see List 3);
4. The reporting steps of risk and emergency occurrences (see List 4);
5. The general duties required of suppliers;
6. The general duties required of local government.

Notification of installation (List 1) indicates that:

- Applications need to be made in writing to the relevant local authority and the provincial director for permission:
 - To erect any Major Hazard Installation;
 - Prior to the modification of any existing installation that may significantly increase the risk related to it (e.g. an increase in the storage or production capacity or alteration of the process);
- Applications need to include the following information:
 - Physical address of installation;
 - Complete material safety data sheets of all hazardous substances;
 - Maximum quantity of each substance envisaged to be on the premises at any one time;
 - The risk assessment of the installation (see List 2);
 - Any further information that may be deemed necessary by an inspector in the interests of health and safety to the public;
- Applications need to be advertised in at least one newspaper serving the surrounding communities and by way of notices posted within these communities.

The risk assessment (List 2):

- Is the process of collecting, organising, analysing, interpreting, communicating and implementing information in order to identify the probable frequency, magnitude and nature of any major incident which could occur at a Major Hazard Installation and the measures required to remove, reduce or control the potential causes of such an incident;
- Needs to be undertaken at intervals not exceeding 5 years and needs to be submitted to the relevant local emergency services;
- Must be made available in copies to the relevant health and safety committee and 60 days must be given to comment thereon and ensure that the results of the assessment be made available to any relevant representative or committee to comment thereon;
- Should be undertaken by competent person(s) and include the following:
 - A general process description;
 - A description of major incidents associated with this type of installation and the consequences of such incidents (including potential incidents);
 - An estimation of the probability of a major incident;
 - The on-site emergency plan;
 - An estimation of the total result in the case of an explosion;
 - An estimation of the effects of thermal radiation in the case of fire;
 - An estimation of concentration effects in the case of a toxic release;
 - Potential effects of a major incident on an adjacent major hazard installation or part thereof;
 - Potential effects of a major incident on any other installation, members of the public (including all persons outside the premises) and on residential areas;
 - Meteorological tendencies;
 - Suitability of existing emergency procedures for the risks identified;
 - Any requirements laid down in terms of the Environmental Conservation Act of 1989 (Act No. 73 of 1989);
 - Any organisational measures that may be required;
 - The employer shall ensure that the risk assessment is of an acceptable standard and shall be reviewed should:
 - It be suspected that the preceding assessment is no longer valid;
 - Changes in the process that affect hazardous substances;
 - Changes in the process that involve a substance that resulted in the installation being classified a Major Hazard Installation or in the methods, equipment or procedures for the use, handling or processing of that substance;
 - Incidents that have brought the emergency plan into operation and may affect the existing risk assessment;
- Must be made available at a time and place and in a manner agreed upon between parties for scrutiny by any interested person that may be affected by the activities.

Requirements related to the on-site emergency plan (List 3) are:

- After submission of the notification, the following shall be established:
 - An on-site emergency plan must be made available and must be followed inside the premises of the installation or the part of the installation classified as a Major Hazard Installation, in consultation with the relevant health and safety representative or the relevant health and safety committee;
 - The on-site emergency plan must be discussed with the relevant local government, taking into consideration any comment on the risk related to the health and safety of the public;
 - The on-site emergency plan must be reviewed and where necessary updated, in consultation with the relevant local government, at least once every three years;
 - A copy of the on-site emergency plan must be signed in the presence of two witnesses, who shall attest the signature;
 - The on-site emergency plan must be readily available at all times for implementation and use;
 - All employees must be conversant with the on-site emergency plan;
 - The on-site emergency plan must be tested in practice at least once a year, and a record must be kept of such testing;
- Any employer, self-employed person and user owning or in control of a pipeline that could pose a threat to the general public shall inform the relevant local government and shall be jointly responsible with the relevant local government for the establishment and implementation of an on-site emergency plan.

In reporting of risk and emergency occurrences (List 4):

- Following an emergency occurrence, the user of the installation shall:
 - Subject to the provisions of Regulation 6 of the General Administrative Regulations, within 48 hours by means of telephone, facsimile or similar means of communication inform the chief inspector, the provincial director and relevant local government of the occurrence of a major incident or an incident that brought the emergency plan into operation or any near miss;
 - Submit a report in writing to the chief inspector, provincial director and local government within seven days;
 - Investigate and record all near misses in a register kept on the premises, which shall at all times be available for inspection by an inspector and local government representatives.

The duties of the supplier refer specifically to:

- The supplying of material safety data sheets for the hazardous substances employed or contemplated in the installation;
- Assessment of the circumstances and substance involved in an incident or potential incident and the informing all persons being supplied with that substance of the potential dangers surrounding it;
- Provision of a service that shall be readily available on a 24-hour basis to all employers, self-employed persons, users, relevant local government and any other body concerned to provide information and advice in the case of a major incident with regard to the substance supplied.

The duties of local government are summarised as follows:

- “ 9. (1) Without derogating from the provisions of the National Building Regulations and Building Standards Act of 1977 (Act No. 103 of 1977), no local government shall permit the erection of a new major hazard installation at a separation distance less than that which poses a risk to:
- (a) Airports;
 - (b) Neighbouring independent major hazard installations;
 - (c) Housing and other centres of population; or,
 - (d) Any other similar facility...

Provided that the local government shall permit new property development only where there is a separation distance which will not pose a risk (our emphasis) in terms of the risk assessment: Provided further that the local government shall prevent any development adjacent to an installation that will result in that installation being declared a major hazard installation.

(2) Where a local government does not have facilities available to control a major incident or to comply with the requirements of this regulation that local government shall make prior arrangements with a neighbouring local government, relevant provincial government or the employer, self-employed person and user for assistance...

(3) All off-site emergency plans to be followed outside the premises of the installation or part of the installation classified as a major hazard installation shall be the responsibility of the local government... ”

1.9.6. Appendix F: Physical Properties

1.9.6.1. LNG and CNG Modelled as Methane

1.9.6.1.1. Methane Constants

Constant	Unit	Value
Acentric Factor		0.01155
Critical Pressure	bar	45.99
Critical Temperature	°C	-82.6
Emissive Power Length Scale	m	6.75
Enthalpy Interpolation Range	°C	0
Heat of Combustion	kJ/kmol	8.03E+05
Heat of Solution	kJ/kg	0
Laminar Burning Velocity	m/s	0.45
Liquid Water Surface Tension	dyne/cm	50
Lower Flammability Limit	ppm	4.40E+04
Maximum Burn Rate	kg/m ² ·s	0.141
Maximum Surface Emissive Power	kW/m ²	220
Melting Point	°C	-182.5
Molecular Weight		16.04
Normal Boiling Point	°C	-161.5
Pool Fire Burn Rate Length	m	7.25
Solubility in Water		0
TNT Explosion Efficiency	%	0
Triple Point Pressure	bar	0.117
Triple Point Temperature	°C	-182.5
Upper Flammability Limit	ppm	1.65E+05

1.9.6.1.2. Methane Coefficients

Parameter	Equation Number	Lower Temp. Limit (°C)	Upper Temp. Limit (°C)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	Coefficient E
Vapour Viscosity	102	-182.5	726.9	5.26E-07	0.5901	105.7	0	
Vapour Thermal Conductivity	102	-182.5	726.9	6325	0.4304	7.70E+08	-3.87E+10	
Vapour Pressure	101	-182.5	-82.59	39.2	-1324	-3.437	3.10E-05	2
Trimer Coefficients	101			0	0	0	0	0
Surface Tension	106	-182.5	-82.59	0.03656	1.147	0	0	0
Second Virial Equation Coefficient	104	-162.3	1227	0.05108	-25.18	-2.56E+05	5.98E+15	-5.77E+17
Saturated Liquid Density	105	-182.5	-82.59	2.921	0.2898	190.6	0.2888	
Octamer Coefficients	101			0	0	0	0	0
Liquid Viscosity	101	-182.5	-85.15	-6.157	178.2	-0.9524	-9.06E-24	10
Liquid Thermal Conductivity	100	-182.5	-93.15	0.4177	-0.00245	3.56E-06	0	0
Liquid Heat Capacity	114	-182.5	-83.15	65.71	3.89E+04	-257.9	614.1	0
Ideal Gas Heat Capacity	107	-223.1	1227	3.33E+04	7.99E+04	2087	4.16E+04	992
Hexamer Coefficients	101			0	0	0	0	0
Dimer Coefficients	101			0	0	0	0	0

1.9.6.2. Chlorine**1.9.6.2.1. Chlorine Constants**

Constant	Unit	Value
Acentric Factor		0.06882
Acid Association Flag		Not modelled
Aerosol Class Number		2
Critical Pressure	bar	77.1
Critical Temperature	°C	144
Dangerous Toxic Load		4.84E+05
Emissive Power Length Scale	m	0
Enthalpy Interpolation Range	°C	0
ERPG-1	ppm	1
ERPG-2	ppm	3
ERPG-3	ppm	20
Flammable/Toxic Flag		Toxic
Heat of Solution	kJ/kg	0
Luminous/Smoky Flame Flag		Luminous
Melting Point	°C	-101
Molecular Weight		70.91
Normal Boiling Point	°C	-34.03
Reaction with Water Model		None
Reactivity with Atmosphere		Not strongly reactive
Solubility in Water		0.0065
Toxic Property A		-4.81
Toxic Property B		0.5
Toxic Property N		2.75

1.9.6.2.2. Chlorine Coefficients

Property	Equation No.	Lower Temp. Limit (°C)	Upper Temp. Limit (°C)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	Coefficient E
Vapour Viscosity	102	-73.15	726.9	2.60E-07	0.7423	98.3	0	
Vapour Thermal Conductivity	102	-73.15	726.9	0.000999	0.5472	458.6	0	
Vapour Pressure	101	-101	144	71.33	-3855	-8.517	0.01238	1
Trimer Coefficients	101			0	0	0	0	0
Surface Tension	106	-101	144	0.06756	1.085	0	0	0
Second Virial Equation Coefficient	104	-64.55	1805	0.06943	-70.43	-4.34E+06	1.09E+19	-2.26E+21
Saturated Liquid Density	105	-101	144	2.23	0.2764	417.1	0.2926	
Octamer Coefficients	101			0	0	0	0	0
Liquid Viscosity	101	-83.15	26.85	-25.68	974.9	2.558	-4.30E-26	10
Liquid Thermal Conductivity	100	-101	136.9	0.2246	-6.40E-05	-7.88E-07	0	0
Liquid Heat Capacity	100	-101	-34.03	6.39E+04	46.35	-0.1623	0	0
Ideal Gas Heat Capacity	107	-223.1	1227	2.91E+04	9176	949	1.00E+04	425
Hexamer Coefficients	101			0	0	0	0	0
Dimer Coefficients	101			0	0	0	0	0

1.9.6.3. Ammonia

1.9.6.3.1. Ammonia Constants

Constant	Unit	Value
Acentric Factor		0.2526
Acid Association Flag		Not modelled
Aerosol Class Number		4
Critical Pressure	bar	112.8
Critical Temperature	°C	132.5
Dangerous Toxic Load		1.03E+09
Emissive Power Length Scale	m	2.75
Enthalpy Interpolation Range	°C	0
AEGL-1	ppm	30
AEGL-2	ppm	60
AEGL-3	ppm	1100
Flammable/Toxic Flag		Both
Heat of Combustion	kJ/kmol	3.17E+05
Heat of Solution	kJ/kg	540
Immediate Ignition Category		Low
Laminar Burning Velocity	m/s	0.45
Lower Flammability Limit	ppm	1.60E+05
Luminous/Smoky Flame Flag		General
Maximum Burn Rate	kg/m ² .s	0
Maximum Surface Emissive Power	kW/m ²	170
Melting Point	°C	-77.74
Molecular Weight		17.03
Normal Boiling Point	°C	-33.43
Pool Fire Burn Rate Length	m	0
Reaction with Water Model		Raj & Reid
Reactivity with Atmosphere		Not strongly reactive
Solubility in Water		0.53
SRK Alpha Calculation Flag		Soave
TNT Explosion Efficiency	%	0
Toxic Property A		-16.21
Toxic Property B		1
Toxic Property N		2
Triple Point Pressure	bar	0.06111
Triple Point Temperature	°C	-77.74
Upper Flammability Limit	ppm	2.50E+05

1.9.6.3.2. Ammonia Coefficients

Parameter	Equation No.	Lower Temp. Limit (°C)	Upper Temp. Limit (°C)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	Coefficient E
Vapour Viscosity	102	-77.74	726.9	4.19E-08	0.9806	30.8	0	
Vapour Thermal Conductivity	102	-33.43	726.9	0.000289	0.9548	653	-4.51E+04	
Vapour Pressure	101	-77.74	132.5	90.48	-4670	-11.61	0.01719	1
Trimer Coefficients	101			0	0	0	0	0
Surface Tension	106	-77.74	132.5	0.1016	1.216	0	0	0
Second Virial Equation Coefficient	104	-73.15	426.9	0.015	-19.9	-4.93E+06	-2.85E+18	4.43E+20
Saturated Liquid Density	105	-77.74	132.5	3.538	0.2544	405.6	0.2888	
Octamer Coefficients	101			0	0	0	0	0
Liquid Viscosity	101	-77.74	120	-6.743	598.3	-0.7341	-3.69E-27	10
Liquid Thermal Conductivity	100	-77.74	126.9	1.169	-0.00231	0	0	0
Liquid Heat Capacity	114	-70	128	61.29	8.09E+04	799.4	-2651	0
Ideal Gas Heat Capacity	107	-173.1	1227	3.34E+04	4.90E+04	2036	2.26E+04	882
Hexamer Coefficients	101			0	0	0	0	0
Dimer Coefficients	101			0	0	0	0	0

1.9.6.4. Hydrogen

1.9.6.4.1. Hydrogen Constants

Constants	Unit	Value
Acentric Factor		-0.216
Critical Pressure	bar	13.13
Critical Temperature	°C	-240
Heat of Combustion	kJ/kmol	2.42E+05
Lower Flammability Limit	ppm	4.00E+04
Maximum Surface Emissive Power	kW/m ²	170
Melting Point	°C	-259.2
Molecular Weight		2.016
Normal Boiling Point	°C	-252.8
Triple Point Pressure	bar	0.0722
Triple Point Temperature	°C	-259.2
Upper Flammability Limit	ppm	7.50E+05

1.9.6.4.2. Hydrogen Coefficients

Parameter	Equation Number	Lower Temp. Limit (°C)	Upper Temp. Limit (°C)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	Coefficient E
Vapour Viscosity	102	-259.2	2727	1.80E-07	0.685	-0.59	140	
Vapour Thermal Conductivity	102	-251.1	1327	0.002653	0.7452	12	0	
Vapour Pressure	101	-259.2	-240	12.69	-94.9	1.113	0.0003292	2
Trimer Coefficients	101			0	0	0	0	0
Surface Tension	106	-259.2	-240	0.005345	1.065	0	0	0
Second Virial Equation Coefficient	104	-256.5	126.9	0.02376	-2.653	-702	3.93E+09	-5.66E+10
Saturated Liquid Density	105	-259.2	-240	5.414	0.3489	33.19	0.2706	
Octamer Coefficients	101			0	0	0	0	0
Liquid Viscosity	101	-259.2	-240.1	-11.66	24.7	-0.261	-4.10E-16	10
Liquid Thermal Conductivity	100	-259.2	-242.1	-0.0917	0.01768	-0.000382	-3.33E-06	1.03E-07
Liquid Heat Capacity	114	-259.2	-241.1	66.65	6766	-123.6	478.3	0
Ideal Gas Heat Capacity	107	-23.15	1227	2.76E+04	9560	2466	3760	567.6
Hexamer Coefficients	101			0	0	0	0	0
Dimer Coefficients	101	-259.2	2727	0	0	0	0	0

1.9.6.5. Diesel Modelled as Dodecane

1.9.6.5.1. Dodecane Constants

Constant	Unit	Value
Acentric Factor		0.5764
Acid Association Flag		Not modelled
Combustion At		0.9418
Combustion Ct		0.01123
Critical Pressure	bar	18.2
Critical Temperature	°C	384.9
Emissive Power Length Scale	m	8.33
Flash Point	°C	73.85
Heat of Combustion	kJ/kmol	7.51E+06
Heat of Solution	kJ/kg	0
Laminar Burning Velocity	m/s	0.52
Liquid Water Surface Tension	dyne/cm	0
Lower Flammability Limit	ppm	6000
Luminous/Smoky Flame Flag		Smoky
Maximum Burn Rate	kg/m ² ·s	0
Melting Point	°C	-9.582
Molecular Weight		170.3
Normal Boiling Point	°C	216.3
Pool Fire Burn Rate Length	m	0.1
Solubility in Water		0
TNT Explosion Efficiency	%	0
Triple Point Pressure	bar	6.15E-06
Triple Point Temperature	°C	-9.582
Upper Flammability Limit	ppm	4.90E+04
Water Heat Transfer Coefficient	W/m ² ·K	0

1.9.6.5.2. Dodecane Coefficients

Parameter	Equation Number	Lower Temp. Limit (°C)	Upper Temp. Limit (°C)	Coefficient A	Coefficient B	Coefficient C	Coefficient D	Coefficient E
Vapour Viscosity	102	-9.58	726.9	6.34E-08	0.8287	219.5	0	
Vapour Thermal Conductivity	102	216.3	726.9	5.72E-06	1.47	579.4	0	
Vapour Pressure	101	-9.58	384.9	137.5	-1.20E+04	-16.7	8.09E-06	2
Trimer Coefficients	0			0				
Surface Tension	106	-9.58	384.9	0.05549	1.326	0	0	0
Second Virial Equation Coefficient	104	55.85	1227	0.88	-1091	-5.03E+07	-5.49E+21	1.50E+24
Saturated Liquid Density	105	-9.58	384.9	0.3554	0.2551	658	0.2937	
Octamer Coefficients	0			0				
Liquid Viscosity	101	-9.58	216.3	-18.8	1839	1.062	0	0
Liquid Thermal Conductivity	100	-9.58	216.3	0.2047	-0.000233	0	0	0
Liquid Heat Capacity	100	-9.58	56.85	5.08E+05	-1369	3.102	0	0
Ideal Gas Heat Capacity	107	-73.15	1227	2.13E+05	6.63E+05	1716	4.52E+05	777.5
Hexamer Coefficients	0			0				
Dimer Coefficients	0			0				

1.9.7. Appendix G: PADHI Land Planning Tables

1.9.7.1. Development Type Table 1: People at Work, Parking

Development Type	Examples	Development Detail and Size	Justification
DT1.1 Workplaces	Offices, factories, warehouses, haulage depots, farm buildings, nonretail markets, builder's yards	Workplaces (predominantly nonretail), providing for less than 100 occupants in each building and less than 3 occupied storeys (Level 1)	Places where the occupants will be fit and healthy and could be organised easily for emergency action Members of the public will not be present or will be present in very small numbers and for a short time
	Exclusions		
		DT1.1 x1 Workplaces (predominantly nonretail) providing for 100 or more occupants in any building or 3 or more occupied storeys in height (Level 2 except where the development is at the major hazard site itself, where it remains Level 1)	Substantial increase in numbers at risk with no direct benefit from exposure to the risk
	Sheltered workshops, Remploy	DT1.1 x2 Workplaces (predominantly nonretail) specifically for people with disabilities (Level 3)	Those at risk may be especially vulnerable to injury from hazardous events or they may not be able to be organised easily for emergency action
DT1.2 Parking Areas	Car parks, truck parks, lockup garages	Parking areas with no other associated facilities (other than toilets; Level 1)	
	Exclusions		
	Car parks with picnic areas or at a retail or leisure development or serving a park and ride interchange	DT1.2 x1 Where parking areas are associated with other facilities and developments the sensitivity level and the decision will be based on the facility or development	

1.9.7.2. Development Type Table 2: Developments for Use by the General Public

Development Type	Examples	Development Detail and Size	Justification
DT2.1 Housing	Houses, flats, retirement flats or bungalows, residential caravans, mobile homes	Developments up to and including 30 dwelling units and at a density of no more than 40 per hectare (Level 2)	Development where people live or are temporarily resident It may be difficult to organise people in the event of an emergency
	Exclusions		
	Infill, back-land development	DT2.1 x1 Developments of 1 or 2 dwelling units (Level 1)	Minimal increase in numbers at risk
	Larger housing developments	DT2.1 x2 Larger developments for more than 30 dwelling units (Level 3)	Substantial increase in numbers at risk
		DT2.1 x3 Any developments (for more than 2 dwelling units) at a density of more than 40 dwelling units per hectare (Level 3)	High-density developments
DT2.2 Hotel or Hostel or Holiday Accommodation	Hotels, motels, guest houses, hostels, youth hostels, holiday camps, holiday homes, halls of residence, dormitories, accommodation centres, holiday caravan sites, camping sites	Accommodation up to 100 beds or 33 caravan or tent pitches (Level 2)	Development where people are temporarily resident It may be difficult to organise people in the event of an emergency
	Exclusions		
	Smaller: guest houses, hostels, youth hostels, holiday homes, halls of residence, dormitories, holiday caravan sites, camping sites	DT2.2 x1 Accommodation of less than 10 beds or 3 caravan or tent pitches (Level 1)	Minimal increase in numbers at risk
	Larger: hotels, motels, hostels, youth hostels, holiday camps, holiday homes, halls of residence, dormitories, holiday caravan sites, camping sites	DT2.2 x2 Accommodation of more than 100 beds or 33 caravan or tent pitches (Level 3)	Substantial increase in numbers at risk
DT2.3 Transport Links	Motorway, dual carriageway	Major transport links in their own right i.e. not as an integral part of other developments (Level 2)	Prime purpose is as a transport link Potentially large numbers exposed to risk but exposure of an individual is only for a short period

Development Type	Examples	Development Detail and Size	Justification
	Exclusions		
	Estate roads, access roads	DT2.3 x1 Single carriageway roads (Level 1)	Minimal numbers present and mostly a small period of time exposed to risk Associated with other development
	Any railway or tram track	DT2.3 x2 Railways (Level 1)	Transient population, small period of time exposed to risk Periods of time with no population present
DT2.4 Indoor Use by Public	Food and drink: restaurants, cafes, drive-through fast food, pubs Retail: shops, petrol filling station (total floor space based on shop area not forecourt), vehicle dealers (total floor space based on showroom or sales building not outside display areas), retail warehouses, super-stores, small shopping centres, markets, financial and professional services to the public Community and adult education: libraries, art galleries, museums, exhibition halls, day surgeries, health centres, religious buildings, community centres. adult education, 6th form college, college of FE Assembly and leisure: Coach or bus or railway stations, ferry terminals, airports, cinemas, concert or bingo or dance halls, conference centres, sports or leisure centres, sports halls, facilities associated with golf courses, flying clubs (e.g. changing rooms, club house), indoor go kart tracks	Developments for use by the general public where total floor space is from 250 m ² up to 5000 m ² (Level 2)	Developments where members of the public will be present (but not resident) Emergency action may be difficult to coordinate

Development Type	Examples	Development Detail and Size	Justification
	Exclusions		
		DT2.4 x1 Development with less than 250 m ² total floor space (Level 1)	Minimal increase in numbers at risk
		DT2.4 x2 Development with more than 5000 m ² total floor space (Level 3)	Substantial increase in numbers at risk
DT2.5 Outdoor Use by Public	Food and drink: food festivals, picnic areas Retail: outdoor markets, car boot sales, funfairs Community and adult education: open-air theatres and exhibitions Assembly and leisure: coach or bus or railway stations, park and ride interchange, ferry terminals, sports stadia, sports fields or pitches, funfairs, theme parks, viewing stands, marinas, playing fields, children's play areas, BMX or go kart tracks, country parks, nature reserves, picnic sites, marquees	Principally an outdoor development for use by the general public i.e. developments where people will predominantly be outdoors and not more than 100 people will gather at the facility at any one time (Level 2)	Developments where members of the public will be present (but not resident) either indoors or outdoors Emergency action may be difficult to coordinate
	Exclusions		
	Outdoor markets, car boot sales, funfairs picnic area, park and ride interchange, viewing stands, marquees	DT2.5 x1 Predominantly open-air developments likely to attract the general public in numbers greater than 100 people but up to 1000 at any one time (Level 3)	Substantial increase in numbers at risk and more vulnerable due to being outside
	Theme parks, funfairs, large sports stadia and events, open air markets, outdoor concerts, pop festivals	DT2.5 x2 Predominantly open-air developments likely to attract the general public in numbers greater than 1000 people at any one time (Level 4)	Very substantial increase in numbers at risk, more vulnerable due to being outside Emergency action may be difficult to coordinate

1.9.7.3. Development Type Table 3: Developments for Use by Vulnerable People

Development Type	Examples	Development Detail and Size	Justification
DT3.1 Institutional Accommodation and Education	Hospitals, convalescent homes, nursing homes, old people's homes with warden on site or 'on call', sheltered housing, nurseries, crèches, schools and academies for children up to school leaving age	Institutional, educational and special accommodation for vulnerable people or that provides a protective environment (Level 3)	Places providing an element of care or protection Because of age, infirmity or state of health the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult
	Exclusions		
	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	DT3.1 x1 24-hour care where the site on the planning application being developed is larger than 0.25 hectare (Level 4)	Substantial increase in numbers of vulnerable people at risk
	Schools, nurseries, crèches	DT3.1 x2 Day care where the site on the planning application being developed is larger than 1.4 hectare (Level 4)	Substantial increase in numbers of vulnerable people at risk
DT3.2 Prisons	Prisons, remand centres	Secure accommodation for those sentenced by court, or awaiting trial, etc. (Level 3)	Places providing detention Emergency action and evacuation may be very difficult

1.9.7.4. Development Type Table 4: Very Large and Sensitive Developments

Development Type	Examples	Development Detail and Size	Justification
[Note: all Level 4 developments are by exception from Level 2 or 3 and are reproduced in this table for convenient reference]			
DT4.1 Institutional Accommodation	Hospitals, convalescent homes, nursing homes, old people's homes, sheltered housing	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where 24-hour care is provided and where the site on the planning application being developed is larger than 0.25 hectare (Level 4)	Places providing an element of care or protection Because of age or state of health the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult The risk to an individual may be small but there is a larger societal concern
	Nurseries, crèches, schools for children up to school leaving age	Large developments of institutional and special accommodation for vulnerable people (or that provide a protective environment) where day care (not 24-hour care) is provided and where the site on the planning application being developed is larger than 1.4 hectare (Level 4)	Places providing an element of care or protection Because of the occupants may be especially vulnerable to injury from hazardous events Emergency action and evacuation may be very difficult The risk to an individual may be small but there is a larger societal concern
DT4.2 Very Large Outdoor Use by Public	Theme parks, large sports stadia and events, open air markets, outdoor concerts, pop festivals	Predominantly open air developments where there could be more than 1000 people present (Level 4)	People in the open air may be more exposed to toxic fumes and thermal radiation than if they were in buildings Large numbers make emergency action and evacuation difficult The risk to an individual may be small but there is a larger societal concern

1.9.8. Appendix H: Legislation, Operating and Technical Standards and Codes and Specifications

Gas Transmission and Distribution Piping System:	
ASME B31	American Society of Mechanical Engineers Code for Pressure Piping
ASME B31.3 (2002 Edition)	Process Piping Aboveground
ASME B31.8 (1999 Edition)	Gas Transmission and Distribution Piping Systems
API 6D	American Petroleum Institute Standard for Pipeline Valves
API 5L	American Petroleum Institute Standard for Pipes
API Standard 1104	American Petroleum Institute Standard for Field Welding of Pipelines
Electrical Installations:	
SANS 10108	The Classification of Hazardous Locations and the Selection of Apparatus for Use in Such Locations

1.9.9. Appendix I: Material Safety Data Sheets

1.9.9.1. Methane

METHANE (cylinder)	ICSC: 0291 Peer-Review Status: 10.02.2000 Validated
Methyl hydride	
CAS #: 74-82-8 RTECS #: PA1490000 UN #: 1971 EC #: 601-001-00-4 EINECS #: 200-812-7	Formula: CH ₄ Molecular mass: 16.0

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE- FIGHTING
FIRE	Extremely flammable.	NO open flames, NO sparks and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out. In other cases, extinguish with water spray, powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking hand tools.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE			
Inhalation	Suffocation. See Notes.	Use ventilation. Use breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
Skin	ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
Eyes	ON CONTACT WITH LIQUID: FROSTBITE.	Wear safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Personal protection: self-contained breathing apparatus. Consult an expert! Ventilation. Remove all ignition sources. NEVER direct water jet on liquid.	EC Classification Symbol: F+; R: 12; S: (2)-9-16-33 UN Classification UN Hazard Class: 2.1 GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-20G1F. NFPA Code: H1; F4; R0.	Fireproof. Cool. Ventilation along the floor and ceiling.

IMPORTANT DATA	
Physical State; Appearance COLOURLESS ODOURLESS COMPRESSED OR LIQUEFIED GAS. Physical dangers The gas is lighter than air. Chemical dangers Occupational exposure limits	Routes of exposure The substance can be absorbed into the body by inhalation. Inhalation risk On loss of containment this substance can cause suffocation by lowering the oxygen content of the air in confined areas. Effects of short-term exposure Rapid evaporation of the liquid may cause frostbite. Effects of long-term or repeated exposure

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: -161°C Melting point: -183°C Solubility in water, ml/100ml at 20°C: 3.3 Relative vapour density (air = 1): 0.6 Flash point: Flammable gas Auto-ignition temperature: 537°C Explosive limits, vol.% in air: 5-15 Octanol/water partition coefficient as log Pow: 1.09	

NOTES

Density of the liquid at boiling point: 0.42 kg/l

High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death.

Check oxygen content before entering area.

Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.

After use for welding, turn valve off; regularly check tubing, etc., and test for leaks with soap and water.

The measures mentioned in section PREVENTION are applicable to production, filling of cylinders, and storage of the gas.

Other UN number: 1972 (refrigerated liquid), Hazard class: 2.1.

Card has been partly updated in October 2005.

See section Emergency Response.

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1.9.9.2. Chlorine

CHLORINE (cylinder)	ICSC: 0126 Peer-Review Status: 31.03.2009 Validated
CAS #: 7782-50-5 RTECS #: FO2100000 UN #: 1017 EC #: 017-001-00-7 EINECS #: 231-959-5	Formula: Cl ₂ Molecular mass: 70.9

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE-FIGHTING
FIRE	Not combustible but enhances combustion of other substances. Many reactions may cause fire or explosion.	NO contact with incompatible substances. See Chemical Dangers.	In case of fire in the surroundings, use appropriate extinguishing media.
EXPLOSION	Risk of fire and explosion. See Chemical Dangers.	NO contact with incompatible materials: See Chemical Dangers	In case of fire: keep cylinder cool by spraying with water. NO direct contact with water.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
Inhalation	Cough. Sore throat. Shortness of breath. Wheezing. Laboured breathing. Symptoms may be delayed. See Notes.	Use breathing protection, closed system or ventilation.	Fresh air, rest. Half-upright position. Refer immediately for medical attention. Artificial respiration may be needed. See Notes.
Skin	ON CONTACT WITH LIQUID: FROSTBITE. Redness. Burning sensation. Pain. Skin burns.	Cold-insulating gloves. Protective clothing.	First rinse with plenty of water for at least 15 minutes, then remove contaminated clothes and rinse again. Refer immediately for medical attention.
Eyes	Watering of the eyes. Redness. Pain. Burns.	Wear face shield or eye protection in combination with breathing protection.	Rinse with plenty of water for several minutes (remove contact lenses if easily possible). Refer immediately for medical attention.
Ingestion		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus. Ventilation. Shut off cylinder if possible. Isolate the area until the gas has dispersed. NEVER direct water jet on liquid. Remove gas with fine water spray. Do NOT let this chemical enter the environment.	Special insulated cylinder. Marine pollutant. EC Classification Symbol: T, N; R: 23-36/37/38-50; S: (1/2)-9-45-61 UN Classification UN Hazard Class: 2.3; UN Subsidiary Risks: 8 GHS Classification Signal: Danger Contains gas under pressure; may explode if heated Fatal if inhaled Causes severe skin burns and eye damage May cause respiratory irritation May cause damage to lungs through prolonged or repeated exposure if inhaled Very toxic to aquatic life 
EMERGENCY RESPONSE	SAFE STORAGE
NFPA Code: H4; F0; R0; OX.	Fireproof if in building. Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs. See Chemical Dangers. Cool. Dry. Keep in a well-ventilated room. Store in an area without drain or sewer access.

IMPORTANT DATA	
Physical State; Appearance GREENISH-YELLOW COMPRESSED LIQUEFIED GAS WITH PUNGENT ODOUR. Physical dangers The gas is heavier than air. Chemical dangers The solution in water is a strong acid. It reacts violently with bases and is corrosive. The substance is a strong oxidant. Reacts violently with combustible substances and reducing agents. The substance reacts with most organic and inorganic compounds, causing fire and explosion hazard. Attacks metals, some forms of plastic, rubber and coatings. Occupational exposure limits TLV: 0.5 ppm as TWA; 1 ppm as STEL; A4 (not classifiable as a human carcinogen); (ACGIH 2009). EU OEL (selected): 0.5ppm, 1.5mg/m³ as STEL;	Routes of exposure Serious by all routes of exposure. Inhalation risk On loss of containment, a harmful concentration of this gas in the air will be reached very quickly. Effects of short-term exposure Lachrymation. The substance is corrosive to the eyes, skin and respiratory tract. Rapid evaporation of the liquid may cause frostbite. Inhalation may cause asthma-like reactions. Inhalation may cause pneumonitis. Inhalation may cause lung oedema, but only after initial corrosive effects on eyes and/or airways have become manifest. See Notes. Exposure could cause death. Effects of long-term or repeated exposure The substance may have effects on the respiratory tract and lungs. This may result in chronic inflammation and impaired functions. The substance may have effects on the teeth. This may result in erosion.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: -34°C Melting point: -101°C Solubility in water, g/100ml at 20°C: 0.7 Vapour pressure, kPa at 20°C: 673 Relative vapour density (air = 1): 2.5	The substance is very toxic to aquatic organisms. It is strongly advised not to let the chemical enter into the environment.

NOTES
The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate inhalation therapy by a doctor or a person authorized by them should be considered. The odour warning when the exposure limit value is exceeded is insufficient. Do NOT use in the vicinity of a fire or a hot surface, or during welding. Do NOT spray water on leaking cylinder (to prevent corrosion of cylinder). Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.

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1.9.9.3. Ammonia

AMMONIA (ANHYDROUS)	ICSC: 0414 March 1998
CAS No: 7664-41-7 RTECS No: BO0875000 UN No: 1005 EC No: 007-001-00-5	NH ₃ Molecular mass: 17.03

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting.	In case of fire: keep cylinder cool by spraying with water.
EXPOSURE		AVOID ALL CONTACT!	
Inhalation	Burning sensation. Cough. Laboured breathing. Shortness of breath. Sore throat. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer for medical attention.
Skin	Redness. Skin burns. Pain. Blisters. ON CONTACT WITH LIQUID: FROSTBITE.	Cold-insulating gloves. Protective clothing.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer for medical attention.
Eyes	Redness. Pain. Severe deep burns.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
Ingestion			

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. NEVER direct water jet on liquid. Remove gas with fine water spray. Personal protection: gas-tight chemical protection suit including self-contained breathing apparatus.	T Symbol N Symbol R: 10-23-34-50 S: (1/2-)9-16-26-36/37/39-45-61 UN Hazard Class: 2.3 UN Subsidiary Risks: 8

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-20S1005 or 20G2TC NFPA Code: H3; F1; R0	Fireproof. Separated from oxidants, acids, halogens. Cool. Keep in a well-ventilated room.

IMPORTANT DATA	
Physical State; Appearance COLOURLESS COMPRESSED LIQUEFIED GAS, WITH PUNGENT ODOUR. Physical dangers The gas is lighter than air. Chemical dangers Shock-sensitive compounds are formed with mercury, silver and gold oxides. The substance is a strong base; it reacts violently with acid and is corrosive. Reacts violently with strong oxidants and halogens. Attacks copper, aluminum, zinc and their alloys. Dissolves in water evolving heat. Occupational exposure limits TLV: 25 ppm as TWA; 35 ppm as STEL; (ACGIH 2004). MAK: 20 ppm, 14 mg/m³; Peak limitation category: I (2); Pregnancy risk group: C; (DFG 2004).	Routes of exposure The substance can be absorbed into the body by inhalation. Inhalation risk A harmful concentration of this gas in the air will be reached very quickly on loss of containment. Effects of short-term exposure The substance is corrosive to the eyes, the skin and the respiratory tract. Inhalation of high concentrations may cause lung oedema (see Notes). Rapid evaporation of the liquid may cause frostbite.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: -33°C Melting point: -78°C Relative density (water = 1): 0.7 at -33°C Solubility in water, g/100 ml at 20°C: 54 Vapour pressure, kPa at 26°C: 1013 Relative vapour density (air = 1): 0.59 Auto-ignition temperature: 651°C Explosive limits, vol.% in air: 15-28	The substance is very toxic to aquatic organisms.

NOTES

The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation is therefore essential. Immediate administration of an appropriate inhalation therapy by a doctor or a person authorized by him/her should be considered.

Turn leaking cylinder with the leak up to prevent escape of gas in liquid state.
Card has been partly updated in October 2005. See sections Occupational Exposure Limits, Emergency Response.

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1.9.9.4. Hydrogen

HYDROGEN (cylinder)	ICSC: 0001 Peer-Review Status: 11.04.2014 Validated
CAS #: 1333-74-0 RTECS #: MW8900000 UN #: 1049 EC #: 001-001-00-9 EINECS #: 215-605-7	Formula: H ₂ Molecular mass: 2.0

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE-FIGHTING
FIRE	Extremely flammable. Many reactions may cause fire or explosion.	NO open flames, NO sparks and NO smoking.	Shut off supply; if not possible and no risk to surroundings, let the fire burn itself out. In other cases extinguish with water spray, powder, carbon dioxide.
EXPLOSION	Gas/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Use non-sparking hand tools. Do not handle cylinders with oily hands.	In case of fire: keep cylinder cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		Use appropriate engineering controls.	
Inhalation	Dizziness. Headache. Lethargy. Suffocation.	Use ventilation.	Fresh air, rest.
Skin	ON CONTACT WITH GAS: FROSTBITE.	Cold-insulating gloves.	ON FROSTBITE: rinse with plenty of water, do NOT remove clothes. Refer immediately for medical attention.
Eyes	ON CONTACT WITH GAS: FROSTBITE.	Wear face shield.	ON FROSTBITE: rinse with plenty of water. Refer immediately for medical attention.
Ingestion			

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Ventilation. Remove all ignition sources. Remove vapour with fine water spray.	EC Classification Symbol: F+; R: 12; S: (2)-9-16-33 UN Classification UN Hazard Class: 2.1 GHS Classification Signal: Danger Extremely flammable gas Contains gas under pressure; may explode if heated 

EMERGENCY RESPONSE	SAFE STORAGE
NFPA Code: H0; F4; R0.	Fireproof. Cool. Ventilation along the floor and ceiling. Separated from oxidizing materials.

IMPORTANT DATA	
Physical State; Appearance ODOURLESS COLOURLESS COMPRESSED GAS. Physical dangers The gas mixes well with air, explosive mixtures are easily formed. The gas is lighter than air. Chemical dangers Heating may cause violent combustion or explosion. Reacts violently with halogens, oxidizing materials and greases. This generates fire and explosion hazard. Metal catalysts, such as platinum and nickel, greatly enhance these reactions. Occupational exposure limits TLV (SIMPLE-ASPHYXIAN): (ACGIH 2002). EU OEL (selected).	Routes of exposure Exposure mainly occurs via inhalation. Inhalation risk On loss of containment this substance can cause suffocation by lowering the oxygen content of the air in confined areas. Effects of short-term exposure Asphyxiation. See Notes. Exposure to cold gas could cause frostbite. Effects of long-term or repeated exposure

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: -253°C Melting point: -259°C Relative vapour density (air = 1): 0.07 Flash point: Flammable gas Auto-ignition temperature: 560°C Explosive limits, vol.% in air: 4-75 Vapour pressure, kPa at 25°C: 165320 Solubility in water, mg/l at 21°C: 1.62 (very poor)	

NOTES

High concentrations in the air cause a deficiency of oxygen with the risk of unconsciousness or death.

Check oxygen content before entering the area.

Measure hydrogen concentrations with suitable gas detector (a normal flammable gas detector is NOT suitable for the purpose).

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1.9.9.5. Diesel

DIESEL FUEL No. 2	ICSC: 1561 Peer-Review Status: 26.10.2004 Validated
Fuels, Diesel, No. 2 Diesel oil No. 2 Gasoil - unspecified	
CAS #: 68476-34-6 RTECS #: LS9142500 UN #: 1202 EC #: 649-227-00-2 EINECS #: 270-676-1	

TYPES OF HAZARD / EXPOSURE	ACUTE HAZARDS / SYMPTOMS	PREVENTION	FIRST AID / FIRE-FIGHTING
FIRE	Flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Use water spray, alcohol-resistant foam, dry powder, carbon dioxide.
EXPLOSION	Above 52°C explosive vapour/air mixtures may be formed.	Above 52°C use a closed system, ventilation and explosion-proof electrical equipment.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
Inhalation	Dizziness. Headache. Nausea.	Use ventilation, local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
Skin	Dry skin. Redness.	Protective gloves.	Rinse and then wash skin with water and soap.
Eyes	Redness. Pain.	Wear safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then refer for medical attention.
Ingestion	See Inhalation.	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	PACKAGING & LABELLING
Personal protection: filter respirator for organic gases and vapours adapted to the airborne concentration of the substance. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent. Then store and dispose of according to local regulations.	EC Classification Symbol: Xn; R: 40; S: (2)-36/37; Note: H UN Classification UN Hazard Class: 3; UN Pack Group: III GHS Classification

EMERGENCY RESPONSE	SAFE STORAGE
Transport Emergency Card: TEC (R)-30S1202. NFPA Code: H0; F2; R0.	Well closed.

IMPORTANT DATA	
Physical State; Appearance BROWN SLIGHTLY VISCOUS LIQUID WITH CHARACTERISTIC ODOUR. Physical dangers Chemical dangers Occupational exposure limits TLV: 100ppm as TWA; (skin); A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2004).	Routes of exposure The substance can be absorbed into the body by inhalation of its aerosol. Inhalation risk A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C. Effects of short-term exposure The substance is irritating to the eyes, skin and respiratory tract. The substance may cause effects on the central nervous system. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. Effects of long-term or repeated exposure. The substance defats the skin, which may cause dryness or cracking.

PHYSICAL PROPERTIES	ENVIRONMENTAL DATA
Boiling point: 282-338°C Melting point: -30 - -18°C Density: 0.87-0.95 g/cm³ Solubility in water, g/100ml at 20°C: 0.0005 Flash point: 52°C c.c. Auto-ignition temperature: 254-285°C Explosive limits, vol.% in air: 0.6-6.5 Octanol/water partition coefficient as log Pow: >3.3	The substance is harmful to aquatic organisms.

NOTES
Additives to Diesel fuel in winter may change physical and toxicological properties of the substance. This card does not address Diesel exhaust.

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

APPENDIX O:

Noise Specialist Study



ATLANTIS GAS-TO-POWER FACILITY

NOISE IMPACTS

1.1.1.1.1.1 Curriculum Vitae – Brett Williams

1.1.1.1.1.2

Brett Williams has been involved in Health Safety and Environmental Management since 1987, and has been measuring noise related impacts since 1996. Brett is the owner of Safetech who have offices in Pretoria and Port Elizabeth. He has consulted too many different industries including, mining, chemical, automotive, food production etc. He is registered with the Department of Labour and Chamber of Mines to measure environmental stressors, which include chemical monitoring, noise and other physical stresses. He has also been trained by the United States Environmental Protection Agency on air pollution measurement and dispersion modelling.

TERTIARY EDUCATION

- National Diploma Health & Safety Management
- Bachelor of Arts (UPE)
- United States EPA Pollution Measurement course conducted at the University Of Cincinnati (EPA Training Centre)
- US EPA Air Dispersion Modelling Training Course
- Master of Business Administration (University of Wales) with dissertation on environmental reporting in South Africa.
- PhD - University of Pretoria.
- Various Health & Safety Courses.
- Environmental Auditor (ISO 14001:2004)
- Advanced Occupational Hygiene Course – Harvard University

KEY EXPERIENCE

The information below presents an abridged list of Brett Williams' project experience relevant to this proposal:

- Crown Chickens – The independent report review of a noise specialist report conducted as part of an EIA to establish a new broiler farm
 - BMW – The evaluation of the impact of the Rosslyn production facilities on the surrounding community.
 - Victory Race Track - Specialist noise report conducted as part of an EIA to establish a new stock car racing track.
 - Continental Tyre - The evaluation of the impact of production facilities on the surrounding community.
 - Media 24 – The measurement portion of an investigation on the impact of a printing press on a local community. The main study was conducted by the University of Stellenbosch.
 - Zwartebosh Quarry - Specialist noise report conducted as part of an EIA to establish a new quarry.
 - Milo Granite - Specialist noise report conducted as part of an EIA to establish a new quarry.
 - Dunlop Tyres - The evaluation of the impact of production facilities on the surrounding community.
 - Sasol Secunda - Independent report review of a noise specialist report conducted to determine the impact of production facilities on the surrounding community.
 - Barlow World Coatings - The evaluation of the impact of production facilities on the surrounding community.
 - Western Platinum Refinery - The evaluation of the impact of production facilities on the surrounding community.
 - CSIR – Noise Impact Study of Namwater Desalination Plant and Kouga Wind Turbine Project and the Nampont Walvis Bay Port Container Terminal extension
 - Innwind Wind Energy Turbine Project, Grahamstown.
 - CSIR - Noise Impact Study of Cookhouse and Overberg Wind Turbine Projects
 - BKS – Classified Study
-

THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS FOR THE PROPOSED PROJECT MUST COMPLETE THE FOLLOWING:

I, **Brett Williams**....., as the appointed independent specialist hereby declare that I:
act/ed as the independent specialist in this application;

- regard the information contained in this report as it relates to my specialist input/study to be true and correct, and
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- have and will not have no vested interest in the proposed activity proceeding;
- have disclosed, to the applicant, EAP and competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the NEMA, the Environmental Impact Assessment Regulations, 2010 and any specific environmental management Act;
- am fully aware of and meet the responsibilities in terms of NEMA, the Environmental Impact Assessment Regulations, 2010 (specifically in terms of regulation 17 of GN No. R. 543) and any specific environmental management Act, and that failure to comply with these requirements may constitute and result in disqualification;
- have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;
- have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;
- have ensured that the names of all interested and affected parties that participated in terms of the specialist input/study were recorded in the register of interested and affected parties who participated in the public participation process;
- have provided the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not; and
- am aware that a false declaration is an offence in terms of regulation 71 of GN No. R. 543.



Brett Williams
Safetech

13/03/2017

ABBREVIATIONS AND ACRONYMS:

Ambient noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far. Note: Ambient noise includes the noise from the noise source under investigation.
Annoyance	General negative reaction of the community or person to a condition creating displeasure or interference with specific activities
A-weighted sound pressure level (LpA and LAeq,T)	A-weighted sound level LpA which is the sound pressure level at specific frequencies and is given using the following equation: $LpA = 10 \log \left(\frac{P_A}{P_0} \right)_2$ Where: PA = is the root-mean-square sound pressure, using the frequency weighting network A PO = is the reference sound pressure (PO = 20 µPa). A-weighted sound pressure level is expressed in decibels dBA Note: For clarity in this study LpA shall equal LAeq,T
dBA	The decibel is the unit used to measure sound pressure levels. The human ear does not perceive all sound pressures equally at all frequencies. The “A” weighted scale adjusts the measurement to approximate a human ear response.
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment

Equivalent continuous day/night rating level (LR,dn)	Equivalent continuous A-weighted sound pressure level (LAeq,T) during a reference time interval of 24 h, plus specified adjustments for tonal character, impulsiveness of the sound and the time of day; and derived from the following equation: $L_{R,dn} = 10 \log \left[\left(\frac{d}{24} \right) 10^{L_{Req,d}/10} + \left(\frac{24-d}{24} \right) 10^{L_{Req,n}+K_n/10} \right] \text{dB}$ Where: LR,dn is the equivalent continuous day/night rating level; d is the number of daytime hours; LReq,d is the rating level for daytime; LReq,n is the rating level for night-time; Kn is the adjustment of 10 dB added to the night-time rating level.
High-energy impulsive sound	Sound from one of the following categories of sound sources: quarry and mining explosions, sonic booms, demolition and industrial processes that use high explosives, explosive industrial circuit breakers, military ordnance (e.g. armour, artillery, mortar fire, bombs, explosive ignition of rockets and missiles), or any other explosive source where the equivalent mass of TNT exceeds 25 g, or a sound with comparable characteristics and degree of intrusiveness
Highly impulsive sound	sound from one of the following categories of sound sources: small arms fire, metal hammering, wood hammering, drop-hammer pile driver, drop forging, pneumatic hammering, pavement breaking, or metal impacts of rail yard shunting operations, or sound with comparable characteristics and degree of intrusiveness
Impulsive sound	Sound characterised by brief excursions of sound pressure (acoustic impulses) that significantly exceed the residual noise
Low frequency noise	Sound which predominantly contains sound energy at frequencies below 100 Hz
Reference time interval	Representative duration of time periods that are regarded as typical for sound exposure of the community within a period of 24 h: – Daytime: 06:00 to 22:00 – Night-time: 22:00 to 06:00

Residual noise	Totally encompassing sound in a given situation at a given time, and usually composed of sound from many sources, both near and far, excluding the noise under investigation
Specific noise	Component of the ambient noise which can be specifically identified by acoustical means and which may be associated with a specific source Note: Complaints about noise usually arise as a result of one or more specific noises.
Sound Reduction Index (R_w)	The measured quantity which characterises the sound insulating properties of a material or building element.

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1. NOISE IMPACT ASSESSMENT

1.1 INTRODUCTION

1.1.1 SCOPE OF WORK AND TERMS OF REFERENCES

The overall objective of this assessment is to provide a comprehensive and detailed Noise Impact Assessment that presents and evaluates potential noise impact associated with the proposed project.

The scope of work of the noise study includes the following:

- Conduct a desktop study of available information that can support and inform the specialist noise study;
- A description of the current environmental conditions from a noise perspective in sufficient detail so that there is a baseline description/status quo against which impacts can be identified and measured i.e. sensitive noise receptors.
- The measurement and description of the present ambient noise levels at the proposed development site, during both the day and night time. This will be quantified by collecting noise measurement samples, in line with relevant specifications and regulations, at representative points and times during a typical weekday and weekend. Noise measurements will be collected with the use of a noise meter. Measure the existing ambient noise at the proposed site;
- Identify the components of the project that could generate significant noise levels;
- Identify the sensitive noise receptors in the vicinity of the proposed project. These include the receptors within 1km of the site boundary (external to the site);
- Prediction of the future ambient noise levels due to the noise emissions during the construction and operation of the proposed project (and alternatives). This will be carried out by developing a detailed model, in line with relevant specifications and regulations, of the noise emissions during both the construction and operational phases. Where possible, measurements of noise for similar activities/operations will be undertaken and used as proxy inputs in the model.
- Identify issues and potential impacts, as well as possible cumulative impacts related to the noise aspects of the project; and
- Identify management and mitigation actions to enhance positive impacts and avoid/reduce negative impacts respectively.
- List and describe any applicable legislation, policies and guidelines, in preventing a disturbing noise/nuisance from occurring, e.g. SANS standards for industrial and residential/rural areas (as applicable), especially from key sources of noise.
- Provide guidelines to be incorporated into the design of the facility to attenuate the noise impacts.

1.1.2 Study Approach

The methodology used in the study consisted of two approaches to determine the noise impact from the proposed plant and associated infrastructures:

- A desktop study to model the likely noise emissions from the plant; and
- Field measurements of the existing ambient noise at three locations in the vicinity of the proposed plant locations and at the shoreline.

Desktop study methodology

The desktop study was done using the available literature on noise impacts as well as numerical calculations using the method described in SANS 10357:2004 version 2.1 (The calculation of sound propagation by the Concawe method). The numerical results were then used to produce a noise map that visually indicates the extent of the noise emissions from the site. CadnaA Software – Version 2017 was used to conduct the modelling.

The worst case weather conditions were used in the study, namely, a temperature of 10°C and 70% humidity and zero wind speed with no wind masking effect. The weather data thus indicates very stable conditions which have little noise attenuation effects.

Field Study

A field study was conducted on the 18th January 2016 during which noise levels were measured at a number of sensitive areas which were chosen based on their proximity to the plant. These points are referred to as Noise Sensitive Areas (NSA).

A number of measurements were taken by placing the noise meter on a tripod and ensuring that it was at least 1.2 m from floor level and 3.5 m from any large flat reflecting surface.

All measurement periods were taken over a period of more than 10 minutes, except where indicated. The noise meter was calibrated before and after the survey. At no time was the difference more than one decibel (dB) (Note: If the difference between measurements at the same point under same conditions is more than 1 decibel, then the meter is not properly calibrated). The weighting used was on the A scale and the meter placed on impulse correction, which is the preferred method as per Section 5 of SANS 10103:2008. No tonal correction was added to the data. A measurement was taken during the day and night-time. The meter was fitted with a windscreen, which is supplied by the manufacturer. The screen is designed so as to reduce wind noise around the microphone and not bias the measurements.

The test environment contained the following noise sources:

- Vehicular traffic.
- Birds.
- Noise from the Ankerlig Power Station.
- Wind.
- Community noise such as people talking, laughing, music, dogs barking etc.

The instrumentation that was used to conduct the study is as follows:

- Rion Precision Sound Level Meter (NL32) with one third Octave Band Analyzer, Serial No. 00151075
- Microphone (UC-53A) Serial No. 307806
- Preamplifier (NH-21) Serial No. 13814

All equipment was calibrated in November 2015 according to the South African National Accreditation System (SANAS) requirements.

1.1.3 Information Sources

The Information used in the noise impact assessment includes:

- The satellite images used in the report from Google earth.
- Site layout maps sourced from Greencape
- Process information sourced from Greencape.

- Information on similar plant sourced from an internet search on Google and Google Scholar.

1.1.4 Assumptions and Limitations

The following assumptions and limitations are applicable to the noise impact assessment:

- The emphasis in this study is on the Atlantis residential areas.
- The infrastructure layout for the preferred site was supplied by Greencape and is a conceptual layout only.
- It is assumed that for modelling purposes the plant could run at 100% during a 24 hour period.
- The construction noise for all infrastructure, regardless of the type, is similar in noise impact.
- The sound power levels for the operational equipment were not available from Greencape as the exact equipment has not been specified yet. Information on similar equipment from previous studies was used in the modelling. Only the major sources of noise were modelled, not small pumps etc. as these have not been specified.
- It is assumed that mitigation measures inherent to the project design, as described in the project description, will be implemented regardless of additional mitigation measures recommended by this study (i.e. ratings for impact 'without additional mitigation' is assumed to already include mitigation measures inherent to the design). Mitigation measures pertaining to this specific field of study that is assumed to be inherent to the project design that were incorporated into the modelling include:
 - All buildings will be constructed out of solid walls of at least 200mm thickness.
 - All high pressure pumps, blowers etc. will be installed in an enclosed building where sound attenuation properties have been considered for the walls, roofs and access doors.
 - All access doors to buildings are kept closed when not in use.
- Cumulative impacts are assessed by adding expected impacts from this proposed development to existing and proposed developments with similar impacts in a 5 km radius. The existing and proposed developments that were taken into consideration for cumulative impacts only include the Ankerlig Power Station.

1.2 PROJECT DESCRIPTION: (NOISE IMPACTS)

The City of Cape Town (CoCT) and GreenCape have been investigating the feasibility of developing a gas-to-power project within the Atlantis Special Development Zone (SEZ) on portions 1 of Portion 4 of Cape Farm 1183, situated in the Atlantis Industrial area, near Cape Town. The project is referred to as the Atlantis Gas-to- Power Project.

The plant will have various processes that generate noise that could impact on the receiving environment. The site is situated in the industrial area of Atlantis and surrounded by sensitive receptors that were identified during a field study. The project description provided in Final Scoping Report was used as the basis for the noise study.

The construction phase could generate noise during different activities such as:

- Site remediation and earthworks;
- Turbine Hall, stacks, cooling equipment etc. and building construction using mobile equipment, cranes, concrete mixing and pile driving equipment;
- Vehicle use and movement;
- Construction of a power line and switch yard.

The number and frequency of use of the various types of vehicles and equipment has been estimated and is presented in Table 1.1 below.

Table 1-1 - Types of vehicles and equipment to be used on site (Construction Phase)

TYPE	DESCRIPTION	TYPICAL SOUND POWER LEVEL (DB)
Cranes	Overhead and mobile	109
Mobile Construction Vehicles	Front end loaders	100
Mobile Construction Vehicles	Excavators	108
Mobile Construction Vehicles	Bulldozer	111
Mobile Construction Vehicles	Dump Truck	107
Mobile Construction Vehicles	Grader	98
Mobile Construction Vehicles	Water Tanker	95
Stationary Construction Equipment	Concrete mixers	110
Compressor	Air compressor	100
Compactor	Vibratory compactor	110
Pile Driver	Piling machine (mobile)	115

Source: GCDA 2006

Blasting may be undertaken during the construction. This could change once the exact site conditions are determined. During blasting atmospheric instantaneous levels up to 125 dB can be expected.

1.2.1 Potential noise sources for the Operational Phase

The nature of the power producing process involves the need to use an energy source to produce gas/steam under high pressure. A number of pieces of plant will be indoors in a Turbine Hall. There are several pieces of equipment that are external to the plant. These include the intake and exhaust air systems and stacks and the air cooled condensers.

The operational phase could typically generate noise from the following sources:

- A Gas Turbine or Gas Engine hall;
- Up to 4 Combustion turbine and generator sets producing approximately 400 MW each (max 1500 MW) or multiple Combustion engine and generator sets producing approximately 20 MW each (max 800 MW);
- Heat recovery steam generators (HRSG);
- Dry cooling radiator systems;
- Exhaust Stacks;
- Air Intakes.

1.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT: (NOISE IMPACTS)

The proposed site is set in an industrial area with industrial operations around the site. The site is situated on a relatively flat portion of land. The residential portion of Atlantis is situated to the north of the site. There are many factories between the proposed site (Alternative 2) and the residential suburbs of Atlantis.

1.3.1 Sensitive Receptors

The main noise-sensitive receptors potentially affected by noise pollution associated with the proposed project are human receptors. three community ambient noise monitoring points were chosen based on their proximity to the plant. A number of other NSA's were identified to include in the modelling as being representative of the surrounding communities. The coordinates of the identified NSA's are presented in Table 1-2 below and the locations of the various receptors are indicated in Figures 1.1.

Table 1-2 – Noise Sensitive Areas

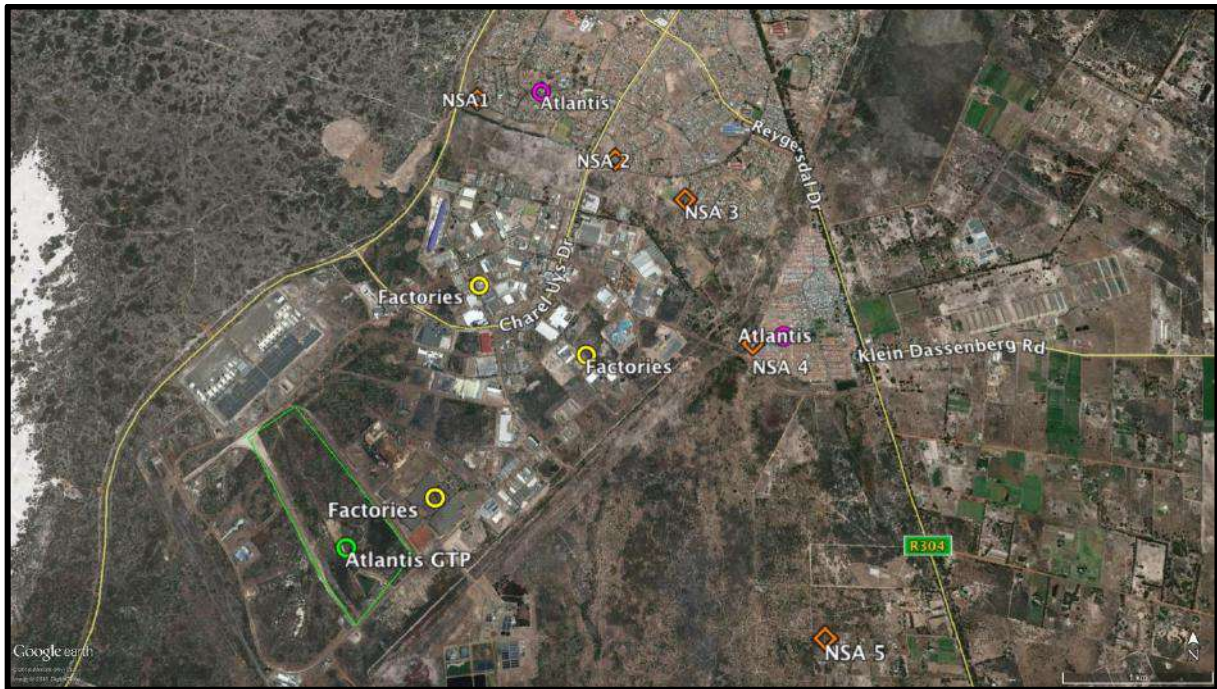
NSA	Description	Latitude	Longitude	Field Test Measured	Distance to plant (m) ⁽¹⁾	Type of District as per SANS 10103:2008
NSA 1	Private House	33°34'21.12"	18°28'43.98"	Yes	3180	Sub-Urban
NSA 2	Private House	33°34'37.76"	18°29'24.91"	Yes	3190	Sub-Urban
NSA 3	Private House	33°34'48.10"	18°29'45.04"	Yes	3390	Sub-Urban
NSA 4	Private House	33°35'24.10"	18°30'2.93	No	3140	Sub-Urban
NSA 5	Private House	33°36'29.75"	18°30'18.72"	No	3260	Rural

Note: All field measurement location co-ordinates are referenced to WGS84.

The distances are the closest distance measured from the sensitive receptors to the noise source (i.e. site boundary at the Plant)

Figure 1.1 below shows the proposed site in green, as well as the noise sensitive areas (NSA) and the factories to the north east of the site.

Figure 1-1 - Site Location and Noise Sensitive Areas



In Figure 1-2 below a conceptual site layout is shown.

CA1183-4

SA-1801

Substation Area

18-21

SA-1150

LOCALITY SKETCH

N

SCALE: 1/10 000

GSU GT1

GSU GT2

GSU GT3

GSU GT4

HRSG1

HRSG2

HRSG3

HRSG4

ST1

ST2

ACC1

ACC2

BOP & Administration Area

CA1183-0

CA1183-100

18-152

18-153

18-154

18-155

18-156

18-157

18-158

18-159

18-160

18-161

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1.3.2 Results of Field Study

The ambient noise was measured at four locations for at least 10 minutes at each point as described above in Section 1.3. The sound levels at three NSA's were measured as well as a test point on the southern boundary of the site (Neil Hare Road). The results thereof are presented in Table 1.3.

Table 1-3 – Noise measurements during Field Study

Location		Start Time	L _{Req.T} dB(A)	Exceeding typical rating levels for noise	Comments
NSA 1	Sub-Urban	13:15	46.1	No	2x cars, dogs barking
NSA 3	Sub-Urban	13:55	45.5	No	1 x car, people talking as they walked past
NSA 5	Rural	15:35	43.2	No	Wind noise
Proposed Site Southern Boundary	Industrial	16:30	56.1	No	5 x trucks, Ankerlig Power Station audible
NSA 1	Sub-Urban	22:05	41.0	Yes	1 x car
NSA 3	Sub-Urban	22:55	43.4	Yes	1 x car, music
NSA 5	Rural	23:20	39.6	Yes	
Proposed Site Southern Boundary	Industrial	00:30	54.7	No	1 x truck, Ankerlig Power Station audible

1.4 APPLICABLE LEGISLATION

The environmental legal requirements for this project are summarized in Chapter 3, which indicates that environmental legislation places an onus on the developer to ensure that the environment is not affected negatively by the development. The eThekweni Municipality has no noise control by-laws. The following standards have been used to aid this study and guide the decision making process with regards noise pollution:

- South Africa - GNR.154 of January 1992: Noise control regulations in terms of section 25 of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989);
- South Africa - GNR.155 of 10 January 1992: Application of noise control regulations made under section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989);
- South Africa - SANS 10103:2008 Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication;

- South Africa - SANS 10357:2004 Version 2.1 - The calculation of sound propagation by the Concawe method);
- United Nations Environment Programme - 2008 Desalination Resource and Guidance Manual for Environmental Impact Assessments; and
- International Finance Corporation – 2007 General EHS Guidelines: Environmental Noise.

SANS 10103:2008 provides typical rating levels for noise in various types of districts, as described in Table 1-4 below.

Table 1-4 - Typical rating levels for noise in various types of districts

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

The rating levels above indicate that in suburban districts (NSA1-4) the ambient noise should not exceed 40 dB(A) at night and 50 dB(A) during the day. The noise sensitive areas to the east of the proposed plant are viewed as being situated in a rural area (NSA5). The rating levels above indicate that in rural districts the ambient noise should not exceed 35 dB(A) at night and 45 dB(A) during the day. The rating levels above indicate that in industrial districts the ambient noise should not exceed 70 dB(A) at night and 60 dB(A) during the day. These levels can thus be seen as the target levels for any noise emissions from the plant.

Furthermore, the South African noise control regulations describe a disturbing noise as any noise that exceeds the ambient noise by more than 7dB. This difference is usually measured at the complainant's location should a noise complaint arise. There are no legal permits or licenses required that are related to noise emissions.

1.5 PERMIT REQUIREMENTS

There are no legal permits or licenses required that are related to noise emissions.

1.6 IDENTIFICATION OF KEY ISSUES AND POTENTIAL IMPACTS

1.6.1 Key Issues Identified During the Scoping Phase

The key issues associated with the construction and operation of the Atlantis Gas-to-Power Plant will include the following:

- Current noise profile for the proposed plant;
- Noise impact during construction and operation of the plant and associated infrastructure;
- Location of local sensitive human receptors (e.g. closest residential areas); and

1.6.2 Key Issues Identified During Public Consultation

Noise impact did not feature as a key concern during the public participation phase of the EIA>

1.6.3 Identification of Potential Impacts

1.6.3.1 Construction Phase

- Impact on the immediate surrounding environment from the construction activities, especially the pile driving if this is required.
- Impacts of blasting activities on the fauna in the immediate vicinity of the blast area.

1.6.3.2 Operational Phase

- Impact on the immediate surrounding environment due to noise from the operation of the Plant, in particular noise from the Air Cooled Condensers, Exhaust Stacks, Air Intakes and energy recovery turbines.

1.6.4 Predicted Noise Levels for the Construction Phase

The construction noise is similar to other projects where the author has measured noise. These readings can be used as a reference for this study. The results are presented in Table 1-5 and 1-6 below.

Table 1-5 - Example of Construction Equipment Noise Emissions

Noise Source	L _{Req.T} dB(A)
CAT 320D Excavator measured at approximately 50 m.	67.9
Mobile crane measured at approximately 70 m	69.6
Drilling Rig /Pile Driver measured at approximately 70 m	72.6

Table 1-6 - Frequency Analysis Construction Equipment (dB)

Frequency (Hertz)	CAT 320D Excavator	Mobile Crane	Drilling Rig
12.5	22.6	9	12.6
16	23.4	8	18.3
20	22.6	11.8	19
25	23	26.5	18
31.5	23.6	23.5	27.5
40	25.6	27.5	30.5
50	33.9	43.3	34.1
63	30	44.1	34.3
80	37.8	58.8	58
100	49.6	45.1	56.6
125	34.7	50.5	49.6
160	39.7	52.1	55.3
200	43.7	52.7	59.7
250	50.7	51.5	56.5
315	50.4	54.5	55.4
400	42.9	57.7	56.8
500	46	54.4	57.9
630	46.6	51.5	54.3
800	47.2	52.1	60.2
1000	47.6	51.7	57.2
1250	48.9	52.1	57.7
1600	47.5	50.3	58.7
2000	47	51.1	57.5
2500	50.1	53.2	65.1
3150	46.4	49.9	64.8
4000	46.8	49	61.9
5000	44.7	47	58.1
6300	39.6	43.3	52.8
8000	35.8	38.7	48.8
10000	33	34.3	40.8

Frequency (Hertz)	CAT 320D Excavator	Mobile Crane	Drilling Rig
12500	27.7	26.9	31.9
16000	24.7	18.2	21.4

Table 1-7 above shows that the construction equipment noise is distributed with higher values at the higher frequencies. The operation of the equipment therefore is not expected to create any long-term low frequency effect. Based on Tables 1-1 and 1-5, the expected noise associated with the construction of the proposed site can be extrapolated. As an example, if a number of pieces of equipment are used simultaneously, the noise levels can be added logarithmically (Tables 1-7 and 1-8) and then calculated at various distances from the site (i.e. attenuation by distance) to determine the distance at which the ambient level will be reached.

Table 1-7 - Combining Different Construction Noise Sources – High Impact

Description	Typical Sound Power Level (dB)
Overhead and mobile	109
Front end loaders	100
Excavators	108
Bull Dozer	111
Piling machine (mobile)	115
Total	117.7

Table 1-8 - Combining Different Construction Noise Sources – Low Impact

Description	Typical Sound Power Level (dB)
Front end loaders	100
Excavators	108
Truck	95
Total	111.8

Noise will also be attenuated by topography and atmospheric conditions such as temperature, humidity, wind speed and direction, but these were not considered in this calculation. Therefore, the distance calculated below would be representative of the maximum distance to reach ambient noise levels.

Table 1-9 below gives an illustration of attenuation by distance for a noise of 117dB and 111dB (Sound Power) Levels measured at the source. This is the worst case scenario if all the construction machines were operating at the same time).

Table 1-9 - Attenuation by Distance for the construction phase (worst case)

Distance from noise source (metres)	Typical Machinery Sound Pressure dB(A)	Heavy Machinery Sound Pressure dB(A)
10	83	89
20	77	83
40	71	77
80	65	71
160	58	64
320	51	57
640	44	50

1.6.5 Predicted noise levels for the Operational Phase

The likely extent of the operational noise pollution was modelled according to the Concawe method using CadnaA Version 2017. Low frequency noise below 20 Hertz, potentially generated by on site machinery, is therefore not considered as part of this modelling. These, however, should not be overlooked. The effects of low frequency noise include sleep disturbance, nausea, vertigo etc. These effects are unlikely to affect residents due to the distance between the plant and the nearest communities. Sources of low frequency noise also include wind and vehicular traffic, which are all current noise sources.

The sound power levels that were chosen for the model were taken from a study conducted by Wartsila (Report DBAB581655 dated 12/2011).

The general sound power level used at each of the processes is presented in Table 1-8 below. The results of the modelling are presented in Table 1-9 and Figure 1-3 below.

Table 1-10 - Sound Power Levels used for Operational Phase Modelling

	Sound Power (dB)	Quantity	Comments
Exhaust Stack	124	4	With 35dB Silencers
HRS	116	4	
Air Intake	106	4	
ACC	107	2	
Roof Cooling Fans	95	20	
Turbine Unit	106	4	Inside Turbine Hall (approx. 40dB attenuation)

Figure 1-3 – Noise Modelling Results

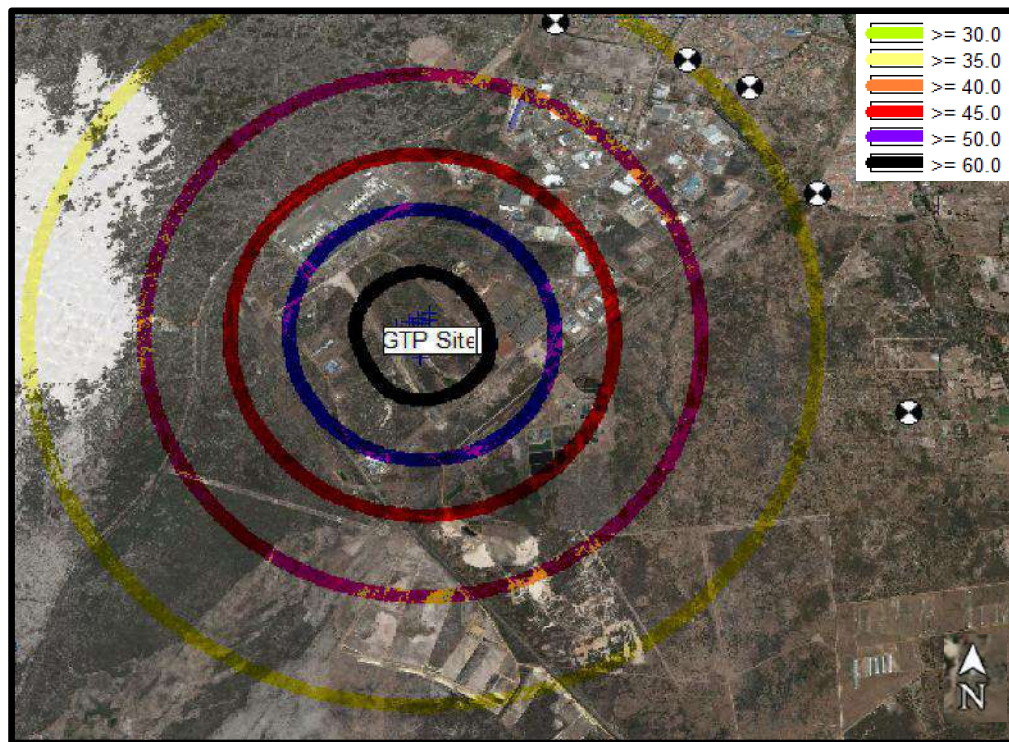


Table 1-11 - Noise Modelling Results

NSA	Noise from Plant under no wind conditions dB(A)	Night Noise Rating Limit as per SANS 10103:2008	Day Noise Rating Limit as per SANS 10103:2008	Type of District as per SANS 10103:2008
NSA 1	36.6	40	50	Sub-Urban
NSA 2	35.2	40	50	Sub-Urban
NSA 3	34.3	40	50	Rural
NSA 4	34.2	40	50	Sub-Urban
NSA 5	31.8	35	45	Rural

1.7 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

1.7.1 Construction Phase

All the equipment used to construct the plant will generate noise. The noise impact is dependent on the following factors:

- The age and service state of the equipment.
- The time of day and duration the equipment is used for.
- The type of equipment.
- The level of operator expertise.

Given that it is not anticipated that piling activities would be undertaken at the same time as other construction activities and that all equipment would be used simultaneously, the following discussion is based on results when using typical machinery (i.e. excluding piling operations).

It can be seen from the modelling results (Table 1-7) that, based on similar noise characteristics, construction noise will reach levels of 50 dB(A) and 40 dB(A) (i.e. typical rating levels for noise during the day and night in sub-urban areas, as defined by SANS 10103:2008 guideline) at approximately 350 metres and 800 m from the source respectively. Furthermore, the South African noise control regulations define a disturbing noise as a noise exceeding the ambient noise level by more than 7 dB. Due to the distance from the site, it is not anticipated that the construction noise will affect the noise sensitive areas.

Construction noise levels would reach 57 dB(A) at about 170 m from the source and 47 dB(A) at approximately 500 m. Therefore, only receptors in very close proximity to the preferred site will be affected by the construction noise during the day.

Given the above, impacts associated with noise generated during construction activities are anticipated to be of low intensity for all sensitive receptors areas identified in this study, although local/regional and of temporary nature. These impacts are therefore predicted to be of **low** significance before mitigation.

1.7.1.1 Recommended mitigation measures

The following key mitigation actions will assist in reducing the noise impact during construction:

- Ensuring that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly.
- All blasting and piling driving, if required, should only occur during the day.
- An environmental noise monitoring survey should be conducted during the construction phase to assess the impact and recommend further actions if required.

In summary, for the construction phase it is unlikely that the construction noise will significantly impact on the noise sensitive areas. With the effective implementation of the above recommended mitigation measures, the residual noise impacts associated with construction activities are predicted to be of **very low** to **low** significance.

It is also recommended that the ambient noise around the project and at the closest residential areas be monitored twice during the construction phase.

1.7.2 Operational Phase

The operation of the power plant is known to be source of noise pollution. Results of the noise levels modelling (refer to Section 1.5.5) associated with the operational phase indicate that noise emissions from the plant will not exceed the suburban night limit of 40 dB(A) and day limit of 50 dB(A). The current ambient noise is higher than this level and it may therefore provide a masking effect. The predicted noise levels associated with the operation of the proposed plant are below current ambient noise levels for all noise sensitive areas assessed.

Furthermore, there are many tall buildings between the source and the residential receivers that will provide a masking effect. The noise on the site boundary will range between 55 and 65 dB(A) which is within the Industrial noise rating limit of 70 dB(A). It must be noted that the receivers within the Atlantis Industrial Park are mostly indoors and exposed to their own noise sources, therefore the likelihood of noise complaints from these receivers is low.

The effect of the operational noise on the fauna surrounding the site will not be significant as the noise emissions are mostly contained on the site.

A cumulative effect of the Atlantis Gas-to-Power Plant and the Ankerlig Power Station is not anticipated as the plant noise is mostly contained on site if the mitigation factors inherent to the design are implemented.

Given the above, impacts associated with noise generated during the operational phase are anticipated to be permanent and of low intensity, although local. These impacts on the surrounding environment are therefore predicted to be of **low** significance before the implementation of key mitigation measures.

The following key mitigation actions will assist in reducing the noise impact during operation:

- All buildings should be designed to acoustically contain as much of the noise emissions as possible. This will include choosing equipment with the lowest noise emissions if a choice is available.
- Ensuring that all equipment that produces a high noise impacts is placed inside buildings that have been designed to reduce noise emissions.
- All buildings containing high noise emission equipment should be housed in buildings that have solid walls (at least 200mm thick) of at least a sound reduction index (R_w) of R_w55-60.
- All ventilation outlets are properly attenuated.
- All air intakes are fitted with attenuators
- All exhaust stacks are fitted with attenuators
- All access doors to the high noise buildings are kept closed when not in use.
- During the commissioning phase an environmental noise survey is conducted to determine if the noise emissions on the site boundary are within the noise rating limits as described in SANS 1013:2008.

With the effective implementation of the above key mitigation measures, the impacts associated with noise generated during the operational phase are anticipated to be of low significance.

1.7.3 Decommissioning Phase

The noise impacts during de-commissioning are the same as the impacts during construction.

1.7.4 Cumulative Impacts

A cumulative effect of the Atlantis Gas-to-Power Plant and the Ankerlig Power Station is not anticipated as the plant noise is mostly contained on site if the mitigation factors inherent to the design are implemented.

1.8 IMPACT ASSESSMENT SUMMARY

The impact of the noise pollution that can be expected from the site during the construction and operational phase will largely depend on the climatic conditions at the site and how the site infrastructure is designed to mitigate noise. An important consideration is that the noise energy reduces in the air by 6 decibels as the distance doubles and the distance between the residential receivers and the plant exceeds 3000m. The results above indicate that there will be little impact on the identified noise sensitive areas if the proposed noise mitigation measures are implemented. The assessment of impacts and recommendation of mitigation measures as discussed above are collated in Tables 1-12 to 1-15 below.

Table 1-12 - Impact assessment summary table for the Construction Phase

Construction Phase											
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence	
								Without Mitigation	With Mitigation		
Alternative 2											
Noise emissions resulting from construction activities	<u>Mitigation measures inherent to the project design include:</u> – Ensuring that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly. – All blasting and piling driving, if required, should only occur during the day. – All reverse noise emitting warning devices on mobile vehicles should be set as low as possible. - An environmental noise monitoring survey should be conducted during the construction phase to assess the impact and recommend further actions if required	Local	Low	Short Term	High	N/A	Probable	Low Negative	Low Negative	High	

Table 1-13 - Impact assessment summary table for the Operational Phase

Operational Phase										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 2										
Noise emissions resulting from the operational activities	• All buildings should be designed to acoustically contain as much of the noise emissions as possible. • Ensuring that all equipment that produces a high noise impact is placed inside buildings that have been designed to reduce noise emissions. • All buildings containing high noise emissions should be housed in buildings that have solid walls (at least 200mm thick) of at least a sound reduction index (Rw) of Rw55-60. • All ventilation outlets are properly attenuated. • All air intakes are fitted with attenuators • All exhaust stacks are fitted with attenuators • All access doors to the high noise buildings are kept closed when not in use.	Local	Low	Long Term	High	N/A	Probable	Low Negative	Low Negative	High

Table 1-14 - Impact assessment summary table for the Decommissioning Phase

Decommissioning Phase										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Alternative 2										
Noise emissions resulting from decommissioning construction activities	Same as construction phase	Local	Low	Short Term	High	N/A	Probable	Low Negative	Low Negative	High

Table 1-15 - Impact assessment summary table for the Cumulative Impacts

Cumulative Impacts										
Impact Description	Mitigation	Spatial Extent	Intensity	Duration	Reversibility	Irreplaceability	Probability	Significance & Status		Confidence
								Without Mitigation	With Mitigation	
Cumulative Impact 1										
Cumulative noise emissions resulting from the operational activities of Ankerlig Power Station and Atlantis GTP	As per Operational phase	Local	Low	Short Term	High	N/A	Probable	Low Negative	Low Negative	High

1.9 CONCLUSION AND RECOMMENDATION SUMMARY

The results of the study indicate the following:

- There will be a short term increase in noise in the immediate vicinity of the site during the construction phase as the ambient noise levels will be exceeded;
- The blasting and drilling impact during the construction phase will be difficult to mitigate; and
- The long term noise impact from the plant during the operation phase will be concentrated in the immediate area around the facility and is not anticipated to affect identified sensitive receptors.

The conclusion is that the Atlantis Gas-to-Power Plant noise impact on receptors is predicted to be of **low** significance during the construction and operational phases respectively, provided the recommendations for mitigating noise impacts are applied effectively.

The following key management actions are recommended:

1.9.1 Construction Activities

- All construction operations should only occur during daylight hours if possible;
- No construction blasting should occur at night. Blasting should only occur during the hottest part of the day to take advantage of unstable atmospheric conditions; and

1.9.2 Operational Activities / Design

The following noise reduction techniques should be considered as inherent to the project design:

- Ensuring building walls are at least 200mm thick with an R_w 55-60
- Acoustic attenuation devices should be installed on all air intake and exhaust ducts;

The following noise reduction techniques should be considered as additional mitigation measures to the project design:

- Selecting equipment with lower sound power levels;
- Installing silencers on fans;
- Installing suitable mufflers on exhausts and compressor components.
- Installing acoustic enclosures for equipment to stop noise at source;
- Improving the acoustic performance of buildings by applying sound insulation where possible;
- Installing vibration isolation products for mechanical equipment.
- High pressure gas or liquid should not be ventilated directly to the atmosphere, but through an attenuation chamber or device;

1.10 REFERENCES

- CSIR Environmental Impact Assessment for the Proposed Desalination Project at Mile 6 near Swakopmund, Namibia
- International Finance Corporation – 2007 General EHS Guidelines: Environmental Noise.
- South Africa - GNR.154 of January 1992: Noise control regulations in terms of section 25 of the Environment Conservation Act (ECA), 1989 (Act No. 73 of 1989)
- South Africa - GNR.155 of 10 January 1992: Application of noise control regulations made under section 25 of the Environment Conservation Act, 1989 (Act No. 73 of 1989)
- South Africa - SANS 10103:2008 Version 6 - The measurement and rating of environmental noise with respect to annoyance and to speech communication.
- South Africa - SANS 10357:2004 Version 2.1 - The calculation of sound propagation by the Concawe method)
- United Nations Environment Programme - 2008 Desalination Resource and Guidance Manual for Environmental Impact Assessments.
-

Table 1-16 - 1. Environmental Management Programme Inputs

Management objective	Management action	Monitoring		
		Methodology	Frequency	Responsibility
Construction Phase: Potential Impact 1				
Limit noise emissions resulting from construction activities	Ensuring that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly.	Construction manager should monitor the implementation of management action to ensure compliance and the prevention of noise emissions as far as possible.	Weekly on an on-going basis throughout construction period.	ECO and Construction Manager
	All blasting and piling driving, if required, should only occur during the day.	Planning blasting activities in advance	As required	ECO and Construction Manager
	An environmental noise monitoring survey should be conducted during the construction phase to assess the impact and recommend further actions if required.	As per SANS 10103:2008 at the identified noise sensitive areas.	Twice during construction phase	Noise Specialist
Operational Phase: Potential Impact 1				
Limit noise emissions resulting from operational activities	- All buildings should be designed to acoustically contain as much of the noise emissions as possible. This will include choosing equipment with the lowest noise emissions if a choice is available. - Ensuring that all equipment that produces a high noise impact is placed inside buildings that have been designed to reduce noise emissions. - All buildings containing high noise emission equipment should be housed in buildings that have solid walls (at least 200mm thick)	As per good design practice	As required	Plant Designer

Management objective	Management action	Monitoring		
		Methodology	Frequency	Responsibility
	of at least a sound reduction index (Rw) of Rw55-60. - All ventilation outlets are properly attenuated. - All air intakes are fitted with attenuators - All exhaust stacks are fitted with attenuators - All access doors to the high noise buildings are kept closed when not in use.			
	An environmental noise monitoring survey should be conducted during the commissioning phase to assess the impact and recommend further actions if required.	As per SANS 10103:2008 at the identified noise sensitive areas.	During commissioning phase	Noise Specialist
Decommissioning Phase: Potential Impact 1				
Limit noise emissions resulting from decommissioning activities	Ensuring that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly.	Construction manager should monitor the implementation of management action to ensure compliance and the prevention of noise emissions as far as possible.	Weekly on an on-going basis throughout construction period.	ECO and Construction Manager
Cumulative Impacts: Cumulative Impact 1				
Limit noise emissions resulting from operational activities	None	N/A	N/A	N/A



DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX P:

Bird Specialist Study

BIRD IMPACT ASSESSMENT REPORT

ATLANTIS GAS-TO-POWER FACILITY AND
ASSOCIATED TRANSMISSION POWER LINE INFRASTRUCTURE



March 2017

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PROFESSIONAL EXPERIENCE

Chris van Rooyen

Chris has 20 years' experience in the management of wildlife interactions with electricity infrastructure. He was head of the Eskom-Endangered Wildlife Trust (EWT) Strategic Partnership from 1996 to 2007, which has received international acclaim as a model of co-operative management between industry and natural resource conservation. He is an acknowledged global expert in this field and has worked in South Africa, Namibia, Botswana, Lesotho, New Zealand, Texas, New Mexico and Florida. Chris also has extensive project management experience and has received several management awards from Eskom for his work in the Eskom-EWT Strategic Partnership. He is the author of 15 academic papers (some with co-authors), co-author of two book chapters and several research reports. He has been involved as ornithological consultant in numerous power line and renewable energy projects. Chris is also co-author of the Best Practice for Avian Monitoring and Impact Mitigation at Wind Development Sites in southern Africa, which is currently accepted as the industry standard. Chris also works outside the electricity industry and had done a wide range of bird impact assessment studies associated with various residential and industrial developments.

Megan Diamond

Megan completed a Bachelor of Science degree in Environmental Management from the University of South Africa and has been involved in conservation for 18 years. She has ten years' experience in the field of bird interactions with electrical infrastructure (both linear and footprint) and during this time has completed impact assessments for at least 80 projects. In various roles (including Programme Manager) with the Endangered Wildlife Trust's Wildlife & Energy Programme and the Programme's primary project (Eskom-EWT Partnership) from 2006 to 2013, Megan was responsible for assisting the energy industry and the national utility in minimising the negative impacts (associated with electrical infrastructure) on wildlife through the provision of strategic guidance, risk and impact assessments, training and research. Megan currently owns and manages *Feathers Environmental Services* and is tasked with providing strategic guidance to industry through the development of best practice procedures and guidelines, reviewing and commenting on methodologies, specialist studies and EIA reports for Renewable Energy projects as well as providing specialist avifaunal input into renewable energy and power line developments within South Africa, elsewhere in Africa and across the globe. In addition, Megan has attended and presented at several conferences and facilitated workshops, as a subject expert, since 2007. Megan is a co-author of the *BirdLife South Africa / Endangered Wildlife Trust best practice guidelines for avian monitoring and impact mitigation at proposed wind energy development sites in southern Africa* and the *Avian Wind Farm Sensitivity Map for South Africa* (2015) and played an instrumental role in facilitating the endorsement of these two products by the South African Wind Energy Association (SAWEA), IAIAsa (International Association for Impact Assessment South Africa) and Eskom. In 2011/2012, she chaired the Birds and Wind Energy Specialist Group in South Africa. From 2013 to 2015, Megan chaired the IUCN/SSC Crane Specialist Group's Crane and Powerline Network, a working group comprised of subject matter experts from across the world, working in partnership to share lessons, develop capacity, pool resources, and accelerate collective learning towards finding innovative solutions to mitigate this impact on threatened crane populations.

DECLARATION OF INDEPENDENCE

I, Chris van Rooyen as duly authorised representative of Chris van Rooyen Consulting, and working under the supervision of and in association with Albert Froneman (SACNASP Zoological Science Registration number 400177/09) as stipulated by the Natural Scientific Professions Act 27 of 2003, hereby confirm my independence (as well as that of Chris van Rooyen Consulting) as a specialist and declare that neither I nor Chris van Rooyen Consulting have any interest, be it business, financial, personal or other, in any proposed activity, application or appeal in respect of the Environmental Impact Assessment for the proposed Atlantis Gas-to-Power facility and its associated Ankerlig-Omega 400kV power line, other than fair remuneration for the specialist investigations completed in a professional capacity as specified by the Environmental Impact Assessment Regulations, 2014.

A handwritten signature in dark ink, appearing to read 'Chris van Rooyen', is written over a horizontal line.

Full Name: Chris van Rooyen
Title / Position: Director

EXECUTIVE SUMMARY

This avifaunal study assesses the potential interactions between avifauna and the proposed Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line. The proposed development is located approximately 40 km north of Cape Town, in the Atlantis Industrial area within the City of Cape Town Metropolitan Municipality in the Western Cape Province.

A combined total of 194 species have been recorded within the relevant pentads during the SABAP2 atlassing period to date. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur along the proposed power line route. Twelve of the aforementioned species are considered to be of conservation concern, according to the 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015) and the IUCN Red List (2016).

In general, the habitat in which the proposed Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line alignment are located, is not of high conservation value in avian terms. Although pockets of natural vegetation are found within the study area, there is evidence of anthropogenic impacts, which is visible in the disturbed state of the majority of the natural fynbos. This has had a negative impact on avifaunal diversity and abundance and is reflected in the low reporting rates for the majority of power line sensitive Red List species in the greater study area, which may also indicate that levels of disturbance are high. The exceptions to this are the high reporting rates for Blue Crane and Great White Pelican. In the case of Blue Crane that would be linked to the presence of cereal crops which is their habitat of choice, while the high reporting rates for Great White Pelican is linked to regular flights over the greater study area of birds commuting between their breeding grounds at Dassen and Vondeling Islands and foraging areas at pig and chicken farms around Cape Town. The construction and operation of the Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line may result in various threats to the birds occurring in the vicinity of the new infrastructure, with impacts ranging from low to moderate. The proposed power lines pose a **moderate** collision risk which can be reduced to **low** through the application of mitigation measures. The habitat transformation and disturbance impacts associated with the construction and decommissioning of the Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line are likely to be **low** in significance.

Taking the above information into account, it can be concluded that the proposed Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line can be constructed with acceptable levels of impact on the resident avifauna subject to the following recommendations below:

- An avifaunal walk through of the final power line route must be conducted prior to construction, to identify any species that may be breeding on the site or within the immediate surrounds and to ensure that any impacts likely to affect breeding species (if any) are adequately managed and to identify the exact sections of power line requiring collision mitigation.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.
- High risk sections of power line (i.e. in areas that contain rivers, wetlands, dams and agricultural lands) must be identified by a qualified avifaunal specialist during a final walk-through, for inclusion

into the final site-specific Environmental Management Plan for the project, once the alignment has been finalized. For those spans identified as sensitive, power line marking in the form of bird flight diverters must be installed on the full span length on the earthwires (according to Eskom guidelines – APPENDIX 2). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifaunal species.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

Bird Impact Assessment Report: Atlantis Gas-to-Power Facility &
Associated Ankerlig-Omega 400kV Power Line Infrastructure

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1 INTRODUCTION

1.1. Background

The National Development Plan (NDP), implemented in 2013, identifies the need for various sectors to invest in a network of infrastructure that will support the country's medium- and long-term economic and social objectives (<https://ipp-projects.co.za>). Not surprisingly, energy infrastructure is a critical component of the NDP. Energy infrastructure plays an important role in fortifying economic activity and growth across the country and therefore the development of this infrastructure needs to be robust and extensive enough to meet industrial, commercial and household needs. One of the key objectives of the Department of Energy (DoE) is to ensure the availability of energy resources, and access to energy services in an affordable and sustainable manner, while minimising the associated adverse environmental impacts (Integrated Energy Plan 2016). In terms of the *Regulations for New Generation Capacity* published on 5 August 2009, the Integrated Resource Plan (IRP) which is a subset of the Integrated Energy Plan (IEP) developed by the DoE, sets out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account (Stroebe *et al.* 2016). With energy and electricity demands predicted to increase, particularly for the regions around the Western Cape, new investments in electricity generation capacity are required.

The City of Cape Town (CoCT) in association with GreenCape are proposing to develop a 1500MW Gas-to-Power facility and associated electrical infrastructure within the Atlantis Special Development Zone (SEZ), situated approximately 40 km north of Cape Town, in the Atlantis Industrial area within the City of Cape Town Metropolitan Municipality in the Western Cape Province (Figure 1). The preferred site for the proposed Atlantis Gas-to-Power project encompasses an area of approximately 38.65 ha of land, however the proposed Gas-to-Power facility and associated infrastructure development envelope is approximately 32 ha in size. A specific technology provider has not been established and therefore a project "envelope" approach will be followed whereby a range of gas-to-power technologies, and emission profiles will be assessed as part of the Environmental Impact Assessment (EIA) process. Two technology options are currently under consideration for this project, namely, gas turbines or gas reciprocating engines. Since combined cycle gas turbine (CCGT) plants are increasingly being installed worldwide, particularly in areas where there is access to substantial quantities of natural gas, it is likely that the proposed Atlantis Gas-to-Power facility will ultimately consist of the following components:

- Combustion/engine turbines located in power blocks and producing up to a maximum of 1500 MW;
- Heat recovery steam generators with associated chimneys;
- Electrical generator;
- Administration buildings;
- Gas pipelines for the reticulation of natural gas on site (not transmission to site); and
- Transmission power lines for the evacuation of power.

The National Environmental Management Act (Act 107 of 1998) (NEMA) and the 2014 NEMA EIA Regulations promulgated in Government Gazette 38282 and Government Notice (GN) R982, R983, R984 and R985 on 8 December 2014, requires that an Environmental Impact Assessment (EIA) be conducted for any development which could have a significant effect on the environment, with the objective to identify, predict and evaluate the actual and potential impacts of these activities on ecological systems; identify alternatives; and provide recommendations for mitigation to minimize the negative impacts. In order to meet

these requirements, the Applicant has appointed the Council for Scientific and Industrial Research (hereinafter referred to as CSIR) as independent environmental practitioners to undertake the EIA processes for the proposed development. The CSIR has appointed Chris van Rooyen Consulting to compile a specialist avifaunal impact assessment that details the sensitive bird habitats within the study area and the potential bird related impacts associated with the proposed Gas-to-Power facility and associated electrical infrastructure.



Figure 1: Regional map showing the approximate location of the study area.

Proposed Atlantis Gas-to-Power facility (Site 2) = orange polygon

Proposed Ankerlig-Omega 400kV Power Line Alternative 1 = green line

2km Buffer = white polygon

1.2. Selection of a Preferred Site Alternative

Identifying a suitable site alternative is an essential component of any development project. In terms of the EIA Regulations, feasible and reasonable alternatives have to be considered within the Scoping Phase, including the 'No Go' option (i.e. the option of not establishing the proposed Atlantis Gas-to-Power facility and its associated electrical infrastructure). Feasible and reasonable alternatives are required to be identified in terms of social, biophysical, economic and technical factors.

The CoCT made two sites available for the purpose of developing the proposed gas-to-power facility, namely:

- Site 1- Cape Farm 1183 and Cape Farm 4 Portion 93; and
- Site 2- Cape Farm 1183 portions 1 of portion 4

A Basic Assessment of the study area and the subsequent Environmental Authorisations, obtained in 2012, for energy related activities on Site 1 and Site 2 revealed that the two sites alternatives for the proposed Atlantis Gas-to-Power facility posed a limited risk to biophysical, agricultural and human infrastructure contained within the proposed study area. From an environmental perspective, Site 1 and Site 2 were considered identical. Given the environmental likeness of the proposed sites, the preferred site alternative was selected based on national level considerations (in particular the proximity of the proposed development to existing infrastructure) and a high-level sensitivity screening study conducted by the CSIR. On a site-specific level, Site 2 was deemed suitable due to all the site selection factors (such as land availability, distance to the national grid, site accessibility, topography, risks, current land use) being favourable (Stroebel *et al.* 2016).

1.3. Legislative Framework

There is no legislation pertaining specifically to the impact of industrial developments on avifauna, or specific permitting requirements. International conventions and national legislation which are relevant to bird conservation in South Africa in a broader context are listed below.

1.3.1. Agreements and conventions

Table 1-1 below lists international agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna^[1].

^[1] (BirdLife International (2016) Country profile: South Africa. Available from: [http://www.birdlife.org/datazone/country/south africa](http://www.birdlife.org/datazone/country/south%20africa). Checked: 2016-04-02).

Table 1-1: Agreements and conventions which South Africa is party to and which is relevant to the conservation of avifauna.

Convention Name	Description	Geographic scope
African-Eurasian Waterbird Agreement (AEWA)	The Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA) is an intergovernmental treaty dedicated to the conservation of migratory waterbirds and their habitats across Africa, Europe, the Middle East, Central Asia, Greenland and the Canadian Archipelago. Developed under the framework of the Convention on Migratory Species (CMS) and administered by the United Nations Environment Programme (UNEP), AEWA brings together countries and the wider international conservation community in an effort to establish coordinated conservation and management of migratory waterbirds throughout their entire migratory range.	Regional
Convention on Biological Diversity (CBD), Nairobi, 1992	The Convention on Biological Diversity (CBD) entered into force on 29 December 1993. It has 3 main objectives: • The conservation of biological diversity • The sustainable use of the components of biological diversity • The fair and equitable sharing of the benefits arising out of the utilization of genetic resources.	Global
Convention on the Conservation of Migratory Species of Wild Animals, (CMS), Bonn, 1979	As an environmental treaty under the aegis of the United Nations Environment Programme, CMS provides a global platform for the conservation and sustainable use of migratory animals and their habitats. CMS brings together the States through which migratory animals pass, the Range States, and lays the legal foundation for internationally coordinated conservation measures throughout a migratory range.	Global
Convention on the International Trade in Endangered Species of Wild Flora and Fauna, (CITES), Washington DC, 1973	CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.	Global
Ramsar Convention on Wetlands of International Importance, Ramsar, 1971	The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.	Global
Memorandum of Understanding on the Conservation of Migratory Birds of Prey in Africa and Eurasia	The Signatories will aim to take co-ordinated measures to achieve and maintain the favourable conservation status of birds of prey throughout their range and to reverse their decline when and where appropriate.	Regional

1.3.2. National Legislation

a) Constitution of the Republic of South Africa, 1996

The Constitution of the Republic of South Africa provides in the Bill of Rights that: Everyone has the right –

- to an environment that is not harmful to their health or well-being; and
- to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –
 - prevent pollution and ecological degradation;
 - promote conservation; and

- secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

b) *The National Environmental Management Act 107 of 1998 (NEMA)*

The National Environmental Management Act 107 of 1998 (NEMA) creates the legislative framework for environmental protection in South Africa, and is aimed at giving effect to the environmental right in the Constitution. It sets out a number of guiding principles that apply to the actions of all organs of state that may significantly affect the environment. Sustainable development (socially, environmentally and economically) is one of the key principles, and internationally accepted principles of environmental management, such as the precautionary principle and the polluter pays principle, are also incorporated.

NEMA also provides that a wide variety of listed developmental activities, which may significantly affect the environment, may be performed only after an environmental impact assessment has been done and authorization has been obtained from the relevant authority. Many of these listed activities can potentially have negative impacts on bird populations in a variety of ways. The clearance of natural vegetation, for instance, can lead to a loss of habitat and may depress prey populations, while erecting structures needed for generating and distributing energy, communication, and so forth can cause mortalities by collision or electrocution.

c) *The National Environmental Management: Biodiversity Act 10 of 2004 (NEMBA) and the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations)*

The most prominent statute containing provisions directly aimed at the conservation of birds is the National Environmental Management: Biodiversity Act 10 of 2004 read with the Threatened or Protected Species Regulations, February 2007 (TOPS Regulations). Chapter 1 sets out the objectives of the Act, and they are aligned with the objectives of the Convention on Biological Diversity, which are the conservation of biodiversity, the sustainable use of its components, and the fair and equitable sharing of the benefits of the use of genetic resources. The Act also gives effect to CITES, the Ramsar Convention, and the Bonn Convention on Migratory Species of Wild Animals. The State is endowed with the trusteeship of biodiversity and has the responsibility to manage, conserve and sustain the biodiversity of South Africa.

2 BRIEF

The terms of reference for this bird impact assessment study are as follows:

- Describe the affected environment and the current state of avifauna in the study area (baseline information), with a particular focus on Red List species.
- Identify Red List and vulnerable species potentially affected by the proposed project.
- Identify species-specific habitats and areas where high avian activity is likely to occur which may be influenced by the proposed project or which may influence the proposed project during construction and operation.

- Identify and assess the significance of the potential impacts of the proposed project on avifauna during construction and operation.
- Identify preliminary mitigation measures for avoiding or mitigating negative impacts on avifauna.
- Identify key avifaunal legislation and permit requirements (if relevant).
- Identify information gaps, limitations and additional information required.

3 STUDY APPROACH

3.1. Sources of information

This study made use of the following data sources:

- Bird distribution data of the South African Bird Atlas 2 (SABAP 2) was obtained from the Animal Demography Unit of the University of Cape Town, as a means to ascertain which species occur within the broader area i.e. within a block consisting of 3 pentad grid cells within which the study area is situated. A pentad grid cell covers 5 minutes of latitude by 5 minutes of longitude (5'× 5'). Each pentad is approximately 8 × 7.6 km. Between 2007 and 2017, a total of 159 full protocol cards (i.e. 159 bird surveys lasting a minimum of two hours each) have been completed for the study area and its immediate surrounds. The relevant pentads where the study area is located are: 3335_1825; 3340_1825; and 3340_1830 (Figure 2);
- The Southern African Bird Atlas 1 (SABAP1) (Harrison *et al.* 1997) was used as a supplementary source of information in that it provided information on the historical occurrence of birds in the study area;
- The Coordinated Avifaunal Roadcount project (CAR) data was consulted to obtain relevant data on large terrestrial bird report rates in the area (<http://car.adu.org.za/>). Route SW08 is relevant to this project (Figure 2).
- The Important Bird Areas (IBA) project data was consulted to get an overview of important bird areas (IBAs) and species diversity that may occur in the study area (Marnewick *et al.* 2015 and Barnes, 1998). There are no IBAs sites in the vicinity of the proposed project;
- The Co-ordinated Waterbird Count (CWAC) data was consulted determine if large concentrations of water birds, associated with South African wetlands, may occur within the study area (<http://cwac.adu.org.za/>). There are no CWAC sites in the vicinity of the proposed project;
- The conservation status of all species considered likely to occur in the area was determined as per the most recent iteration of the 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland (Taylor *et al.* 2015) and the IUCN Red List of Threatened Species (<http://www.iucnredlist.org/>) and the most recent and comprehensive summary of southern African bird biology (Hockey *et al.* 2005);
- The power line bird mortality incident database of the Endangered Wildlife Trust (1996 to 2007) was consulted to determine which of the species occurring in the study area are typically impacted upon by power lines (Jenkins *et al.* 2010);
- Data on vegetation types in the study area was obtained from the Vegetation Map of South Africa, (Mucina & Rutherford 2006);
- High resolution Google Earth ©2016 imagery was used to further examine the micro habitats within the study area;

- Personal observations, especially experience from other projects which the authors have completed in South Africa since 1996, have also been used to supplement the data that is available from SABAP2, and has been used extensively in forming a professional opinion of likely bird/habitat associations;
- A field visit to the study area was conducted on 23 February 2017 to form a first-hand impression of the micro-habitat on site (Figure 3). This information, together with the SABAP2 data was used to compile a comprehensive list of species that could occur in the study area; and
- Maps and shapefiles detailing the location of the proposed site alternative (Site 2) and proposed power line option were obtained from the CSIR.

3.2. Methodology

The following methodology was employed to compile this report:

- The study area was defined as a 2km buffer around the gas-to-power facility and the proposed power line alternative (Figure 1).
- Suitable bird habitats and potential sensitive areas within the proposed site, where the potential impacts are likely to occur, were assessed using various GIS (Geographic Information System) layers, Google Earth imagery and **confirmed** during the one-day site visit to the study area.
- Various avifaunal data sets (listed above) were collected and examined to determine the avifauna likely to occur within the impact zone of the proposed gas-to-power facility and its associated electrical infrastructure.
- The potential impacts of the proposed facility and associated infrastructure were evaluated based on the authors' experience in gathering and analysing data on avian impacts with various forms of linear infrastructure and developments in southern Africa since 1996.
- The significance of each potential impact was assessed according to criteria provided by the CSIR (APPENDIX 3).
- Practical mitigation recommendations for potentially significant impacts have been provided for inclusion in the EMPr (APPENDIX 4).

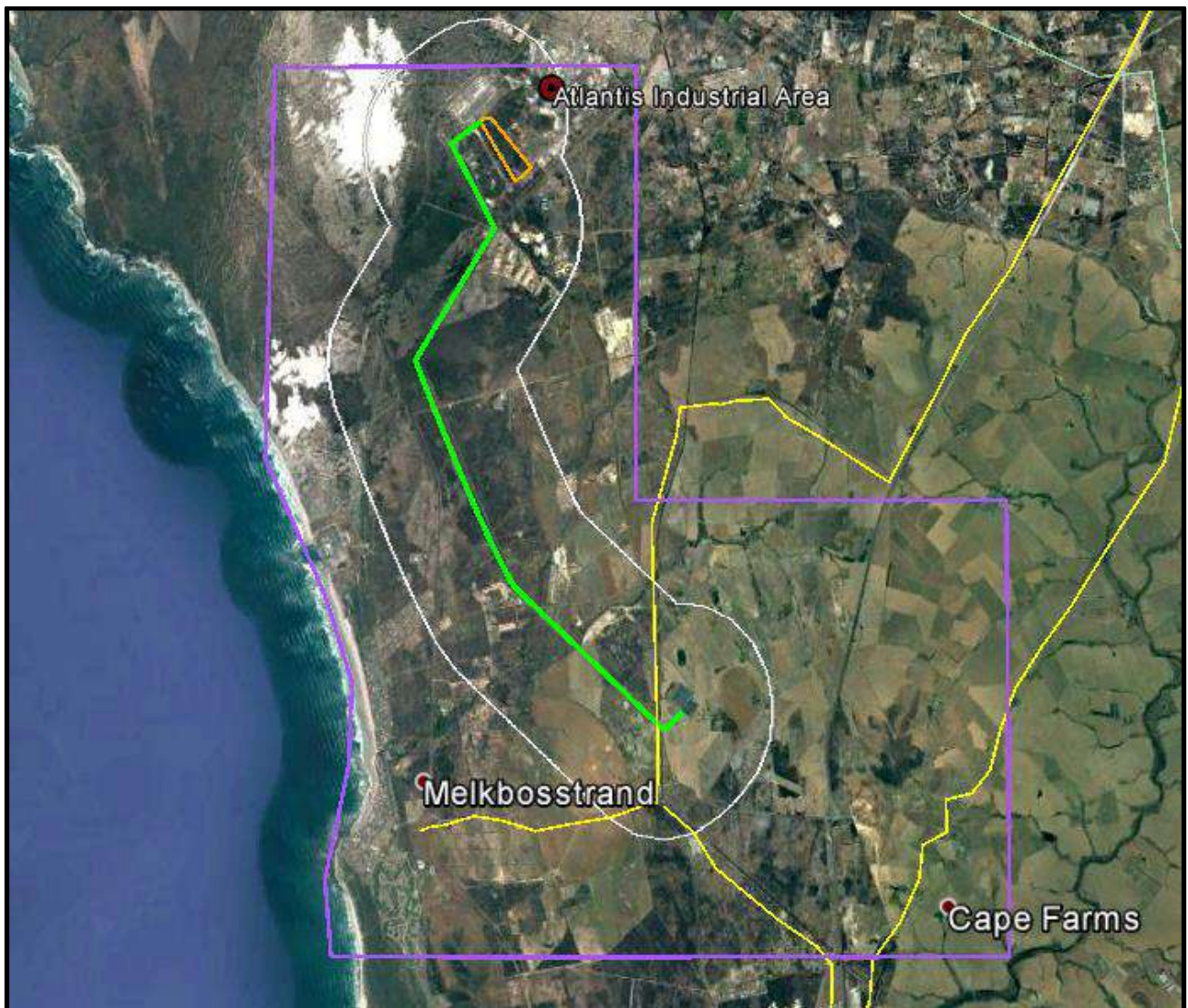


Figure 2: Regional map showing the study area in relation to the SABAP2 pentads and the Coordinated Avifaunal Roadcount Route (SW08).

Proposed Atlantis Gas-to-Power facility (Site 2) = orange polygon
Proposed Ankerlig-Omega 400kV Power Line Alternative = green line
Pentads = Purple Polygon
Coordinated Avifaunal Roadcount Route SW08 = yellow line
2km Buffer = white polygon

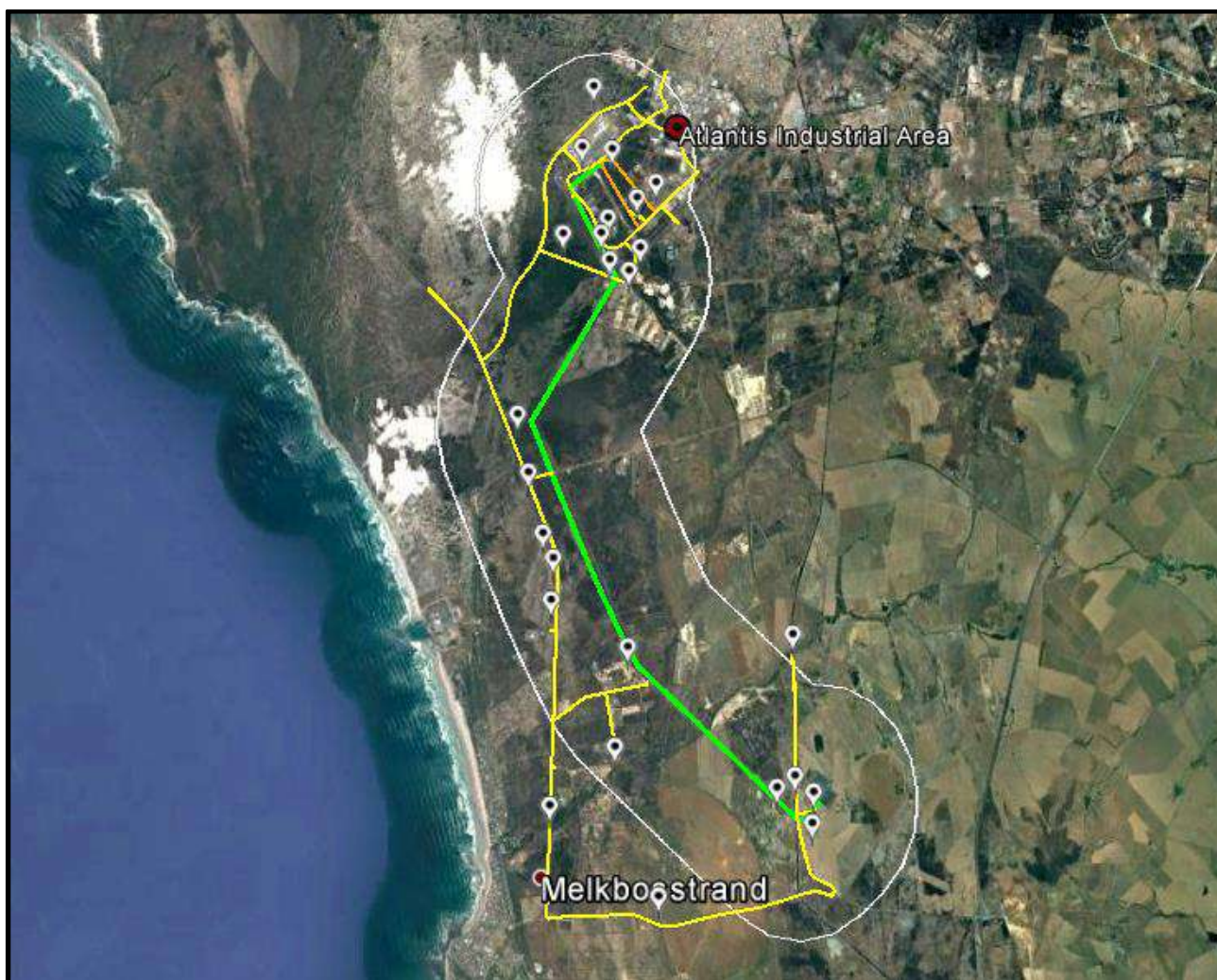


Figure 3: Regional map detailing the track log and habitat points surveyed during the site visit to the study area.

Proposed Atlantis Gas-to-Power facility (Site 2) = orange polygon

Proposed Ankerlig-Omega 400kV Power Line Alternative = green line

Survey Points = white markers

Site Visit Track Log = yellow line

2km Buffer = white polygon

3.3. Assumptions & limitations

The findings in this report are subject to the following assumptions and limitations:

- The report is the result of a short-term study and is based on a one-day site visit to the proposed development area. No long-term monitoring was conducted by the avifaunal specialist.
- A specific gas-to-power technology has not been established as yet. However, this avifaunal impact assessment has identified the potential impacts (i.e. displacement as a result of habitat transformation and disturbance) associated with the physical footprint of the proposed Atlantis Gas-to-Power facility regardless of the technology that will be utilised. Provided the proposed development, both in terms of the gas-to-power facility and the associated Ankerlig-Omega 400kV power line remain within the

delineated 38.65 ha (Site 2) area and within the proposed power line route corridor, the findings of this report will remain valid.

- The study area was defined by the three SABAP2 pentads, within which the preferred site alternative and the power line alternative occur. The field visit was conducted mostly from public roads as access to private property, was largely restricted. However, representative avifaunal habitat types were easily accessed from the aforementioned public roads.
- It is not possible to eliminate all risk of impacts of a proposed facility such as this on avifauna. Our best possible efforts can probably not ensure zero impact on birds. Studies such as this attempt to minimise the risk as far as possible, but it is probably unavoidable that the facility will impact on birds, and perhaps in ways not yet understood.
- Predictions in this study are based on experience of these and similar species in different parts of southern Africa. Bird behaviour can never be entirely reduced to formulas that will hold true under all circumstances. Therefore, professional judgment based on extensive field experience, played an important role in this assessment. It should also be noted that the impact of power lines on birds has been well researched with a robust body of published research stretching over thirty years.

4 DESCRIPTION OF THE AFFECTED ENVIRONMENT

4.1 Relevant Bird Populations

4.1.1. Coordinated Avifaunal Roadcount (CAR) Data

Cranes, bustards, storks and other large birds that spend most of their time on the ground, need wide, open spaces and are certainly not restricted to protected areas. Agricultural habitats, like those in the Western Cape, are used extensively for feeding, roosting and breeding, often because no natural, pristine habitats are available, and sometimes because the agricultural habitats are especially attractive to birds. Because of their size and conspicuous nature, these birds can be monitored using a relatively simple technique i.e. the road count. The Coordinated Avifaunal Roadcounts (CAR) project monitors the populations of 36 species of large terrestrial birds in agricultural habitats along 350 fixed routes covering over 19 000km (http://car.adu.org.za/about_car.php). Although CAR road counts do not give an absolute count of the all the individuals in a population, they do provide a measure of relative abundance in a particular area. CAR route SW08 has relevance to this study area, the majority of this 65km route runs to the west of the study. Approximately 6km of the route traverses across the southern portion of the study area, close to the Omega substation. Blue Crane *Anthopoides paradiseus*, Black-headed Heron *Ardea melanocephala*, Spur-winged Goose *Plectropterus gambensis*, Steppe Buzzard *Buteo buteo*, Jackal Buzzard *Buteo rufofuscus*, Black-shouldered Kite *Elanus caeruleus*, Secretarybird *Sagittarius serpentarius*, White Stork *Ciconia ciconia* and Black Harrier *Circus maurus* have been recorded regularly along the SW08 route between 2010 and 2015. It is therefore possible that these species could potentially occur in the southern portion of the study area, along the proposed power line route as it enters the Omega substation, especially within the agricultural areas that are prevalent along this CAR route and that also feature within the study area.

4.1.2. Southern African Bird Atlas Project 2 Data (SABAP2)

A combined total of 194 species have been recorded within the relevant pentads during the SABAP2 atlassing period to date. The presence of these species in the broader area provides an indication of the diversity of species that could potentially occur within the study area. Of these, 20 species are considered to be of conservation concern, according to the 2015 Eskom Red Data Book of Birds of South Africa, Lesotho

and Swaziland (Taylor *et al*, 2015) and the IUCN Red List (2016). Eight of recorded regionally threatened species (Bank Cormorant *Phalacrocorax neglectus*, Cape Cormorant *Phalacrocorax capensis*, Crowned Cormorant *Phalacrocorax coronatus*, Cape Gannet *Morus capensis*, Red Knot *Calidris canutus*, African Black Oystercatcher *Haematopus moquini*, African Penguin *Spheniscus demersus* and Antarctic Tern *Sterna vittata*) are pelagic or restricted to the country's coastline and will therefore not be negatively impacted on by the construction or operation of the proposed gas-to-power facility or the associated Ankerlig-Omega 400kV power line. For each of the remaining regionally threatened species (n=12), the potential for occurring in a specific habitat class is indicated in Table 4.1, in addition to the type of impact that could potentially affect each species.

Although this assessment focuses on the impacts on Red List species, as these are the species of highest conservation concern, the impact on non-threatened species has also been considered, although not on an individual species basis. It is worth noting that since the impacts are usually the same across various species, Red List species can usually be used as surrogate species for related non-threatened species in terms of impacts and the necessary mitigation.

In addition, birds can and will, by virtue of their mobility, utilise almost any areas in a landscape from time to time. However, the analysis in Table 4-1 represents each species' most preferred or usual habitats. These locations are where most of the birds of that species will spend most of their time – so logically that is where potential impacts (also indicated) on those species will be most significant.

The following Red List species were recorded during the February 2017 site visit:

- Black Harrier
- Lanner Falcon *Falco biarmicus*,

Table 4-1: Red List species that could potentially occur in the study area

[illegible]

4.2. Study Area Vegetation Classification and Description of Bird Habitat Classes

It is widely accepted that vegetation structure is more critical in determining bird habitat, than the actual plant species composition (Harrison *et al.* 1997). The description of vegetation presented in this report therefore concentrates on factors relevant to the bird species present, and is not an exhaustive list of plant species present. From an avifaunal perspective, the Atlas of southern African Birds (SABAP1) recognises six primary vegetation divisions or biomes within South Africa, namely (1) Fynbos (2) Succulent Karoo (3) Nama Karoo (4) Grassland (5) Savanna and (6) Forest (Harrison *et al.* 1997). These vegetation descriptions are based on set criteria used by the SABAP1 authors to amalgamate botanically defined vegetation units, which include (1) the existence of clear differences in vegetation structure, likely to be relevant to birds, and (2) the results of published community studies on bird/vegetation associations.

The study site falls within the Fynbos biome, and the West Strandveld bioregion (Mucina & Rutherford 2006), and includes an area of Cape Flats Dune Strandveld in the north-west, with the central and south-eastern portion comprising Atlantis Sand Fynbos. Just east of the intersection of the R27 and the R307 there is a small patch of Cape Inland Salt Pan vegetation, coincident with a sizeable wetland area and sewage treatment plant. In terms of the avian vegetational zones identified by the Southern African Bird Atlas Project (SABAP1, Harrison *et al.* 1997), the area includes elements of both the Fynbos and the Succulent Karoo regions.

4.2.1. Fynbos

The natural vegetation in the pentads where the proposed gas-to-power facility and its associated Ankerlig-Omega 400kV power line are located is classified as fynbos vegetation (Harrison *et al.* 1997 and Mucina & Rutherford 2006). Fynbos is dominated by low shrubs and can be divided into two categories, fynbos proper and renosterveld. Despite having a high diversity of plant species, fynbos and renosterveld has a relatively low diversity of bird species. Large sections of the study area have been completely transformed by industrialisation and commercial properties (including a small airport and shooting range), cultivation, residential areas in the form of small-holdings, the mining of sand and the infestations of alien Port Jackson Willow and *Eucalyptus* plant species. Very little undisturbed fynbos remains, but patches of good quality, natural vegetation still persist within the study area. These are largely restricted to the north-western part of the study area and west of the proposed power line route alternative. Red List species that could potentially occur in natural fynbos vegetation in the study area are Black Harrier, Secretarybird, Martial Eagle *Polemaetus bellicosus*, African Marsh-Harrier *Circus ranivorus*, Lanner Falcon and Southern Black Korhaan *Afrotis afra*. Non-threatened, impact sensitive species which could occur in this habitat are Black-shouldered Kite, Jackal Buzzard, Booted Eagle *Aquila pennatus*, Steppe Buzzard, Rock Kestrel *Falco rupicolus*, Rufous-chested Sparrowhawk *Accipiter rufiventris* and Helmeted Guineafowl *Numida meleagris*.

4.2.2. Rivers

The study area contains the Sout River which discharges into the Atlantic Ocean between Riebeeckstrand and Melkbosstrand. Rivers and drainage lines are important habitat for birds in that they act as corridors of microhabitat for waterbirds, while the riparian vegetation on the banks provide potential cover for skulking species. Ephemeral drainage lines generally only flow for short periods in the rainy season, but pools of water can persist for many months and aquatic organisms that are trapped in those pools could provide potential sources of food for various species. Rivers and the surrounding riparian habitat could potentially attract many waterbirds. However, the Sout River has been largely modified and is choked with *Typha capensis* (Bulrush) in most places and is therefore unlikely to attract many waterbirds.

4.2.3. Wetlands

Wetlands are characterized by slow flowing seasonal water (or permanently wet) and tall emergent vegetation (rooted or floating) and provide habitat for many water birds. The conservation status of many of the bird species that are dependent on wetlands reflects the critical status of wetlands worldwide, with many having already been destroyed. There are examples of localized wetlands occurring in the study area which are likely to represent attractive roosting and foraging areas for certain species year-round – not only after rainfall. Of the impact-sensitive species found within this study area, the Red List Black Harrier and African Marsh-harrier are likely to use these wetlands, while the non-threatened White Stork could also roost in wetlands on occasion.

4.2.4. Surface Water (dams, pans, retention ponds, water and sanitation facilities)

Many thousands of earthen and other dams exist in the southern African landscape. Whilst dams have altered flow patterns of streams and rivers, and affected many bird species detrimentally, a number of species have benefited from their construction. The construction of these dams has probably resulted in a range expansion for many water bird species that were formerly restricted to areas of higher rainfall. Man-made impoundments, although artificial in nature, can be very important for variety of birds, particularly water birds. Apart from the water quality, the structure of the dam, and specifically the margins and the associated shoreline and vegetation, plays a big role in determining the species that will be attracted to the dam. The study area contains a variety of surface water examples in the form of farm dams, pans, retention ponds and water and sanitation facilities. Red List species that could be attracted to these areas include Great White Pelican *Pelecanus onocrotalus*, and Greater Flamingo *Phoenicopterus roseus*. Non-threatened, impact sensitive species that could utilise these areas include Reed Cormorant, White-breasted Cormorant, African Darter, African Black Duck, White-backed Duck, Yellow-billed Duck, Egyptian Goose, Spur-winged Goose, several heron, egret and ibis species, African Spoonbill, Cape Teal *Anas capensis* and Red-billed Teal *Anas erythrorhyncha*.

4.2.5. Agricultural clearings, old lands and pasture

The tilling of soil is one of the most drastic and irrevocable transformations brought on the environment. It completely destroys the structure and species composition of the natural vegetation, either temporarily or permanently. However, arable or cultivated land may represent a significant feeding area for many bird species in any landscape for the following reasons: through opening up the soil surface, land preparation makes many insects, seeds, bulbs and other food sources suddenly accessible to birds and other predators; the crop or pasture plants cultivated are often eaten themselves by birds, or attract insects which are in turn eaten by birds; during the dry season arable lands often represent the only green or attractive food sources in an otherwise dry landscape. Agricultural clearings, mostly in the form of dryland cultivation, feature prominently in the southern portion of the study area. Other parts of the study area consist of old lands and a few pastures. The old lands resemble grassland, with varying levels of shrub infestation. Structurally, the pastures resemble very short grassland. Red List species that are most likely to utilise this habitat on occasion are the Blue Crane, Lanner Falcon, Black Harrier and Secretarybird. Non-threatened, impact sensitive species that could also use this habitat are White Stork, Black-shouldered Kite, Jackal Buzzard, Steppe Buzzard, Black Sparrowhawk *Accipiter melanoleucus*, Rufous-chested Sparrowhawk and Spur-winged Goose.

4.2.6. Exotic/Alien Trees

The study area is peppered with stands of alien trees, mainly *Eucalyptus* and although this species is strictly speaking an invader species, they have become important refuges for certain species of raptors. The alien trees converge to form dense stands along the river, in close proximity to homesteads and lining road infrastructure (acting as wind-breaks) and within the industrial areas. Non-threatened, impact sensitive species that could use this habitat are Black-shouldered Kite, Jackal Buzzard, Steppe Buzzard, Black Sparrowhawk, Rufous-chested Sparrowhawk, Booted Eagle and African Fish-Eagle. The Red List Martial Eagle could also utilise this habitat but the species is unlikely to occur with any regularity.

4.2.7. Industrial and Commercial Properties and Residential Areas (Small Holdings)

These areas include commercial properties (factories and warehousing), extraction pits, quarries, a small airport, shooting range and surface infrastructure such as roads and buildings with significant habitat degradation and high volumes of disturbance associated with pedestrian and vehicle traffic. Built-up areas generally are of little value to sensitive Red List bird species due to their degraded nature and the associated disturbance factor. Few impact sensitive species are likely to be attracted specifically to these areas, but the Red List Lanner Falcon and non-threatened Rufous-chested Sparrowhawk may occasionally hunt small birds converging on small holdings/farm yards. Barn Owl *Tyto alba* may also be attracted to farm yards and commercial/farm buildings.

SABAP2 reporting rates for the majority of Red List avifauna potentially occurring in the seven habitat classes discussed above are, with some notable exceptions, low (see Table 4-1), indicating that human activity has impacted on the avifauna and that levels of habitat transformation and disturbance are high.

Table 4-1 details the micro habitats that each Red List bird species typically frequents in the broader study area. APPENDIX 1 provides a photographic record of the bird habitats that occur within the confines of the study area.

5 DESCRIPTION OF EXPECTED IMPACTS

The effects of any development on birds are highly variable and depend on a wide range of factors including the specification of the development, the topography of the surrounding land, the habitats affected and the number and diversity of birds present. With so many variables involved, the impacts of each development must be assessed individually. Each of these potential effects can interact, either increasing the overall impact on birds or, in some cases, reducing a particular impact (for example where habitat loss and disturbance causes a reduction in birds using an area which may then reduce the risk of collision). The principal areas of concern for Red List species related to the proposed Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line are:

- Displacement due to habitat loss in the physical infrastructure footprint;
- Displacement due to disturbance associated with construction and maintenance; and
- Mortality due to collision with the earthwire of the transmission line.

5.1 Construction Phase

5.1.1. Displacement as a result of habitat loss or transformation in the physical footprint

Although this impact is dependent on the location and the scale of the facility, this is potentially the most significant impact associated with the construction of the gas-to-power facility. Extensive areas of vegetation (habitat) are cleared to accommodate the considerable amount of infrastructure required at these facilities, reducing the amount of habitat available to birds for foraging, roosting and breeding (Smallie, 2013).

This impact may potentially have dire consequences for the smaller passerine species with small home ranges as entire territories could be removed during construction activities. However, the natural vegetation present at the preferred Site 2 is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support sensitive Red List species and any habitat transformation impacts that may occur are likely to be low in significance and likely to affect local, non-threatened bird populations. The physical size of the footprint is also fairly small (32ha), thereby reducing the potential impact on Red List species further.

5.1.2. Displacement as a result of disturbance

Excavation and construction activities are a source of significant disturbance particularly as a result of the machinery and construction personnel that are present on site for the duration of the construction of the facility. For most bird species, construction activities are likely to be a cause of temporary disturbance and will impact on foraging, breeding and roosting behaviours or in more extreme cases, result in displacement from the site entirely.

Blue Crane, African Marsh Harrier and Black Harrier are all Red List species (the former and the latter are also regional endemics) which nest on the ground and could occur as breeding residents within the impact area of the proposed powerline. Both harrier species breed in the nearby Koeberg Nature Reserve, and Blue Cranes have been reported breeding over an increasingly wide area in the western Swartland (Young *et al.* 2003). All three are likely to favour situations close to water – Blue Crane on open ground, often near dams or pans, Black Harrier in tall, damp vegetation adjacent to small pans or wetlands, and African Marsh Harrier in wet reedbeds (Hockey *et al.* 2006). Should any of these species be breeding close to the power line route alignment at the time at which the line is constructed, the breeding effort could be interrupted due to temporary displacement of the breeding birds.

The study area is already subjected to a fairly significant degree of disturbance due to industrial activities in the immediate vicinity of the preferred gas-to power site. Based on the small footprint and the location of the gas-to-power facility (and the associated Ankerlig-Omega 400kV power line) and the bird species likely to occur in the study area, the proposed development is unlikely to have any long-term, significant negative displacement impact on the local avifauna due to disturbance.

5.2 Operational Phase

5.2.1. Mortality due to collision with the earth wire of the transmission line

Because of their size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines. (Ledger and Annegarn 1981; Ledger 1983; Ledger 1984; Hobbs and Ledger 1986a; Hobbs and

Ledger 1986b; Ledger, Hobbs and Smith, 1992; Verdoorn 1996; Kruger and Van Rooyen 1998; Van Rooyen 1998; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000; Anderson 2001; Shaw 2013).

Collisions are probably the biggest single threat posed by power lines to birds in southern Africa (van Rooyen 2004; Shaw 2013). Most heavily impacted upon are bustards, storks, cranes and various species of waterbirds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004; Anderson 2001; Shaw 2013).

In a recent PhD study, Shaw (2013) provides a concise summary of the phenomenon of avian collisions with power lines:

“The collision risk posed by power lines is complex and problems are often localised. While any bird flying near a power line is at risk of collision, this risk varies greatly between different groups of birds, and depends on the interplay of a wide range of factors (APLIC 1994). Bevanger (1994) described these factors in four main groups – biological, topographical, meteorological and technical. Birds at highest risk are those that are both susceptible to collisions and frequently exposed to power lines, with waterbirds, gamebirds, rails, cranes and bustards usually the most numerous reported victims (Bevanger 1998, Rubolini et al. 2005, Jenkins et al. 2010).

The proliferation of man-made structures in the landscape is relatively recent, and birds are not evolved to avoid them. Body size and morphology are key predictive factors of collision risk, with large-bodied birds with high wing loadings (the ratio of body weight to wing area) most at risk (Bevanger 1998, Janss 2000). These birds must fly fast to remain airborne, and do not have sufficient manoeuvrability to avoid unexpected obstacles. Vision is another key biological factor, with many collision-prone birds principally using lateral vision to navigate in flight, when it is the low-resolution and often restricted, forward vision that is useful to detect obstacles (Martin & Shaw 2010, Martin 2011, Martin et al. 2012). Behaviour is important, with birds flying in flocks, at low levels and in crepuscular or nocturnal conditions at higher risk of collision (Bevanger 1994). Experience affects risk, with migratory and nomadic species that spend much of their time in unfamiliar locations also expected to collide more often (Anderson 1978, Anderson 2002). Juvenile birds have often been reported as being more collision-prone than adults (e.g. Brown et al. 1987, Henderson et al. 1996).

Topography and weather conditions affect how birds use the landscape. Power lines in sensitive bird areas (e.g. those that separate feeding and roosting areas, or cross flyways) can be very dangerous (APLIC 1994, Bevanger 1994). Lines crossing the prevailing wind conditions can pose a problem for large birds that use the wind to aid take-off and landing (Bevanger 1994). Inclement weather can disorient birds and reduce their flight altitude, and strong winds can result in birds colliding with power lines that they can see but do not have enough flight control to avoid (Brown et al. 1987, APLIC 1994).

The technical aspects of power line design and siting also play a big part in collision risk. Grouping similar power lines on a common servitude, or locating them along other features such as tree lines, are both approaches thought to reduce risk (Bevanger 1994). In general, low lines with short span lengths (i.e. the distance between two adjacent pylons) and flat conductor configurations are thought to be the least dangerous (Bevanger 1994, Jenkins et al. 2010). On many higher voltage lines, there is a thin earth (or ground) wire above the conductors, protecting the system from lightning strikes. Earth wires are widely

accepted to cause the majority of collisions on power lines with this configuration because they are difficult to see, and birds flaring to avoid hitting the conductors often put themselves directly in the path of these wires (Brown et al. 1987, Faanes 1987, Bevanger 1994)."

As mentioned by Shaw (2013) in the extract above, several factors are thought to influence avian collisions, including the manoeuvrability of the bird, topography, weather conditions and power line configuration. An important additional factor that previously has received little attention is the visual capacity of birds; i.e. whether they are able to see obstacles such as power lines, and whether they are looking ahead to see obstacles with enough time to avoid a collision. In addition to helping explain the susceptibility of some species to collision, this factor is essential to planning effective mitigation measures. Recent research provides the first evidence that birds can render themselves blind in the direction of travel during flight through voluntary head movements (Martin & Shaw 2010). Visual fields were determined in three bird species representative of families known to be subject to high levels of mortality associated with power lines i.e. Kori Bustards, Blue Cranes and White Storks. In all species, the frontal visual fields showed narrow and vertically long binocular fields typical of birds that take food items directly in the bill under visual guidance. However, these species differed markedly in the vertical extent of their binocular fields and in the extent of the blind areas which project above and below the binocular fields in the forward-facing hemisphere. The importance of these blind areas is that when in flight, head movements in the vertical plane (pitching the head to look downwards) will render the bird blind in the direction of travel. Such movements may frequently occur when birds are scanning below them (for foraging or roost sites, or for conspecifics). In bustards and cranes pitch movements of only 25° and 35° respectively are sufficient to render the birds blind in the direction of travel; in storks, head movements of 55° are necessary. That flying birds can render themselves blind in the direction of travel has not been previously recognised and has important implications for the effective mitigation of collisions with human artefacts including wind turbines and power lines. These findings have applicability to species outside of these families especially raptors (*Accipitridae*) which are known to have small binocular fields and large blind areas similar to those of bustards and cranes, and are also known to be vulnerable to power line collisions.

Thus, visual field topographies which have evolved primarily to meet visual challenges associated with foraging may render certain bird species particularly vulnerable to collisions with human artefacts, such as power lines and wind turbines that extend into the otherwise open airspace above their preferred habitats. For these species placing devices upon power lines to render them more visible may have limited success since no matter what the device the birds may not see them. It may be that in certain situations it may be necessary to distract birds away from the obstacles, or encourage them to land nearby (for example by the use of decoy models of conspecifics, or the provision of sites attractive for roosting) since increased marking of the obstacle cannot be guaranteed to render it visible if the visual field configuration prevents it being detected. Perhaps most importantly, the results indicate that collision mitigation may need to vary substantially for different collision prone species, taking account of species specific behaviours, habitat and foraging preferences, since an effective all-purpose marking device is probably not realistic if some birds do not see the obstacle at all (Martin & Shaw 2010).

Despite speculation that line marking might be ineffective for some species due to differences in visual fields and behaviour, or have only a small reduction in mortality in certain situations for certain species, particularly bustards (Martin & Shaw 2010; Barrientos *et al.* 2012; Shaw 2013), it is generally accepted that marking a line with PVC spiral type Bird Flight Diverters (BFDs) can reduce the collision mortality rates (Sporer *et al.*

2013; Barrientos *et al.* 2012, Alonso & Alonso 1999; Koops & De Jong 1982). Regardless of statistical significance, a slight mortality reduction may be very biologically relevant in areas, species or populations of high conservation concern (e.g. Ludwig's Bustard) (Barrientos *et al.* 2012). Beaulaurier (1981) summarised the results of 17 studies that involved the marking of earth wires and found an average reduction in mortality of 45%. A recent study reviewed the results of 15 wire marking experiments in which transmission or distribution wires were marked to examine the effectiveness of flight diverters in reducing bird mortality. The presence of flight diverters was associated with a decrease in bird collisions. At unmarked lines, there were 0.21 deaths/1000 birds ($n = 339,830$) that flew among lines or over lines. At marked lines, the mortality rate was 78% lower ($n = 1,060,746$) (Barrientos *et al.* 2011). Koops and De Jong (1982) found that the spacing of the BFDs was critical in reducing the mortality rates - mortality rates are reduced up to 86% with a spacing of 5 metres, whereas using the same devices at 10 metre intervals only reduces the mortality by 57%. Line markers should be as large as possible, and highly contrasting with the background. Colour is probably less important, as during the day the background will be brighter than the obstacle with the reverse true at lower light levels (e.g. at twilight, or during overcast conditions). Black and white interspersed patterns are likely to maximise the probability of detection (Martin *et al.* 2010).

A potential impact of the proposed power line is collisions with the earth wire present on the proposed power line. Quantifying this impact in terms of the likely number of birds that will be impacted, is very difficult because such a huge number of variables play a role in determining the risk, for example weather, rainfall, wind, age, flocking behaviour, power line height, light conditions, topography, population density and so forth. However, from incidental record keeping by the Endangered Wildlife Trust: Wildlife & Energy Programme (South African NGO) it is possible to give a measure of what species are likely to be impacted upon (see Figure 4 below - Jenkins *et al.* 2010). This only gives a measure of the general susceptibility of the species to power line collisions, and not an absolute measurement for any specific line.

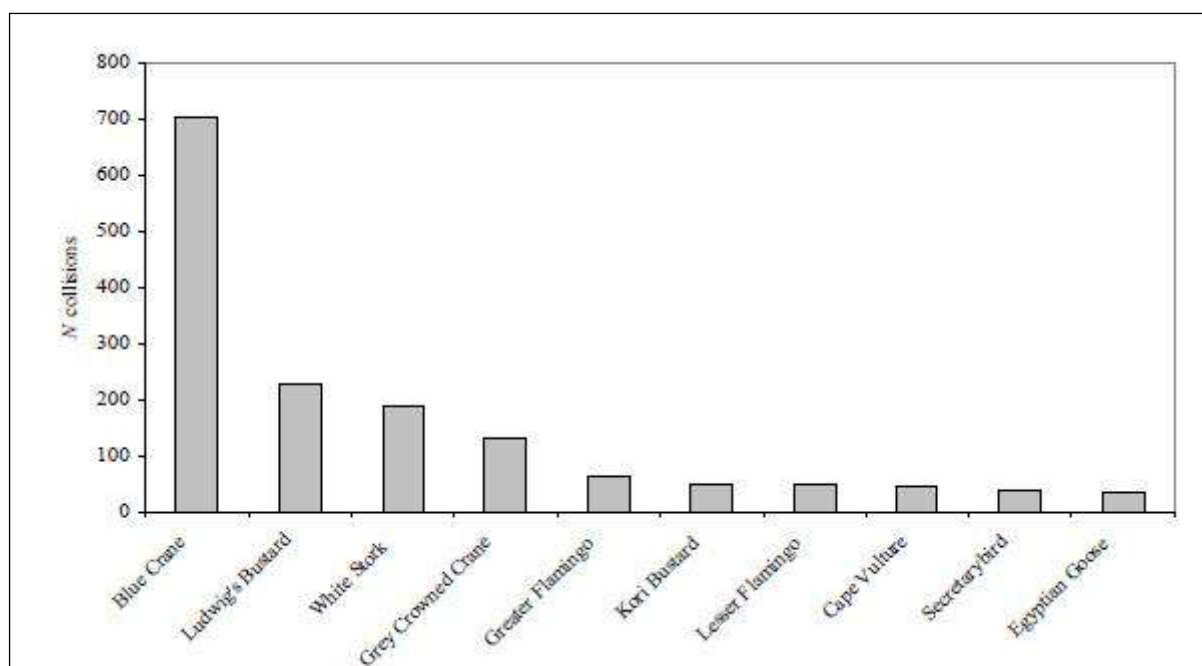


Figure 4: The top ten collision prone bird species in South Africa, in terms of reported incidents contained in the Eskom/EWT Strategic Partnership central incident register 1996 - 2007 (Jenkins *et al.* 2010)

Relevant to this study, the following Red List species that are considered likely candidates for collision mortality include:

- Blue Crane occurs in substantial (and increasing) numbers in the Swartland (Young *et al.* 2003), as part of the core distribution of this species globally which lies largely in the grain croplands of the Western Cape Province (Hockey *et al.* 2005), and is likely to frequent, and possibly even breed in the farmland traversed by the proposed Ankerlig-Omega 400kV power line. Blue Cranes are highly collision prone with overhead lines.
- Secretarybird is probably a regular visitor to the area, if not a breeding resident, and is likely to occur most frequently in the open farmland and Strandveld/Fynbos areas of the study area.
- The recently de-listed Peregrine Falcon *Falco peregrinus* is a breeding resident in the adjacent Koeberg Nature Reserve, and almost certainly forages over open habitat available in the study area, particularly farmland where preferred prey such as columbids and other granivorous birds are likely to congregate.
- Greater Flamingo and Great White Pelican occur in numbers at wetlands along the West Coast, and commute between these on a regular basis, and all are prone to collision with overhead lines, especially where these occur close to wetlands where flocks are likely to fly low in the process of take-off or landing.

Mitigation measures intended to reduce impacts on the Red List species listed above should also be effective for other collision prone species, including a variety of more common, non-threatened large terrestrial and waterbird species.

5.2.3. Electrocution

Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution risk is strongly influenced by the power line voltage of the and design of the pole structure and mainly affects larger, perching species, such as vultures, eagles and storks, easily capable of spanning the spaces between energized components.

Due to the large size of the clearances on most overhead lines of above 132kV, electrocutions are generally ruled out as even the largest birds cannot physically bridge the gap between dangerous components. It can be concluded that electrocutions on the proposed Ankerlig-Omega 400kV power line will **not be possible** through conventional mechanisms will therefore not be assessed in terms of its significance.

Although not part of the brief for this study, electrocutions within the existing Ankerlig and Omega substations are possible, but should not affect the more sensitive Red List bird species as these species are unlikely to use the infrastructure within the substation yards for perching or roosting. The risk of electrocution within the substation yard is therefore evaluated to be low. Since it is difficult to predict with any certainty where birds are likely to nest within the substation yard, coupled with the costs associated with insulating the entire substation, electrocutions will need to be mitigated using site-specific recommendations if and when they occur.

5.3. Decommissioning phase

Decommissioning is expected after 20+ years. The assumption is made that this entails the dismantling of the gas-to-power facility and the restoration of the status quo. It is difficult to make projections 20 years into

the future, as avifaunal distribution patterns and densities are dynamic, and linked to a variety of environmental variables, which may change in the next two decades (e.g. land-use and climate). Predicting impacts is therefore based on the assumption that the environment will remain broadly similar to what it is currently, which may of course be incorrect.

5.3.1. *Displacement due to disturbance*

The impacts associated with the dismantling of the gas-to-power facility are likely to be broadly similar to the construction phase, namely the potential displacement of mainly non-threatened species due to the construction activities (see the discussion under 5.1.2 above). This should be a temporary impact, and depending on the species involved, re-colonisation of the site in the short to medium term is a likely scenario.

5.3. Cumulative Impact

Large sections of the study area have been completely transformed by industrialisation and commercial properties (including a small airport and shooting range), cultivation, transmission lines, residential areas in the form of small-holdings, the mining of sand and the infestations of alien Port Jackson Willow and *Eucalyptus* plant species. This has made the habitat in the study area largely unsuitable for Red List avifauna, due to the existing levels of transformation and habitat degradation. The impact of the proposed development on Red List avifauna is therefore expected to be fairly minor from a cumulative perspective.

6 ASSESSMENT OF EXPECTED IMPACTS

A quantitative methodology was used to describe, evaluate and rate the significance of the aforementioned impacts. This assessment is presented in tabular format below for both pre- and post-mitigation according to set criteria (APPENDIX 4). The different phases (Construction, Operation, and Decommissioning) are treated separately:

Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE										
Scenario 1: Displacement of Red List species as a result of habitat loss or transformation										
1.1 Avifaunal habitat is cleared to accommodate the gas-to-power facility, reducing the amount of habitat available to birds for foraging, roosting and breeding	Negative	Local (2). The impact will be restricted to the physical footprint of the infrastructure	Long term (4), Construction of the facility will result in loss of avifaunal habitat, but implementing the appropriate mitigation & management actions by restricting the construction footprint can minimise this impact	Low. The construction of the infrastructure will require the complete eradication of the vegetation in the foot print	Medium (4), since the natural vegetation present at Site 2 is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red List species.	Low Probability (0.25), Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to its degraded nature.	Low (2.5), The degraded state of the vegetation makes it unlikely that Red List species will be attracted to the area on a regular basis.	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.	Low (2), The degraded state of the vegetation makes it unlikely that Red List species will be attracted to the area on a regular basis to start with.	High, based on extensive experience in this field of study and in-field observations made during the site visit
1.2 Potential	Negative	Local (2),	Long term (4),	Moderate	Low (4), since	Low	Low (2.5) Low	Construction	Low (2), Low	High, based on

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avifaunal habitat is cleared to accommodate the power line towers and the 10m servitude for the stringing of the conductors reducing the amount of habitat available to birds for foraging, roosting and breeding		The impact should only affect local populations of birds	The vegetation clearing is continued for the lifetime of the powerline	Some regrowth of vegetation will always happen	the proposed power line will run within/alongside an existing power line corridor which is devoid of woody vegetation. It is possible that some Red List species such as Secretarybird or even Blue Crane will be attracted to the cleared areas in the servitude.	Probability (0.25) , Low reporting rates for most Red List species as well as possible usage of cleared areas by some species Red List species make for low probability of displacement	reporting rates for most Red List species as well as possible usage of cleared areas by some species Red List species make for low probability of displacement	activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.	reporting rates for most Red List species as well as possible usage of cleared areas by some species Red List species make for low probability of displacement	extensive experience in this field of study and in-field observations made during the site visit

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Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
CONSTRUCTION PHASE										
Scenario 2: Displacement of Red List species as a result of disturbance										
2.1 Displacement as a result of disturbance associated with the construction of the gas-to-power facility (i.e. noise and movement of construction and operational equipment and personnel) resulting in a negative direct impact on the resident avifauna.	Negative	Local (2) , The impact should only affect local populations of birds	Temporary (1) , The impact should largely be confined to the construction phase	High. After the construction activities, have ceased, the source of displacement will disappear	Medium-Low (2) , the natural vegetation present at Site 2 is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red List species.	Low Probability (0.25) , Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	Low (1.25) Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Measures to control noise should be applied according to current best practice in the industry.	Low (1) Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	High , based on extensive experience in this field of study and in-field observations made during the site visit
2.2 Displacement as a result of disturbance associated with the construction of the power line (i.e. noise and movement of construction and operational	Negative	Local (2) , The impact should only affect local populations of birds	Temporary (1) , The impact should largely be confined to the construction phase	High. After the construction activities, have ceased, the source of displacement will disappear	Medium (4) , the natural vegetation is degraded to a fairly large extent and subject to significant existing disturbance. It	Probable (0.5) , There is the potential for the disturbance of Blue Crane in the extreme southern part of the study area around	Low (3.5) The impact should largely be confined to the construction phase	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the	Low (1.25) The impact should largely be confined to the construction phase	High , based on extensive experience in this field of study and in-field observations made during the site visit

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equipment and personnel) resulting in a negative direct impact on the resident avifauna.					is therefore unlikely to support the more sensitive Red List species. An exception is the area around Omega substation where the crop fields may attract Blue Crane.	Omega Substation.		site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Measures to control noise should be applied according to current best practice in the industry. - An avifaunal walk-through of the final power line route must be conducted to identify Red List species that may be breeding within the power line corridor to ensure that the impacts to breeding species (if any) are adequately managed		

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Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
OPERATIONAL PHASE										
Scenario 1: Mortality of Red List species due to collision with power line earth wire/conductor										
1.1 Collisions of Red List avifauna with the earthwire of the transmission line, resulting in a negative direct mortality impact, particularly large terrestrial species (Blue Crane and Secretarybird), waterbirds and to a lesser extent raptors.	Negative	Local (2). The impact should only affect local populations of birds	Long term (4), The collision risk will be present for the life-time of the powerline	High. If the powerline is de-commissioned the risk of collisions will disappear.	Medium (4), the natural vegetation is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red List species. An exception is the area around Omega substation where the crop fields may attract Blue Crane.	Probable (0.5), There is a reasonable chance of the impact materialising	Medium (5) the natural vegetation is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red List species. An exception is the area around Omega substation where the crop fields may attract Blue Crane. There may be some mortality of Red List species.	High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized. If power line marking is required, bird flight diverters must be installed on according to Eskom guidelines (APPENDIX 2).	Low (0.25) While marking of powerlines with bird flappers is not a fool-proof method to prevent collisions, it does reduce the risk significantly	High, based on extensive experience in this field of study and in-field observations made during the site visit

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Impact description	Status	Extent	Duration	Reversibility	Potential Intensity	Probability	Significance (without mitigation)	Mitigation	Significance (with mitigation)	Confidence level
DECOMMISSIONING PHASE										
Scenario 1: Displacement as a result of disturbance associated with decommissioning activities										
2.1 Displacement as a result of disturbance associated with the decommissioning of the gas-to-power facility (i.e. noise and movement of equipment and personnel) resulting in a negative direct impact on the resident avifauna.	Negative	Local (2) , The impact should only affect local populations of birds	Temporary (1) , The impact should largely be confined to the decommissioning phase	High. After the decommissioning activities, have ceased, the source of displacement will disappear	Medium-Low (2) , the natural vegetation present at Site 2 is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive Red List species.	Low Probability (0.25) , Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	Low (1.25) Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	- Decommissioning activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Measures to control noise should be applied according to current best practice in the industry.	Low (1) Red List species are unlikely to frequent the area earmarked for the proposed gas-to-power facility due to the existing disturbance factors	High , based on extensive experience in this field of study and in-field observations made during the site visit
2.2 Displacement as a result of disturbance associated with the decommissioning of the power line (i.e. noise and movement of equipment and personnel) resulting in a negative direct impact on the resident avifauna.	Negative	Local (2) , The impact should only affect local populations of birds	Temporary (1) , The impact should largely be confined to the decommissioning phase	High. After the decommissioning activities, have ceased, the source of displacement will disappear	Medium (4) , the natural vegetation is degraded to a fairly large extent and subject to significant existing disturbance. It is therefore unlikely to support the more sensitive	Probable (0.5) , There is the potential for the disturbance of Blue Crane in the extreme southern part of the study area around Omega Substation.	Low (3.5) The impact should largely be confined to the decommissioning phase	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary	Low (1.25) The impact should largely be confined to the decommissioning phase	High , based on extensive experience in this field of study and in-field observations made during the site visit

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					Red List species. An exception is the area around Omega substation where the crop fields may attract Blue Crane.			disturbance of Red List species. • Measures to control noise should be applied according to current best practice in the industry.		

7 MITIGATION MEASURES FOR INCLUSION IN THE ENVIRONMENTAL MANAGEMENT PROGRAMME

Based on the anticipated impacts described above, the following recommendations are provided regarding practical mitigation measures for potentially significant impacts to be included in the Environmental Management Programme (EMPr).

CONSTRUCTION PHASE					
Impact	Objective/Target	Mitigation/ Management action	Monitoring		
			Methodology	Frequency	Responsibility
Displacement of Red List avifauna due to habitat transformation.	Minimise the ecological footprint of the project on the local environment	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum. - The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint and rehabilitation of disturbed areas is concerned.	Environmental Control Officer should monitor the implementation of management action to ensure compliance.	Throughout the construction period on a continual basis	Environmental Control Officer and Construction Manager
Displacement of Red Listed avifauna due to disturbance.	Minimise all activities which could lead to disturbance of Red List avifauna	- Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Measures to control noise should be applied according to current best practice in the industry. - An avifaunal walk-through of the final power line route must be conducted to	Environmental Control Officer in conjunction with the avifaunal specialist should monitor the implementation of management action to ensure compliance.	Walk-through to be conducted prior to construction, once the alignment has been finalised.	Avifaunal Specialist, Environmental Control Officer and Construction Manager

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		identify Red List species that may be breeding within the power line corridor to ensure that the impacts to breeding species (if any) are adequately managed			
OPERATIONAL PHASE					
Impact	Objective/Target	Mitigation/ Management action	Monitoring		
			Methodology	Frequency	Responsibility
Collisions of Red List avifauna with the earthwire of the transmission line, resulting in a negative direct mortality impact, particularly large terrestrial species (Blue Crane and Secretarybird), waterbirds and to a lesser extent raptors.	Reduce the risk of Red List avifaunal collision mortality as far as practically possible	High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalised. If power line marking is required, bird flight diverters must be installed on according to Eskom guidelines (APPENDIX 2).	The Environmental Control Officer should monitor the implementation of management action to ensure compliance with the recommendations of the Avifaunal Specialist	- Walk-through to be conducted prior to construction, once the alignment has been finalised - Bird flight diverters must be installed as soon as the conductors are strung. - Bird flight diverters must be maintained throughout the project life span	Avifaunal Specialist, Environmental Control Officer and Construction Manager

8 CONCLUSIONS

In general, the habitat in which the proposed Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line alignment are located, is not of high conservation value in avian terms. Although pockets of natural vegetation are found within the study area, there is evidence of anthropogenic impacts, which is visible in the disturbed state of the majority of the natural fynbos. This has had a negative impact on avifaunal diversity and abundance and is reflected in the low reporting rates for the majority of power line sensitive Red List species in the greater study area, which may also indicate that levels of disturbance are high. The exceptions to this are the high reporting rates for Blue Crane and Great White Pelican. In the case of Blue Crane that would be linked to the presence of cereal crops which is their habitat of choice, while the high reporting rates for Great White Pelican is linked to regular flights over the greater study area of birds commuting between their breeding grounds at Dassen and Vondeling Islands and foraging areas at pig and chicken farms around Cape Town. The construction and operation of the Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line may result in various threats to the birds occurring in the vicinity of the new infrastructure, with impacts ranging from low to moderate. The proposed power lines pose a **moderate** collision risk which can be reduced to **low** through the application of mitigation measures. The habitat transformation and disturbance impacts associated with the construction and decommissioning of the

Atlantis Gas-to-Power facility and the associated Ankerlig-Omega 400kV power line are likely to be low in significance.

The project can proceed subject to the following recommendations:

- An avifaunal walk through of the final power line route must be conducted prior to construction, to identify any species that may be breeding on the site or within the immediate surrounds and to ensure that any impacts likely to affect breeding species (if any) are adequately managed and to identify the exact sections of power line requiring collision mitigation.
- High risk sections of power line (i.e. in areas that contain rivers, wetlands, dams and agricultural lands) must be identified by a qualified avifaunal specialist during a final walk-through, for inclusion into the Environmental Management Plan of the project, once the alignment has been finalized. For those spans identified as sensitive, power line marking in the form of bird flight diverters must be installed on the full span length on the earthwires (according to Eskom guidelines – APPENDIX 2). Light and dark colour devices must be alternated so as to provide contrast against both dark and light backgrounds respectively. These devices must be installed as soon as the conductors are strung.
- The recommendations of the ecological and botanical specialist studies must be strictly implemented, especially as far as limitation of the construction footprint (especially the removal of natural vegetation) and rehabilitation of disturbed areas is concerned.
- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of avifaunal species.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- In addition to this, the normal suite of environmental good practices should be applied, such as ensuring strict control of staff, vehicles and machinery on site and limiting the creation of new roads as far as possible.

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<https://ipp-projects.co.za>
<http://www.iucnredlist.org>
<http://cwac.adu.org.za/>

APPENDIX 1: AVIFAUNAL HABITATS



Figure 1: Alien (Port Jackson) vegetation dominates the area earmarked for the proposed gas-to-power facility (Preferred Site 2)



Figure 2: Pockets of undisturbed fynbos found along the power line route alignment



Figure 3: Dam (or retention pond) located in the south-eastern corner of Site 2. The pond is covered with bulrush (*Typha capensis*) and are surrounded by alien vegetation.



Figure 4: The Sout River choked with bulrush (*Typha capensis*) and are surrounded by alien vegetation.



Figure 5: Wetland area associated with the Sout River near the Omega substation.



Figure 6: Surface water in the form of a pan near the Omega substation.



Figure 7: Agricultural lands feature prominently in the southern portion of the study area near Omega substation



Figure 8: Stands of *Eucalyptus* trees are found in various parts throughout the study area



Figure 9: The existing power line corridor is completely devoid of natural vegetation



Figure 10: Commercial properties found within the Atlantis Industrial Area



Figure 11: Residential areas in the form of small holdings and small scale farming



Figure 12: Residential areas in the form of informal settlements

APPENDIX 2: SPECIFICATIONS FOR POWERLINE MARKING

	GUIDELINE	Disclosure Classification: CONTROLLED DISCLOSURE

Title: **TRANSMISSION BIRD
COLLISION PREVENTION
GUIDELINE**

Unique Identifier: **41-335**

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Date: **NOVEMBER 2014**

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DATE 24/03/2010

DATE 24/03/2010

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PREVENTION GUIDELINE**

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1 Introduction

A bird collision incident happens when a bird physically strikes either the overhead conductor or the overhead ground wire of a power line. In the case of transmission lines, the overhead ground wire is usually involved. It is generally accepted that birds usually avoid the highly visible bundled conductors but often fail to see the thin ground wire. In South Africa, bird collisions with Transmission lines are a major form of unnatural mortality among several threatened species. Research is ongoing to attempt to gauge the effect of this form of mortality on these species, especially cranes. Preliminary results indicate that the mortality could be unsustainable for regional population of species such as Blue Crane in the central Karoo. When a bird incident is recorded via the EWT helpline (0860111535) recommendations for mitigation will follow these guidelines.

2 Supporting Clauses

2.1 Scope

This document covers the subject of birds colliding with Transmission lines and gives information about the application of bird flight diverters (BFD).

2.1.1 Purpose

The purpose of this document is to describe the problem of bird collisions with transmission lines and to indicate which mitigation methods are available to address the problem.

2.1.2 Applicability

This guideline shall apply throughout Transmission Division.

2.2 Normative/Informative References

Parties using this guideline shall apply the most recent edition of the documents listed below

2.2.1 Normative

Anderson, M.D. 2001. The effectiveness of two different marking devices to reduce large terrestrial bird collisions with overhead electricity cables in the eastern Karoo, South Africa. Draft report to Eskom Resources and Strategy Division. Johannesburg. South Africa.

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2.2.2 Informative

Barnes, K.N. (ed.) 1998. The Important Bird Areas of southern Africa. BirdLife South Africa: Johannesburg.

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Koops F B J and De Jong J, Vermindering van draadslachtoffers door markering van hoogspanningsleidingen in de omgeving van Heerenveen. 1982 Electrotechniek 60 (12): pp641 – 645.

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2.3 Definitions

Red Data Species: A compilation of endangered wildlife species.

2.4 Abbreviations

EWT: Endangered Wildlife Trust

2.5 Roles and Responsibilities

The Line and Servitude managers of each Grid shall be responsible to ensure compliance with this document.

2.6 Implementation Date

The implementation date is April 2010.

2.7 Process for monitoring

The line and Servitude managers of each grids shall monitor servitudes for evidence of bird collisions and inform the EWT accordingly.

2.8 Related / Supporting Documents

N/A

3 Document Content

3.1 Document Specification

3.1.1 Background and extent of the problem of bird collisions

Collisions are the biggest single threat posed by Transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001).

Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The graph below shows the number of collisions reported per species on Transmission lines from August 1996 to present (EWT unpublished data). Most of the heavily affected species are Red Data species. It should be noted that these are only the reported mortalities, it is suspected that a large number of mortalities go unreported. It is also important to note that the mortalities recorded by Anderson (2001) as discussed below are not included in the graph below.

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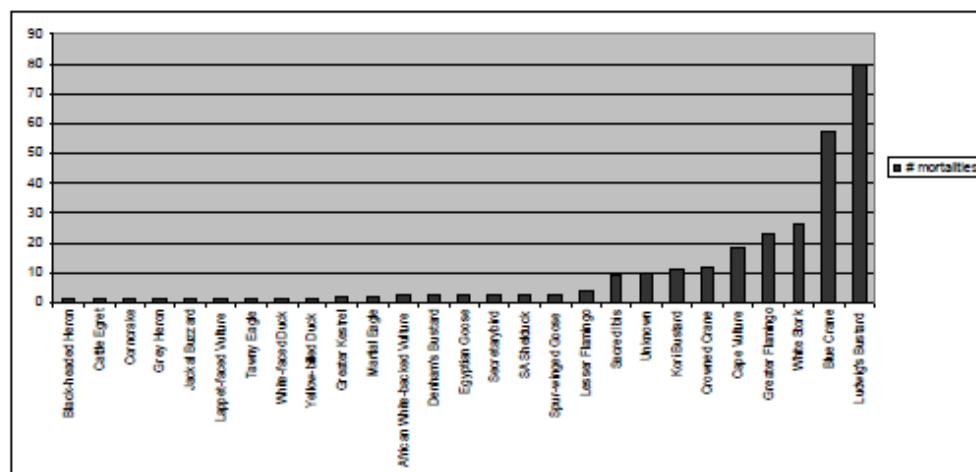


Figure 1: Number of reported collisions per species on transmission lines from August 1996 to the present (EWT unpublished data).

Although significant in itself, figure 1 is not a true reflection of the extent of the problem, because few of the collision localities were closely monitored over a substantial period of time. Where long term monitoring did happen, the picture is disturbing. In one instance, where bi-monthly monitoring did take place, a single 10 km section of 132kV distribution line killed 59 Blue Cranes, 29 Ludwig's Bustard, and 13 White Storks in a three year period (van Rooyen unpubl. data). In 2004, fifty-four Blue Crane carcasses were discovered near Graaf-Reinett in the Northern Cape province under 3.7km of distribution line.

Data collected in the Northern Cape province between 1997 and 1999 provides further evidence of the gravity of the problem. During an initial clearing of transects, a total of 194 large bird carcasses were found under 40km of Transmission line (220 and 400kV) near De Aar in the Northern Cape. Subsequent monitoring of 140 km of power lines (transects of 10km each from 22kV up to 400kV) in the same area over a period of 12 months produced another 196 carcasses (mostly cranes and bustards) the majority under transmission lines (Anderson 2001).

The Red Data species vulnerable to power line collisions are generally long-lived, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to very small areas. A good example of this is the two flamingo species that occur in southern Africa, which have experienced hardly any successful breeding attempts at Etosha Pan in Namibia for several decades. Another example is the Great White Pelican that only breeds successfully at Dassen Island in the Western Cape. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term.

Using Vortex computer modelling, the South African Crane Working Group estimated that an annual mortality rate of 150 adult Blue Cranes could reduce the eastern population of Blue Cranes (app. 2000 individuals in Mpumalanga and KwaZulu-Natal) by 90% by the end of the 21st century (McCann *et.al.* 2001). At that stage the population would be functionally extinct.

From the figures quoted above, it is clear that power lines are a major cause of avian mortality among power line sensitive species, especially Red Data species.

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Furthermore, the cumulative effects of power lines and other sources of unnatural mortality might only manifest itself decades later, when it might be too late to reverse the trend. It is therefore imperative to reduce any form of unnatural mortality in these species, regardless of how insignificant it might seem at the present moment in time.

3.2 General Document Guideline

3.2.1 Solutions to the problems of bird collisions

3.2.2 Background

A measure that has been proved to be reasonably successful in reducing collisions is to fit the earth wire with anti-collision devices.



Figure 2: The installation of flappers on the shield wire from a helicopter.

Success rates of up to 60% reduction in mortality and even more have been documented (Ferrer and Janns, 1999). There are several devices available in southern Africa for the marking of power lines. These devices will be described below and the advantages and disadvantages discussed. The fitting of the marking devices are typically done from a helicopter, which adds considerably to the cost of any project.

3.2.3 Static Devices

Static devices are mechanically more durable than dynamic devices because they lack the element of wear and tear that moving parts inevitably have. However, in South Africa, static devices, particularly the so called Bird Flight Diverter (also known as the pigtail) has had limited success (Anderson 2001). The most obvious reason seems to be that they are simply less visible, especially the small ones (see figure 5). A better option would be to use the bigger pigtail (see figure 5, right), although it is still not the preferred option.

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Figure 3: Example of static devices.

3.2.4 Dynamic Devices

Dynamic devices (usually called bird flappers), have moving parts as opposed to static devices where there are none. Dynamic devices are very effective in reducing collisions as the birds seem to see them very well (van Rooyen unp. data) probably because of the movement that attracts attention. The disadvantage of dynamic devices is that they are subject to extensive wear and tear, inevitably limiting the lifespan of the device. Wear and tear has been observed on both those devices as well as recently on ADLASH optical fibres. In the latter case solution is in hand yet other than to avoid earth wires and placing devices on one shield wire only.



Figure 4: Examples of the dynamic bird flapper devices

This has obvious cost implications if a line needs to be re-marked at intervals of a few years. No solution to that problem has been found to date and it must be accepted as a constraint. Figure 4 shows examples of bird flappers currently available on the market.

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3.2.5 Reflective devices

A new product that shows great potential is the Inotec BFD88, a reflective stainless steel sphere of 70mm diameter. Experiments have shown the visibility of this device to be superior to coloured (red, yellow, white, black) objects especially during the low light conditions at dawn and dusk when birds may be flying from roosting areas to feeding areas and back. Due to the spherical shape, the device reflects any available light in all directions and is therefore visible from all directions including above or below the diverter. The diverter does not require direct sunlight and is effective during overcast conditions and the low light conditions before sunrise and after sunset (Van Rooyen, pers obs.) When viewed during these low light conditions the device is particularly visible against dark backgrounds such as the ground, trees or high ground. It is also particularly visible against bright cloud when viewed from below.



Figure 5: A Reflective Bird Diverter (left) installed on a line with conventional bird flappers (right).



Figure 6: An example of reflective diverters on a test line at dusk with white conventional bird flappers in between

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An option could be to string the Inotec NFD88 diverters close enough to form a dotted line on each earth wire on those spans crossing the river (see figure 6). Due to the relatively small size of the spheres, it would need to be spaced very close together to make it effective, maximum 5 metres apart on both earth wires.

3.2.6 Spacing Intervals

Research in the Netherlands has shown that spacing intervals have a major influence on the effectiveness of anti-collision devices. In South Africa, the same has been found. See Figure 7 for a suggested marking method with Bird Flappers. In the case of the Inotec BFD88 diverters, a similar 5 metre interval is suggested.

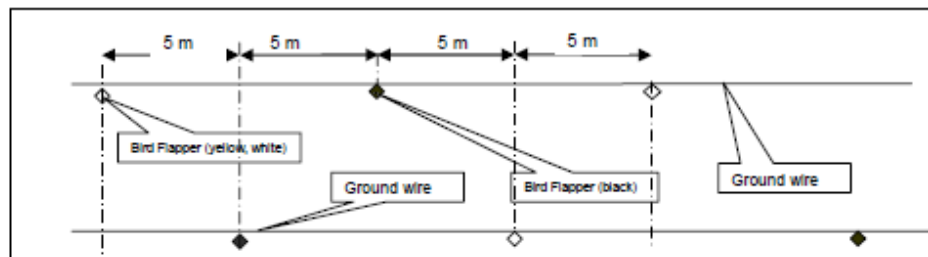


Figure 7: Marking method with Bird Flappers on overhead ground wires (viewed from above)

NB. It is important to alternate the colours (yellow-white) in order for maximum contrast.

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3.2.7 Portion of span to be marked

Only the middle 60% of each span needs to be marked as this is where most of the collisions occur.

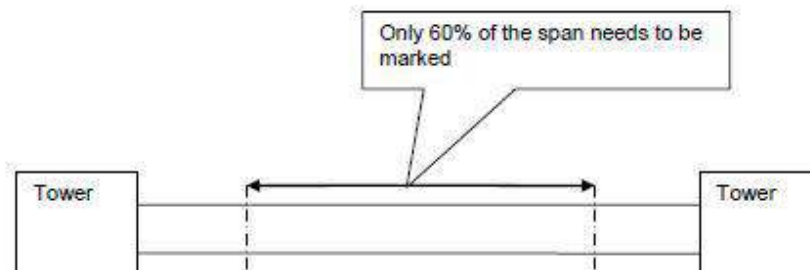


Figure 8: The section that needs to be marked

3.2.8 Illuminated devices

A specific problem is posed by birds that fly at night, for example flamingos that migrate great distances at night. A device is available for this problem, namely the Mace Bird Lite, which is a Perspex tube with a fluorescent tube inside.

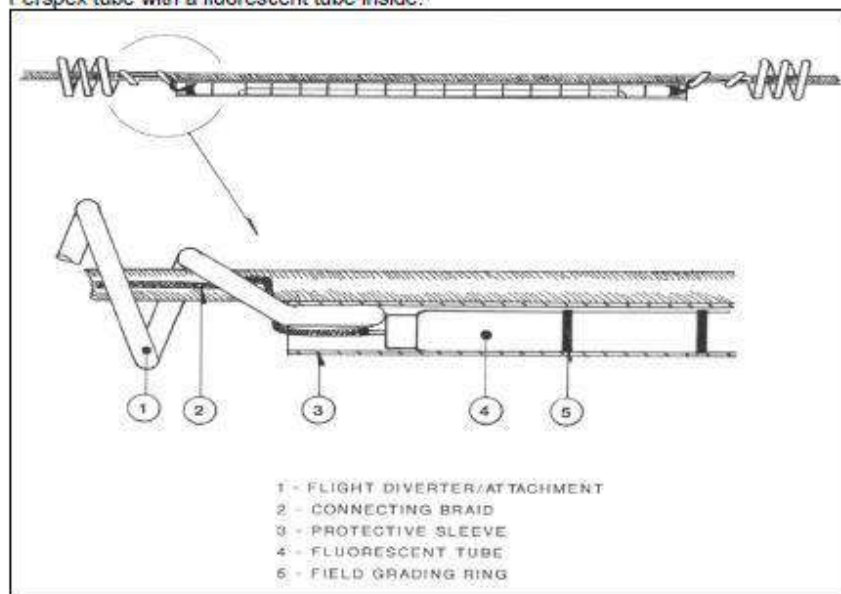


Figure 9: The Mace Bird Lite

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It is mounted on the overhead ground wire and the light is energized by the ambient electrical field generated by the conductors. It has been used in South Africa and Botswana and is reported to have worked well for curbing flamingo mortality on power lines. No scientific data is available on the effectiveness but it is generally claimed to be effective.

3.3 Revision Control

A contract exists between ESKOM Transmission and EWT for reporting of any wildlife interactions with the power lines including bird collision.

4 Authorisation

This document has been seen and accepted by:

Name	Designation
W. Majola	GM (Asset Management)
J. Machinjike	GM (Grids)

5 Revisions

Date	Rev.	Remarks
November 2014	1	Review document and update to new format

6 Development team

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APPENDIX 3: IMPACT ASSESSMENT CRITERIA

The assessment of impact significance should be based on the following convention

1. **Nature of impact** - this reviews the type of effect that a proposed activity will have on the environment and should include “what will be affected and how?”
 - **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
 - **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
 - **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. The cumulative impacts will be assessed by identifying other land use/human activity/projects in the local area.
2. **Status of the impact:** A description as to whether the impact will be positive (environment overall benefits from impact), negative (environment overall adversely affected), or neutral (environment overall not affected).
3. **Potential Intensity** - here it should be established whether the impact is potentially destructive or innocuous and should be described as either:
 - Very High/Fatal Flaw (irreversible human health damage (morbidity/mortality); Loss of species (fauna and/or flora))
 - High (severe alteration of natural systems, patterns or processes such that they temporarily or permanently cease, severe impact on livelihood and/or quality of life)
 - Medium (notable alteration of natural systems, patterns or processes; where the environment continues to function but in a modified manner)
 - Low (negligible or no alteration of environmental functions, natural systems, patterns or processes).

The concept of “**potential intensity**” is an acknowledgement at the outset of the potential significance of the impact (e.g. emissions of SO₂ have the potential to result in adverse human health effects, which is a significant potential impact, and that potential must be acknowledged in the significance rating. In this case, even a limited extent or duration will still

be significant and the risk can only be reduced by reducing the likelihood of the impact occurring)

Potential Intensity Description (negative)	Rating	Score
Potential to severely impact Human Health (morbidity/mortality); or to lead to Loss of species ¹ (fauna and/or flora)	Very High/Fatal Flaw	16
Potential to reduce faunal/flora population or to lead to severe reduction/alteration of natural process, loss of livelihoods or severe impact on quality of life ² , individual economic loss	High	8
Potential to reduce environmental quality – air, soil, water. Potential Loss of habitat, loss of heritage, reduced amenity	Medium	4
Nuisance	Medium-Low	2
Negative change – with no other consequence	Low	1
Potential Intensity Description (positive)	Rating	Score
Potential Net improvement in human welfare	High	8
Potential to improve environmental quality – air, soil, water. Improved individual livelihoods	Medium	4
Potential to lead to Economic Development	Medium-Low	2
Potential positive change – with no other consequence	Low	1

Note that the concept of “**irreplaceable loss of a resource**” is to be taken into account in the Potential Intensity score of an impact

4. **Spatial Extent** - this indicates the impact footprint, i.e. whether the impact will be local and limited to the immediate area of development, or whether the impact may be realised regionally, nationally or even internationally. E.g. if a species were to be lost, then the extent would be global because that species would be lost for the world)

¹ Note that a Loss of species is a global issue and is differentiated from a loss of “flora/fauna” population

² Note that a visual impact or air emissions for example could be considered as severely impacting on quality of life should it constitute more than a nuisance but not being life threatening

Extent Description	Score
Site specific	1
Local (<2 km from site)	2
Regional (within 30 km of site)	3
National	4
International/Global	5

5. **Duration** - this should review the lifetime (timeframe) during which the impact will be experienced. The concept of “reversibility” is reflected in the duration scoring. I.e. the longer the impact endures the less likely it will be reversible.

Duration Description	Score
Temporary (less than 2 year) or duration of the construction period. This impact is fully reversible. <i>E.g. the construction noise temporary impact that is highly reversible as it will stop at the end of the construction period</i>	1
Short term (2 to 5 years). This impact is reversible.	2
Medium term (5 to 15 years). The impact is reversible with the implementation of appropriate mitigation and management actions.	3
Long term (> 15 years but where the impact will cease after the operational life of the activity). The impact is reversible with the implementation of appropriate mitigation and management actions. <i>E.g. the noise impact caused by the desalination plant is a long term impact but can be considered to be highly reversible at the end of the project life, when the project is decommissioned</i>	4
Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient). This impact is irreversible. <i>E.g. The loss of a palaeontological resource on site caused by construction activities is permanent and would be irreversible.</i>	5

6. Reversibility

- **Highly reversible** - this is the most favourable assessment for the environment. For example, the noise impact caused by the desalination plant is a long term impact but

can be considered to be highly reversible at the end of the project life, when the project is decommissioned

- **Moderate reversibility**
- **Low reversibility**
- **Irreversible** - this is the least favourable assessment for the environment. The impact is permanent. For example, the loss of a palaeontological resource on site caused by construction activities is permanent and could be irreversible

7. **Irreplaceability of resource** loss caused by impacts

- **High irreplaceability** of resources (project will destroy unique resources that cannot be replaced);
- **Moderate** irreplaceability of resources;
- **Low** irreplaceability of resources; or
- **Resources are replaceable** (the affected resource is easy to replace/rehabilitate).

8. **Probability** - this considers the likelihood of the impact occurring (and not the likelihood of the aspect to happen) and should be described as:

Probability Description	Score
Improbable (little or no chance of occurring <10%)	0.1
Low Probability (10 - 25% chance of occurring)	0.25
Probable (25 - 50% chance of occurring)	0.5
Highly probable (50 – 90% chance of occurring)	0.75
Definite (>90% chance of occurring).	1

9. **Degree of confidence in predictions** - The degree of confidence in the predictions, based on the availability of information and specialist knowledge. This should be assessed as high, medium or low.

10. **Significance** - Based on the above considerations, the specialist must provide an overall evaluation of the significance of the potential impact, which should be described as follows:

Significance rating = Impact magnitude * Probability

Impact Magnitude = Potential Intensity + duration + extent

Bird Impact Assessment Report: Atlantis Gas-to-Power Facility &
Associated Ankerlig-Omega 400kV Power Line Infrastructure

Scoring	Significance rating	Description
18-26	Fatally flawed	The project cannot be authorised unless major changes to the engineering design are carried out to reduce the significance rating.
10-17	High	The impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making.
5-9	Medium	The impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated.
<5	Low	The impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making.

The above assessment must be described in the text (with clear explanation provided on the rationale for the allocation of significance ratings) and summarized in an impact assessment Table as shown in the example below.

Where relevant, this assessment must also include an identification and description of scenarios (i.e. “environmental” scenarios such as winter vs. summer, or “operational” scenarios such as normal vs. upset conditions, if relevant). The impact assessment must be described in the text and summarized in a Table as shown in the example below. The table below may be tailored according to scenarios (e.g. summer/winter), however it MUST contain all the columns as described below and impacts must be described separately for the construction, operational and decommissioning phases.

Furthermore, the following must be considered:

- The specialist studies must attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. **Where appropriate, national and/or international standards** are to be used as a measure of the level of impact.
- Management actions: Where negative impacts are identified, specialists must specify practical mitigation objectives (i.e. ways of avoiding or reducing negative impacts). Where no mitigation is feasible, this should be stated and the reasons given. Where positive impacts are identified, management actions to enhance the benefit must also be recommended. The specialists should set quantifiable standards for measuring the effectiveness of mitigation and enhancement. For each impact assessment/discussion, management actions should be listed under three categories which are:

- Mitigation measures/**management actions inherent** to the project design (to be implemented regardless of this study – i.e. mitigation/management actions that the proponent had planned to implement as part of the project description);
 - **Key management** actions proposed by specialist (pertinent measures that will be written into, and enforced through the EMPr – these key management actions (to minimise negative impacts or enhance positive impacts) are **not negotiable** and have to be implemented to ensure that the significance of the associated impact is acceptable); and
 - **Additional management actions** (i.e. nice to have) proposed by the specialist (management actions to be considered by proponent and authority).
-
- Impacts should be described both before **and** after the proposed mitigation and management measures have been implemented. Note that the scenario “without mitigation” must consider all management actions already proposed by the proponent as part of the project description (i.e. **management actions inherent** to the project design). The scenario “With mitigation” will assess the significance rating of the potential impact, taking into account **any key management actions** recommended by the specialist (i.e. not taking into account the additional “nice to have” actions).

APPENDIX 4: EMPR CRITERIA

The Environmental Management Programme (EMPr) is divided into four or five phases of the project cycle:

- Detailed design phase, including micro-siting of turbines (if needed);
- Construction phase;
- Operational phase; and
- Decommission phase.

The EMPr is based largely on the findings and recommendations of the EIA process. However, the EMPr is considered a “live” document and must be updated with additional information or actions during the design, construction and operational phases.

The EMPr follows an approach of identifying an over-arching goal and objectives, accompanied by management actions that are aimed at achieving these objectives. The management actions are presented in a table format in order to show the links between the goal and associated objectives, actions, responsibilities, monitoring requirements and targets. The management plans for the design, construction, operation and decommissioning phases consist of the following components:

- **Management objective:** The objective for a potential positive or negative impact of the development to be enhanced, mitigated or eliminated;
- **Mitigation/Management action:** The actions needed to achieve the objectives of enhancing, mitigating or eliminating impacts;
- **Monitoring:** The key monitoring actions required to check whether the objectives are being achieved, taking into consideration methodology, frequency and responsibility.

Goal for environmental management:

The overall goal for environmental management is to construct and operate the project in a manner that:

- Minimises the ecological footprint of the project on the local environment;
- Minimises impacts on birds, bats and other fauna;
- Facilitates harmonious co-existence between the project and other land uses in the area, such as agriculture; and
- Contributes to the environmental baseline and understanding of environmental impacts of wind farms in a South African context through providing monitoring records from the construction and operation phases, especially with regard to potential impacts on birds and bats.

Roles and responsibilities

For the purposes of the EMPr, the generic roles that need to be defined are those of the:

- Project Developer;
- Environmental Control Officer (ECO);
- Construction Manager; and
- Operations Manager.

Note: The specific titles for these functions will vary from project to project. The intent of this section is to give a generic outline of what these roles typically require.

Project Developer

The Project Developer is the 'owner' of the project and as such is responsible for ensuring that the conditions of the environmental authorisation issued in terms of NEMA (should the project receive such authorisation) are fully adhered to, as well as ensuring that any other necessary permits or licenses are obtained and complied with. It is expected that the Project Developer will appoint the Construction Manager and the Operations Manager.

Environmental Control Officer

The Environmental Control Officer (ECO) will be responsible for overseeing the implementation of the EMPr during the construction and operations phases, and for monitoring environmental impacts, record-keeping and updating of the EMPr as and when necessary. As well as a responsibility for implementing the EMPr, the ECO is also responsible for monitoring compliance with the conditions of the Environmental Authorisation that may be issued to the developer.

During construction, the Environmental Control Officer will be responsible for the following:

- Meeting on site with the Construction Manager prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Weekly or bi-weekly (i.e. every two weeks) monitoring of site activities during construction to ensure adherence to the specifications contained in the EMPr, using a monitoring checklist that is to be prepared by the ECO at the start of the construction phase;
- Preparation of the monitoring report based on the weekly or bi-weekly site visit;
- Reporting of any non-conformances within 48 hours of identification of such non-conformance to the relevant agents; and
- Conducting an environmental inspection on completion of the construction period and 'signing off' the construction process with the Construction Manager.

During operation, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMPr for the operation phase;
- Ensure that the necessary environmental monitoring takes place as specified in the EMPr; and
- Update the EMPr and ensure that records are kept of all monitoring activities and results.

During decommissioning, the Environmental Control Officer will be responsible for:

- Overseeing the implementation of the EMPr for the decommissioning phase; and
- Conducting an environmental inspection on completion of decommissioning and 'signing off' the site rehabilitation process.

At the time of preparing this draft EMPr, the ECO is still to be appointed by the proponent or the Matzikama Municipality.

Lead Contractor

The Lead Contractor will be responsible for the following:

- Overall construction programme, project delivery and quality control for the construction for the wind project;
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction;
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment;
- Ensuring that safe, environmentally acceptable working methods and practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operation to be carried out safely;
- Meeting on site with the Environmental Control Officer prior to the commencement of construction activities to confirm the construction procedure and designated activity zones;
- Ensuring that all appointed contractors and sub-contractors are aware of this Environmental Management Plan and their responsibilities in relation to the plan; and
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the Environmental Management Plan, to the satisfaction of the Environmental Control Officer.

At the time of preparing this draft EMPr, the Lead Contractor is still to be appointed by the proponent.

Operations Manager

The Operations Manager will be responsible for the following:

- Operation of the wind energy facility;
- Required maintenance of the turbines; and
- Ensuring that the specified environmental monitoring programmes during operations are undertaken effectively and that the findings are analysed and applied.



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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX Q:

Heritage Western Cape Input

Letter from Heritage Western Cape regarding previous Environmental Authorization

Case No: 120621ZS32M
File No: HM/ATLANTIS/PTNS 4 & 1 OF FARM CA1183, PTN 0 OF FARM CA1183 & PTN 93 OF FARM CA4
Enquiries: Zwelibanzi G Shiceka
E-mail: Zwelibanzi.Shiceka@westerncape.gov.za
Tel: (021) 483 9533
Date: 15 July 2012



ORIGINAL

FINAL COMMENT

Doug Jeffery
Environmental Consultant
Simondium Road
PO Box 44
Klapmuts
7625

Dear Mr Doug Jeffery

CASE NO: 120621ZS32M

LETTER OF EXEMPTION FROM FURTHER ARCHAEOLOGICAL ASSESSMENT FOR THE PROPOSED 'GREEN TECHNOLOGY MANUFACTURING CLUSTER' INDUSTRIAL DEVELOPMENT ON PTNS 4 & 1 OF FARM CA1183, PTN 0 OF FARM CA1183 & PTN 93 OF FARM CA4, ATLANTIS IN TERMS OF SECTION 38(8) OF THE NATIONAL HERITAGE RESOURCES ACT (ACT 25 OF 1999)

The matter above has reference.

Heritage Western Cape (HWC) is in receipt of your correspondence on the above matter, dated 10/07/2012.

You are herewith notified that, since there is no reason to believe that the proposed rezoning will impact on heritage resources, therefore Section 38 of the National Heritage Resources Act (Act 25 of 1999) does not apply.

However should any evidence of burials or archaeological material be discovered during earth-moving activities, all works must be stopped immediately and Heritage Western Cape be notified without undue delay.

This letter does not exonerate the applicant from obtaining any necessary approval from any other applicable statutory authority.

Should you have any further queries, please contact the official above and quote the case number above.

Yours faithfully

AB Hall
(CEO: Heritage Western Cape)

www.capegateway.gov.za/culture_sport

Street Address: Protea Assurance Building, Green Market Square, Cape Town, 8000 • Postal Address: Private Bag X9067, Cape Town, 8001
• Fax: +27 (0)21 483 9842 • E-mail: hwc@pwc.gov.za

Streetadres: Protea Assuransiegebou, Groentemarkplein, Kaapstad, 8000 • Posadres: Privaatsak X9067, Kaapstad, 8001
• Faks: +27 (0)21 483 9842 • E-pos: hwc@pwc.gov.za

Confirmation from HWC that this exemption still stands for the proposed Atlantis gas-to-power project

From: Zwelibanzi Shiceka <Zwelibanzi.Shiceka@westerncape.gov.za>
To: Kelly Stroebeel <KStroebeel@csir.co.za>
CC: Ceoheritage <Ceoheritage@westerncape.gov.za>, Colette M Scheermeyer <Colette.Scheermeyer@westerncape.gov.za>
Date: 20/09/2016 12:36
Subject: RE: HWC Letter of Exemption & update

Dear Mrs Kelly,

The matter above has reference.

Please be advised that HWC's previous comments stands and this email serves as the endorsement that exemption is granted irrespective of whether the proposed development is the 1500mW gas to power.

Yours faithfully,

Zwelibanzi G Shiceka

Assistant Director (Professional Services)

Heritage Western Cape
Department of Cultural Affairs and Sport
Western Cape Government
3rd Floor, Protea Assurance Building
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Website: www.westerncape.gov.za<http://www.westerncape.gov.za/>



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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX R:

Biodiversity Offset Report

INTEGRATED RESERVE MANAGEMENT PLAN

KLEIN DASSENBERG NATURE RESERVE



City of Cape Town

October 2014

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List of Abbreviations

APO	Annual Plan of Operations
BIONET	Biodiversity Network
CAPEX	Capital Budget
CARA	Conservation of Agricultural Resources Act, 1983
CBD	Central Business District
CBNRM	Community Based Natural Resource Management
CCT	City of Cape Town
CDF	Conservation Development Framework
CFR	Cape Floral Region
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
EIA	Environmental Impact Assessment
EMS	Environmental Management System
EN	Endangered
ESKOM	Electricity Supply Commission (of South Africa)
ERMD	Environmental Resource Management Department
GN	Government Notice
GIS	Geographic Information System
IUCN	International Union for Conservation of Nature and Natural Resources
IDP	Integrated Development Plan
IMEP	Integrated Metropolitan Environmental Policy
IRMP	Integrated Reserve Management Plan
LBSAP	Local Biodiversity Strategic Action Plan
MEC	Member of Executive Council
METT-SA	Management Effectiveness Tracking Tool
MOU	Memorandum of Understanding
MPA	Marine Protected Area
NEMA	National Environmental Management Act, 107 of 1998
NEM:BA	National Environmental Management: Biodiversity Act, 10 of 2004
NGOs	Non-Governmental Organisations
SAAQIS	South African Air Quality Information System
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SLA	Service Level Agreement
ToR	Terms of Reference
WfW	Working for Water
WfWet	Working for Wetlands
WWF	World Wildlife Fund for Nature

PART A

PART 1 - DESCRIPTION

1 INTRODUCTION

The Klein Dassenberg Nature Reserve will be proclaimed a nature reserve in terms of Protected Areas Act No. 57 of 2003 section 23(1).

The strategic management planning process (which results in the development of an Integrated Reserve Management Plan), for the Klein Dassenberg Nature Reserve begins with the definition of the Vision which is followed by the Purpose for the reserve. This Purpose is then supported by Desired States for the Reserve. The Reserve objectives contribute to realising the Purpose and Desired States. For each Desired State a number of Management objectives are identified. These Management objectives are then made operational through the identification of outputs. Objectives for each Desired State are prioritised for the five-year time horizon of the plan. Time frames, deliverables, performance indicators and targets are then allocated for each objective, or a group of linked outputs contributing to the Desired State.

In context, this management plan is a dynamic document that should be updated every five years or as soon as new information comes to light that may better inform decisions on responsible land management.

1.1 Aim of the Integrated Reserve Management Plan

The aim of the Integrated Reserve Management Plan (IRMP) is to ensure that the Klein Dassenberg Nature Reserve has clearly defined objectives and activities to direct the protection and sustainable use of its natural, scenic and heritage resources over a five year time period. The IRMP thus provides the medium-term operational framework for the prioritised allocation of resources and capacity in the management, use and development of the reserve. The IRMP intends to add value and continuity by clearly stating management objectives, scheduling action and providing guidelines on the management approach.

The context of the Reserve planning process for the Klein Dassenberg Nature Reserve are: (i) City's Integrated Development Plan (IDP) (Anon 2010); (ii) City's Integrated Metropolitan Environmental Policy (IMEP) (Anon 2003¹); (iii) Biodiversity Strategy (Anon 2003²) and Local Biodiversity Strategic Action Plan (LBSAP) (Anon 2009¹); and (iv) Bioregional context (Cape Action for People and the Environment (C.A.P.E.). The major elements of the IRMP are: this document (overall strategy, vision and context); the detailed subsidiary plans (as required) and an annual plan of operations (APO). The IRMP for the Klein Dassenberg Nature Reserve is supported by a State of Biodiversity Report (2012), Operational Guidelines, and Monitoring and Evaluation framework to ensure on-going implementation and review of protected area management activities (Figure 1).

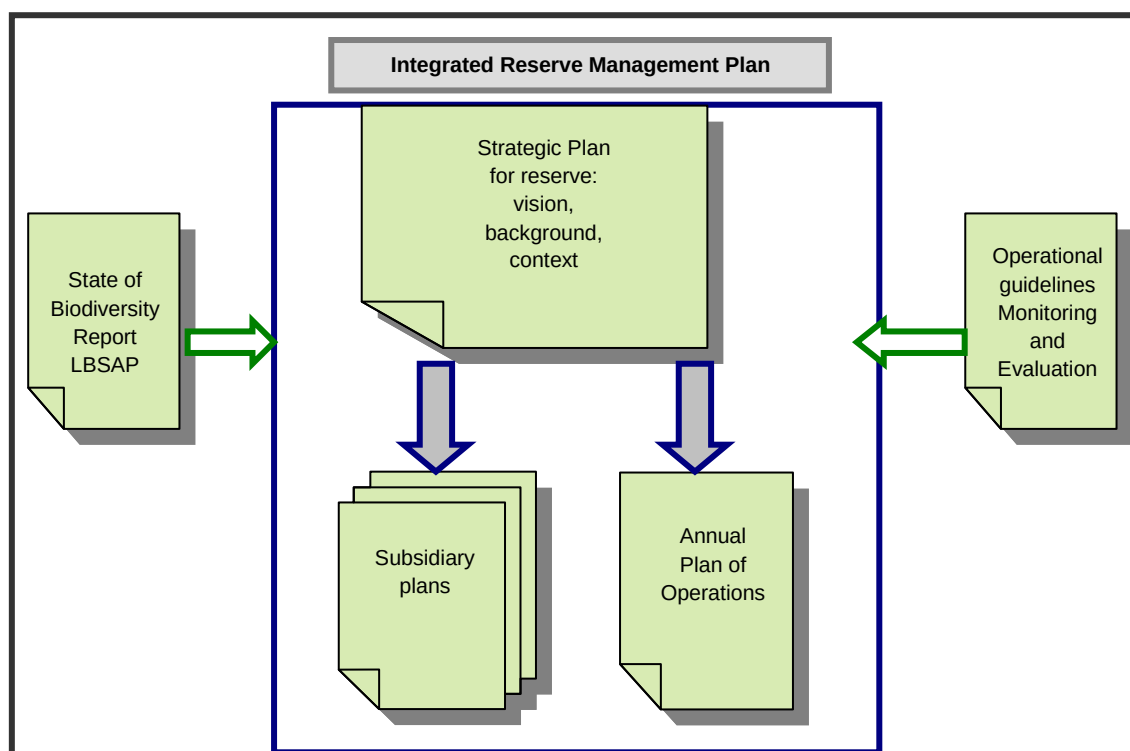


Figure 1: The elements of the Integrated Reserve Management Plan

The IRMP for the Klein Dassenberg Nature Reserve forms part of a tiered series of policies, legislation and related planning documents at the sectorial, institutional, agency and local levels (Figure 2).

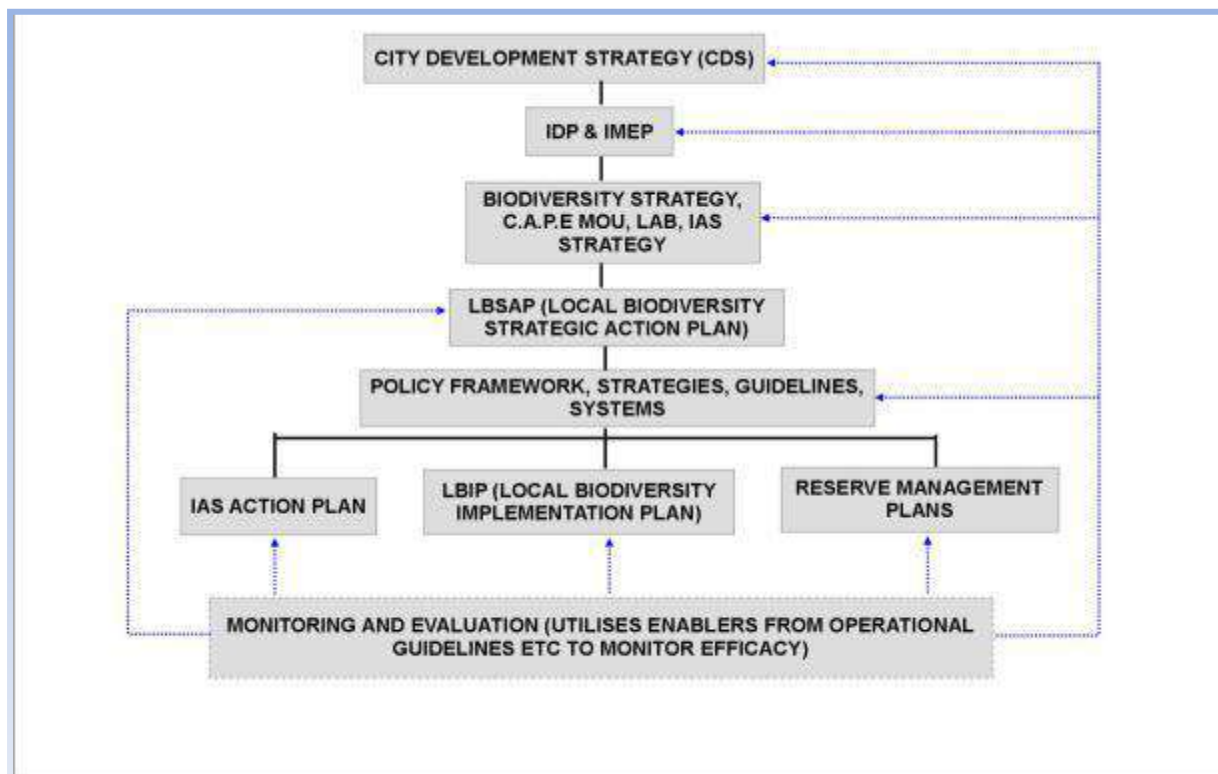


Figure 2: Legal and planning framework for the Integrated Management Plan

Where possible, emphasis has been placed on the following:

- Assigning responsibility for management interventions;
- Scheduling, said management interventions; and
- Quantifying management costs.

This approach has the specific intention of creating a mechanism whereby management intervention can be monitored and audited on an annual basis. In context, this IRMP is a dynamic document and the detailed subsidiary plans should be updated on an annual basis or as soon as new information comes to light that may better inform decisions on responsible land management. The IRMP should be updated every five years.

1.2 Location and Extent

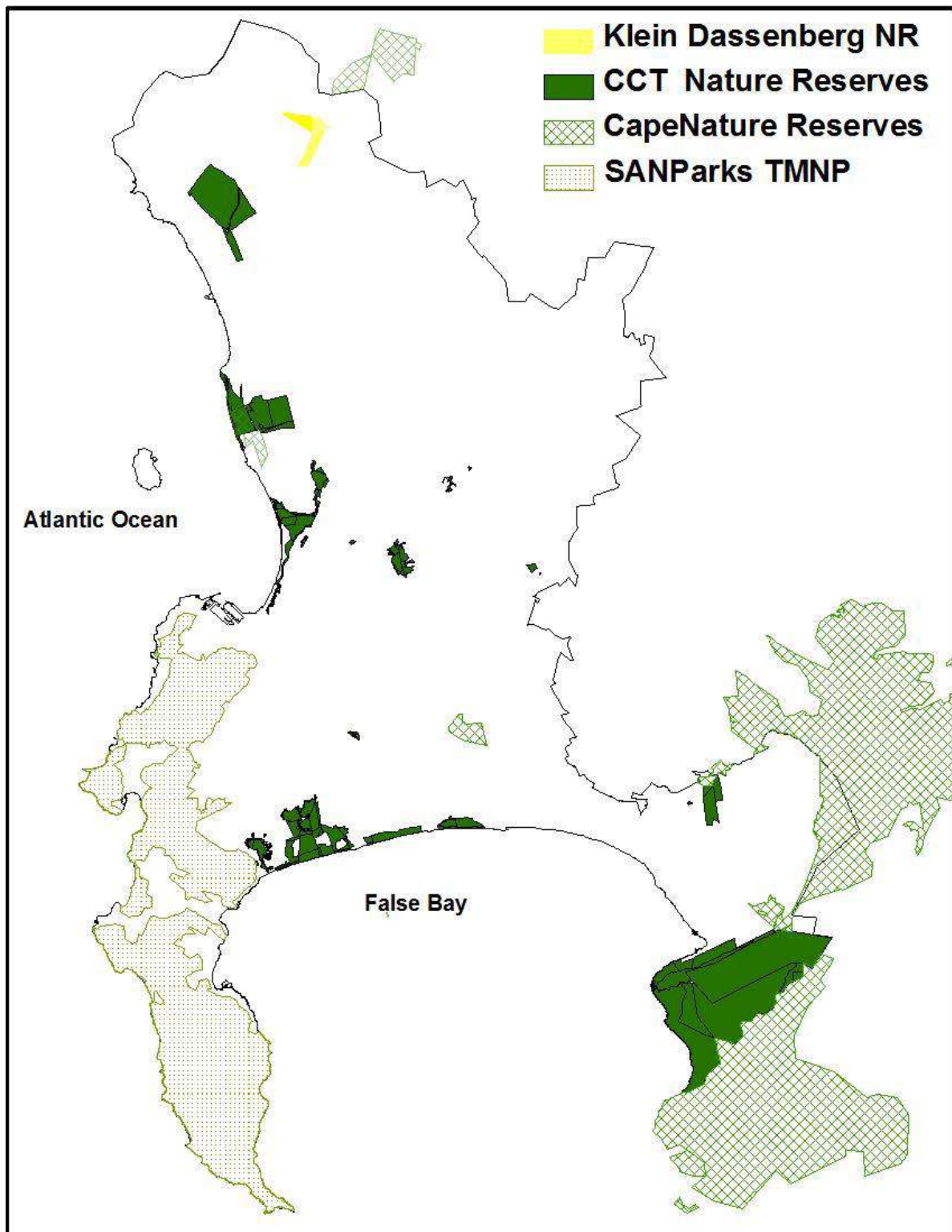
The Klein Dassenberg Nature Reserve is situated about 45 km from Cape Town's Central Business District (CBD), immediately east of Atlantis and directly adjacent to Pella on the northern boundary, Western Cape, South Africa (Map 1). The approximate coordinates are (Google Earth, 2013):

18°30'29.888"E

33°32'26.044"S

The Reserve is currently 371.9699ha in extent (see Map 2) consisting of the farm Klein Dassenberg No 20/9 and farms No 7, 8, 10 and an unregistered portion of 1502 Cape road and Cape Farm No 17/1.

Portion 3 of the farm Papekuil Outspan No 6 is currently unregistered state land and is being managed as part of the current reserve network. This portion is 183.5218ha in extent.



Map 1: Reserve location in the City of Cape Town

The Farm No CA20-9, situated in the City of Cape Town Municipality, Division Cape, Western Cape Province;

In extent: 535,939 (Five Hundred and Thirty Five comma Nine Three Nine) Hectares;

Held by Deed of Transfer No. T61440/88

And

The Farm No CA7-0, situated in the City of Cape Town Municipality, Division Cape, Western Cape Province;

In extent: 5,930 (Five comma Nine Three Zero) Hectares;

Held by Deed of Transfer No. T9989/1936

And

The Farm No CA8-0, situated in the City of Cape Town Municipality, Division Cape, Western Cape Province;

In extent: 47,752 (Forty Seven comma Seven Five Two) Hectares;

Held by Deed of Transfer No. T9989/1936

And

The Farm No CA10-0, situated in the City of Cape Town Municipality, Division Cape, Western Cape Province;

In extent: 14,608 (Fourteen comma Six Zero Eight) Hectares;

Held by Deed of Transfer No. G65/1939

And

The Farm No CA1502-0, situated in the City of Cape Town Municipality, Division Cape, Western Cape Province;

In extent: 31,876 (Thirty One comma Eight Seven Six) Hectares;

Held by Deed of Transfer No. T62457/2005

2.2 Landscape Perspective

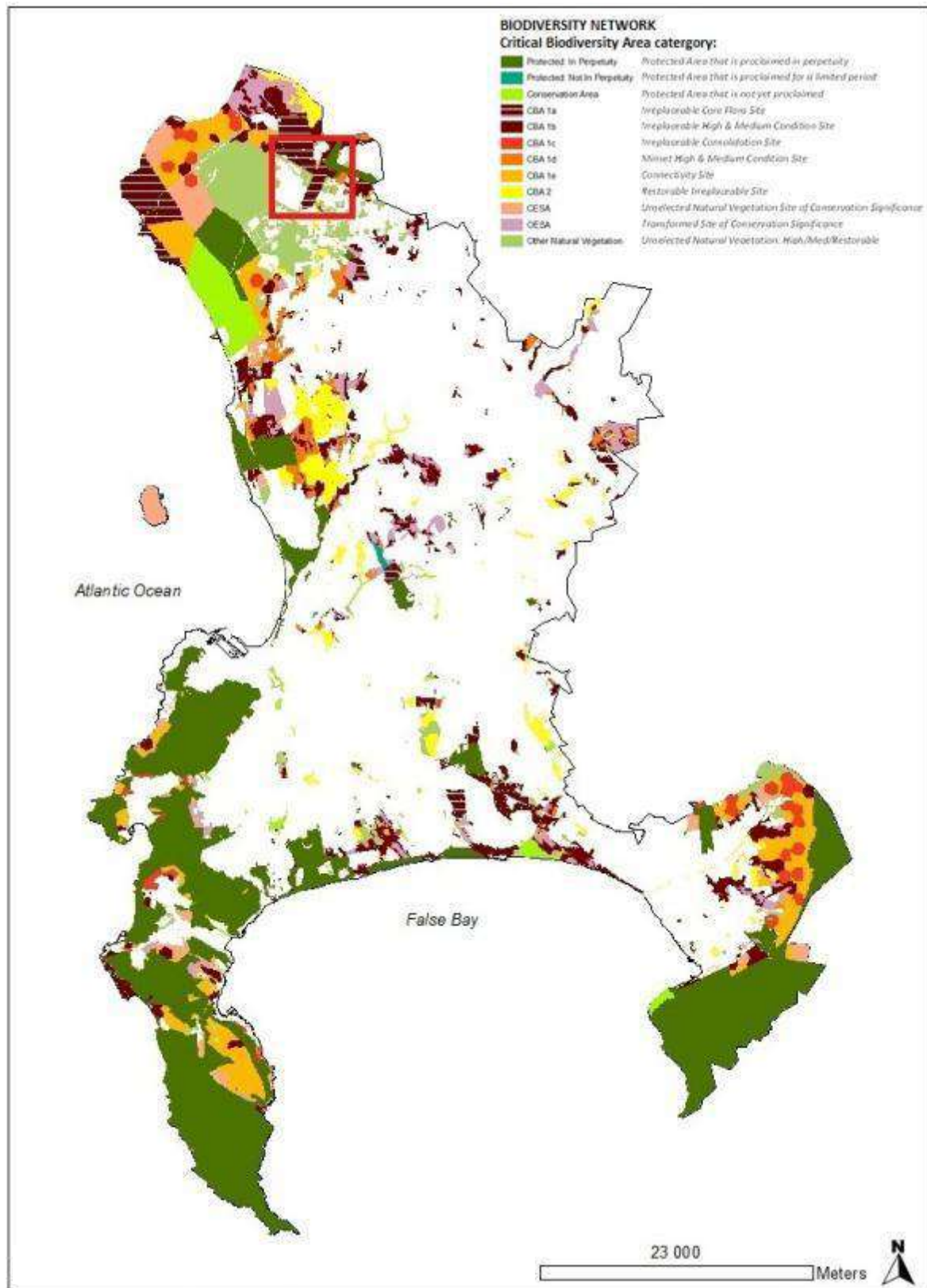
South Africa is globally known as a biodiversity-rich country, owing to the three hotspots that occur in the country. The Cape Floristic Region (CFR), one of the three hotspots, which is concentrated within the Western Cape is famous for its high species diversity and endemism, such that it is recognised as an entirely separate Floral Kingdom, one of only six globally (Cowling et al., 2003; van Wilgen, 2009; Parnell et al., 2010). Within the Western Cape, the Cape Town Metropole is not only recognised as a centre of plant endemism but also contains more than 120 threatened plant species (Rouget et al. 2003).

To date more than 30% of the CFR has been lost. The extensive loss of biodiversity is as a result of the large-scale transformations that have taken place in the lowlands (Cape Flats) for urban development, commercial agriculture, extensive alien species invasion, changes in fire regimes and unsustainable natural resource use (Hall, 1987; Rebelo and Siegfried, 1990; Rouget et al., 2003). In addition to anthropogenic disturbances, climate change and global warming has been predicted to further threaten the natural ecosystems of the Western Cape, especially in terms of rainfall and temperature.

The Klein Dassenberg Nature Reserve contains high quality Critically Endangered Atlantis Sand Fynbos which supports numerous threatened fauna and flora. It has been identified since the 1980's as a key conservation priority and a Core Botanical site critical for conservation if a representative of the Cape Flat's natural heritage is to be conserved (Jarman, 1986; Kilian, 1995). Klein Dassenberg was specifically identified in 1999 to be an important fynbos corridor between the fynbos habitats in the Dassenberg/Pella region with the remnants to the south of Atlantis (Jeffery, 1999).

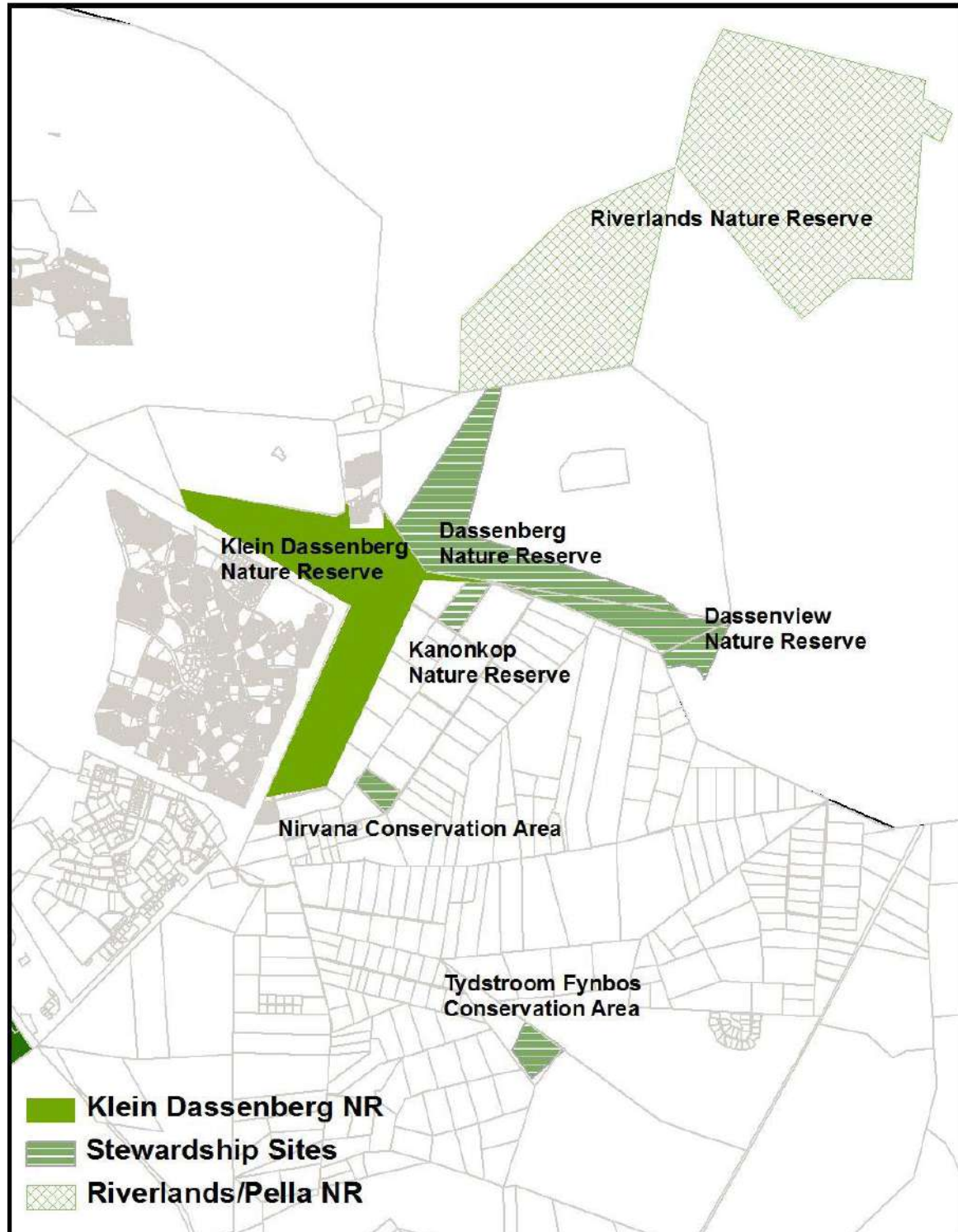
The Klein Dassenberg Nature Reserve forms part of the City's Biodiversity Network (BioNet), a systematic, fine-scale conservation plan that is used to identify important areas for protected area expansion. This initiative highlighted Klein Dassenberg as an "Irreplaceable Core Flora Site" (CCT, 2012) (Refer to Map 5). Additionally, the greater Atlantis and Dassenberg area, was highlighted as a Critical Biodiversity Area by Cape Nature's 2010 Protected Area Expansion Strategy (Purnell et al., 2010) as well as by the 2010 WWF-Table Mountain Fund Climate Change Corridor (Huyser and Pence, 2010). Following these reports, the landscape initiative known as the Dassenberg Coastal Catchment Partnership (DCCP) was initiated. This initiative aims to protect and link important Fynbos remnants while maximising associated social and economic opportunities. Therefore, without Klein Dassenberg Nature Reserve, the DCCP would not exist. The stakeholders involved in this initiative include the Environmental Resource Management Department of the City of Cape Town, CapeNature, WWF, Table Mountain Fund, Wilderness Foundation, Cape West Coast Biosphere, SANParks and SANBI.

In conjunction with the DCCP, Klein Dassenberg Nature Reserve falls within the buffer of the southern core of the greater Cape West Coast Biosphere Reserve (CWCBR).



Map 5: Klein Dassenberg Nature Reserve encircled in the red block

The Klein Dassenberg Nature Reserve neighbours Dassenberg farm which links Klein Dassenberg to Riverlands Nature Reserve. Future expansion potential exists with Nirvana Conservation Area, a 15ha Stewardship site that is situated SE of the Nature Reserve and isolated by only one property. See Map 6.



2.3 Physical Environment

2.3.1 Climate

The area is associated with a Mediterranean climate with winter rainfall, hot dry summers and cold, wet winters. Rainfall is mainly produced by the passage of westerly wave cold frontal systems. Summers are relatively dry due to the effects of the South Atlantic Anticyclone system (Mugabe, 2008). The mean maximum temperature in summer (November, December, January) is 26 °C. The mean minimum temperature in winter (June, July, August) is 7 °C. The warmest month on average is February and the coldest month on average is July. Mist occurs frequently in winter, supplying additional precipitation. The Winter-rainfall regime includes precipitation peaking from May to August. The Mean Annual Rainfall is 290–660 mm (mean: 440 mm) (Mucina and Rutherford, 2006). The mean annual evaporation rate is 1445 mm (Mabihi, 2009).

Management needs to look into obtaining reliable rainfall stats for the area by means of setting up a rain gauge in the Nature Reserve which must be systematically monitored and recorded after each rainfall to obtain updated reliable local rainfall data.

2.3.2 Geology, geomorphology, soils and land types

The soil type of Atlantis Sand Fynbos is acidic tertiary grey regic sand originally derived from Cambrian Cape Granite with an Aeolian origin (Stabbert *et al.*, 2010). Granite intrusions of the Cape Granite Suite are to be found in the Mamre area. Shale outcrops occur along the coast and inland to the north and south of Atlantis. The Centre for Scientific and Industrial Research (CSIR, 2002) report further states that the granite outcrops of Dassenberg, Kanonkop and Mamre-Darling near Mamre, constitutes the highest points in the area at heights of 210 and 410m above sea level.

2.4 Biological Environment

The most recent botanical species lists for the Nature Reserve forms part of the appendices (Appendix 3) and was drawn up by volunteers of the Custodians of Rare and Endangered Wildflowers (CREW). The species list will be updated on a regular basis, as new information becomes available. The species list can also be accessed through the South African Biodiversity Database (www.biodiversity.co.za), which contains all listed species and statistics for all City managed conservation areas as well as other areas as part of the BioNet (see Map 5 above).

2.4.1 Vegetation

The natural vegetation in the Klein Dassenberg Nature Reserve consists of Atlantis Sand Fynbos with a very small portion of Swartland Granite Renosterveld on the slopes of Kanonkop. See Map 7.

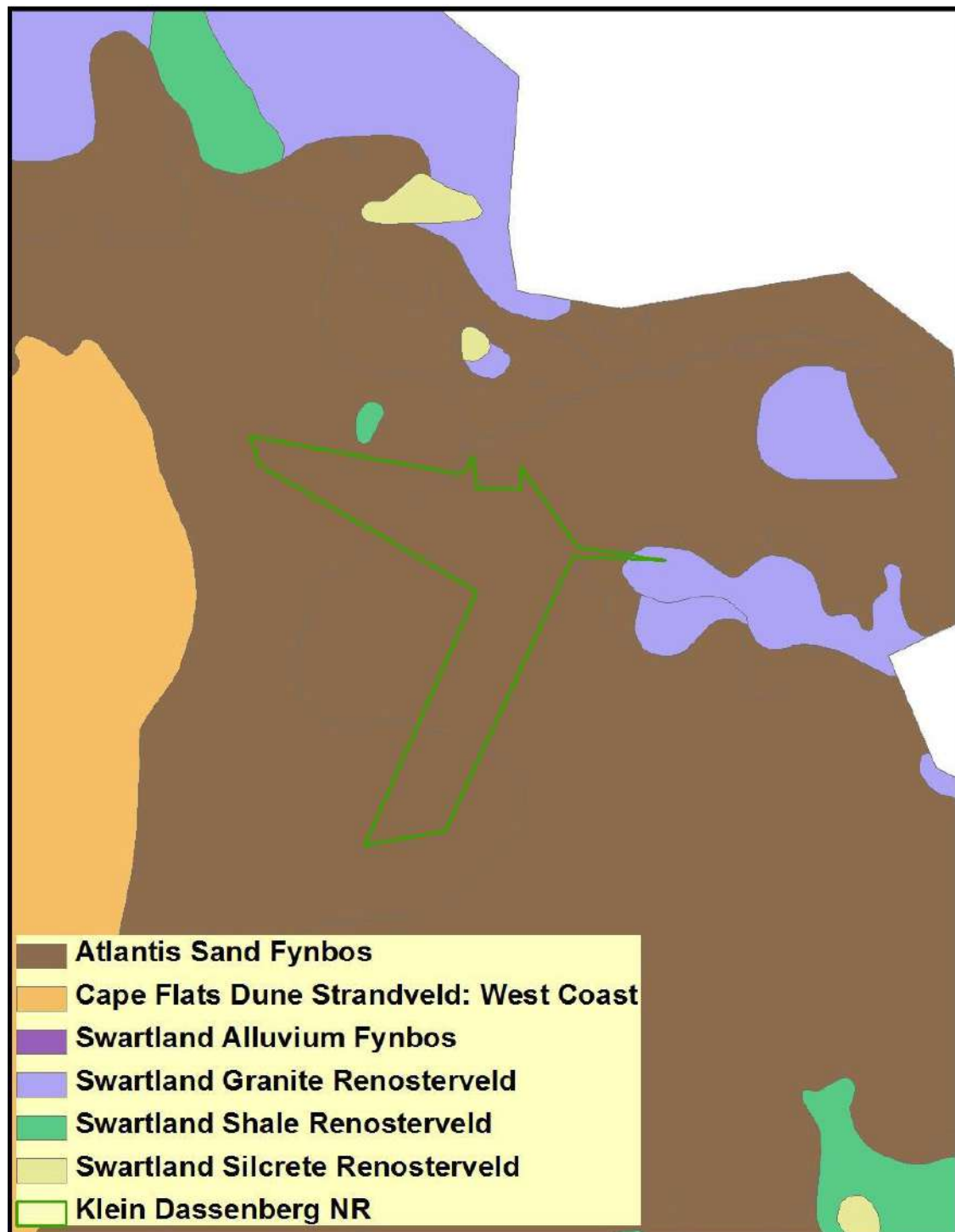
To date a total of 152 plant species, of which two are classified/listed as Near Threatened (NT), 12 Vulnerable (V), 10 Endangered (E), two Critically Endangered (CR) and one Declining have been recorded at the Klein Dassenberg Nature Reserve (Appendix 3).

According to the latest national ecosystem conservation status (2011), Atlantis Sand Fynbos is Critically Endangered (CR). The reason for this status is largely due to transformation, by urban and agricultural development and the intense invasive of alien vegetation (Mucina and Rutherford, 2006). To date 45% has already been transformed with only 15% of Atlantis Sand Fynbos remaining within the City, of which 6% is currently conserved in Riverlands, Paardenberg and at the Pella Research Site. The National conservation target for Atlantis Sand Fynbos is 30%. With the proclamation of Klein Dassenberg Nature Reserve, a further 1.26% will be conserved, increasing the total protected area to 7.26%.

2.4.1.1 Atlantis Sand Fynbos

Sand Fynbos occurs on deep sands of marine or aeolian origin (Jacobs and Jangle, 2008). Structural dominance is dependent on the depth of the water table. When the water table is deep and moisture is only derived from precipitation, restioid fynbos will be dominant. Where the water table is shallow and non-fluctuating, proteoid fynbos dominates. Asteraceous fynbos dominates where it is deeper but still accessible and ericaceous fynbos dominates where the surface is seasonally moist. Sand Fynbos is characterised by the presence of the *Erica mammosa* (Ninepin Heath), *Phyllica cephalantha* (Starface), *Trichocephalus stipularis* (Baboon Face), and the restioids including *Thamnochortus obtusus* and *T. punctatus* (Sandveld Thatching Reed) (Rebelo et al., 2011).

According to Mucina and Rutherford (2006), Atlantis Sand Fynbos, which is found at altitudes of 40-250m, is distributed in the Western Cape from Rondeberg to Blouberg on the West Coast coastal flats; along the Groen River on the eastern side of the Dassenberg-Darling Hills through Riverlands and between Atlantis and Kalbaskraal. It is also found between Klipheuwel and the Paardeberg with outliers west of the Berg River east and north of Riebeek-Kasteel between Hermon and Heuningberg. Vegetation features include moderating undulating to flat sand plains with dense, moderately tall, ericoid shrubland intermixed with emergent, tall sclerophyllous shrubs and an open, short restioid stratum. The dominant vegetation type is restioid and proteoid fynbos interlaced with patches of asteraceous and ericaceous fynbos.



Map 7: Vegetation types within Klein Dassenberg Nature Reserve and surrounding areas

2.4.2 Mammals

To date, no dedicated baseline fauna collection has been conducted for the greater Dassenberg Area. Historically, numerous large mammal species would have occurred within the area. This assemblage of large fauna would have included Eland (*Taurotragus oryx*), Red Hartebeest (*Alcelaphus buselaphus*) and Brown Hyena (*Hyaena brunnea*). These species were quickly eradicated once formal agricultural practices became established in the Cape.

However, the majority of smaller and medium sized mammal species still occur within the area. These include three small antelope, namely Steenbok (*Raphicerus campestris*), Cape Grysbok (*Raphicerus melanotis*) and Common Duiker (*Sylvicapra grimmia*). Other animals confirmed to occur in the area are Small Spotted Genet (*Genetta genetta*), Caracal (*Felis caracal*), Porcupine (*Hystrix africaeaustrali*) and Small Grey Mongoose (*Galerella pulverulenta*).

Numerous rodent and shrew species can be expected to occur but only Forest Shrew (*Myosorex varius*), Grey Climbing Mouse (*Dendromus melanotis*), Striped Field Mice (*Rhabdomys pumilio*) and Cape Gerbil (*Tatera afra*) have been confirmed to date. Rock Hyrax (*Procavia capensis*) is also present near the summit of Kanonkop. Recent records of species with extremely large home ranges such as Honey Badger (*Mellivorus capensis*) and Aardvark (*Orycteropus afer*) in the general vicinity can be seen as a positive sign. Their continued occurrence is evidence that the area of natural veld is relatively extensive and that there is at least some ecological connectivity to the north and west.

Many of the indigenous mammal species are inconspicuous, secretive and nocturnal. As such, they are not easily observed. Their presence is often most easily noted by observing signs of their presence, namely middens, scat and spoor.

2.4.3 Birds

A collated bird list has not been compiled for the conservation area as yet. However, the common bush bird's characteristic of Fynbos and Renosterveld vegetation have been confirmed from the site. These include: Grey-backed Cisticola (*Cisticola subruficapillus*), Karoo Prinia (*Prinia maculosa*), Southern Double-collared Sunbird (*Cinnyris chalybea*), Long-billed Crombec (*Sylvietta rufescens*), Malachite Sunbird (*Nectarinia famosa*), Cape Francolin (*Pternistis capensis*), Stone Chat (*Saxicola torquata*) and Cape Robin-Chat (*Cossypha caffra*).

In the dense thicket and areas dominated by invasive alien Acacias, Cape Batis (*Batis capensis*), Bar-throated Apalis (*Apalis thoracica*), Cape White-eye (*Zosterops pallidus*), Fiscal Flycatcher (*Sigelus silens*), and Acacia Pied Barbet (*Tricholaema leucomelas*) have all been recorded.

Additional common birds include Cape Sparrow (*Passer melanurus*), Common Fiscal (*Lanius collaris*), Cape Bulbul (*Pycnonotus capensis*), Cape Wagtail (*Motacilla capensis*), White-throated Canary (*Serinus albogularis*) and Bokmakierie (*Telophorus zeylonus*). Annually, the bird diversity is augmented with the arrival of the summer migrants. These include Eurasian Bee-eater (*Merops apiaster*), Pearl-breasted

Swallow (*Hirundo dimidiata*), Yellow-billed Kite (*Milvus parasitus*), Barn Swallow (*Hirundo rustica*), and White-rumped Swift (*Apus caffer*).

No species of conservation concern have been identified on the reserve to date but it is expected that a few red listed species may occur in the vicinity. These are listed in Table 1.

Table 2: Potential threatened species of birds which could occur within the immediate area.

#	Common Name	Scientific Name	IUCN Status
1	Black Harrier	<i>Circus maurus</i>	Near-threatened
2	White Pelican	<i>Pelecanus onocrotalus</i>	Near-threatened
3	Secretarybird	<i>Sagittarius serpentarius</i>	Near-threatened
4	Martial Eagle	<i>Polemaetus bellicosus</i>	Near-threatened
5	Blue Crane	<i>Anthropoides paradiseus</i>	Vulnerable

2.4.4 Reptiles

As the nature reserve falls within a large, relatively intact, landscape the reptile diversity can be assumed to be high. It is also unlikely that any species have become locally extinct on the site due to anthropogenic influences. Baseline data collection recorded on neighbouring Papekuil included the following reptile species: Delalandes Beaked Blind Snake (*Rhinotyphlops lalandei*), Mole Snake (*Pseudaspis cana*), Cape Skink (*Trachylepis capensis*), Silvery Dwarf Burrowing Skink (*Scelotes bipes*) and Red Sided Skink (*Trachylepis homalocephala*). Other reptile sightings in the surrounding areas but not on Klein Dassenberg include Cape Girdled Lizard (*Cordylus cordylus*) in the exposed granite areas and both Angulate (*Chersina angulata*) and Parrot-beaked Tortoise (*Homopus aeriolatus*). Snake species that have been confirmed as occurring are Cape Cobra (*Naja nivea*), Boomslang (*Dispholidus typus*), Rhombic Skaapsteker (*Psammophylax rhombeatus*), Spotted Harlequin Snake (*Homoroselaps lacteus*) and Mole Snake (*Pseudaspis cana*).

The discovery of a dead Southern Adder (*Bitis armata*) on Papekuil was of immense conservation significance. It has long been assumed that this endangered reptile was extinct within the City boundaries. There is a strong probability that there are more dwarf adders within the area. The confirmation of the species status in the area is a priority and any possible records must be reported to the Conservation Authorities. It is also probable that the near-threatened Cape Sand Snake (*Psammophis leightonii*) occurs in the area.

Numerous additional reptiles are expected to occur on the site and dedicated baseline data collection needs to be conducted for the area.

2.4.5 Amphibians

Minimal baseline data conducted within the Reserve recorded the common and widespread Clicking Stream Frog (*Strongylopus grayii*). It can be expected that there will be limited amphibian diversity on

the Nature Reserve area. It is highly likely that the specialist rain frogs, Sand Rain Frog (*Breviceps rosei*) and Namaqua Rain Frog (*B. namaquensis*) do occur on site.

It is unlikely that any threatened amphibian species occur in the Reserve.

2.4.6 Invertebrates

To date, only arachnids were collected during invertebrate surveys on Papekuil, neighbouring the reserve. These include Funnel-web spider (*Benoitia ocellata*), Termite feeders (*Ammonoxenus kalaharicus*), Orange Lung-less Spider (*Caponia capensis*), Ground Velvet Spider (*Dresserus collinus*), Flat-bellied Ground Spider (*Asemesthes montanus* and *Camillina biplagia*), Wolf Spider (*Lycosoid* spp.), Tube-trapdoor (*Pionotheie* spp.), Palp-footed Spider (*Diaphorocellus* spp.), Hackled-meshweb Weavers (*Vidole capensis*), Huntsman Spider (*Parapalstes* spp.), Baboon Spider (*Harpactira atra* and *Harpactirella helenae*), Crab Spider (*Xysticus subjugalis*), Burrowing Spider (*Psammoduon arenicola*, *Psammoduon canosum*, *Psammorygma* spp., *Cydrela* spp., *Chariobas cylindraceus* and *Australutica* spp.).

The immense importance of the Dassenberg area for threatened and localised invertebrates was highlighted by lepidopterist, Jonathan Ball. Although, the last known sighting of the Critically Endangered Dickson's Copper (*Chrysoritis dicksoni*) in the area was in 1994, it is likely that the species still occurs in high quality Atlantis Sand Fynbos remnants.

Also of significance was the discovery of the paddle winged lacewing (*Halterina pulchellum*), in the Nature Reserve in 2011 by Andrew Morton. The species was only known from the type specimen described in 1910 and was presumed extinct.

2.5 Socio-Political Context

2.5.1 History

Papekuil, also known as Papekuil/Papenkuil Outspan, which was owned by the then Cape Metropolitan Council (which was formally known as the Western Cape Regional Services Council), was historically used as grazing land and the occasional flower picking (Kilian, 1995). The area originated when it was proclaimed part of the Mamre Rural Coloured Area in 1970. Mamre, which is situated North West of the Nature Reserve originated in 1791 as a military post (CapeBiosphere, 2012).

Klein Dassenberg was owned by Klein Dassenberg Trust who purchased the property in 1988. In 1996, ownership of the land was changed with the intent to subdivide and develop the area. These developments were prevented due to botanical assessment and the City of Cape Town offered to purchase the land in writing. However, this transaction only occurred recently (See Appendix 1).

The Blaauwberg Municipality, along with all of the other municipalities in the Cape Town area, were grouped together to form the City of Cape Town in 2000. The reserve is now managed by the City of

Cape Town, specifically the Biodiversity Management Branch under the Environmental Resource Management Department.

2.5.2 Socio-economic Context

Currently, a site coordinator, a field ranger and an intern are employed to manage the Klein Dassenberg Nature Reserve. The goal is to eventually appoint another field ranger/ general worker and a community conservation officer.

The Atlantis, Mamre and Pella communities are the closest residential communities to the site, with Pella and Atlantis bordering the Reserve.

Atlantis was established as an industrial growth point in the mid-1970s with the aim of decreasing concentrated housing and development away from the Cape Metropolitan Area (CMA). However, with removal of several large employing industries, the scheme was unsuccessful, resulting in very high levels of unemployment in the area (CapeBiosphere, 2012).

2.6 Protected Area Expansion

Future expansion of the Reserve exists with Nirvana, a 15ha Stewardship Site found to the South East of the Reserve (See Map 6). Furthermore negotiations into signing privately owned land situated in Mamre into Stewardship Agreements are currently underway, as well as approaching viable farms east of Klein Dassenberg for future Stewardship Agreements. Expansion of the Reserve is important in terms of reaching the National Conservation Targets of conserving 30% of Atlantis Sand Fynbos as well as reaching the DCCP's goal.

3 PURPOSE, VISION / MISSION, SIGNIFICANCE / VALUE

3.1 Purpose of the Protected Area

The Klein Dassenberg Nature Reserve is located in the Cape Floristic Region, an area of global biodiversity significance. The Nature Reserve conserves a unique combination of habitats, ecosystems and species, many of which are either rare or endemic to the area. With 80% of the CFR falling within the Western Cape, the primary purpose of the Nature Reserve is the conservation of this unique biodiversity and associated ecosystem features and functions.

The natural systems of the CFR and Western Cape are under serious threat from a range of factors such as unsustainable natural resource use, extensive alien species invasion and recent rapid infrastructural development. Many areas, particularly the lowlands, have been reduced to a fraction of their original range of which little is protected. With 21 Critically Endangered (CR), 13 Endangered

(EN) and 22 Vulnerable (VU) ecosystems listed from the Western Cape alone, this Nature Reserve is of immense importance. In addition to anthropogenic disturbances, climate change and global warming has been predicted to further threaten the natural ecosystems of the Western Cape, especially in terms of rainfall and temperature. Not only do these ecosystems support exceptionally threatened biodiversity, they also provide an irreplaceable source of environmental goods and services for the people and economy of South Africa. A fine scale conservation plan, namely the City of Cape Town's Biodiversity Network, was used to identify the areas where the protection of important remnant vegetation was needed.

As per Chapter 3, section 17 of the **National Environmental Management: Protected Areas Act (NEM:PAA)** the purpose of declaring Klein Dassenberg Nature Reserve are:

- (a) that Critically Endangered Atlantis Sand Fynbos is found on the property;
- (b) good representation of endemic, rare and threatened species;
- (c) that the property supports high biodiversity;
- (d) the presence of an edaphic interface and altitudinal gradient;
- (e) that the property contributes to the Dassenberg Coastal Catchment Partnership (DCCP);
- (f) that the property was identified as a Critical Biodiversity Area on the BIONET;
- (g) that the property is in need of long-term protection for the maintenance of its biodiversity and for the provision of environmental goods and services.

3.2 Vision and Mission

3.2.1 Vision

To conserve and protect the critically endangered biodiversity that occurs in the Klein Dassenberg Nature Reserve as to contribute to the DCCP.

3.3 Mission

To manage and restore the natural environment and its associated ecological processes and services through the implementation of the management objectives of Klein Dassenberg Nature Reserve.

Significance of Property (Biodiversity, Heritage and Social)

The Klein Dassenberg Nature Reserve contains one National vegetation type, Atlantis Sand Fynbos, which is classified as Critically Endangered. The site was identified by The City of Cape Town's Biodiversity Network as an "Irreplaceable Core Flora Site". Additionally the greater Atlantis and Dassenberg region was highlighted as a priority in CapeNature's Provincial Protected Area Expansion Strategy as well as one of two most important Climate Change adaption corridors in the Western Cape by the TMP-WWF study. The area has been identified since the 1980s as an important conservation area (Jarman, 1986).

Therefore this area forms an integral part of the Biodiversity Network, as well as an essential part of the DCCP (See section 2.2 above). The Nature Reserve has a confirmed plant species list of 152 of which 28 are threatened.

Summary of qualifying site assessment criteria:

- Core botanical site
- Critically Endangered Atlantis Sand Fynbos
- Klein Dassenberg is a critical component of the Dassenberg Coastal Catchment Partnership (DCCP) a priority landscape conservation initiative.
- The area has the potential to incorporate some of the high quality state land in the vicinity into the Nature Reserve through stewardship or other opportunities
- Identified as important site for conservation in 1986 by Jarman
- Preliminary assessment has revealed at least 24 threatened plant species on site
 - *Amphithalea ericifolia* ssp *erecta* (CR)
 - *Macrostylis villosa* (EN)
 - *Ruschia tecta* (EN)
 - *Lampranthus explanatus* (EN)
 - *Leucospermum parile* (EN)

(See Appendix 3 for a more detailed species list)

- • The Nature Reserve is well connected through natural open space to extensive natural areas to the north, west and east and there is also potential to incorporate some of the high quality private and state land in the vicinity into the Nature Reserve through stewardship or various other opportunities in order to further maximise conservation for the broader Cape Metropolitan Area and further opportunities for integrating viable linkages (corridors) between the Nature Reserve and neighbouring areas; and
- Extension potential exists with Nirvana, a Private Conservation Area of 15 ha situated to the North West of the Nature Reserve.

PART 2 - MANAGEMENT POLICY FRAMEWORK

4 ADMINISTRATIVE AND LEGAL FRAMEWORK FOR THE MANAGEMENT AUTHORITY

4.1 Legal Framework

Table 3: Legal Framework

The following is a list of Legislation applicable to the management of the CCT's Biodiversity Management Branch, and specifically applicable to the Klein Dassenberg Nature Reserve:

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
Constitution of the Republic of South Africa Act, No 108 of 1996	Lists South African citizen's environmental rights.	- Constitution of the Republic of South Africa Amendment Act, No. 2 of 2003 - Constitution of the Republic of South Africa Second Amendment Act, No. 3 of 2003 - Constitution Seventeenth Amendment Act of 2012	Chapter 2: Bill of rights assigns citizens with particular rights.
ENVIRONMENTAL LEGISLATION			
National Legislation			
National Environmental Management Act, No 107 of 1998	One of the most important environmental laws relating to most aspects of the environment including EIA's the roles of DWE, environmental information and legal standing etc.	National Environment Laws Amendment Act 14 of 2009	Provides for cooperative environmental governance
National Environmental Management:	The objectives of the Act are to provide for: the management and conservation of South	National Environmental Laws Amendment Act 14 of 2013	

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
Biodiversity Act, No 10 of 2004	Africa's biodiversity within the framework of the National Environmental Management Act, 1998 - the protection of species and ecosystems that warrant national protection - the sustainable use of indigenous biological resources - the fair and equitable sharing of benefits arising from bio-prospecting involving indigenous biological resources - the establishment and functions of a South African National Biodiversity Institute - In essence, the Act was put in place to safeguard the important biodiversity attributes in the country, whilst allowing people to benefit equally from the natural resources. In order to achieve these goals, the Act made provision for the South African National Biodiversity Institute (SANBI), which has been designated certain functions and has been afforded powers and duties in respect of this Act.		
National Environmental Management: Protected Areas Act, No 57 of 2003	- To provide for the protection and conservation of ecologically viable areas representative of South Africa's biological diversity and its natural landscapes and seascapes; - For the establishment of a national register of all national, provincial and local protected areas; - For the management of those areas in accordance with national norms and standards; - For inter-governmental cooperation and public consultation in matters concerning protected	National Environmental Management: Protected Areas Amendment Act, No 15 of 2009	Regulations Notice 1029 of 2009 list specific regulations for nature reserves proclaimed by the MEC (draft August 2009)

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
	areas; And for matters in connection therewith.		
Conservation of Agricultural Resource Act, No 43 of 1983	CARA Regulations contain a list of alien invasive vegetation categorized according to their legal status. Act regulates sale position and use of listed species	- Abolition of Racially Based Land Measures Act 108 of 1991 - Abolition of Restrictions on the Jurisdiction of Courts Act 88 of 1996	Alien invasive plant legislation to be included under NEM:BA in future
National Veld and Forest Fire Act; No 101 of 1998	Relates to veld fire prevention, fire protection associations, fire danger indexing, enforcement of fire legislation and the fighting of fires	- National Forest and Fire Laws Amendment Act No, 12 of 2001 - Forestry Laws Amendment Act No. 35 of 2005	
Environment Conservation Act, No 73 of 1989	The Environment Conservation Act is the other law that relates specifically to the environment. Although most of this Act has been replaced by NEMA there are still some important sections that remain in operation. These sections relate to: - protected natural environments - littering - special nature reserves - waste management - limited development areas - regulations on noise, vibration and shock - environmental impact assessment (EIA)	National Environmental Laws Amendment Act No. 14 of 2009	
National Water Act, No 36 of 1998	Relates to all use of water and the management of all water resources within South Africa.	National Water Amendment Act, No. 45 of 1999	
National Environmental Management: Air Quality Act, No 39 of 2004	To provide for enhancing the quality of ambient air for the sake of securing an environment which is not harmful to the health and well-being of the people	National Environment Laws Amendment Act No. 14 of 2013	Promulgated to give effect to section 24(b) of the Constitution. South African Air Quality Information System (SAAQIS) is a web-based system which provides

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
			information on the quality of ambient air across the country
Animal Protection Act, No 71 of 1962	To consolidate and amend the laws relating to the prevention of cruelty to animals	Animal Matters Amendment Act, No. 42 of 1993	
Animal Diseases Act, No 35 of 1984	Provides for control measures relating to animal diseases	- General Law Amendment Act 102 of 1972 - Animals Protection Amendment Act 7 of 1972 - Animals Protection Amendment Act 54 of 1983 - Animals Protection Amendment Act 20 of 1985 - Animals Protection Second Amendment Act 84 of 1985 - Protection of Animals Amendment Act 7 of 1991 - Animal Matters Amendment Act 42 of 1993 - Abolition of Corporal Punishment Act 33 of 1997	
Animal Health Act, No 7 of 2002	Regulates animal health	To be proclaimed	
Game Theft Act, No 105 of 1991	Regulates the ownership and protection of game	- Justice Laws Rationalisation Act No. 18 of 1996 - Judicial Matters Amendment Act No. 62 of 2000	
Mountain Catchment Areas Act, No 63 of 1970	Provides for catchment conservation	- Expropriation Act 63 of 1975 - Mountain Catchment Areas Amendment Act 41 of 1976 - Mountain Catchment Areas Amendment Act 76 of 1981 - Abolition of Racially Based Land Measures Act 108 of 1991 - Constitution of the Republic of South Africa 200 of 1993 - General Law Amendment Act 49 of 1996	Administered under the Western Cape Nature Conservation Board Act 15 of 1998
National Heritage	Provides for the protection of heritage resources		

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
Resources Act, No 25 of 1999			
World Heritage Conservation Act, No 49 of 1999	Incorporates the World Heritage Convention into South African law		
Problem Animal Control Ordinance, No 26 of 1957	Regulates problem animals		Administered under the Western Cape Nature Conservation Board Act 15 of 1998
Mineral and Petroleum Resources Development Act, No 28 of 2002	Provides for equitable access to and sustainable development of mineral and petroleum resources	Mineral and Petroleum Resources Development Amendment Act No. 49 of 2008	
Atmospheric Pollution Prevention Act, No 45 of 196		Whole repealed 01 April 2010 in favour of the National Environmental Management: Air Quality Act 39 of 2004 – National Environmental Laws Amendment Act No. 14 of 2013	
Provincial Legislation			
Land Use Planning Ordinance, No 15 of 1985	The purpose of the ordinance is to regulate land use and to provide for incidental matters related to land use.	- Assented to 22 November 1985 - Western Cape Land Use Planning Ordinance, 1985, Amendment Act, 2004	
Cape Nature and Environmental Conservation Ordinance, No 19 of 1974	The purpose of this ordinance is to regulate wild animals and plants and the establishment of nature reserves.	- Publication date 1 September 1975 - Western Cape Nature and Environmental Conservation Ordinance Amendment Act No. 8 of 1999 - Western Cape Nature Conservation Laws Amendment Act No. 3 of 2000 - Proclamation No. 25 of 2003	Administered under the Western Cape Nature Conservation Board Act 15 of 1998
Western Cape Nature Conservation Board Act,			Biodiversity Agreements are signed under this act

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
No 15 of 1998			
Municipal Legislation			
City of Cape Town: Integrated Waste Management By-Law, 2009	To regulate the avoidance, minimization, generation, collection, cleaning and disposal of waste; and for matters related thereto.	Approved by council on the: 30 March 2009	
City Of Cape Town By- Law Relating To Stormwater Management , LA 31420	To provide for the regulation of stormwater management in the area of the City of Cape Town, and to regulate activities which may have a detrimental effect on the development, operation or maintenance of the stormwater system	Publication date 23 September 2005	
City of Cape Town: Air Pollution Control By-Law, LA 12649	The purpose of this by-law is: to give effect to the right contained in section 24 of the Constitution of the Republic of South Africa Act, 1996 (Act 108 of 1996) by controlling air pollution within the area of the Council's jurisdiction; to ensure that air pollution is avoided, or where it cannot be altogether avoided, is minimized and remedied.	Publication date 4 February 2003	
By-Law Relating to Community Fire Safety; Province of the Western Cape, LA 11257	The purpose and scope of the By-law is: to promote the achievement of a fire-safe environment for the benefit of all persons within the area of jurisdiction of the Municipality; to provide for procedures, methods and practices to regulate fire safety within the area of jurisdiction of the Municipality.	Publication date 28 February 2002	
City of Cape Town Draft Animal By-Law, 2009	The purpose of this By-law is: To formulate a new single by-law including 10	Draft, 2009	

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
	different municipal dog by-laws and the Animal Protection Act of 1962. This includes chapters on dogs, cats, poultry and working equines.		
HUMAN RESOURCES/ADMINISTRATION LEGISLATION			
National Legislation			
Occupational Health and Safety Act, No 1993	To provide for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety; and to provide for matters connected therewith.	Occupational Health and Safety Amendment Act , No 181 of 1993	
Basic Conditions of Employment Act, No 3 of 1997	Provides for control measures pertaining to employment	Amendment Act 11 of 2002	
Labour Relations Amendment Act, No 66 of 1995	The labour relations act aims to promote economic development, social justice, labour peace and democracy in the work place.	- Amendment Labour Relations Act , 42 of 1996 - Amendment Afrikaans Labour Relations Act 1998 - Amendment Labour Relations Act , 127 of 1998 - Amendment Labour Relations Act 2000 - Amendment Act 12 of 2002	
Local Government Municipal Systems Act, No 32 of 2000	Establishes core principles, process and mechanisms relating to local government	Local Government: Municipal Systems Amendment Act No. 7 of 2011	
Promotion of Equality/Prevention of Unfair Discrimination Act,	Provides for the prevention of discrimination and other related matters	- Promotion of Equality and Prevention of Unfair Discrimination Amendment Act No. 52 of 2002 - Judicial Matters Second Amendment Act No. 55 of	

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
No 4 of 2000		2003 - Judicial Matters Amendment Act No. 22 of 2005 - Judicial Matters Amendment Act No, 66 of 2008	
Criminals Procedures Act	Regulates all matters relating to Criminal Procedures	- Criminal Procedure Amendment - Act No. 9 of 2012	
Firearms Control Act, No 60 of 2000	Regulates all matters relating to Firearms	Firearms Control Amendment Act No. 28 of 2006	
Civil Aviation Act, No 13 of 2009	Regulates all matters relating to Civil Aviation		
Fencing Act, No 31 of 1963	Regulates all matters relating to fencing	- Fencing Amendment Act No. 4 of 1978 - Agricultural Laws Amendment Proclamation R116 of 1994	
Hazardous Substances Act 15 of 1973	Controls substances which may cause injury or ill health to, or death of, human beings by reason of their toxic nature	Hazardous Substances Amendment Act No. 53 of 1992	
Land Survey Act, No 8 of 1997	Regulates land surveying, beacons and other related matters		
Promotion of Access to Information Act, No 2 of 2000	Promotes access to information		
Promotion of Administrative Justice Act, No 3 of 2000	Provides for the promotion of administrative justice	- Promotion of Administrative Justice Amendment Act No.53 of 2002 - Judicial Matters Amendment Act No. 66 of 2008	
Regional Services Council Act, No 109 of 1985	Regulates and controls land, land usage and other related matters	Regional Services Council Amendment Act No. 75 of 1991	
Skills Development Act, No 97 of 1998	Promotes the development of skills		
State Land Disposal Act, No 48 of 1961	Regulates the disposal of state owned land		

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
Subdivision of Agricultural Land Act, No 70 of 1970	Regulates the subdivision of agricultural land	- Subdivision of Agricultural Land Amendment Act No. 33 of 1984 - General Law Amendment Act No. 49 of 1996	
Tourism Act, No 72 of 1993	Provides for the promotion of tourism and regulates the tourism industry	Tourism Second Amendment Act No. 70 of 2000	
Municipal Ordinance 20 of 1974	Regulates pollution and waste management		
South African National Road Agency Limited (SANRAL) and National Road Act, No 7 of 1998			
Aviation Act, No 74 of 1962	Provides for the control, regulation and encouragement of aviation activities in the Republic of South Africa	Repealed in favour of the Civil Aviation Act 13 of 2009	
Provincial Legislation			
Western Cape Constitution Act, No 1 of 1998	Introduces a constitutional framework for the province		
Western Cape Land Administration Act, No 6 of 1998	Regulates land and land usage		
Western cape Planning and Development Act, No 7 of 1999	Regulates planning and development within the province		
Municipal Legislation			
City of Cape Town By-Law relating to Filming	The Purpose of the By-law is to regulate and facilitate filming in the City of Cape Town	Provincial Gazette 6277, 24 June 2005	
By-law relating to Streets, Public Places and the prevention of noise	The purpose of the by-law is to regulate activities in streets and public places and prevent excessive noise nuisance	Promulgated 28 September 2007, PG 6469; LA 44559	

Legislation: Act, Ordinance, By-law	Relevance: Description	Amendment: Latest Amendment Date	Comment: Other Notes
nuisances 2007			
Signage	The purpose of the by-law is to regulate the use of land and buildings for outdoor advertising and signage	Provincial Gazette 5801, 5 December 2001	

4.2 Administrative Framework

The Klein Dassenberg Nature Reserve will be managed under the direction of the Biodiversity Management Branch, Environmental Resource Management Department, Strategy and Planning Directorate of the CCT.

The Klein Dassenberg Nature Reserve is located within the North Region (District B, which is one of the CCT's Eight Districts) and falls under the oversight of the Regional Manager who reports to the Branch Manager. The Klein Dassenberg Nature Reserve is under the management responsibility of a Site Coordinator who is assisted by a field ranger and an intern (Refer to Figure 3). The Site Manager reports to the Area Manager, who in turn reports to the Regional Manager.

In the North Region, the Area Manager's area of jurisdiction covers the entire Greater Atlantis Area (Appendix 6). The operational management of Klein Dassenberg Nature Reserve is supported by various other City of Cape Town departments including but not limited to Law Enforcement, Human Resources and Finance. The Bulk Water Branch, Water and Sanitation, City Parks and Roads and Stormwater.

The Regional Manager and regionally based Administrative Officer operate from the Biodiversity Management Branch Head Office, located in Maitland, 52 kilometres south from the Nature Reserve.

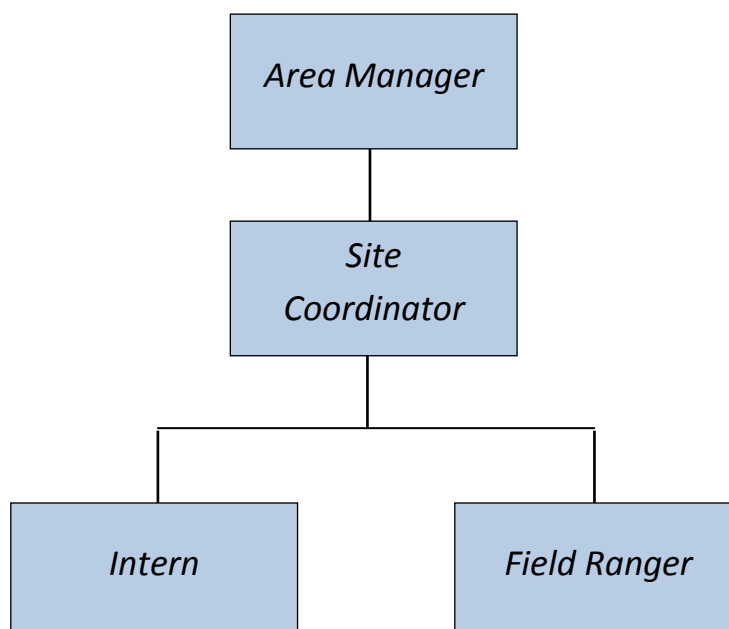


Figure 3: Klein Dassenberg Nature Reserve Staff Organogram

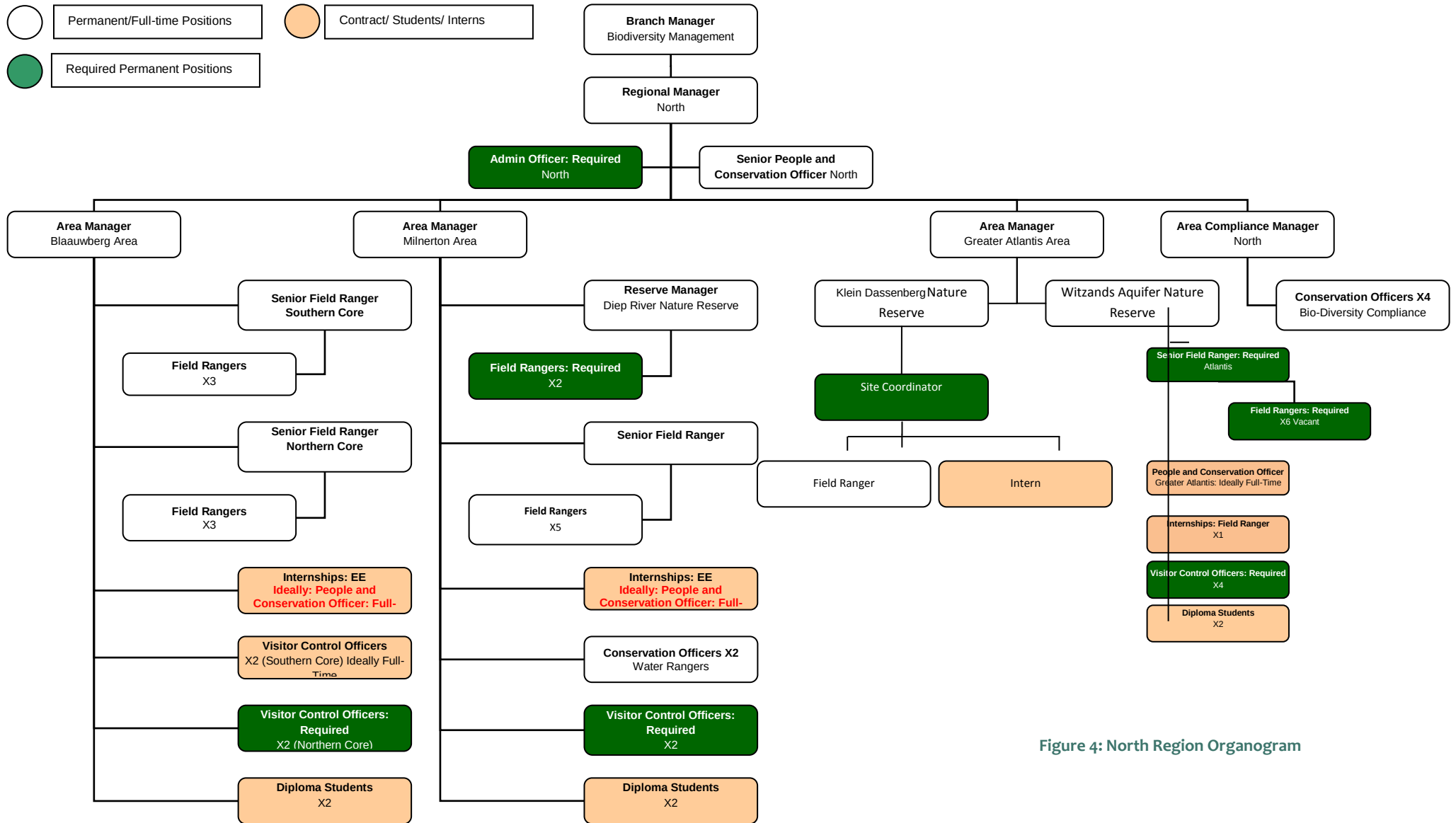


Figure 4: North Region Organogram

5 PROTECTED AREA POLICY FRAMEWORK & GUIDING MANAGEMENT PRINCIPLES

5.1 Management Objectives

5.1.1 Biodiversity and Heritage Objectives

Table 4: Biodiversity and Heritage Objectives for Klein Dassenberg Nature Reserve

High level objective	Objective	Sub-objective	Initiative	Low level plan
CONSERVATION OF REPRESENTATIVE, FUNCTIONAL ECOSYSTEMS: To conserve a representative sample of the Western Cape's ecosystem through a linked landscape, and maintaining or restoring ecological processes to allow natural spatial and temporal variation of the structural, function and compositional biodiversity components.	Representative ecosystems: To incorporate a representative range of viable terrestrial ecosystems, unique to Klein Dassenberg Nature Reserve, and to re-introduce missing elements where necessary.	Consolidation and expansion of land areas: Linking protected areas with the main focus on under representative ecosystems, functional linkages and processes.	(1) Identification of underrepresented (2) Link Reserve boundaries. (3) Include untransformed fynbos. (4) Establish corridors linking Klein Dassenberg Nature Reserve with Nirvana Private Conservation Area.	Reserve expansion plan (to be developed within the next five years)
		Reintroduction of biota: Re-establishment of locally extinct or depleted biodiversity components and populations where possible and in accordance with IUCN principles and guidelines.	(1) Re-establish indigenous herbivore fauna as to suit Reserve size and urban setting.	Faunal Management Plan (to be developed within the next five years)
		Fire management: Apply appropriate fire regime in fynbos areas (frequency, season, intensity, size).	(1) Implement an ecological fire management plan that complements the objectives of conserving the biodiversity and threatened biota within the Reserve. (2) Continuous monitoring of impact of fire management regime on natural vegetation.	Fire management plan (in process of being developed)

High level objective	Objective	Sub-objective	Initiative	Low level plan
		Threatened biota: Maintain viable populations of threatened species in order to meet obligations in terms of international agreements and conventions.	(1) Maintain viable populations of rare/threatened plant and animal species where applicable (identify, locate & monitor populations of priority species)	Incorporated into a Branch wide monitoring Strategy
		Monitoring Plan: Implement and maintain an approved and suitable Monitoring Plan for the Reserve	(1) Implement and maintain a biological monitoring programme for the Reserve.	Monitoring Plan to be aligned with Branch wide plan
	Rehabilitation: Rehabilitate degraded fynbos areas, including the re-establishment of natural biodiversity patterns and processes which are responsible for fynbos persistence.	Vegetation: Re-establishment of physical, chemical and biological processes in degraded vegetation areas.	(1) Rehabilitate all old degraded sites where applicable.	Vegetation Rehabilitation plan (in process for Atlantis Sand Fynbos)
		Alien plants and other alien biota: Control and where possible eliminate alien biota to facilitate re-establishment of natural biodiversity pattern and process in invaded and disturbed areas.	(1) Establish invasive species distribution and density. (2) Prioritise areas for alien removal according to biodiversity restoration goals. (3) Implement removal programs for priority species and areas.	Invasive plant management plan ; Invasive animal management plan where applicable (in process of being developed, Branch wide process)
MITIGATE INTERNAL and EXTERNAL PRESSURES: To reduce threats and pressures from resource use and limit environmental impacts from non-biodiversity management aspects and operations in and around Reserve.	Reconciling biodiversity with other Reserve objectives: To ensure that non-biodiversity management aspects (revenue generation including visitors, resource use, developments, management activities) are governed by biodiversity conservation objectives to	Internal developments: Minimise the impacts associated with the Reserves infrastructural development, and ensure that the biodiversity's objectives are not compromised. Internal activities: Minimise the impacts associated with visitor and Reserve management, and ensure that the biodiversity's objectives are not compromised.	(1) Reserve zonation (2) Develop and implement CDF. (3) Developments in accordance with EIA process (NEMA) and corporate policies. (4) Establish visitor carrying capacities if applicable (5) Implement green standards and environmental best practice based on corporate policy	CDF (to be developed within five years)

High level objective	Objective	Sub-objective	Initiative	Low level plan
	minimise impacts of these activities on Reserve's ecosystem.	Extractive resource use: Minimise the impacts of extractive resource use and ensure such activities coincide with corporate guidelines; fall within management capacity constraints, and do not compromise biodiversity objectives.	(1) Record current extractive resource use activities. (2) Define opportunities and constraints in line with corporate guidelines. (3) Regulate/ prevent resource use, according to adaptive management process	Sustainable resource use management plan (within the next five years, a feasibility study is required)
	Reconciling biodiversity with external threats: To reduce external threats and pressures, and limit impacts of surrounding land & resource use on biodiversity conservation within the Reserve.	External developments: Minimise the impacts associated with inappropriate developments outside the Reserve	(1) Engage with regional land management authorities, incl. IDP's and SDF's at local & regional level. (2) Alignment with bioregional planning, including explicitly identified areas for the maintenance of biodiversity pattern and processes with appropriate land use guidelines. (3) Provide input into planning and decision making process for external development that may compromise Reserve and Biodiversity Network objectives. (4) Negotiate to ensure that external developments are not visually obtrusive or out of character with the Reserve.	Branch wide communication strategy and action plan (to be development Branch wide)
		External activities: Negotiate to ensure that external resource and land use do not undermine the ecological processes within the Reserve.	(1) Negotiate to mitigate or improve the management of external potentially detrimental impacts. (2) Encourage eco-friendly resource use and land management practices on adjacent properties. (3) Mitigate the impacts of oil and other pollution events, through appropriate contingency planning	Oil Spill Contingency Plan (Cooperative governance and communication plan) (ERMD plan)
		Illegal harvesting of resources: Prevent the illegal collection, removal and destruction of physical and biological resources.	(1) Staff visibility (2) Signage (3) Public liaison (4) Law enforcement	Reserve Protection Plan, Security and Safety Programme (a Security audit to take place within five years)

High level objective	Objective	Sub-objective	Initiative	Low level plan
WILDNESS / REMOTENESS: To maintain and restore wilderness/remoteness in Papekuil Nature Reserve such that the spiritual and experiential qualities of wilderness is maintained, enhanced, or where necessary restored	Range of experiences: Provide a range of visitor experiences.		(1) Reserve zonation (2) Develop CDF and sensitivity-value analysis.	(1) CDF (to be developed with the Sensitivity and Zonation report within the next five years) (2) Reserve expansion plan (to be developed within the next five years) (3) Invasive alien plant management plan, (in process, Branch wide)
	Sense of place: Maintain or restore appropriate sense of place.		(1) Implement & update CDF (2) Establish and apply appropriate visitor carrying capacity (3) Negotiate to ensure that external developments are not visually obtrusive or out of character with the Reserve.	

5.1.2 Socio-economic objectives:

Table 5: Socio-economic objectives for Klein Dassenberg Nature Reserve

High level objective	Objective	Sub-objective (where required)	Initiative	Low level plan
Nurture productive and mutually beneficial partnerships that result in gains in economic and/ or biodiversity equity.	Enhance socio- economic benefits to local communities		(1) Contribute to local community development by supporting the Expanded Public Works / Poverty Relief Programmes (2) Contribute to local skills development by supporting the Skills Programmes and Learnership programmes (3) Identification and facilitating the creation of business opportunities in association with the Reserve. (4) Support community based Social Development Initiatives.	Local socio economic development plan (to be developed, as part of the Community Conservation Management plan for the North within the next 3 years)
	Increase environmental awareness and encourage participation in conservation initiatives	Inspire visitors and communities towards considering the natural environment as an interrelated and interdependent system of which they are an integral part.	(1) Develop and implement an Interpretation Plan that feeds into both the Education and zonation plans. (2) Implement, if applicable, environmental education and youth development programmes suited to the needs of specific focus groups.	Education development plan (as part of the North Environmental Education Strategy Plan and in process of being developed)
		Educate various groups to be able to apply environmental action where necessary. Support educators and community leaders with resource and information materials	(1) If applicable, establish and market an environmental resource centre with a range of interpretive and informative resources.	
Support co-operative governance that will	Maintain good Reserve/community/stakeholder relations	N/A	(1) Identify and involve all relevant stakeholders for participation in the Reserve Advisory forum.	Stakeholder relationship plan (as part of the

High level objective	Objective	Sub-objective (where required)	Initiative	Low level plan
build in custodianship			(2) Develop effective communication tools and divide responsibilities for representatives accordingly.	North Community Conservation plan)
	Effective co-operative governance	Minimise negative impact and consequences of inappropriate development in and around the Reserve	(1) Establish and maintain good working relationship with relevant government departments as well as internal City departments.	
		Ensure support / buy-in for management decisions through participatory decision making processes	(1) Define roles and responsibilities with stakeholder groups, partnerships, City Departments and government through written agreements/ ToR's and MOU's and SLA's	
Become the Nature Based Visitor destination of choice in the region	To develop, manage and enhance a range of sustainable visitor products		(1) Design customer satisfaction survey (2) Analysis of current product usage and identification of opportunity	Visitor plan (to be developed with reference to the Zonation and Sensitivity report)
			(1) Plan for Visitor infrastructure and facilities as identified by the CDF (2) Develop and implement the infrastructure management plan (in compliance with state of infrastructure report) (3) Compile a state of infrastructure report	Infrastructure program (to be developed with reference to the Zonation and Sensitivity report)
Transform the domestic Visitor Profile, through growth, to be representative of South African	Ensure that the domestic Visitor Profile of the Reserve is representative of regional demographics	N/A	(1) Promote and manage access to the Reserve (2) Develop and support dedicated access programmes. (3) Actively market Reserve resources and services	Marketing plan (to be developed, Branch wide process within the next five years)

High level objective	Objective	Sub-objective (where required)	Initiative	Low level plan
society				
Enhance the City's Reputation	Enhance the Reserve's reputation	N/A	(1) Develop and implement a Communication Plan to promote Reserve activities	Communication program (to be developed within the parameters of the CCT policies for the Branch)
Advance Strategic Human Resource Management	To ensure good human resource management	N/A	(1) Implement and support Learnerships and Volunteer Programmes (2) Ensure all staff have access to training initiatives as per the WPSP (3) Ensure all Corporate HR Policies are adhered to	Staff Capacity Building Program/ Institutional Development and staff capacity building programme (to be developed, CCT wide process)
Financial Management	To ensure sound financial management practices are applied to Reserve	N/A	(1) Manage cost spending appropriately (2) Ensure that adequate budgets are allocated to the Reserve in light of the developments required to ensure it is a destination of choice	Financial sustainability program (to be developed Branch wide process.)
Achieve Good Corporate Governance Management	Effective management of risk profile	N/A	Do legal review	Risk management program (to be developed)

5.2 SWOT analysis

The following identifies the Strengths, Weaknesses, Opportunities and Threats for the Klein Dassenberg Nature Reserve.

Strengths:

- The Nature Reserve forms part of the DCCP and was identified as a key area for protected area expansion by Cape Nature's 2010 Protected Area Expansion Strategy as well as the 2010 WWF-Table Mountain Fund Climate Change Corridor
- Local knowledge and expertise of areas under jurisdiction
- Community involvement and participation
- Management commitment to compiling and implementing management plans and Biodiversity Action plans
- Legislative support- Municipal By-laws, Nature Conservation Ordinance, NEMA and various other relevant or related legislations.
- Constitutional support
- Management has experience and knowledge in managing Protected areas
- Corporate Support Services exist
- Staff determination and will to succeed
- Fully functional ecosystems exist
- Access to Specialist services and databases
- Borders Dassenberg Nature Reserve, expanding the DCCP initiative
- Potential expansion with Nirvana
- Protects Critically Endangered Atlantis Sand Fynbos vegetation

Weaknesses:

- The Nature Reserve is not enclosed so management of illegal activities will be difficult
- Managements lack of knowledge of area and history
- Limited knowledge of security threats within the Nature Reserve
- Operational Budget needs review
- Law enforcement tends to be reactive instead of proactive
- Lack of operationally mandated staff to adequately utilise environmental legislation
- Ignorance by public of applicable environmental legislation
- Lack of adequate operational and administrative office space and equipment
- Geographically far from City Administrative hubs
- Lack of co-ordination and co-operation between Nature Reserve and National/Provincial government departments
- Invasive alien plants (invasion of/by alien invasive plant species)
- Community liaison

Opportunities:

- Aesthetic beauty of the Nature Reserve which could potentially attract tourists
- Potential expansion which would form part of the DCCP
- Community development

- The implementation of biological monitoring systems
- Increased environmental awareness/ education opportunities
- Increased community ownership
- Creation of job opportunities and career succession and planning
- To proactively engage communities closest to the Nature Reserve and recognising their needs.
- Continuous liaison with Community Based Organisations (CBOs) and other Non-Governmental Organisations (NGOs)
- To link up with surrounding land owners, share knowledge, resources in order to effectively manage the Biodiversity Network
- Promote the Nature Reserve as a destination of choice for outdoor environmentally sound activities
- To build and establish a viable volunteer group to actively participate in Nature Reserve management activities
- To entrench and maintain strong political support from local Ward Councillors

Threats:

- Conflict between surrounding communities
- Conflict between CCT and surrounding communities on land ownership
- Illegal activities (illegal harvesting of fauna and flora, illegal sand mining, illegal dumping, off-road vehicles, inappropriate fire regimes).
- Poor reserve management (plus lack of staff)
- Lack of funding for necessary infrastructure to increase tourist attraction
- Unemployment leads to rising crime levels
- Threats and intimidation towards conservation staff when applying legislation
- Lack of commitment from stakeholders
- Lack of appropriate training
- Personal safety of staff
- Growing external communities with increasing needs
- Lack of sustainable funding for students and Interns
- Lack of adequate funding to hire appropriate numbers of full-time staff
- Lack of adequate operational funding
- Loss of biodiversity due to inappropriate fires, invasive species, illegal activities and inappropriate land-use practices
- Change in local government political structures
- Illegal entry points not controlled i.e. off-road vehicles and the network of footpaths and tracks
- Inappropriate development – edge effect impacts could reduce the viability of the Nature Reserve through fragmentation of the habitat
- Climate change

5.3 Protected Area Management Policy Framework and Guiding Principles

5.3.1 Community Participation

The Klein Dassenberg Nature Reserve is to become the future focus of community- and tourist-centred programmes directed at the sustainable long-term conservation and use of its ecological and historical landscape.

For the Reserve to succeed in the absence of substantial public funding, mutually beneficial partnerships which will result in economic and/or biodiversity equity will be pursued.

In the development of a Regional Community Conservation Management Plan, the objectives should closely coincide with the DCCP's.

A contribution towards the development of local skills can be achieved through the participation in Skills Development and Learnership Programmes in working partnerships with CBOs and NGOs. Through the support of community based Social Development initiatives the Nature Reserve can also enhance socio-economic benefits to local communities.

5.3.2 Security and safety

The aim of a safety and security audit is to investigate the current security situation, security services, infrastructure, staffing and social context of Klein Dassenberg Nature Reserve.

This audit is a priority for the Nature Reserve as known security problems currently occurring is partly due to inadequate fencing and dense Acacia stands. The current illegal activities include illegal access and trespassing; illegal harvesting; illegal dumping and livestock grazing.

5.3.3 Tourism development and management

Tourism potential for the Nature Reserve as part of the Greater Atlantis/Mamre tourism route concept exists. Currently, no tourism development is considered as the priority of the Nature Reserve is to allow the vegetation to recover after too frequent fires and the extensive alien infestation and consequent clearing. Any future tourism ventures should be assessed when this management plan is reviewed in five years. The Nature Reserve has been zoned so that tourism development can only occur on the most degraded area of the Reserve which is situated next to the R304 on the Klein Dassenberg Section.

5.3.4 Infrastructure management

Minimum infrastructure exists within the Klein Dassenberg Nature Reserve, with only a few dilapidated houses on the outskirts of Klein Dassenberg, next to R304. Currently these houses are occupied, but negotiations with the residents are in process to find alternative housing. Since these buildings conditions prevent cost-effective restoration, it is recommended to knock them down once

planning has been put in place for tourism development. It is essential that any future infrastructure be managed in such a way that there are no negative impacts on the already Critically Endangered vegetation. The infrastructure should also add to visitors overall experience.

The road network infrastructure as well as footpaths also needs to be accessed and prioritised in order to avoid continuous damage to the already sensitive vegetation types in the Nature Reserve. Illegal entrance will never fully be stopped therefore this situation should be monitored and managed in terms of preventing damage to natural vegetation and illegal activities.

5.3.5 Biodiversity Conservation Management

5.3.5.1 Community-based natural resource management (CBNRM)

The illegal harvesting that is occurring in the Nature Reserve should be stopped or at least limited until a harvesting feasibility study is done. Little is known about the long-term effects of harvesting on the viability of wild flower populations (Lamont *et al.*, 2001). However it is known non-sprouting species are more vulnerable to loss of flowers, fruits or seeds and that the removal of flowering stems or fruits directly affects seed availability for future generations and reduces the vigour of the plant. Nevertheless, more seeds are usually produced than what is required for self-replacement which leads to strong intraspecific competition and seedling mortality. Therefore in theory it should be possible to remove the “excess” without threatening population viability. A study done by Lamont *et al.* (2001), picking should be banned for the first 10 years post-fire, with picking commencing at 20% in year 11. However these results are site specific therefore a harvesting feasibility plan is imperative for Papekuil Nature Reserve. The feasibility plan should be produced in conjunction with veld age and fire management.

A species harvesting plan where necessary should be developed in order to ensure the sustainability of the relevant species and community livelihoods.

5.3.5.2 Fire Management

Fire plays a fundamental ecological role in the life-cycle of fynbos as it is both fire-prone and fire-dependent. Fire is crucial to the long term conservation of the vegetation within the Papekuil Nature Reserve as it shapes the structure and composition of fynbos, it is therefore considered an important factor of nature reserve management (Rutherford *et al.*, 2011). Fire management involves controlling the season, frequency, size and intensity of fires to meet all ecological requirements of the vegetation.

Invasive alien flora has been found to increase fuel load by 50-100%. Thus, it is essential that any fire management plan should be carefully integrated with a plan to control invasive alien plants. Currently, the fire management for Papekuil Nature Reserve is to strongly prevent any fires from occurring, especially in the young veld and areas containing invasive alien flora. This plan must be assessed during the revision of the management plan.

Too frequent fires, or fires which don't occur during the natural burning regime, could force slower-growing species into extinction. It also results in veld degradation, allowing alien species, especially grasses to invade. Grasses maintain a shorter fire cycle and permanently change the vegetation structure and biodiversity value. On the other hand, if fire is excluded, encroachment by other indigenous species can occur which would result in decreased species richness and species coexistence.

Atlantis Sand Fynbos

Historically, unnatural fires have occurred too frequently in the Nature Reserve, resulting in a mosaic of veld ages. Records of these fires as well as post fire monitoring records have been used to determine veld ages which will influence fire management (Refer to Figure 11). As depicted, fire exclusion in the young veld is a major priority as most of the Reserve is younger than 10 years. The natural fire season is between November-April with a peak between November and February (Brown *et al.*, 1991). However, natural fires are limited in spread within the constraints of ecological, project and public safety requirements. Firebreaks and other fire control measures required by law will be implemented where necessary and feasible.

The Reserve's terrain and property boundaries increase the chances of fire spreading both into- and out of the Reserve. Therefore pre-fire protection measures and a plan of action are necessary in the event of a fire. The interaction by various CCT departments, independent stakeholders and continuous public and private landowner involvement is essential.

Prescribed burning is used as a management tool when fynbos becomes senescent which poses a risk of species loss. It is suggested that controlled burning be done at intervals which would allow at least 50% of individuals in a population of the slowest-growing, obligate reseeding plant species that have flowered and set seed for at least three consecutive seasons (van Wilgen *et al.*, 2010). This practice will assist in maintaining a vegetation mosaic which would promote plant and animal diversity.

The Regional Conservation Policy statements of regular burning (12-20 years) in late summer/autumn is largely based on the response of serotinous and other Proteaceae to fire. There is no optimum regime for conserving diversity as a fixed regime will favour certain species while others are suppressed, therefore a variation in the fire regime is important for ensuring species coexistence (van Wilgen *et al.*, 1994).

Veld age maps should be used to determine prescribed burning patches (See Map 11). The decision to administer prescribed burns is considered on an annual basis, and if required planned and implemented accordingly. Fire may be used to keep fuel loads low so as to reduce the risk of uncontrolled fires, particularly on the urban edge and in areas which become a potential risk to infrastructure and public safety.

Implementation with regards to fire management in the Nature Reserve involves:

- Application of guidelines on season, burning intervals and species requirements acquired from relevant documentation and Biophysical Specialists;
- Accurate record keeping of all fires, including details and maps;

- Use of fire data and GIS for recording and mapping;
- Application of post-fire monitoring programmes;
- Application of fire data to determine prescribed burning needs; and
- Development and Implementation of a Fire Protection and Reaction plan which includes affected stakeholders, City of Cape Town department and private landowners neighbouring the Nature Reserve.

5.3.5.3 Soil erosion and control

Within the Klein Dassenberg Nature Reserve, natural erosion processes are allowed to operate without any interference, except where needed. In the case of human-induced aggravated erosion, appropriate management action should take place. The source of problem erosion sites and the management thereof will also be considered.

Currently there is no serious erosion occurring in the Nature Reserve, but frequent monitoring is suggested especially during veld recovery after invasive alien removal.

Implementation with regards to soil management in the Nature Reserve includes:

- Identification and recording of erosion sites, including restoration plans when required
- The use of GIS for recoding and mapping of erosion sites
- Application of fixed-point monitoring programmes at identified sites; and
- Accurate documentation of applied management actions to restoration sites including subsequent results

5.3.5.4 Invasive species management

Invasive alien organisms are a major global environmental problem and considered the second most significant threat to biodiversity following direct habitat destruction (Holmes *et al.*, 2000). Not only do invasive alien trees and shrubs pose a threat to fynbos vegetation, but it also reduces our already scarce water resources. Once alien trees have established, they outcompete indigenous species, forming close stands which reduce light penetration and alter nutrient recycling patterns, litter fall and fuel properties.

It is for this reason that alien clearing and follow-up is a priority within the Reserve. This is done in order to facilitate the re-establishment of the Critically Endangered Atlantis Sand Fynbos. The most dense invasive alien trees in the Nature Reserve is Port Jackson-Willow (*Acacia saligna*), followed by Eucalyptus (*Eucalyptus sp.*) and Pine (*Pinus sp.*). Herbaceous weeds should also be monitored in order to prevent invasive establishment.

Invasive species management within the Nature Reserve is applied in accordance with the CCT Invasive Alien Species Strategy and in co-ordination with various government funded initiatives, including Working for Water (WfW) and Working for Wetlands (WfWet). Management should aim to implement a carefully planned and co-ordinated programme in order to prevent reestablishment or spread of invasive alien fauna.

The cleared vegetation should be stacked into small brush piles and burnt during the cool winter months. It is recommended to burn the piles during winter to reduce the adverse ecological effects on the soil and allow greater indigenous seed recruitment. Although this technique requires a more intensive follow-up control of *Acacia* species, it is less destructive to indigenous seed banks and results in higher recruitment than stand burns (Jasson, 2005).

After the removal of invasive alien plant species, the gerbil (*Tetra afra*) and Cape dune mole-rat (*Bathyergus suillus*) populations need to be monitored in case management strategies need to be implemented to control their activities which prevent veld recovery through added disturbances. This could be achieved by putting up owl boxes in the Reserve and through the recovery of native snake species.

There is currently no alien faunal species within the Nature Reserve. However, this should be monitored and formal plans outlining the removal and management of an alien faunal species is required.

In order to achieve these objectives the following is required:

- Mapping the extent of invasion in terms of density and species;
- Determining the costs of removal and a plan of operations listing Initial control, Follow-up control and Maintenance;
- Prioritisation of lightly infested areas for alien removal in accordance with the management blocks focussing on biodiversity restoration (Refer to Map 12/ Table 8);
- The implementation of removal programmes for priority species and areas;
- Keeping a detailed record of clearing operations

5.3.5.5 Species introductions

The potential to reintroduce faunal species which historically occurred in the Nature Reserve and for which suitable habitats and eco-niches occur, does exist. However, it is not recommended until the vegetation has fully recovered from alien clearing and anthropogenic disturbances.

The potential for game reintroduction should be considered in five years time during the revision of the management plan.

A full proposal prior to the re-introduction of any species must be submitted to the Fauna and Flora Management Committee for consideration and endorsement. This ensures a full investigation into the availability of suitable habitat for the species, the historical occurrence and status of the species and the effect of re-introduction on the area. Public participation would be required if the species is potentially dangerous or has the potential to become problematic.

Only once the proposal is approved by the committee and Provincial authorities may implementation take place. The implementation programme must also be specified in the plan of action and documented accurately.

5.3.5.6 Water management

Water management within the Nature Reserve must comply with the National Water Act No. 36 of 1998, this includes the use of boreholes.

5.3.5.7 Strategic research

The collection of baseline data is essential for determining the presence of species and to illustrate any changes in some features of the ecosystem. This data can also be used to predict future vegetation patterns. It is also essential in determining whether management practices are successful and where improvements are needed.

Fixed point photography is a very useful tool for monitoring and documenting change. It is definitely essential in adapting the management plan in terms of burning regimes and rehabilitation.

Sensitivity Analysis of the Klein Dassenberg Nature Reserve

The Nature Reserve is important as it forms part of the DCCP and makes a significant contribution to the national vegetation targets of threatened vegetation types as listed in the National Spatial Biodiversity Assessment (Driver *et al.* 2005)

The development of a Sensitivity and Zonation plan is one of the steps required in compiling a Conservation Development Framework (CDF) for the Nature Reserve. A CDF is a tool to reconcile the various land-use needs and to demarcate visitor user zones and the positioning and nature of new infrastructure; access points, roads and facilities. Currently, there is no Sensitivity and Zonation report for the Nature Reserve but it is a priority that should take place during the revision of this management plan in five years time. It is recommended that infrastructural development occur only in Block 1 (See Map 8) of Klein Dassenberg and none in Papekuil.

The CDF process has grown in response to the requirements of the National Environmental Management: Biodiversity Act, Act 10 of 2004, hereby referred to as the NEM:BA (2004) and is a strategy to comply with the spatial planning requirements of these Acts. The CDF will ensure that best practice and sustainable development principles are integrated into spatial planning within protected areas.

The Sensitivity-Value analysis is the landscape analysis portion of the broader Conservation Development Framework. It is a multi-criteria decision-support tool for spatial planning that is designed to integrate the best available information into a format that allows for defensible and transparent decisions to be made. The Sensitivity-Value process is based on the principle that the acceptability of a development (or placement of a structure) at a site is based on the site's value

(either from biodiversity, heritage, aesthetic or a combination of values) and its sensitivity or vulnerability to a variety of types of disturbance (Holness *et al.* 2005).

- The Sensitivity-Value analysis, the CDF and the associated zonation plan should form part of an adaptive management system. They will grow and change over time as the understanding of the landscapes and ecosystems improve; and
- It does not replace the need for detailed site and zone planning and Environmental Impact Assessment (EIA) compliance at site level.

5.4 Zonation Plan of the Klein Dassenberg Nature Reserve

5.4.1 Zoning Informants

This section briefly outlines the values underlying the identification of broad tourism use zones. It is important to remember that the landscape/biodiversity analysis is just one of the informants in the zonation process. Although the biodiversity analysis of the zoning process is relatively objective, there are other informants that are not.

Although every attempt is made to place high sensitivity-value sites into more protected zones where possible, the zoning process is in its essence a compromise between environment and development. In particular, often the identified high value sites are the key biodiversity assets that need to be made available in an appropriate manner to the ecotourism market. Direct links between the biodiversity layers and the spatial management of the Nature Reserve are made during the identification of special management areas (where applicable). Even within high tourist use zones, there are likely to be areas subject to very tight conservation controls (potentially including complete exclusion of human impacts from an area).

Underlying decision making rules used in the zonation process:

- The zonation process is aimed at striking a balance between environmental protection and the development required to meet the broader economic and social objectives of the Nature Reserve;
- The zoning process takes into account existing development footprints and tourism access routes;
- This is based on the underlying principle that all else being equal, an existing transformed site is preferable to a greenfields site from a biodiversity perspective;
- Infrastructure costs are dramatically increased when developments take place away from existing infrastructure;
- Existing tourism nodes and access routes are a reality of the economic landscape, and it is would not be possible to shut down existing tourism sites compromising the development objectives of the Nature Reserve;

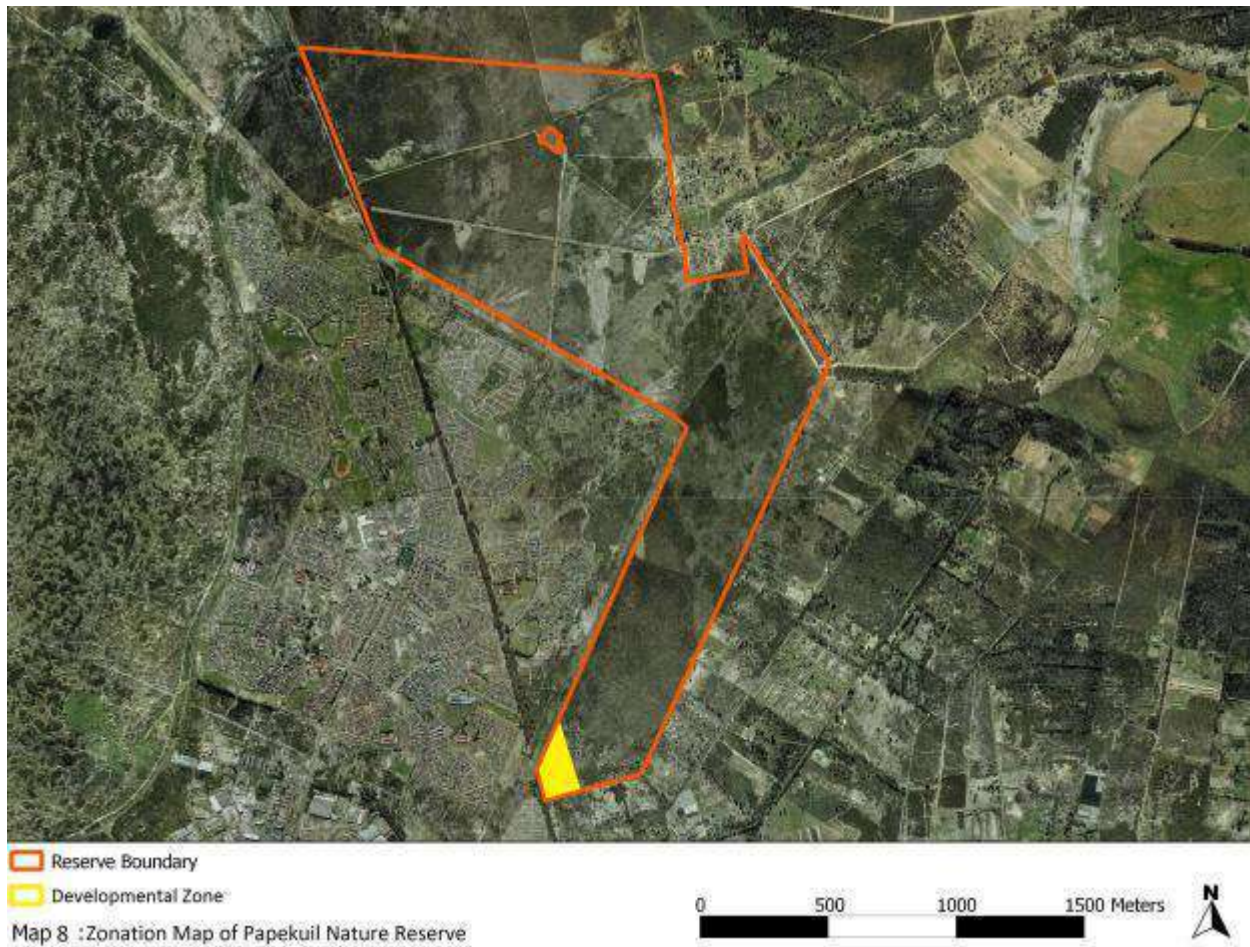
- Where existing development nodes, tourist sites and access routes occur in areas with high sensitivity-value, then the broad use zoning aims to keep the development footprint as small as is realistically possible, preferably within the existing transformed site;
- Where possible, sites with high biodiversity sensitivity-value are put into stronger protection zones;
- Peripheral development is favoured and where possible should be located outside of the conservation area;
- Two key points need to be emphasized:
- The designation of a broad use zone does not imply that all sites within that zone would be suitable for all the development types anticipated within that use zone. Detailed site level planning is still required, and many sites may prove to be unsuitable at a site/precinct/EIA level of planning; and
- Special Management Areas/Overlays need to be formalised and the links made to the management plans. (Adapted from Holness 2008)

5.4.2 Zoning Definitions and Descriptions

The zonation definitions and descriptions were work shopped with Regional and Area managers. Four categories were decided on, namely; Primary Conservation zone, Conservation zone, Low Intensity leisure zone and High Intensity leisure zone.

6 DEVELOPMENT PLAN

No development will occur within the Nature Reserve until the IRMP is reviewed in five years time. The Reserve has however been zoned so that development of conservation related infrastructure can only occur on the most degraded sites of the Reserve which is situated next to the R304 of the Klein Dassenberg Section (Map 8). This zone has been allocated according to veld degradation and tourism potential.



7 COSTING PLAN

Table 6: Broad costing management breakdown for Klein Dassenberg Nature Reserve:

Management Action	Funding Source	Approximate Costs 2013-2014	Approximate Costs 2014-2015	Approximate Costs 2015-2016	Approximate Costs 2016-2017	Approximate Costs 2017-2018
1. Invasive Alien Plant Program	Grant Funding	R1,075257	R1,139773	R1,208159	R1,268566.95	R1,1331995.30
2. Fire Management Maintenance of Fire breaks	Operating	R20 000	R21 000	R22 050	R23 152.50	R24 310.13
3. Road and Trail Maintenance Road Repairs	Grant Funding	R90 000	-	-	-	-
	Operating	R2 000	R2 100	R2 205	R2 315.25	R2 431.01
Footpath Maintenance	Operating	R2 500	R2 625	R2 757.25	R2 894.06	R3 038.77
4. Fencing New fence Reserve	Operating	R474 750	R478 487.50	-	-	-
Repairs and Maintenance	CAPEX		R7 500	-	-	R8 682.19
5. Infrastructure Development	CAPEX	R700,000.00	R10,000,000	R10,000,000		
6. Human Resources Direct HR costs	Operating	R500 000	R540 000	R583 200	R612 360	R661 348.80
7. General Expenses General Operating Costs	Operating	R15 000	R15 750	R17 325	R18 191	R19 100
8. Special Projects	Grant/ CAPEX					
Note: HR costs are escalated at 8% per annum Operating Expenditure is escalated at 5% per annum						

PART 3 – MONITORING AND AUDITING

8 MONITORING & AUDITING

8.1 ANNUAL AUDIT PROCEDURE [Set format taken from previous CCT Management Plan]

8.1.1 *Management Effectiveness Tracking Tool –METT*

The METT-SA is a rapid, site-level assessment tool adapted from the World Bank & WWF's system (2007). The system is based on the concept that appropriate protected area management encompasses six distinct stages:

1. Understanding the **context** (where are we now?) of existing values and threats,
2. Progress through **planning** (where do we want to be?)
3. Allocation of resources (**inputs**) (what do we need?)
4. Implementing management actions (**processes**) (how do we go about it?)
5. Producing products and services from the management actions (**outputs**) (what were the results?),
6. The management **outcomes** (what did we achieve?).

This version has been compiled so that it can be applied to the full range of protected areas managed by all C.A.P.E. Partners. It is also applicable to protected areas in other regions and with minor adaptations could be applied outside of South Africa. It may also be applied to MPA's and islands, but in the long run it may be necessary to amend the system to be more specific to these areas. It may be necessary to develop a system for "off reserve" conservation areas such as conservancies or stewardships.

When applying METT-SA it is important that the following be kept in mind:

- The METT-SA is intended to report on progress of the reserve. Thus the score is the baseline against which future assessments are made to see if there has been an improvement;
- It is site specific and must thus not be used to compare scores between different protected areas;
- It is a useful tool to give indications of trends in management. In this version the six groups of elements of the management process as defined in the original version are scored as subsets of the total. This gives an indication of where improvement in management needs to focus;
- It is not intended to replace more detailed assessments as part of adaptive management systems;
- The METT has limitations in the quantitative measurement of Outcomes and these should be measured by more objective and quantitative systems;
- This version adjusts the total score where questions are not relevant; and

- Often low scores in some questions can be a reflection on the organization and are out of the control of the protected area manager. **Thus under no circumstances should the performance of managers be measured against the results of the METT-SA.**

Frequency of application: Tracking the trends of management effectiveness is a long term process and instant improvements are unlikely to be obtained. Generally the METT is applied at three year intervals, but an annual application is acceptable if it is understood that changes may only be slight.

8.1.2 Protected Area Review

The PA Review is an internal review conducted annually to assist managers in reviewing their sites and to allow for adaptive management actions to take place where required (and within the managers control).

8.2 Management Plan review

On a five-yearly basis, this Management Plan should be reviewed and adjusted accordingly. To achieve this, the following questions (and others as needed) should be addressed:

- Did this Integrated Reserve Management Plan make a significant contribution to management of the Papekuil Nature Reserve?
- Were individual management “prescriptions” realistic and achievable? Were they written unambiguously which led to misunderstanding?
- Were allocated budgets for each management activity realistic? If not, were they too much or too little?
- Were sufficiently qualified staff members allocated to each management activity?

There will be some overlap between the review and the audit and they should therefore be done on the same day, by the same team.

8.3 Biodiversity Monitoring

Table 7: The Reserve's monitoring requirements:

All baseline data is captured into the South African Biodiversity Database

Action	Responsible Party	Means of Verification	Frequency
Vegetation Monitoring a. <u>Invasive Alien Vegetation</u> Monitor effectiveness of the clearing operation; the follow-up and the methods used. Monitor compliance with the alien clearing schedule and subsequent environmental damage. Use data to continuously update Reserve's Invasive Species Management Programme	Site Coordinator, Reserve staff and Intern	Weekly Inspections, Final Inspections, Field Verification Sheet.	Weekly Once off – completion of contract Annually - to determine Management Unit Clearing Plan
b. <u>Atlantis Sand Fynbos</u> Monitor recovery of fynbos after alien clearing and exclusion of other disturbances.	Intern	Species identification, abundance	Depends on veld recovery but it should be monitored seasonally for at least 3 years
Vegetation Abundance, Density & Structure	Site Coordinator, Reserve staff and Intern	Fixed point photography, Presence, abundance, density	Annually Every 3 years-permanent vegetation plots
Fine scale vegetation community mapping	Site Coordinator, Reserve Staff, Biophysical Specialist and Intern	Surveying of land use of area and neighbouring properties, in field density assessments of plant communities	Once off
Rainfall collection	Intern	Rain gauge placed in open area with no disturbances	Daily
Fire mapping	Site Coordinator, Reserve staff and		Post fire

Action	Responsible Party	Means of Verification	Frequency
The accurate mapping and recording of all veld fires must be done to build up a useful record that will assist with veld interpretation. All the fire data should be recorded on GIS. Minimum recording requirement is a simple map indicating the date of the fire and extent of the burn.	Intern	Veld age map, fire map	
Post Fire Recruitment	Site Coordinator, Reserve staff and Intern	Stratified Sampling plots	Post fire 6 months 12 months Annually for 3 years
Faunal Monitoring Small antelope sample survey	Site Coordinator, Reserve staff and Intern	Game Drive Count	As required
Small mammal	Intern	Trap cages, Sherman traps	Annually
Bird Distribution	Site Coordinator, Reserve staff and Intern	Field Observations	Monthly
Reptile survey	Site Coordinator, Reserve staff and Intern	Traps used to capture, identify and release	Once every five years
Amphibian Survey	Site Coordinator, Reserve staff and Intern	Audio and visual observation	Once every five years

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9 REFERENCES

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PART 5 - APPENDECES

10 APPENDICES

Appendix 1: The S.G. Diagrams

Appendix 2: The Dassenberg Coastal Catchment Partnership (DCCP)

The Dassenberg Coastal Catchment Partnership (DCCP) is a landscape initiative between the Environmental Resource Management Department of the City of Cape Town, CapeNature, WWF, Table Mountain Fund, Wilderness Foundation, Cape West Coast Biosphere, SANParks and SANBI. This region is highlighted as a priority in CapeNature's Provincial Protected Area Expansion Strategy. The area has also been identified as one of the two most important Climate Change adaptation corridors in the Western Cape by the TMF-WWF study and is arguably one of the highest priority conservation areas in the country.

This conservation initiative aims to look at the protection and consolidation of the incredible natural heritage in the region while maximising associated social and economic opportunities. The concept strives for a balanced approach as the success of the initiative is dependent on unlocking social and economic opportunities while focussing on a more inclusive, people and community orientated approach. The envisaged area borders on the communities of Atlantis, Mamre, Pella, Riverlands and Chatsworth and will focus on the high quality natural remnants that are outside of the urban edge. In addition, the area contains immense cultural and historical significance and there are numerous tourism opportunities contained within the area.

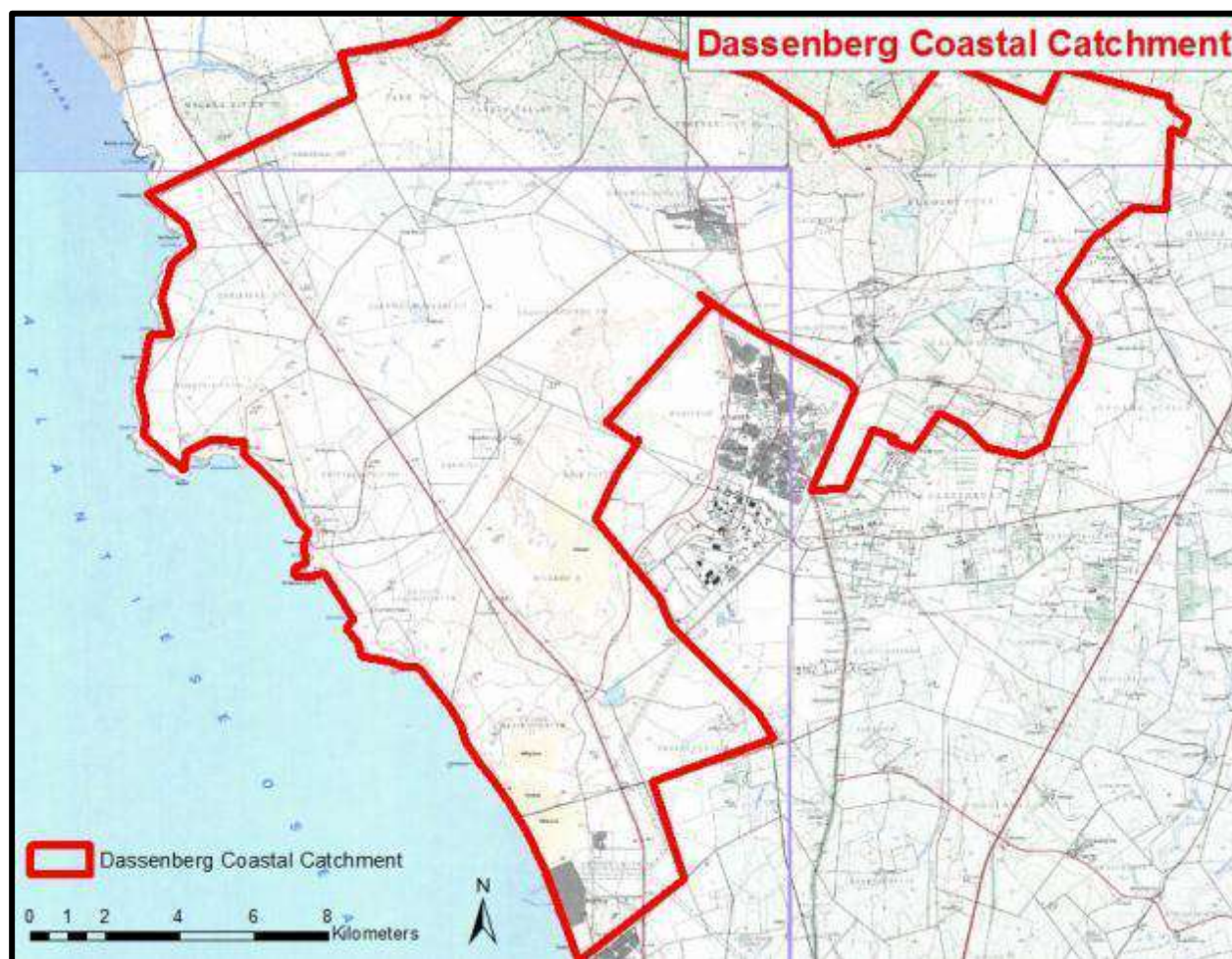


Figure 5: The greater Dassenberg Coastal Catchment Partnership

The main objectives of DCCP are to:

➤ Protect critical ecological infrastructure

The Witzands Aquifer currently supplies 40 % of Atlantis's water and its continued functioning is critical to Cape Town's water security. The capital costs of replacing this water should the aquifer become degraded is estimated to be R300 million to build new pipe lines and pump stations or R800 million to build a desalination plant.

➤ Deliver Socio Economic opportunities to the surrounding communities

- Already R1.8 million Working for Water funding has been secured for alien vegetation clearing within the area. This project will start in August 2012 and employ three teams from the surrounding communities for a three year period.
- Currently, the Mayor's Kader Asmal Memorial Project is employing four teams of 44 people from the surrounding communities. These EPWP teams are being trained and are conducting alien vegetation clearing.
- The area is an excellent locality for skills development projects and economic opportunities
- For alien clearing alone, at least 450 000 person days are required for the initial three years

- Several current recreation and tourism activities occur; the focus should be to build on these existing initiatives. (e.g. Mamre Heritage and Wild Flower show)
 - The area contains numerous potential recreation and tourism activities – the areas close proximity to Cape Town is highly advantageous.
 - The sound management of fire and alien vegetation in the area will reduce cover for illegal activities and reduce fire risk. There is potential to create a 22 strong Working on Fire Team to be based in the region.
- Ensure the protection of the identified critical climate change adaptation and mitigation corridor

The area has been identified as one of the two priority climate change adaptation and mitigation corridors in the Western Cape. This is due to the large areas of natural vegetation which still occurs in the area, the coastal to inland link and the incredibly high levels of biodiversity and endemism.

- Protect and promote the incredible natural and cultural heritage of the area
- There are many highly significant cultural heritage features in the area.
 - The potential is to create a large and ecologically viable area.
 - There is good potential to reintroduce game such as Eland and Red Hartebeest.
 - The area contains extensive high quality remnants of three Critically Endangered and one Endangered Vegetation types.
 - It is estimated that more than 200 threatened plant species occur in the Dassenberg Coastal Catchment corridor (30% endemic to the corridor & 60% endemic within 50km of the corridor).



Appendix 3: The most recent plant species list for Klein Dassenberg Nature Reserve (updated 25/09/2014)

#	FAMILY	TAXA	Status
1	AIZOACEAE	<i>Aizoon sarmentosum</i>	LC
2	AIZOACEAE	<i>Carpobrotus edulis</i>	LC
3	AIZOACEAE	<i>Conicosia pugioniformis</i>	LC
4	AIZOACEAE	<i>Lampranthus cf aurantium</i>	LC
5	AIZOACEAE	<i>Mesembryanthemum canaliculatum</i> (=Phyllobolus)	LC
6	AIZOACEAE	<i>Ruschia</i> sp - pink flowers	LC
7	AIZOACEAE	<i>Tetragonia nigrescens</i>	LC
8	AIZOACEAE	<i>Lampranthus explanatus</i>	EN
9	AIZOACEAE	<i>Ruschia indecora</i>	EN
10	AIZOACEAE	<i>Ruschia tecta</i>	EN
11	AIZOACEAE	<i>Lampranthus aurantiacus</i>	LC
12	AMARYLLIDACEAE	<i>Haemanthus pubescens</i>	LC
13	ANACARDIACEAE	<i>Searsia laevigata laevigata</i>	LC
14	ANACARDIACEAE	<i>Searsia rosmarinifolia</i>	LC
15	ANACARDIACEAE	<i>Rhus rosmarinifolia</i>	LC
16	APOCYNACEAE	<i>Asclepias crispa</i>	LC
17	APOCYNACEAE	<i>Cynanchum africanum</i>	LC
18	ASPHODELACEAE	<i>Trachyandra hirsutiflora</i>	LC
19	ASPARAGACEAE	<i>Asparagus lignosus</i>	LC
20	ASPARAGACEAE	<i>Asparagus capensis</i>	LC
21	ASPARAGACEAE	<i>Asparagus rubicundus</i>	LC
22	ASTERACEAE	<i>Arctotheca calendula</i>	LC
23	ASTERACEAE	<i>Arctotis acaulis</i>	LC
24	ASTERACEAE	<i>Arctotis hirsuta</i>	LC
25	ASTERACEAE	<i>Cotula duckittiae</i>	VU
26	ASTERACEAE	<i>Cotula turbinata</i>	LC
27	ASTERACEAE	<i>Dimorphotheca nudicaulis</i>	LC
28	ASTERACEAE	<i>Dimorphotheca pluvialis</i>	LC
29	ASTERACEAE	<i>Eriocephalus racemosus</i>	LC
30	ASTERACEAE	<i>Elytropappus glandulosus</i>	LC
31	ASTERACEAE	<i>Felicia cf tenella</i>	LC
32	ASTERACEAE	<i>Gazania</i> sp	LC
33	ASTERACEAE	<i>Gymnodiscus capillaris</i>	LC
34	ASTERACEAE	<i>Helichrysum cochleariforme</i>	NT
35	ASTERACEAE	<i>Helichrysum cf moesianum</i>	LC
36	ASTERACEAE	<i>Metalasia adunca</i>	NT
37	ASTERACEAE	<i>Metalasia brevifolia</i>	LC
38	ASTERACEAE	<i>Metalasia capitata</i>	VU
39	ASTERACEAE	<i>Metalasia muricata</i>	LC

40	ASTERACEAE	<i>Oedera imbricata</i>	LC
41	ASTERACEAE	<i>Osteospermum clandestinum</i>	LC
42	ASTERACEAE	<i>Othonna filicaulis</i>	LC
43	ASTERACEAE	<i>Othonna gymnodiscus</i>	LC
44	ASTERACEAE	<i>Othonna linearifolia</i>	EN
45	ASTERACEAE	<i>Pteronia camphorata</i>	LC
46	ASTERACEAE	<i>Petalacte coronata</i>	LC
47	ASTERACEAE	<i>Senecio foeniculoides</i>	CR
48	ASTERACEAE	<i>Senecio pubigerus</i>	LC
49	ASTERACEAE	<i>Stoebe plumosa</i>	LC
50	ASTERACEAE	<i>Trichogyne ambigua</i>	LC
51	ASTERACEAE	<i>Ursinia chrysanthemoides</i>	LC
52	BORAGINACEAE	<i>Lobostemon glaucophyllus</i>	LC
53	BORAGINACEAE	<i>Lobostemon fruticosus</i>	LC
54	BRUNIACEAE	<i>Berzelia abrotanoides</i>	LC
55	BRUNIACEAE	<i>Staavia radiata</i>	LC
56	CAMPANULACEAE	<i>Prismatocarpus sp</i>	LC
57	CAMPANULACEAE	<i>Roella cf arenaria</i>	VU
58	CAMPANULACEAE	<i>Wahlenbergia androsacea</i>	LC
59	CAMPANULACEAE	<i>Wahlenbergia capensis</i>	LC
60	CRASSULACEAE	<i>Crassula dichotoma</i>	LC
61	CRASSULACEAE	<i>Crassula cf multiflora</i>	LC
62	CYPERACEAE	<i>Ficinia deusta</i>	LC
63	CYPERACEAE	<i>Ficinia cf secunda</i>	LC
64	CYPERACEAE	<i>Ficinia cf paradoxa</i>	LC
65	CYPERACEAE	<i>Ficinia sp compact head</i>	LC
66	CYPERACEAE	<i>Ficinia sp single spikelet cf F. indica</i>	LC
67	DROSERACEAE	<i>Drosera trinervia</i>	LC
68	EBENACEAE	<i>Diospyros glabra</i>	LC
69	FAMILY	TAXA	Status
70	ERICACEAE	<i>Erica axillaris</i>	LC
71	ERICACEAE	<i>Erica corrifolia</i>	LC
72	ERICACEAE	<i>Erica ferrea</i>	EN
73	ERICACEAE	<i>Erica lasciva</i>	LC
74	ERICACEAE	<i>Erica mammosa</i>	LC
75	ERICACEAE	<i>Erica plukenetii</i>	LC
76	ERICACEAE	<i>Erica plumosa</i>	LC
77	ERIOSPERMACEAE	<i>Eriospermum capensis</i>	LC
78	ERIOSPERMACEAE	<i>Eriospermum nanum</i>	LC
79	EUPHORBIACEAE	<i>Euphorbia tuberosa</i>	LC
80	FABACEAE	<i>Acacia saligna</i>	LC
81	FABACEAE	<i>Argyrolobium cf velutinum</i>	EN
82	FABACEAE	<i>Aspalathus albens</i>	VU
83	FABACEAE	<i>Aspalathus retroflexa cf bicolor</i>	CR

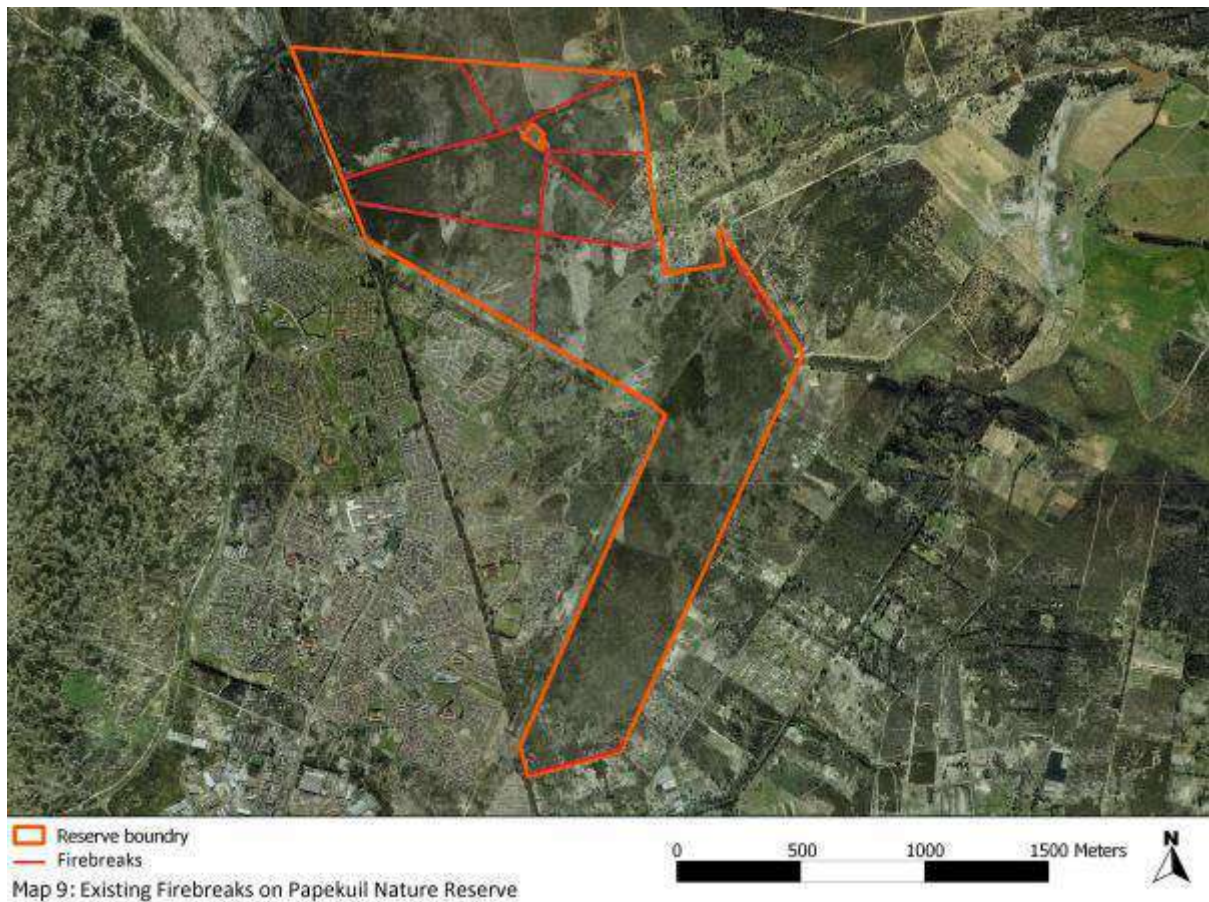
84	FABACEAE	<i>Amphithalea ericifolia ssp erecta</i>	CR
85	FABACEAE	<i>Rafnia angulata angulata</i>	LC
86	FABACEAE	<i>Cyclopia genistoides</i>	LC
87	GERANIACEAE	<i>Pelargonium capitatum</i>	LC
88	GERANIACEAE	<i>Pelargonium oenothera</i>	LC
89	GERANIACEAE	<i>Pelargonium sp</i>	LC
90	GERANIACEAE	<i>Pelargonium myrrhifolium fruticosum</i>	
91	GERANIACEAE	<i>Pelargonium psammophilum (m.s.Marais)</i>	
92	GERANIACEAE	<i>Pelargonium triste</i>	LC
93	HAEMODORACEAE	<i>Wachendorfia sp</i>	LC
94	HEMEROCALLIDACEAE	<i>Caesia sabulosa</i>	VU
95	HYACINTHACEAE	<i>Albuca cooperi</i>	LC
96	HYACINTHACEAE	<i>Lachenalia sp</i>	LC
97	HYACINTHACEAE	<i>Lachenalia rubida</i>	LC
98	IRIDACEAE	<i>Aristea sp cf A.africana</i>	LC
99	IRIDACEAE	<i>Babiana ambigua</i>	LC
100	IRIDACEAE	<i>Babiana ringens</i>	LC
101	IRIDACEAE	<i>Bobartia cf indica</i>	LC
102	IRIDACEAE	<i>Gladiolus brevifolius</i>	LC
103	IRIDACEAE	<i>Gladiolus carinatus</i>	LC
104	IRIDACEAE	<i>Moraea flaccida</i>	LC
105	IRIDACEAE	<i>Moraea galaxia</i>	LC
106	IRIDACEAE	<i>Moraea neglecta</i>	LC
107	IRIDACEAE	<i>Moraea tripelata</i>	LC
108	IRIDACEAE	<i>Romulea cf flava - white form</i>	LC
109	IRIDACEAE	<i>Romulea flava - yellow form</i>	LC
110	IRIDACEAE	<i>Romulea rosea</i>	LC
111	IRIDACEAE	<i>Romulea schlechteri</i>	LC
112	IRIDACEAE	<i>Watsonia marginata</i>	LC
113	LAMIACEAE	<i>Salvia lanceolata</i>	LC
114	LAURACEAE	<i>Cassytha ciliolata</i>	LC
115	LOBELIACEAE	<i>Lobelia coronopifolia</i>	LC
116	MOLLUGINACEAE	<i>Pharnaceum cf lanatum</i>	LC
117	ORCHIDACEAE	<i>Disa bifida (= Schizodium)</i>	LC
118	ORCHIDACEAE	<i>Pterygodium sp</i>	LC
119	ORCHIDACEAE	<i>Satyrion sp</i>	LC
120	OROBANCHACEAE	<i>Orobanche sanguinea</i>	LC
121	OXALIDACEAE	<i>Oxalis luteola</i>	LC
122	OXALIDACEAE	<i>Oxalis obtusa</i>	LC
123	OXALIDACEAE	<i>Oxalis pes-caprae</i>	LC
124	PENAEACEAE	<i>Stylapterus fruticosus</i>	EN
125	POACEAE	<i>Avena sativa</i>	LC
126	POACEAE	<i>Briza maxima</i>	LC
127	POACEAE	<i>Ehrhatha villosa</i>	LC

128	FAMILY	TAXA	Status
129	POACEAE	<i>Tribolium uniolae</i>	LC
130	POLYGALACEAE	<i>Muraltia cf ericoides</i>	LC
131	POLYGALACEAE	<i>Polygala garcinii</i>	
132	POLYGALACEAE	<i>Polygala recognita</i>	LC
133	POLYGONACEAE	<i>Rumex sp</i>	LC
134	PROTEACEA	<i>Leucadendron salignum</i>	LC
135	PROTEACEAE	<i>Leucodendron lanigerum</i>	VU
136	PROTEACEAE	<i>Leucospermum hypophyllocarpodendron</i> hybrid X <i>L. parile</i>	VU
137	PROTEACEAE	<i>Leucospermum hypophyllocarpodendron</i> subsp <i>canaliculata</i>	VU
138	PROTEACEAE	<i>Leucospermum parile</i>	EN
139	PROTEACEAE	<i>Protea scolymocephala</i>	VU
140	PROTEACEAE	<i>Serruria decipiens</i>	VU
141	PROTEACEAE	<i>Protea repens</i>	LC
142	PROTEACEAE	<i>Serruria fasciflora</i>	VU
143	RESTIONACEAE	<i>Calopsis impolita</i>	VU
144	RESTIONACEAE	<i>Cannomois cf arenicola</i>	LC
145	RESTIONACEAE	<i>Chondropetalum nudum</i>	LC
146	RESTIONACEAE	<i>Staberoha cernua</i>	LC
147	RESTIONACEAE	<i>Staberoha distachyos</i>	LC
148	RESTIONACEAE	<i>Thamnochortus punctatus</i>	Declining
149	RESTIONACEAE	<i>Thamnochortus sp</i>	LC
150	RESTIONACEAE	<i>Willdenowia arescens</i>	LC
151	RHAMNACEAE	<i>Phylica cephalantha</i>	LC
152	RHAMNACEAE	<i>Phylica imberbis</i>	LC
153	RHAMNACEAE	<i>Trichocephalus stipularis</i>	LC
154	ROSACEAE	<i>Cliffortia falcata</i>	LC
155	ROSACEAE	<i>Cliffortia polygonifolia</i>	LC
156	RUBIACEAE	<i>Anthospermum spathulatum</i>	LC
157	RUBIACEAE	<i>Carpacoce vaginellata</i>	LC
158	RUTACEAE	<i>Adenandra cf villosa</i>	LC
159	RUTACEAE	<i>Agathosma imbricata</i>	LC
160	RUTACEAE	<i>Diosma oppositifolia</i>	LC
161	RUTACEAE	<i>Macrostylis villosa</i>	EN
162	RUTACEAE	<i>Macrostylis villosa villosa</i>	EN
163	SANTALACEAE	<i>Thesium aggregatum</i>	LC
164	SANTALACEAE	<i>Thesium cf pubescens</i>	LC
165	SANTALACEAE	<i>Thesium capitatum</i>	LC
166	SANTALACEAE	<i>Thesium cf diversifolium</i>	LC
167	SANTALACEAE	<i>Thesium sp, gracile</i>	LC
168	SCROPHULARIACEAE	<i>Diascia capensis</i>	LC
169	SCROPHULARIACEAE	<i>Hebenstretia repens</i>	LC
170	SCROPHULARIACEAE	<i>Lyperia tristis</i>	LC
171	SCROPHULARIACEAE	<i>Microdon capitatus</i>	LC

172	SCROPHULARIACEAE	<i>Microdon dubius</i>	LC
173	SCROPHULARIACEAE	<i>Manulea rubra</i>	LC
174	SCROPHULARIACEAE	<i>Nemesia strumosa</i>	NT
175	SCROPHULARIACEAE	<i>Nemesia versicolor</i>	LC
176	TECOPHILAEACEAE	<i>Cyanella hyacinthoides</i>	LC
177	THYMELAEACEAE	<i>Gnidia pinifolia</i>	LC
178	THYMELAEACEAE	<i>Lachnaea capitata</i>	VU
179	THYMELAEACEAE	<i>Lachnaea grandiflora</i>	VU
180	THYMELAEACEAE	<i>Passerina corymbosa</i>	LC
181	THYMELAEACEAE	<i>Struthiola ciliata</i>	LC
182	THYMELAEACEAE	<i>Struthiola striata</i>	LC
183	THYMELAEACEAE	<i>Struthiola dodecandra</i>	LC
184	TRICHOCEPHALUS	<i>Trichocephalus stipularis</i>	LC
185	URTICACEAE	<i>Urtica cf urens</i>	LC
186	ZYGOPHYLLACEAE	<i>Zygophyllum flexuosum</i>	LC
187	ZYGOPHYLLACEAE	<i>Zygophyllum sessilifolium</i>	LC
188	ZYGOPHYLLACEAE	<i>Zygophyllum spinosum</i>	LC

Status	Definition of Status	Amount
Critically Endangered (CR)	Taxa which is facing an extremely high risk of extinction in the wild in the immediate future	3
Endangered (EN)	Taxa which is not CR but is facing a very high risk of extinction in the wild in near future	10
Vulnerable (VU)	Taxa which is not CR or EN but is facing high risk of extinction in the wild in medium-term future	14
Near Threatened (NT)	Taxa which do not qualify for Conservation dependent, but which are close to qualifying for VU	3
Declining	Taxa which do not qualify for Conservation dependent, but which are close to qualifying for NT	1
Least Concern (LC)	Taxa which do not qualify for Conservation dependent or NT	147
Data Deficient (DD)	When there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and / or population status	
Exotic	Taxa which did not originally occur in the area but has been introduced	
TOTAL		178

Appendix 4: Existing Firebreaks on Papekuil Nature Reserve



Appendix 5: Annual Review Procedure (Example of an audit proforma)

Ecological Auditing for Contractual Reserves & Biodiversity Agreements.

The ecological auditing pro-forma is a guideline document, developed primarily to capture biodiversity management performance for a given vegetation type. It should be adapted to the specific circumstances stipulated in the management plan for the Management Agreement & Contractual Reserve in question.

Name of Property			
Name of Owners		Name of Auditors	
Tel		Tel	
Fax		Fax	
Cell		Cell	
E-mail		E-mail	
Date of Audit:			
Date of next Audit:			

Alien Vegetation: Is there an alien vegetation management plan? YES/NO

Management Objective	Measurable	Responsible Party	Yes/No	Quality H/M/L
Are objectives for the 12 month management period clearly stated?	Have objectives for the 12 month management period been met?			
	<i>If NOT UNDERTAKEN / UNSUCCESSFUL please state reasons and attach as Appendix 1: Alien Vegetation</i>			

Note:

Fire Management: Is there a Fire management plan? YES/NO

Management Objective Are objectives for the 12 month management period clearly stated? No	Measurable Have objectives for the 24 month management period been met?	Responsible Party	Yes/No	Quality H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 2: Fire Management.</i>			

Note:

Game management: Is there a game management plan? YES/NO

Management Objective	Measurable Have objectives for the 12 month management period been met?	Responsible Party	Yes/No	Quality H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 3: Game Management.</i>			

Development:

Management Objective	Measurable	Responsible	Yes/No	Quality

Are objectives for the 12 month management of animals clearly stated?	Have the objectives for the 24 month management period been undertaken?	Party	o	H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 4: Development.</i>			

Business

Management Objectives Are objectives for resource use for the 12 month management period clearly stated?	Measurable Have objectives for the 12 month management period been met?	Responsible Party	Yes/ No	Quality H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 5: Business.</i>			

Road Maintenance and Erosion

Management Objective Are the objectives for the 12 month management of fire clearly stated?	Measurable Have the objectives for the 12 month management period been undertaken?	Responsible Party	Yes/ No	Quality H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 6: Road Maintenance and Erosion.</i>			

Water management: Is there a water management plan? YES/NO

Management Objective Are objectives for the 12 month management plan clearly stated?	Measurable Have objectives for the 12 month management period been met?	Responsible Party	Yes/N o	Quality H/M/L
	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 7: Water Management.</i>			

Monitoring: Is there a Monitoring management plan? YES/NO

Management Objectives Are objectives for resource use for the 12 month management period clearly stated?	Measurable Have objectives for the 12 month management period been met?	Responsible Party	Yes/ No	Quality H/M/L

	<i>If NOT UNDERTAKEN/UNSUCCESSFUL please state reasons and attach as Appendix 8: Monitoring.</i>			

Addendum 1 – Alien Vegetation

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Addendum 2 – Fire Management

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Addendum 3 – Game Management

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Addendum 4 – Development

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Addendum 5– Business

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Addendum 6 – Road maintenance & Erosion

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New Interventions			

Addendum 7 – Water Management

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New Interventions			

Addendum 8 – Monitoring

	List	Reason	Actions
Interventions not undertaken			
Interventions unsuccessful			
New interventions			

Appendix 6: Fixed Point Photography Data Sheet

FIXED POINT PHOTOGRAPHY DATA SHEET			
PLOT NO:		DATE:	SURVEYOR:
GPS CO-ORDINATE:			
GRID REF NO:			
POINT DESCRIPTION: (How to find the points)			
HABITAT DESCRIPTION: (use back of form, if necessary)			
VEGETATION TYPE:			
TREE & SHRUB SPECIES:			
DWARF SCRUB SPECIES:			
HERBACEOUS PLANT SPECIES:			
COVER DESCRIPTION:			
COVER TYPE	HEIGHT	% OF PLOT	DOMINANT SPECIES
CANOPY COVER			
GROUND COVER			
UTILIZATION:			
BROWSING DENSITY:		PLANTS BROWSED	BROWSING HERBIVORES
HEAVY			
MODERATE			
LIGHT			
GRAZING INTENSITY:		PLANTS GRAZED	GRAZING HERBIVORES
HEAVY			
MODERATE			
LIGHT			
OTHER NOTES:			

PART B

PART 6 - MANAGEMENT SCHEDULE

11 PROGRAMME OF IMPLEMENTATION

This section focuses on specific programmes that were identified in Section A, paragraph 5.3 Protected Area Management Policy Framework and Guiding Principles, describing the day-to-day management activities and assigning responsibility for the implementation thereof.

11.1 Management Programmes: Details of Annual Plan of Operations (APOs)

Management Programme 1: Community Participation (see section 5.3.1. above)

Management Action 1 – Community Participation	
Objective	To develop a constructive, mutually beneficial relationship between the Reserve, communities close to or adjacent to the Reserve and the surrounding landowners to establish the long term success of Papekuil Nature Reserve.
Responsible Party	The City of Cape Town
Time Frame	Continuous
Means	Establish community based initiatives and partnerships to promote and support economic and employment opportunities. Provide related alien clearing training and awareness initiatives.

Management Programme 2: Security and Safety (see section 5.3.2 above)

Management Action 2 – Safety and Security	
Objective	To provide a safe environment for staff members and potential tourists.
Responsible Party	The City of Cape Town
Time Frame	Continuous
Means	Implement a Safety and Security Audit to highlight problem areas. Firebreaks should ensure safety of neighbouring communities from fire risks.

Management Programme 3: Tourism Development and Management (see section 5.3.3 above)

Management Action 3 - Tourism	
Objective	Legal Tourism Ventures that adhere to the zoning rights of the property and which do not impede on any National Environmental Management Act (NEMA) principles are supported. Establish tourism ventures within Nature Reserve which would provide visitors with meaningful experience while preventing damage to the critically endangered vegetation.

Responsible Party	The City of Cape Town
Time Frame	To be reviewed in five years time
Means	Review the Development Plan to determine the extent of tourism adventure development necessary. Monitor tourism related impacts on vegetation and implement corrective management where necessary (See Management Programme 11 - Strategic Research). Determine feasibility of tourism activities. All infrastructure need to be maintained.

Management Programme 4: Infrastructure Management (see section 5.3.4 above)

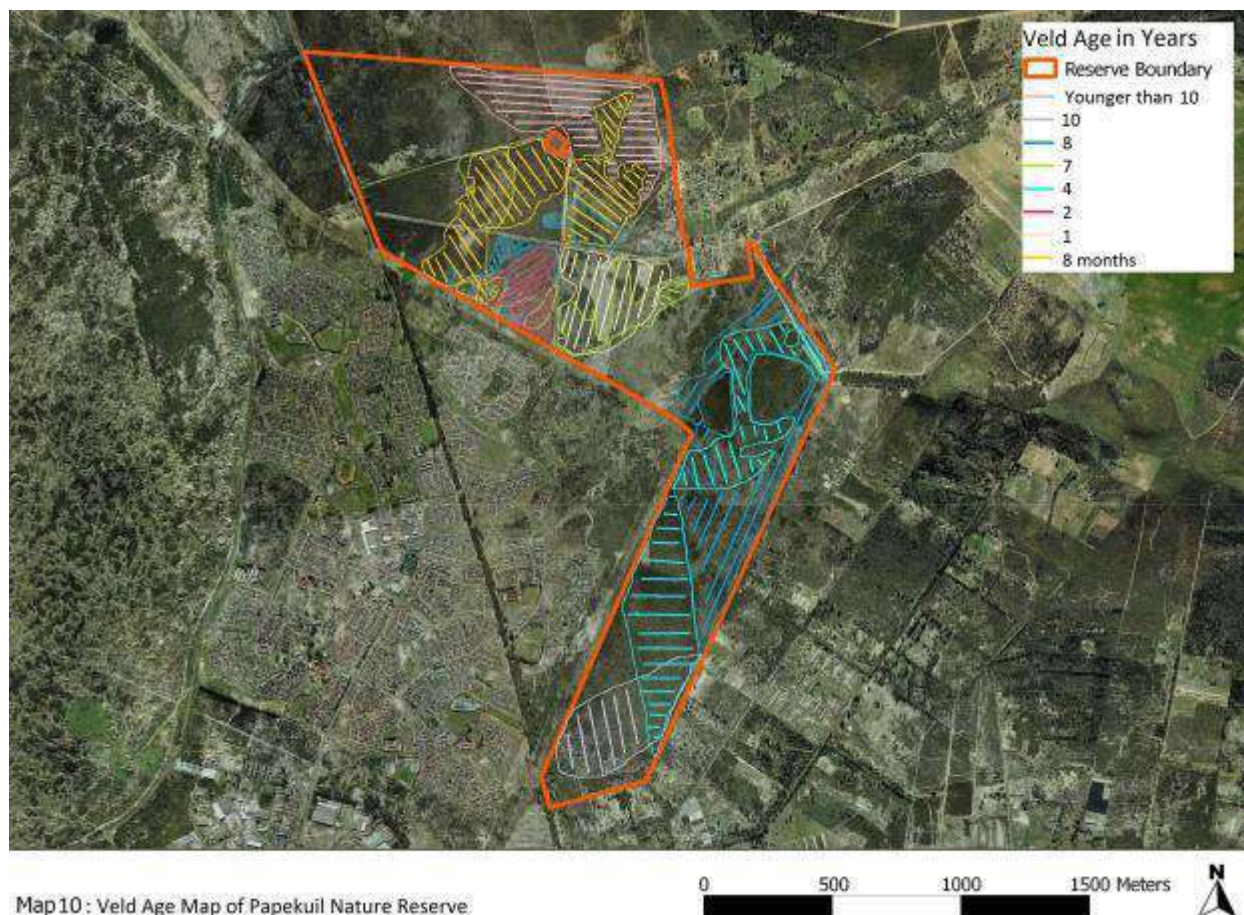
Management Action 4 - Development	
Objective	With exception of the demarcated development zone (33°34'25.02"S, 18°31'11.63"E, See Map 8), the marked footpaths/ firebreaks and fencing, no further development is to occur within the Nature Reserve. Any proposed development needs to be done in accordance with NEMA principles and follow all stakeholders' applicable legislation and procedures. Additionally, infrastructure should also align to the Zonation Plan of the Nature Reserve. Roads and footpaths within the Reserve should be maintained. All the tracks and firebreaks that are not needed within the Reserve should be closed off and rehabilitated.
Responsible Party	The City of Cape Town
Time Frame	Continuous
Means	To be developed with reference to the Zonation and Sensitivity report.

Management Programme 4: Biodiversity Conservation Management (see section 5.3.5 above)

Management Action 6 – Community-Based Natural Resource Management (CBNRM)	
Objective	Determine impact of flower harvesting on vegetation survival and recruitment.
Responsible Party	The City of Cape Town
Time Frame	Continuously
Means	Implement a Harvesting Feasibility Study within the next five years. See Management Action 11 - Monitoring

Management Action 7 – Fire Management	
Objective	Prevent too frequent fires, create and maintain firebreaks, carry out management/ ecological burns, allow appropriate natural fires, and conform to Fire Reaction Plan. Fire Management should be carried out in accordance with the National Veld and Forest Act No. 101 of 1998. Fire Breaks Firebreaks need strategic placement to provide optimal protection to the natural veld, surrounding communities and private areas. Existing roads and firebreaks need to be mapped (See Appendix 4). Once the Reserve is fenced and operational, these networks need to be assessed as

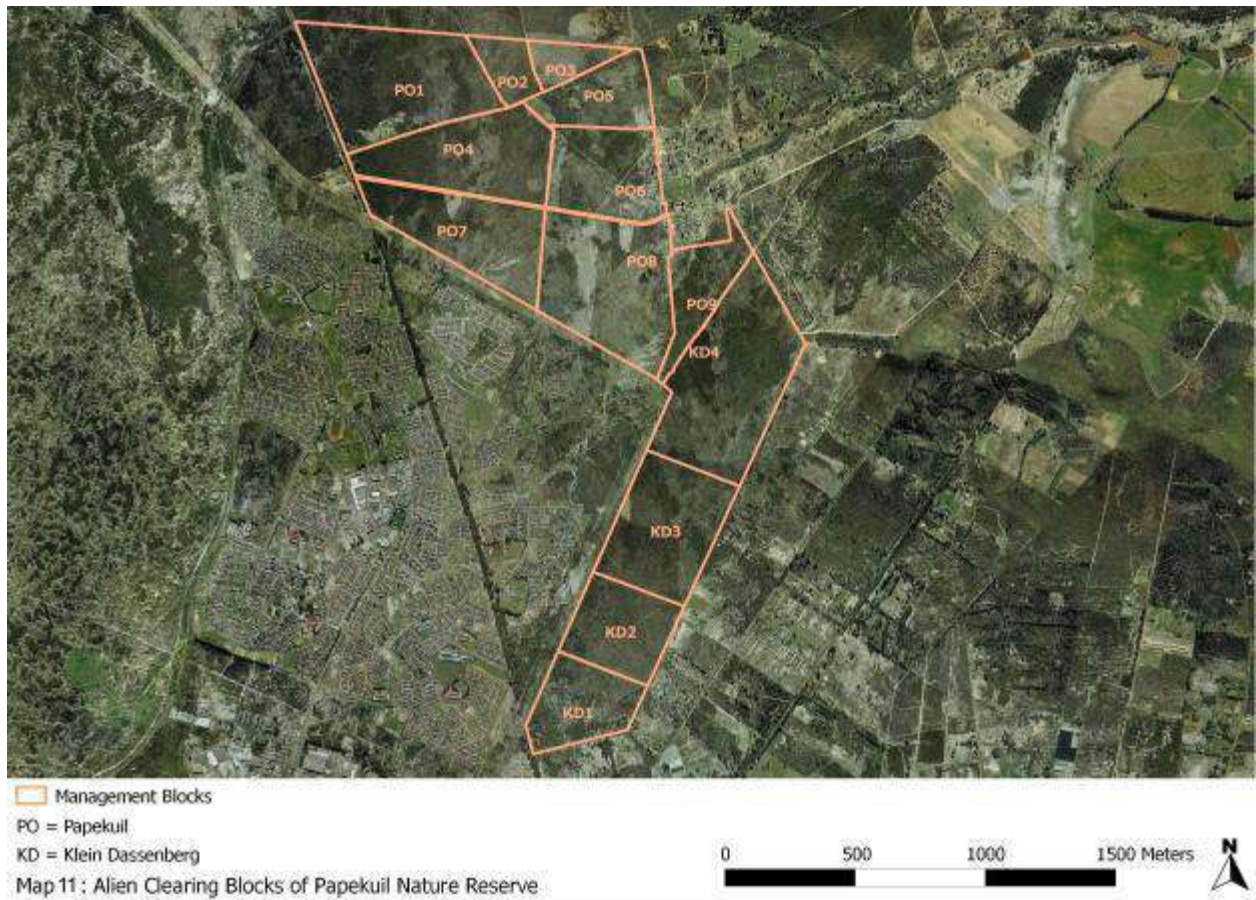
	to determine whether they are sufficient or whether realignment is required. Any excess firebreaks/ tracks should be closed off and rehabilitated. New firebreaks/ tracks, if applicable, should be carefully planned to prevent excessive damage to the veld. Firebreaks should not be burnt or ploughed, instead it should be mowed annually, during October, before the start of fire season. They should not be wider than 3m. Veld Age The veld age varies between 8 months and older than 10 years. While a basic veld age map is available, all efforts should be made to determine the veld age of areas not covered by the map in (Map 10) to ensure proper fire management planning. Prescribed Burns Fire should be used as a management tool on Papekuil Nature Reserve by simulating natural the natural burning regime to prevent vegetation from becoming senescent. These burns need to be thoroughly planned and complement the alien clearing operation (See Map 10/ Table 8). Currently, no prescribed burns are needed in the Nature Reserve as the veld is too young.
Responsible Party	Fire Breaks The City of Cape Town Veld Age The use of prescribed burns should be assessed in combination with the veld age map (Map 10). Prescribed Burns The City of Cape Town
Time Frame	Firebreaks should be maintained at least once a year prior to the fire season (October). A self-audit should be carried out prior to the start of the fire season (October). Each block should be evaluated to establish its readiness to be burnt with the aid of the veld age map (See Map 10). It has been recommended to burn Atlantis Sand Fynbos every 8-15 years.
Means	Firebreaks should be prepared according to National Veld and Forest Act, No. 101 of 1998, however it is recommended that firebreaks be mowed annually in October, prior to the start of the fire season. Firebreaks should not be wider than 3m, as this is sufficient to allow vehicle access when required. Prescribed burns should be based on sound ecological principles. Alien clearing and fire management should be integrated as to control some invasive alien species. Conversely, following a wildfire, the alien clearing plan should be reviewed to prioritize the recently burnt area for alien clearing.



Management Action 8 – Soil Erosion and Control	
Objective	Conduct a soil erosion assessment on all fence lines, tracks and firebreaks. Management control measures need to be implemented to stabilize the affected areas should any signs of erosion be visible.
Responsible Party	The City of Cape Town
Time Frame	Regularly monitoring should be done by the staff of the Reserve.
Means	Monitor all tracks, fence lines and firebreaks within the Reserve in order to implement control measures as soon as stages of erosion are detected. As soon as erosion is detected, the site must be repaired and the cause of the erosion minimised or stopped where possible. Monitor the affectivity of the erosion control method. Erosion of Roads Map all roads and tracks to determine inappropriate roads that should be closed off and rehabilitated. The method of erosion repair is dependent on the location and type of erosion therefore each case should be assessed individually. Monitor cost effectiveness of maintenance.

Management Action 9 – Invasive Species Management	
Objective	Alien vegetation clearing should be carried out in accordance with the Conservation

	of Agricultural Resources Act No.43 of 1983. Manage invasive species in accordance with the Alien Clearing Schedule (See Table 8).
Current Status	The invasive alien trees were not managed before the site became a Nature Reserve thus there are areas of high infestation. Invasive species management was implemented in 2012 and continues.
Responsible Party	The City of Cape Town
Time Frame	Implement according to Alien Clearing Schedule (See Table 8)
Means	Invasive species schedule should include: • A map (Map 11) outlining the perimeter and Management Blocks. • Identify and map all alien and invasive flora and determine densities and age in the various management blocks. • The clearing schedule and method should follow the best practice as defined by the City of Cape Town's Invasive Unit. • Keep record of clearing operations, especially the cost of each cleared block as to determine cost effectiveness of clearing. Actual costs should also be compared with planned costs for a given area/ year to assist in future budgeting. • Only trained personnel should be used for alien clearing. Prevent the introduction of invasive alien species by ensuring surrounding landowners are aware of relevant legislation. Brush Piles • Brush piles are only to be burnt in the cool winter months to prevent soil damage. • Brush piles should be stacked at least 5m wide, 5m high and at least 5m apart. • Each stack should be ignited one at a time using drip torches with a diesel/petrol mix. • Light branches should be stacked separately from heavy timber as to prevent intensely hot fires and consequent soil damage. • Stockpiles should not be stacked under trees, power and telephone lines or within 30 metres of a fire belt. Footpaths After alien clearing has occurred in the various management blocks, unnecessary footpaths should be rehabilitated. This can be achieved by placing branches over the degraded area to prevent further damage (See Map 12).



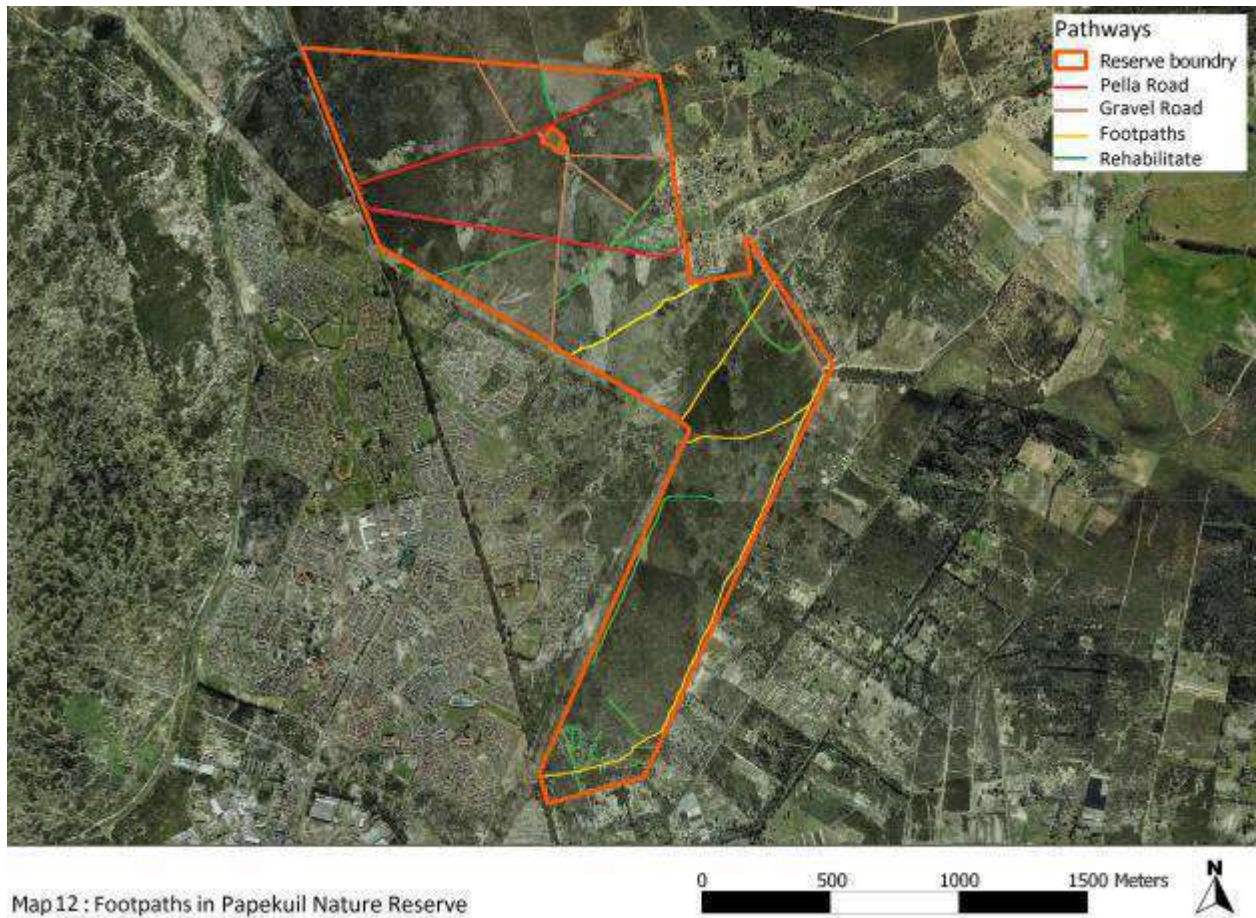


Table 8: Invasive Species, Densities and Age (to be updated annually, or as information changes)

Block	Hectare	Initial Density	Dominant Species	Initial	F1	F2	F3	F4	F5	Date of Fire
PO 1	112	55	Port Jackson	May 2012	January 2013					
PO 2	20	20.02	Port Jackson	August 2012	March 2013					
PO 3	18	1.2	Port Jackson	August 2012	March 2013					
PO 4	85	55	Port Jackson	June 2013	December 2013					Burnt Dec 2012
PO 5	42	15	Port Jackson	December 2012	July 2013					
PO 6	63	35	Port Jackson	February 2013	August 2013					Burnt Feb 2013
PO 7	78	51	Port Jackson	December 2012	June 2013					Burnt Dec 2012
PO 8	109	10	Port Jackson	November 2012	May 2013					Burnt Nov 2012
PO 9	39	70	Port Jackson	To be decided						
KD 1	49	70	Port Jackson	November 2013	July 2014					
KD 2	54	10	Port Jackson							
KD 3	84	25	Port Jackson	October 2013	April 2014					
KD 4	124	60	Port Jackson	To be decided						

Management Action 10 – Species Introduction	
Objective	No faunal species are to be introduced until the IRMP is reviewed in five years time. At such time no extra-limital or inappropriate game is to be introduced. Before any game is reintroduced into the Reserve the following procedures must be adhered too: • All introductions need to be in accordance with the necessary permits and permissions of CapeNature. This includes the construction and maintenance of suitable fence according to CapeNature policy, after which a Certificate of Adequate Enclosure (CoAE) will be issued. • Before game is introduced, a feasibility study should be done to determine whether the Reserve's vegetation would be able to support the introduced game.
Responsible Party	The City of Cape Town
Time Frame	To be reviewed in five years time
Means	Faunal Management Plan

Management Action 11 – Water Management	
Objective	All water management within the Nature Reserve must comply with the National Water Act No. 36 of 1998. Abstraction of water from any water source originating within the Nature Reserve must not affect the biodiversity.
Responsible Party	The City of Cape Town
Time Frame	Continuous
Means	Monitoring of water use and abstraction.

Management Action 11 – Strategic Research	
Objective	Monitoring is important to determine the impact of management practices on the vegetation as well as the veld recovery after alien clearing. Therefore it is essential to monitor the effect of management practices so that changes can be made accordingly. Invasive Alien Clearing Actions to be monitored include: effectiveness of operation, follow-up, methods used; compliance with the alien clearing schedule and subsequent environmental damage such as herbicide spillage. Fire Management Actions to be monitored include: the placements and maintenance of fire belts. All fires should be mapped and veld age maps updated.

	The accurate mapping and recording of all veld fires is essential for veld interpretation. The minimum requirement is a simple map indicating the extent of the burn and the date. All data is to be uploaded onto the Biodiversity Database (biodiversity@capetown.gov.za). Game Management Game counts should be done to determine densities. Game activities should be monitored. Vegetation and Threatened Plant Species Monitor rare and threatened plant species. Monitor flower harvesting and implement a Harvesting Feasibility Study. Tourism Monitor tourism related impacts on vegetation recovery and adapt management practices accordingly.
Responsible Party	The City of Cape Town Assistance from Custodians of Rare and Endangered Wild Flowers (CREW)
Time Frame	Yearly
Means	Fixed-Point Photography Fixed-point photography should be used to determine plant species and densities in and around the Reserve. A record sheet is completed at each of the photo sites (See Appendix 6). A harvesting feasibility study is required to determine the impact of flower harvesting on vegetation survival. Indicators should be established for monitoring purposes. Analyse gathered data, re-access management practices and implement adaptive management strategies. Currently, no species have been identified for regular monitoring.

11.2 Annual Plan of Operation

Management Intervention	Management Action	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Alien Clearing	Initial clearing												
	1st Follow-up	6 months after Initial clearing											
	Maintenance Sweep												
Fire Management:	Fire Break Maintenance												
	Unplanned fire response												
	Scheduled Blockburn	Assess in 2018 only											
Infrastructure maintenance:	Tracks - maintenance												
	Fences - put up												
	- maintenance												
Monitoring & Evaluation:	Baseline data collection												
	Post fire monitoring	To occur for, 3 months after any fire											
	Threatened Plants												
	Fixed point photography												
Other management interventions:	Erosion control												
	Restoration (eg: planting)												
	Law enforcement (trespassing / illegal harvesting and hunting)												
	Litter pick up												
Annual review	CCT to review APO and plan next APO.												

Colour indicates responsibility

Red: Managing Authority

Blue: CapeNature

Green: Both

Comment from CapeNature on the Biodiversity Offset



SCIENTIFIC SERVICES

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reference SSD14/2/6/1/4/1/1183-0&4_gas power_Atlantis
date 1 February 2016

CSIR
P.O. Box 320
Stellenbosch
7599

Attention: Kelly Stroebel
By email: kstroebel@csir.co.za

Dear Kelly

**Draft Scoping Report for the Proposed Atlantis Gas-to-Power Project on Portion 1 of
Portion 4 of Cape Farm 1183, Atlantis, Cape Town
(CSIR ref. no.: CSIR/CAS/EMS/ER/2015/0010/A)**

CapeNature would like to thank you for the opportunity to comment on the proposed development and would like to make the following comments. Please note that our comments only pertain to the biodiversity related impacts and not to the overall desirability of the proposed development.

The proposed development entails the acquisition of development rights to develop a gas power project, which will then be provided to an independent power producer. CapeNature did comment on the background information document (BID) for the proposed project, in which we discussed the biodiversity offset process that has been undertaken as part of an approval process for both of the alternative sites for the proposed development.

As a result of the biodiversity offset process described above, the impacts on biodiversity, specifically with respect to loss of habitat were addressed. In terms of the specialist studies proposed for the EIA Phase, there are none related to biodiversity, which CapeNature agrees with due to existing approvals for the properties, along with the biodiversity offset.

CapeNature does however recommend that the EIA Report must include a thorough description of how these impacts have been addressed through the previous application and associated biodiversity offset process. Reference can be made to the previous studies and subsequent negotiations. This has been briefly described in Section 3.3.8 of the Draft Scoping Report.

In terms of the description of potential freshwater features on the proposed properties, this has been included under 3.3.4 Agricultural Capability and Sensitivity. Reference was made to the botanical specialist study undertaken for the previous approval.

As referred to, the only wetland mapped by NFEPA is the artificial stormwater pond in the south west of Site Alternative 2. However, the Biodiversity Network for the City of Cape Town also mapped a natural wetland in the centre of Site 2. The botanical specialist ground-truthed this feature for the previous study, and only encountered a grassy area with aliens and did not identify it as a wetland. It is assumed that this was based on the species

The Western Cape Nature Conservation Board trading as CapeNature
Board Members: Prof Gavin Maneveldt (Chairperson), Mr Carl Lotter (Vice Chairperson), Mr Mervyn Burton, Prof Francois Hanelkom,
Dr Bruce McKenzie, Ms Merle McOmbring-Hodges, Adv Mandla Mdludlu, Mr Danie Nel, Prof Aubrey Redinghuls, Mr Paul Slack

composition. The botanical specialist did however identify another small stormwater detention excavation on Site 2.

Based on the above information, CapeNature is satisfied that a freshwater specialist study is not required, as the small excavation is not natural or of noteworthy biodiversity value. However, the stormwater management on the site could potentially impact on the groundwater, and ultimately freshwater features, therefore it must be ensured that stormwater management is adequately addressed. While it is acknowledged that a detailed stormwater management plan cannot be designed yet, as there are no detailed project plans yet either, sufficient information must be provided indicating the overall plans for stormwater management and placement of detention ponds.

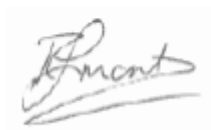
While a biodiversity offset has been obtained for the entire property for both alternative sites, therefore implying complete loss of habitat, the design of the facility should still be informed by the all of the studies undertaken to date and provide general guidelines.

It is noted that Site 2 was selected as the preferred alternative, based on socio-economic factors. As described above both sites were offset therefore, the terrestrial biodiversity impacts can be considered equivalent. Site 2 does however have the presence of the stormwater ponds, therefore it must be ensured that this aspect is adequately addressed.

CapeNature had mentioned in our comments on the BID that the impact on avifauna on the connecting powerlines must be addressed. It is noted that connecting powerlines have not been included as part of this application.

CapeNature reserves the right to revise initial comments and request further information based on any additional information that may be received.

Yours sincerely



Rhett Smart
For: Manager (Scientific Services)



CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

Making progress possible. Together.

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX S:

Other Information

1. Amended Application form (submitted with the Draft EIR to DEA 22 March 2017)

APPLICATION FORM FOR ENVIRONMENTAL AUTHORISATION

File Reference Number:	(For official use only)
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), (the Act) and the Environmental Impact Assessment Regulations, 2014 (the Regulations)

PROJECT TITLE

Scoping and Environmental Impact Assessment for the proposed Atlantis Gas-to-Power facility on Portion 1 of Portion 4 of Cape Farm 1183, Western Cape

Indicate if the **DRAFT** report accompanies the application

Yes X
No

Kindly note that:

1. This application form is current as of 1 April 2016. It is the responsibility of the applicant to ascertain whether subsequent versions of the form have been published or produced by the competent authority.
2. The application must be typed within the spaces provided in the form. The sizes of the spaces provided are not necessarily indicative of the amount of information to be provided. Spaces are provided in tabular format and will extend automatically when each space is filled with typing.
3. Where applicable **black out** the boxes that are not applicable in the form.
4. The use of the phrase "not applicable" in the form must be done with circumspection.
5. This application must be handed in at the offices of the National Department of Environmental Affairs where the Minister is the competent authority in respect of the application.
6. No faxed or e-mailed applications will be accepted. An electronic copy (in the form of a CD) of the signed application form must be submitted together with two hardcopies (one of which must contain the original signatures).
7. Unless protected by law, all information filled in on this application form may become public information on receipt by the competent authority.
8. Should a specialist report or report on a specialised process be submitted at any stage for any part of this application, the terms of reference for such report and declaration of interest of the specialist must also be submitted.
9. Proof of payment must accompany this application. The application will not be processed without proof of payment unless one of the exclusions provided for the Fee Regulations (Fees for consideration and processing of applications for environmental authorisations and amendments thereto Government Notice No.141, published on 28 February 2014) is applicable AND such information in section 1 of this application form has been confirmed by this Department.

Departmental Details

The application must be addressed to the Chief Directorate: Integrated Environmental Authorisations at:

Postal address:

Department of Environmental Affairs
Attention: Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:

Department of Environmental Affairs
Attention: Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia
Pretoria

Queries must be addressed to the contact below:

E-mail: EIAAdmin@environment.gov.za

Please note that this form must be copied to the relevant provincial environmental department/s.

View the Department's website at <http://www.environment.gov.za/> for the latest version of the documents.

1. PROOF OF PAYMENT

Applicants are required to tick the appropriate box below to indicate that either proof of payment is attached or that, in the applicant's view, an exclusion applies. Proof and a motivation for exclusions must be attached to this application form in **Appendix 1**.

Proof of payment attached as **Appendix 1** ☐

Exclusion applies ☒

An applicant is excluded from paying fees if:

The activity is a community based project funded by a government grant; or
The applicant is an organ of state.

TYPE OF EXCLUSION	Tick where applicable. Proper motivation must be attached to the application
The activity is a community based project funded by a government grant	
The applicant is an organ of state	✓

FEE AMOUNT	Fee
Application for an environmental authorisation for which basic assessment is required in terms of the Environmental Impact Assessment Regulations	R2 000
Application for an environmental authorisation, for which S&EIR is required in terms of the Environmental Impact Assessment Regulations	R10 000

Department of Environmental Affairs' details for the payment of application fees:

Payment Enquiries: Tel: 012 399 9119 Email: eiafee@environment.gov.za Banking details: ABSA Bank Branch code: 632005 Account number: 1044 2400 72 Current account Reference number : Reference number to be provided in the specific format indicating centre point coordinates of site in decimal degrees to 5 or 6 decimal places: latitude/longitude eg. -33.918861/18.423300 Proof of payment must accompany the application form: Indicate reference number below. Tax exemption status: Status: Tax exempted Reference number:

2. PROJECT DESCRIPTION

Please provide a **detailed** description of the project.

South Africa is an energy intensive country, largely as a result of our historic economic focus on energy intensive industries such as mining and primary metal processing. With current energy and electricity demands projected to continue increasing, new investments in electricity generation capacity are required. Future increases in electricity demand are particularly expected for the regions around the Western Cape. In terms of the New Generation Regulations, the Integrated Resource Plan (IRP) will be developed by the Department of Energy and will set out the new generation capacity requirement per technology, taking energy efficiency and the demand-side management projects into account. The introduction of private sector generation has multiple benefits and will contribute greatly to the diversification of both the supply and nature of energy production and enable the benchmarking of performance and pricing.

Liquefied Natural Gas (LNG) has a significantly lower emission profile than coal fired power, in addition this green technology can provide balancing power for an increased roll out of renewable energy. If this project is successful, a key off-taker of LNG will allow a regional gas economy to develop around it, unlocking more fuel switching opportunities and a significantly lower emissions path for South Africa.

It is important to point out at the outset that the exact specifications of the proposed project components will be determined during the detailed engineering phase.

Linked to enhancing energy production within South Africa, the Atlantis gas-to-power facility proposed by The City of Cape Town will cover an approximate area of 38.65 hectares (ha).

The proposed project will make use of Open Cycle Gas Turbines (OCGT), Combined Cycle Gas Turbine (CCGT) or gas engine technologies to generate electricity from natural gas. The Applicant is proposing to develop a facility with a possible maximum installed capacity of 1500 MW.

The gas-to-power facility will consist of the following components:

- Up to 4 Combustion turbine and generator sets producing approximately 400 MW each (max 1500 MW)
- Heat recovery steam generators;
- Dry cooling radiator systems/cooling towers
- Building Infrastructure:
 - Offices;
 - Operational and maintenance control centre;
 - Warehouse/workshop;
 - Ablution facilities;
 - On-site substation building; and
 - Guard House.
- Associated Infrastructure
 - Associated electrical infrastructure at the Eskom Omega Substation (including but not limited to transmissions lines to the Omega Substation)
 - Access roads;
 - Internal roads;
 - Fencing;
 - Maintenance and cleaning area;
 - Stormwater channels;
 - Water pipelines; and
 - Temporary work area during the construction phase (i.e. laydown area).

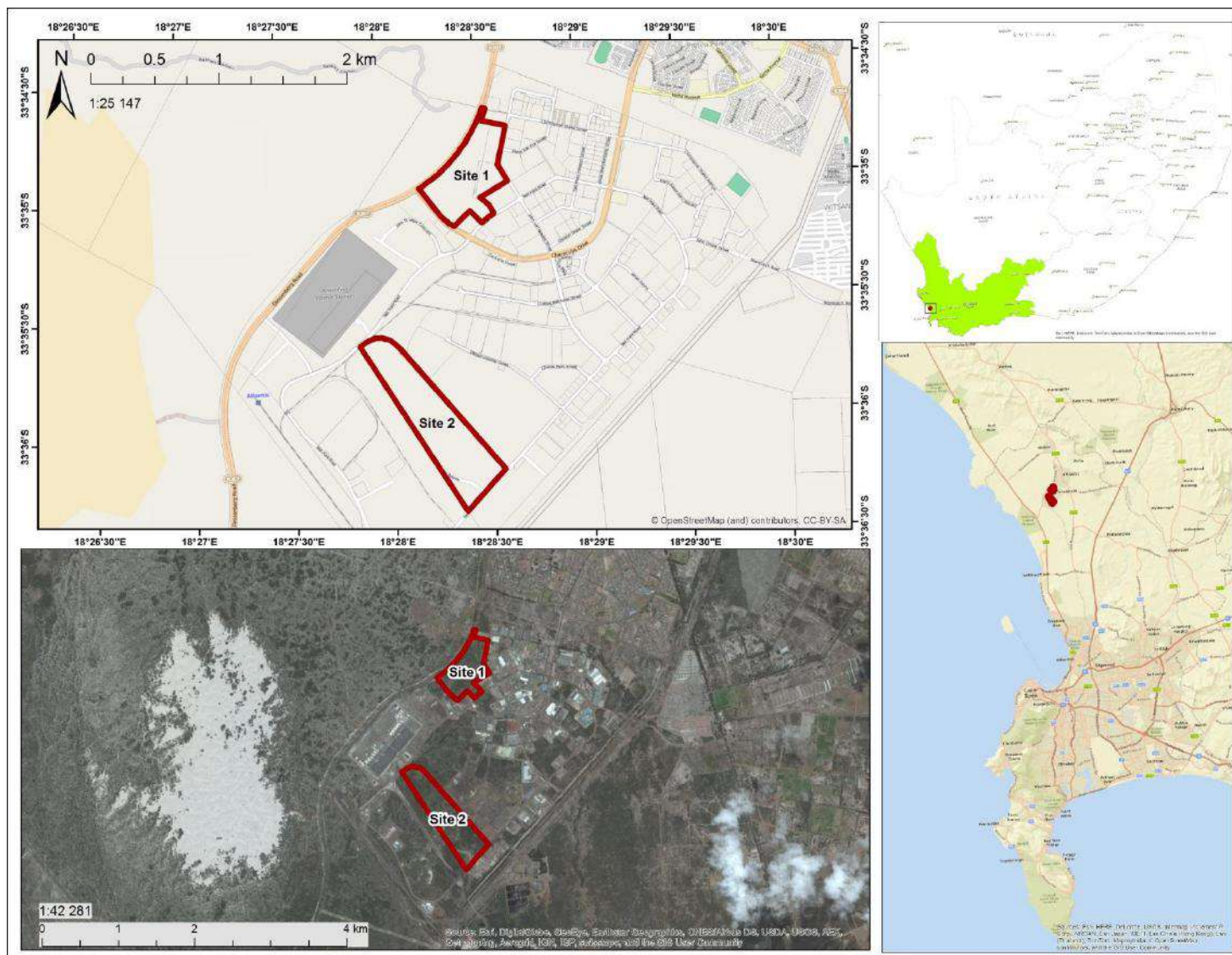


Figure 1: Locality of the proposed Atlantis Gas-to-Power facility (site 2 is preferred alternative)

Does the project form part of any of the Strategic Infrastructure Projects (SIPs) as described in the National Development Plan, 2011?	YES	

If YES, please indicate which SIPs are applicable in **Appendix 2**. You are also required to provide confirmation of SIP applications from the relevant sector representative which must be attached in **Appendix 2**

Is the project subject to the Integrated Resource Plan 2010 – 2030 (IRP) bidding process?		NO

Please indicate which sector the project falls under by crossing out the relevant block in the table below:

Table 1

Green economy + “Green” and energy-saving industries		Greenfield transformation to urban or industrial form (including mining)	
Infrastructure – electricity (generation, transmission & distribution)	✓	Biodiversity or sensitive area related activities	
Oil and gas	✓	Mining value chain	

Biofuels		Potential of metal fabrication capital & transport equipment – arising from large public investments	
Nuclear		Boat building	
Basic services (local government) – electricity and electrification		Manufacturing – automotive products and components, and medium and heavy commercial vehicles	
Basic services (local government) – area lighting		Manufacturing – plastics, pharmaceuticals and chemicals	
Infrastructure – transport (ports, rail and road)		Manufacturing – clothing textiles, footwear and leather	
Basic services (local government access roads)		Forestry, paper, pulp and furniture	
Basic services (local government) – public transport		Business process servicing	
Infrastructure – water (bulk and reticulation)		Advanced materials	
Basic services (local government) – sanitation		Aerospace	
Basic services (local government) – waste management		Basic services (local government) – education	
Basic services (local government) water		Basic services (local government) – health	
Agricultural value chain + agro-processing (linked to food security and food pricing imperatives)		Basic services (local government) - housing	
Infrastructure – information and communication technology		Basic services (local government) security of tenure	
Tourism + strengthening linkages between cultural industries and tourism		Other	
Basic services (local government) – public open spaces and recreational facilities			

Table 2

Does the listed activity/ies applied for form part of a larger project which is not a listed activity itself e.g. a road that is a listed activity that is needed to access a drilling site where the drilling does not constitute a listed activity.		NO
If indicated yes above, please provide a brief description on how the activity/ies relate to the larger project that forms part there of:		

3. GENERAL INFORMATION

Applicant name:	City of Cape Town Metropolitan Municipality (CoCT)
Registration number (if applicant is a company)	N/A
BBBEE Status	Level 4
Trading name (if any)	N/A

Responsible person name (If the applicant is a company):	Andre Alfred Human		
Applicant/ Responsible person ID number:	5704035023086		
Responsible position, e.g. Director, CEO, etc.:	Manager: Property Development		
Physical address:	13 th Floor, Civic Centre, 12 Hertzog Boulevard, cape Town		
Postal address:	Private Bag X9181		
Postal code:	8001	Cell:	084 208 3524
Telephone:	021 400 2366	Fax:	021 4195303
E-mail:	andre.human@capetown.gov.za	BBBEE status	N/A

Provincial Authority:	Department of Environmental Affairs & Development Planning		
Contact person:	Fernel Abrahams		
Postal address:	Private Bag X9086		
Postal code:	8000	Cell:	-
Telephone:	021 483 4091	Fax:	021 483 3016
E-mail:	fernel.abrahams@westerncape.gov.za		

Local municipality	N/A
Contact person:	
Postal address:	
Postal code:	
Telephone:	
E-mail:	

In instances where there is more than one local authority involved, please attach a list of those local authorities with their contact details as **Appendix 3**.

Landowner:	N/A (Applicant is land owner)
Contact person:	
Postal address:	
Postal code:	
Telephone:	
E-mail:	

In instances where there is more than one landowner, please attach a list of those landowners with their contact details as **Appendix 4**. If the applicant is not the owner or person in control of the land, proof of notice to the landowner or person in control of the land on which the activity is to be undertaken must be submitted in **Appendix 4**.

Identified Competent Authority to consider the application:	National Department of Environmental Affairs (DEA)
Reason(s) in terms of S 24C of NEMA 1998 as amended	The National Department of Environmental Affairs (DEA) in Pretoria will be the competent authority (CA). This is based on a directive that was issued by the (then) Dept. of Minerals and Energy (DME) in 2009 indicating that all energy-related EIAs must be fast-tracked and that National DEA must be the CA. Since the project is in support of the development of an energy project, the responsibility of deciding whether to grant Environmental Authorisation remains with the DEA.

4. ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) INFORMATION

EAP company name:	Council for Scientific and Industrial Research (CSIR)			
B-BBEE	Contribution level (indicate 1 to 8 or non compliant)	Level 2	Percentage Procurement recognition	110%
Professional affiliation/registration:	IAIAsa, Cand.Sci.Nat (Registration no.: 100151/14)			
Contact person:	Ms. Kelly Stroebel			
Company:	Council for Scientific and Industrial Research (CSIR)			
Physical address:	11 Jan Celliers Road, Stellenbosch			
Postal address:	PO Box 320, Stellenbosch			
Postal code:	7599	Cell:	082 660 1907	
Telephone:	021 888 2432	Fax:	021 888 2473	
E-mail:	kstroebel@csir.co.za			

The appointed EAP must meet the requirements of Regulation 13 of GN R.982, dated December 2014. The declaration of independence of the EAP and undertaking under oath or affirmation that all the information submitted or to be submitted for the purposes of the application is true and correct must be submitted as **Appendix 9**.

5. SITE DESCRIPTION

Provide a detailed description of the site involved in the application.

Province	Western Cape Province
District Municipality	City of Cape Town Metropolitan Municipality
Local Municipality	N/A
Ward number(s)	Ward 32 (Atlantis Industrial)
Nearest town(s)	Atlantis
Farm name(s) and number(s)	Cape Farm 1183
Portion number(s)	Portion 1 of Portion 4

SG 21 Digit Code(s)

(If there are more than 4, please attach a list with the rest of the codes as **Appendix 5**)

C	0	1	6	0	0	0	0	0	0	0	0	1	1	8	3	0	0	0	0	4
C	0	1	6	0	0	0	0	0	0	0	0	1	1	8	3	0	0	0	0	1
1	2			3			4				5									

Are there any other applications for Environmental Authorisation on the same property?	YES	
If YES, please indicate the following:		
Competent Authority	Western Cape Department of Environmental Affairs and Development Planning	
Reference Number	16/3/1/1/A1/2/3036/12	
Project Name	The proposed Green Technology manufacturing cluster industrial development and associated infrastructure on portion 4 and portion 1 of farm 1183, Atlantis.	
Please provide details of the steps taken to ascertain this information:		
Proof of Environmental Authorization provided to the EAP by the applicant (City of Cape Town).		

6. ACTIVITIES TO BE AUTHORISED

For an application for authorisation that involves more than one listed activity that, together, make up one development proposal, all the listed activities pertaining to this application must be indicated.

Detailed description of listed activities associated with the project	
Listed activity as described in GN R 983, 984 and 985	Description of project activity that triggers listed activity
GN R.983 Activity 11: The development of facilities or infrastructure for the transmission and distribution of electricity (i) Inside an urban area or industrial complex with a capacity of 275 kilovolts or more.	The site is zoned "General Industrial" and falls within the Atlantis Industrial Complex. Powerlines will be incorporated into the project to evacuate power from site to the Omega-Sterrekus Substation (approximately 13 km south of the Atlantis area on the farm Groot Olifantskop 81).
GN R.983 Activity 41: The expansion of facilities or infrastructure for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.	The proposed project will potentially result in the need for the transmission lines from Ankerlig power station to the existing Omega Substation (approximately 13 km south of the Atlantis area on the farm Groot Olifantskop 81) to be expanded to include a greater capacity for this proposed facility.
GN R.984 Activity 2: The development and related operation of facilities or infrastructure for the generation of electricity from a non-renewable resource where the electricity output is 20 megawatts or more.	The proposed Atlantis gas-to-power facility will produce up to a maximum of 1500 MW via the use of liquefied natural gas to generate electricity through open or closed cycle gas turbines.
GN R.984 Activity 5: The development and related operation of facilities or infrastructure for the refining, extraction or processing of gas, oil or petroleum products with an installed capacity of 50 cubic metres or more per day, excluding – (i) facilities for the refining, extraction or processing of gas from landfill sites; or (ii) the primary processing of a petroleum resource in which case activity 22 in this Notice applies.	The proposed project will entail the construction of a facility and all associated components for the refining and processing of gas in LNG form. This gas resource intake will exceed 50 cubic meters per day for the expected maximum output of 1500 MW.
GN R.984 Activity 6: The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent, excluding (i) activities which are identified and included in Listing Notice 1 of 2014 (ii) activities which are included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the	The proposed Gas-to-Power facility will involve the processing of LNG to generate electricity, this will result in certain levels of air emissions and thus an Air Emissions License may be required.

National Environmental Management: Waste Act, 2008 applies; or (iii) The development of facilities or infrastructure for the treatment of effluent, wastewater or sewage where such facilities have a daily throughput capacity of 2000 cubic metres or less.	
GN R.984 Activity 9: The development of facilities or infrastructure for the transmission and distribution of electricity with a capacity of 275 kilovolts or more, outside an urban area or industrial complex.	The proposed gas-to-power facility will require transmission of electricity to the nearby substation.
GN R.984 Activity 15: The clearance of an area of 20 hectares or more of indigenous vegetation, excluding where such clearance of indigenous vegetation is required for- (i) the undertaking of a linear activity; or (ii) Maintenance purposes undertaken in accordance with a maintenance management plan.	The proposed project may entail the excavation, removal and moving of more than 20 ha of indigenous vegetation on Portions 1 and 4 of Cape Farm 1183 in Atlantis Industrial.
GN R.984 Activity 28: Commencing of an activity, which requires an atmospheric emissions license in terms of section 21 of NEM:AQA, 2004, (Act no. 39 of 2004)- Excluding: i) Activities which are identified in Listing Notice 1 of 2015 ii) Activities which are included in the list of waste management activities in section 19 of NEM:WA.	This project will require an Air Emissions License as per section 21 of NEM:AQA, 2004, (Act no. 39 of 2004).
GN R.985 Activity 12: The clearance of 300 square meters or more of indigenous vegetation except where such clearance is required for the maintenance purposes undertaken in accordance with a maintenance management plan. (a) In the Western Cape- i. Within any critically endangered or endangered ecosystem in terms of section 52 of the NEMBA	The proposed project will entail the removal of 38.65 ha of indigenous vegetation which consists of the following ecosystems: 1. Cape Flats Dune Strandveld (CFDS): an ENDANGERED ecosystem, covering almost the entire site; and 2. Atlantis Sand Fynbos (ASF): a CRITICALLY ENDANGERED ecosystem, covering a small section along southern boundary.

Please note that any authorisation that may result from this application will only cover activities specifically applied for. Co-ordinate points indicating the location of each listed activity must be provided with the relevant report (i.e. either BAR or EIR).

Please provide a project map indicating any sensitive areas (e.g. critical biodiversity area, World Heritage Site, etc.) overlaid by the study area in **Appendix 6**.

A project schedule, indicating the different phases and timelines of the project, must be attached as **Appendix 7**.

7. PUBLIC PARTICIPATION

Provide details of the public participation process proposed for the application as required by Regulation 41(2) of GN R .982, dated December 2014.

The integrated PPP will include the following:

▪ **Advertisements:**

Adverts were placed in the following newspapers:

Newspaper	Language	Date
Cape Times	English	08/10/2015
Die Burger	Afrikaans	08/10/2015

▪ **Site Notices:**

Regulation 41 (2) (a) of the 2014 EIA Regulations require that a notice board providing information on the project and EIA Process is fixed at a place that is conspicuous to and accessible by the public at the boundary, on the fence or along the corridor of the site where the application will be undertaken or any alternative site. To this end, A3 site notice boards were placed at 2 locations on the boundaries of the site.

These site notice boards have been placed for the commencement of the Scoping and EIA Process. A copy of the notice boards and proof of placement thereof will be included in the Scoping and EIA Reports.

▪ **Written Notices:**

Project Announcement documents including a Background Information Document (BID) and comment and registration form (Dated 7 September 2015) were sent by post/email to all pre-identified key stakeholders on the database (where postal and physical addresses are available), which at the time consisted of 55 I&APs. This provided I&APs with a 30-day period to register their interest on the project database. The purpose of the BID was to inform the public of the proposed project, provide information on the project description, the EIA Processes and to provide an overview of the opportunities and mechanisms for public participation.

In order to accommodate the varying needs of I&APs and develop their capacity to participate in the process, information sharing forms an integral and ongoing component of the EIA Process to ensure effective public participation. The following provides an overview of how information sharing is being effected throughout the EIA Process in order to develop the capacity of I&APs to effectively engage in the PPP:

- **Website** – placing EIA related project information on the project website (<http://www.csir.co.za/AtlantisEIA/>)
- **Language** – encouraging I&APs to use the language of their choice at meetings or during telephonic discussions and providing translations at meetings in Afrikaans, when required;
- **BID (September 2015)** – which contains information on the proposed project, the EIA Process and PPP;
- **Newspaper Advertisements** - requesting I&APs to register their interest in the project, raise issues of concern or notifying I&APs of potential public meetings (if required to be held);
- **Letters to I&APs** - notifying them of the various stages of the EIA Process, availability of reports for comment and inviting them to attend potential public meetings (if required to be held). These letters will be sent via registered mail and email (where postal, physical and email addresses are available for I&APs and organs of state on the project database);
- **Report Distribution** – Electronic copies of reports will be loaded onto the project website for access. Key organs of state will be provided with hard copies and/or electronic copies of the reports;
- **Public Meetings** – no public meetings are proposed during the Scoping Phase, however a meeting could possibly be held during the review of the EIA Report if warranted and if there is

substantial public interest during the EIA Phase. Furthermore, telephonic consultations with key I&APs will take place, upon request; and

- **Focus Group Meetings** – may be undertaken (depending on the interest in the projects) with key I&AP groups (Councillors, ratepayers association, surrounding landowners, affected organs of state, environmental organisations).

Documents will continuously be uploaded onto the project website (<http://www.csir.co.za/AtlantisEIA/>) mas and when they become available. I&APs will be notified accordingly.

Regulation 41 (2) (e) of the GN R982 states “*using reasonable alternative methods, as agreed to by the competent authority, in those instances where a person is desiring of but unable to participate in the process due to (i) illiteracy; (ii) disability; or any other disadvantage*”. This particular regulation is not applicable at this stage, however it will be complied with as agreed by the Competent Authority should the need arise as part of the PPP.

General

- I&APs on the project database will be notified of the application for the proposed activities via registered mail and email (where postal, physical and email addresses are available).
- All project information throughout the EIA Processes will be made available to I&APs through a project website.
- Telephonic consultations will take place with I&APs as required. Notes of telephonic consultations will be kept and included in the relevant reports.

The I&AP database will be regularly updated throughout the EIA Processes to indicate, amongst others, requests to register interest, correspondence sent to I&APs and comments received from I&APs.

8. OTHER AUTHORISATIONS REQUIRED

LEGISLATION	AUTHORISATION REQUIRED		APPLICATION SUBMITTED	
SEMA				
National Environmental Management: Air Quality Act	YES*	NO	YES	NO
To be determined				
National Environmental Management: Biodiversity Act		NO*		NO
Biodiversity offset secured for this site				
National Environmental Management: Integrated Coastal Management Act		NO		NO
National Environmental Management: Protected Areas Act		NO		NO
National Environmental Management: Waste Act		NO		NO
National legislation				
Mineral Petroleum Development Resources Act*	YES*	NO	YES	NO
To be determined				
National Water Act		NO		NO
National Heritage Resources Act		NO*		NO
Confirmation by HWC for previous authorization				
Others: Please specify				

If authorisation is necessary in terms of the National Environmental Management: Waste Act, please contact the Department for guidance on the Integrated Permitting System.

Note that in terms of sections 7B and 7C of the National Environmental Management: Integrated Coastal Management Act, 2008 (Act No. 24 of 2008) ICMA, a pre-approval for a reclamation application

in terms of the ICMA should first be issued by the Minister prior to the submission of a NEMA Chapter 5 EA application to the NEMA competent authority (CA).

9. LIST OF APPENDICES

		SUBMITTED	
Appendix 1	Motivation for exclusion	YES	
Appendix 1	Strategic Infrastructure Projects	YES	
Appendix 2	List of Local Municipalities (with contact details)		N/A
Appendix 3	List of land owners (with contact details) and proof of notification of land owners.		N/A
Appendix 4	List of SGIDs		N/A
Appendix 5	Project map	YES	
Appendix 6	Project schedule	YES	
Appendix 7	Declaration of Applicant	YES	
Appendix 9	Declaration of EAP and undertaking under oath or affirmation	YES	

APPENDIX 1
PROOF OF PAYMENT/ MOTIVATION FOR EXCLUSION



Motivation for exclusion of Application Fee

The City of Cape Town Metropolitan Municipality (applicant and landowner) is exempted from paying the R2000 application fee for application for Environmental Authorization. The reason for exemption is due to the fact that this entity is a Metropolitan Municipality and therefore an organ of state. GreenCape is a sector development agency established by the City and Western Cape Provincial government with the task of unlocking and unblocking opportunities in the Green economy. GreenCape has been appointed as the project management office for the proposed special economic zone (SEZ) in Atlantis.

APPENDIX 2

STRATEGIC INFRASTRUCTURE PROJECTS

SIP 1: Unlocking the northern mineral belt with Waterberg as the catalyst

- Unlock mineral resources
- Rail, water pipelines, energy generation and transmission infrastructure
- Thousands of direct jobs across the areas unlocked
- Urban development in Waterberg - first major post-apartheid new urban centre will be a “green” development project
- Rail capacity to Mpumalanga and Richards Bay
- Shift from road to rail in Mpumalanga
- Logistics corridor to connect Mpumalanga and Gauteng.

SIP 2: Durban-Free State-Gauteng logistics and industrial corridor

- Strengthen the logistics and transport corridor between SA's main industrial hubs
- Improve access to Durban's export and import facilities
- Integrate Free State Industrial Strategy activities into the corridor
- New port in Durban
- Aerotropolis around OR Tambo International Airport.

SIP 3: South-Eastern node & corridor development

- New dam at Mzimvubu with irrigation systems
- N2-Wild Coast Highway which improves access into KwaZulu-Natal and national supply chains
- Strengthen economic development in Port Elizabeth through a manganese rail capacity from Northern Cape
- A manganese sinter (Northern Cape) and smelter (Eastern Cape)
- Possible Mthombo refinery (Coega) and transshipment hub at Ngqura and port and rail upgrades to improve industrial capacity and performance of the automotive sector.

SIP 4: Unlocking the economic opportunities in North West Province

- Acceleration of investments in road, rail, bulk water, water treatment and transmission infrastructure
- Enabling reliable supply and basic service delivery
- Facilitate development of mining, agricultural activities and tourism opportunities
- Open up beneficiation opportunities in North West Province.

SIP 5: Saldanha-Northern Cape development corridor

- Integrated rail and port expansion
- Back-of-port industrial capacity (including an IDZ)
- Strengthening maritime support capacity for oil and gas along African West Coast
- Expansion of iron ore mining production and beneficiation.

SIP 6: Integrated municipal infrastructure project

Develop national capacity to assist the 23 least resourced districts (19 million people) to address all the maintenance backlogs and upgrades required in water, electricity and sanitation bulk infrastructure. The road maintenance programme will enhance service delivery capacity thereby impacting positively on the population.

SIP 7: Integrated urban space and public transport programme

Coordinate planning and implementation of public transport, human settlement, economic and social infrastructure and location decisions into sustainable urban settlements connected by densified transport corridors. This will focus on the 12 largest urban centres of the country, including all the metros in South Africa. Significant work is underway on urban transport integration.

SIP 8: Green energy in support of the South African economy Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP2010) and support bio-fuel production facilities. <i>Indicate capacity in MW:</i>	
SIP 9: Electricity generation to support socioeconomic development Accelerate the construction of new electricity generation capacity in accordance with the IRP2010 to meet the needs of the economy and address historical imbalances. Monitor implementation of major projects such as new power stations: Medupi, Kusile and Ingula. <i>Indicate capacity in MW:</i>	✓
SIP 10: Electricity transmission and distribution for all Expand the transmission and distribution network to address historical imbalances, provide access to electricity for all and support economic development. Align the 10-year transmission plan, the services backlog, the national broadband roll-out and the freight rail line development to leverage off regulatory approvals, supply chain and project development capacity.	
SIP 11: Agri-logistics and rural infrastructure Improve investment in agricultural and rural infrastructure that supports expansion of production and employment, small-scale farming and rural development, including facilities for storage (silos, fresh-produce facilities, packing houses); transport links to main networks (rural roads, branch train-line, ports), fencing of farms, irrigation schemes to poor areas, improved R&D on rural issues (including expansion of agricultural colleges), processing facilities (abattoirs, dairy infrastructure), aquaculture incubation schemes and rural tourism infrastructure.	
SIP 12: Revitalisation of public hospitals and other health facilities Build and refurbish hospitals, other public health facilities and revamp 122 nursing colleges. Extensive capital expenditure to prepare the public healthcare system to meet the requirements of the National Health Insurance (NHI) system. The SIP contains major builds for 6 hospitals.	
SIP 13: National school build programme A national school build programme driven by uniformity in planning, procurement, contract management and provision of basic services. Replace inappropriate school structures and address basic service backlog and provision of basic services under the Accelerated School Infrastructure Delivery Initiative (ASIDI). In addition, address national backlogs in classrooms, libraries, computer labs and admin buildings. Improving the learning environment will strengthen outcomes especially in rural schools, as well as reduce overcrowding.	
SIP 14: Higher education infrastructure Infrastructure development for higher education, focusing on lecture rooms, student accommodation, libraries and laboratories, as well as ICT connectivity. Development of university towns with a combination of facilities from residence, retail to recreation and transport. Potential to ensure shared infrastructure such as libraries by universities, FETs and other educational institutions. Two new universities will be built - in Northern Cape and Mpumalanga.	
SIP 15: Expanding access to communication technology Provide for broadband coverage to all households by 2020 by establishing core Points of Presence (POPs) in district municipalities, extend new Infraco fibre networks across provinces linking districts, establish POPs and fibre connectivity at local level, and further penetrate the network into deep rural areas. While the private sector will invest in ICT infrastructure for urban and corporate networks, government will co-invest for township and rural access, as well as for e-government, school and	

health connectivity.

The school roll-out focus is initially on the 125 Dinaledi (science and maths-focussed) schools and 1525 district schools. Part of digital access to all South Africans includes TV migration nationally from analogue to digital broadcasting.

SIP 16: SKA & Meerkat

SKA is a global mega-science project, building an advanced radio-telescope facility linked to research infrastructure and high-speed ICT capacity and provides an opportunity for Africa and South Africa to contribute towards global advanced science projects.

SIP 17: Regional integration for African cooperation and development

Participate in mutually beneficial infrastructure projects to unlock long-term socio-economic benefits by partnering with fast growing African economies with projected growth ranging between 3% and 10%.

The projects involving transport, water and energy also provide competitively-priced, diversified, short and medium to long-term options for the South African economy where, for example, electricity transmission in Mozambique (Cesul) could assist in providing cheap, clean power in the short-term whilst Grand Inga in the DRC is long-term.

All these projects complement the Free Trade Area (FTA) discussions to create a market of 600 million people in South, Central and East Africa.

SIP 18: Water and sanitation infrastructure

A 10-year plan to address the estimated backlog of adequate water to supply 1.4m households and 2.1m households to basic sanitation.

The project will involve provision of sustainable supply of water to meet social needs and support economic growth. Projects will provide for new infrastructure, rehabilitation and upgrading of existing infrastructure, as well as improve management of water infrastructure.

APPENDIX 3 (IF APPLICABLE)
LIST OF LOCAL MUNICIPALITIES

N/A

APPENDIX 4
LIST OF LAND OWNERS
PROOF OF NOTIFICATION OF LAND OWNERS

N/A (Applicant is land owner)

APPENDIX 5 (IF APPLICABLE)
LIST OF SGID

N/A

APPENDIX 6 PROJECT MAP

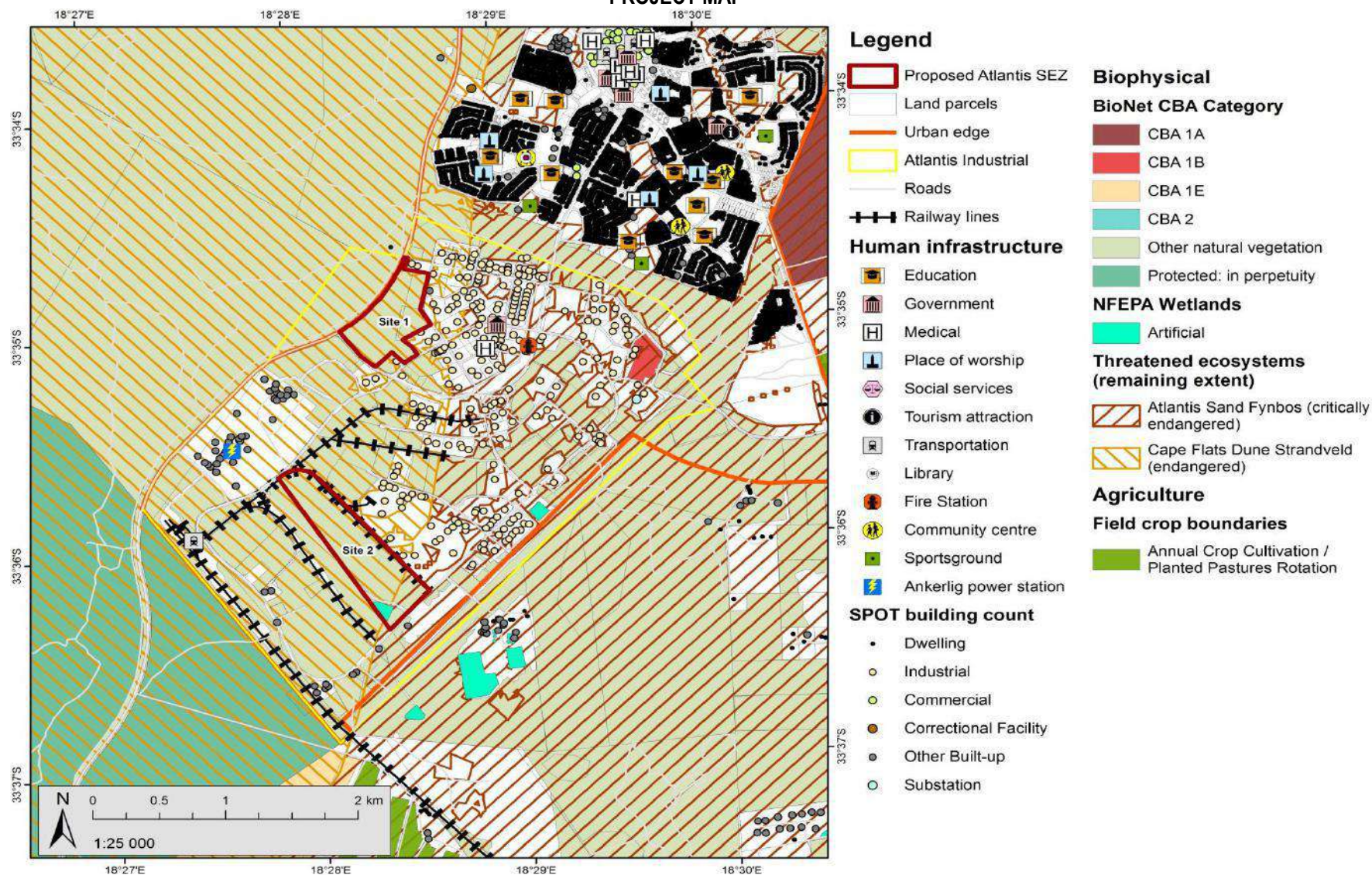


Figure 2: Composite map of the proposed Atlantis Gas-to-Power facility (site 2) showing all potentially sensitive features

APPENDIX 7 PROJECT SCHEDULE

			Sep-16				Oct-16				Nov-16				Dec-16				Jan-17				Feb-17				Mar-17				Apr-17				May-17				Jun-17				Jul-17				Aug-17				Sep-17		
Phase	Task	Days	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3								
Pre-application Phase	Pre-application Meeting	40																																																			
	Prepare Application & Draft Scoping Report																																																				
Scoping Phase	Submit EIA Application	44																																																			
	Submit DSR to CA																																																				
	PPP (Draft Scoping Report)- 30 days																																																				
	Submit Final Scoping Report																																																				
End of scoping phase	CA to accept/refuse SR	43																																																			
EIA Phase	Complie EIR and EMPr	75																																																			
	PPP 2- 30 days																																																				
	Integrate comments into EIR																																																				
	Submit EIR to CA																																																				
End of EIA phase	CA to grant/refuse EA	107																																																			
Notification phase	CA to provide feedback	14																																																			
	Notify I&AP/s of EA decision																																																				
	Total:	323																																																			

2. DEA's acceptance of Scoping and PoS (February 2017)



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

Private Bag X 447 · PRETORIA · 0001 Environment House · 473 Steve Biko Road · Arcadia · PRETORIA
Tel (+ 27 12) 399 9372

DEA Reference: 14/12/16/3/3/2/981

Enquiries: Mmamohale Kabasa

Telephone: (012)399 9420 E-mail: MKabasa@environment.gov.za

Ms Kelly Stroebel
Council for Scientific and Industrial Research
PO Box 320
STELLENBOSCH
7599

Telephone Number: (021) 888 2432
Email Address: kstroebel@csir.co.za

PER E-MAIL / MAIL

Dear Ms Stroebel

ACCEPTANCE OF THE SCOPING REPORT FOR THE PROPOSED 1500 MW ATLANTIS GAS POWER FACILITY ON PORTION 1 OF PORTION 4 OF THE CAPE FARM 1183 WITHIN THE ATLANTIS INDUSTRIAL ZONE OF THE CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY IN THE WESTERN CAPE PROVINCE

The Scoping Report (SR) and Plan of Study for Environmental Impact Assessment (PoSEIA) dated November 2016 and received by this Department on 06 January 2017 refer.

This Department has evaluated the submitted SR and the PoSEIA dated November 2016 and is satisfied that the documents comply with the minimum requirements of the Environmental Impact Assessment (EIA) Regulations, 2014. The SR is hereby accepted by the Department in terms of Regulation 22(a) of the EIA Regulations, 2014.

You may proceed with the EIA process in accordance with the tasks contemplated in the PoSEIA and the requirements of the EIA Regulations, 2014.

All comments and recommendations made by all stakeholders and Interested and Affected Parties (I&APs) in the draft SR and submitted as part of the final SR must be taken into consideration when preparing an Environmental Impact Assessment report (EIAR) in respect of the proposed development. Please ensure that all mitigation measures and recommendations in the specialist studies are addressed and included in the final EIAR and Environmental Management Programme (EMPr).

Please ensure that comments from all relevant stakeholders are submitted to the Department with the final EIAR. This includes but is not limited to the Western Cape Department of Environmental Affairs and Development Planning, the Department of Agriculture, Forestry and Fisheries (DAFF), the provincial Department of Agriculture, SENTECH, the Department of Transport, the Department of Water and Sanitation (DWS), the South African National Roads Agency Limited (SANRAL), the South African Heritage Resources Agency (SAHRA), the Endangered Wildlife Trust (EWT), BirdLife SA, the Department of Mineral Resources, Cape Nature and the Department of Environmental Affairs: Air Quality Management and Biodiversity and Conservation Directorates.

You are also required to address all issues raised by Organs of State and I&APs prior to the submission of the EIAr to the Department.

Please ensure that the EIAr and EMPr comply with Appendix 3 and Appendix 4 of Regulation 2014, before submission to the Department. You are also required to address all issues raised by organs of state and I&APs prior to the submission of the EIAr to the Department.

Proof of correspondence with the various stakeholders must be included in the EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.

The EAP must, in order to give effect to Regulation 8, give registered I&APs access to, and an opportunity to comment on the report in writing within 30 days before submitting the final EIAr to the Department.

In addition, the following additional information is required for the EIAr:

- i. The draft EIAr must provide an assessment of the impacts and mitigation measures for each of the listed activities applied for.
- ii. The listed activities represented in the EIAr and the application form must be the same and correct.
- iii. The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions. A sample for the minimum information required is listed under point 2 of the EIA information required for gas facilities below.
- iv. The EIAr must provide the four corner coordinate points for the proposed development site (note that if the site has numerous bend points, at each bend point coordinates must be provided) as well as the start, middle and end point of all linear activities.
- v. The EIAr must provide clearly indicate the following:
 - The envisioned area for the proposed facility; i.e. placing of all associated infrastructure should be mapped at an appropriate scale.
 - Areas of the facilities to be utilised during the different phases of the operation.
 - Indicate the power output for all phases of the development.
 - The preferred layout and length of the 132kV power line.
 - Description of all associated infrastructure. This description must include, but is not limited to the following:
 - Power lines;
 - Internal roads infrastructure; and;
 - All supporting onsite infrastructure such as laydown area, guard house and control room etc.
 - All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation.
- vi. The EIAr must also include a comments and response report in accordance with Appendix 2 h (iii) of the EIA Regulations, 2014.
- vii. The EIAr must include the detail inclusive of the PPP in accordance with Regulation 41 of the EIA Regulations.
- viii. The EIAr must adhere to the all the comments issued by this Department on the draft SR dated 14 November 2016.
- ix. Details of the future plans for the site and infrastructure after decommissioning in 20-30 years and the possibility of upgrading the proposed infrastructure to more advanced technologies.
- x. The terms of reference (ToR) for the following specialist studies are accepted to be assessed in the assessment phase:

Specialist study	Responsible Specialist	Appointed company
1. Avifauna (birds)	Mr. Chris van Rooyen	Chris van Rooyen consulting CC
2. Terrestrial ecology	Dr. David McDonald	Bergwind Botanical Surveys and Tours
3. Noise	Dr Brian Williams	SafeTech

4.	Archaeology)	Cr. Lita Webley	ACO Associates
5.	Palaeontology	Dr. Graham Avery	N/A
6.	Air quality	Mr. Mark Zucknel	Air quality Specialist Study
7.	Risk	Mr. Mike Oberholzer	Riscom (Pty) Ltd.

- xi. A traffic impact assessment must be conducted and included in the draft EIAr. The terms of reference for the traffic impact assessment must include:
 - Evaluation of the impacts of the proposed development on existing road network and traffic volumes;
 - Identification of the position and suitability of the preferred access road alternative;
 - Evaluation of the roadway capacity of the road network;
 - Confirmation of the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites;
 - Confirmation of the freight and transport requirements during construction, operation and maintenance;
 - Propose origins and destinations of equipment; and
 - Determination of (Abnormal) Permit requirements if any.
- xii. A social impact assessment must be conducted and included in the draft EIAr. The terms of reference for the social impact assessment must include:
 - A description of the socio-economic context of the area;
 - A description of the development planning context;
 - Discussion of the social benefits for the area;
 - Identification and assessment of the socio-economic impacts of the proposed development in the area throughout all the phases of the development; and
 - Recommendation of the mitigation of identified negative impacts and enhancement of identified positive impacts.
- xiii. A specialist study must be conducted to investigate and assess the climate change risks associated with the proposed development.
- xiv. The air quality assessment must also identify and predict the significance of direct, indirect and cumulative risks / impacts arising from the activity for the key stages of the project including preconstruction, construction, operation and post-closure; and identify management and mitigation measures and actions that addresses the direct, indirect and cumulative risks and impacts.
- xv. It is noted that the LNG supply for the proposed development depends on the finalisation of the proposed gas pipeline between Saldanha Bay and the Caltex Tableview Refinery, as such, the EIAr must clearly assess the preferred connection route and indicate the terms of reference for assessment of all associated impacts.
- xvi. **The EIAr must clearly indicate information on services required on the site, e.g. sewage, refuse removal, water and electricity.**
- xvii. Where specialist studies are conducted in-house or by a specialist other than a suitably qualified specialist in the relevant field, such specialist reports must be peer reviewed by a suitably qualified external specialist in the relevant field. The terms of reference for the peer review must include:
 - A CV clearly showing expertise of the peer reviewer;
 - Acceptability of the terms of reference;
 - Is the methodology clearly explained and acceptable;
 - Evaluate the validity of the findings (review data evidence);
 - Discuss the suitability of the mitigation measures and recommendations;
 - Identify any short comings and mitigation measures to address the short comings;
 - Evaluate the appropriateness of the reference literature;
 - Indicate whether a site-inspection was carried out as part of the peer review; and
 - Indicate whether the article is well-written and easy to understand.

- xviii. Should the appointed specialists specify contradicting recommendations, the EAP must clearly indicate the most reasonable recommendation and substantiate this with defensible reasons; and where necessary, include further expertise advice.
- xix. It is imperative that a reliable water source is secured for the success of this project. The Department requests proof of availability of water for the facility from the relevant authority.
- xx. The EIA must adequately assess and provide a comparative analysis for alternative water sources for the proposed development. The preferred water source alternative must further motivate the preferred technology choice for the facility.
- xxi. A cumulative assessment must be undertaken for the sourcing of water as the facility is located in a water stressed area.
- xxii. The EIA must assess the impacts of use of water on site (sourcing, treating, disposing etc.).
- xxiii. The EIA must provide a detailed description of the need and desirability, not only providing motivation on the need for clean energy in South Africa of the proposed activity. The need and desirability must also indicate if the proposed development is needed in the region and if the current proposed location is desirable for the proposed activity compared to other sites. The need and desirability must take into account cumulative impacts of the proposed development in the area.
- xxiv. Due to the presence of a similar electricity generation facility in the area, all the specialist assessments must include a cumulative environmental impact assessment for all identified and assessed impacts. The cumulative impact assessment must indicate the following:
 - Identified cumulative impacts must be clearly defined, and where possible the size of the identified impact must be quantified and indicated, i.e. hectares of cumulatively transformed land.
 - Detailed process flow and proof must be provided, to indicate how the specialist's recommendations, mitigation measures and conclusions from the various similar developments in the area were taken into consideration in the assessment of cumulative impacts and when the conclusion and mitigation measures were drafted for this project.
 - The cumulative impacts significance rating must also inform the need and desirability of the proposed development.
 - A cumulative impact environmental statement on whether the proposed development must proceed.
- xxv. Please note that information on location of renewable energy developments can be accessed from <https://www.environment.gov.za/maps/graphics>.
- xxvi. A copy of the final site layout map and alternatives. All available biodiversity information must be used in the finalisation of the layout map. Existing infrastructure must be used as far as possible e.g. roads. The layout map must indicate the following:
 - Positions of the power island, steam turbine and generator, fuel storage tanks, water storage reservoir and tanks, water and gas supply pipelines;
 - Permanent laydown area footprint;
 - Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible);
 - Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used;
 - The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure;
 - Substation(s) and/or transformer(s) sites including their entire footprint;
 - Connection routes (including pylon positions) to the distribution/transmission network;
 - All existing infrastructure on the site, especially roads;
 - Buffer areas;
 - Buildings, including accommodation; and
 - All "no-go" areas.
- xxvii. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.
- xxviii. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.

- xxix. A shapefile of the preferred development layout/footprint must be submitted to this Department. The shapefile must be created using the Hartebeesthoek 94 Datum and the data should be in Decimal Degree Format using the WGS 84 Spheroid. The shapefile must include at a minimum the following extensions i.e. .shp; .shx; .dbf; .prj; and, .xml (Metadata file). If specific symbology was assigned to the file, then the .avl and/or the .lyr file must also be included. Data must be mapped at a scale of 1:10 000 (please specify if an alternative scale was used). The metadata must include a description of the base data used for digitizing. The shapefile must be submitted in a zip file using the EIA application reference number as the title.

The shape file must be submitted to:

Postal Address:

Department of Environmental Affairs
Private Bag X447
Pretoria
0001

Physical address:

Environment House
473 Steve Biko Road
Pretoria

For Attention: Muhammad Essop
Integrated Environmental Authorisations
Strategic Infrastructure Developments
Telephone Number: (012) 399 9406
Email Address: MEssop@environment.gov.za

The Environmental Management Programme (EMPr) to be submitted as part of the EIAR must include the following:

- i. All recommendations and mitigation measures recorded in the EIAR and the specialist studies conducted.
- ii. The final site layout map.
- iii. Measures as dictated by the final site layout map and micro-siting.
- iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.
- v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.
- vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.
- vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.
- viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.
- ix. An open space management plan to be implemented during the construction and operation of the facility.
- x. A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.

- xi. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.
- xii. A fire management plan to be implemented during the construction and operation of the facility.
- xiii. An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.
- xiv. An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems.
- xv. Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.
- xvi. An air quality management plan.
- xvii. Emergency preparedness response plan.

The EAP must provide detailed motivation if any of the above requirements is not required by the proposed development and not included in the EMP.

The EAP must provide the final detailed Site Layout Plan as well as the final EMP for approval with the final EIA as this Department needs to make a decision on the EA, EMP and Layout Plan.

Please ensure that all the relevant Listing Notice activities are applied for, that the Listing Notice activities applied for are specific and that they can be linked to the development activity or infrastructure in the project description.

You are hereby reminded that should the EIA fail to comply with the requirements of this acceptance letter, the project will be **refused** in accordance with Regulation 24(1)(b) of the EIA Regulations, 2014.

The applicant is hereby reminded to comply with the requirements of Regulation 45 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 43 and 44 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making. The reports referred to are listed in Regulation 43(1).

Furthermore, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999. Comments from SAHRA and/or the provincial department of heritage must be provided in the EIA.

You are requested to submit two (2) electronic copies (CD/DVD) and one (1) hard copies of the EIA to the Department as per Regulation 23(1) of the EIA Regulations, 2014.

Please also find attached information that must be used in the preparation of the EIA. This will enable the Department to speedily review the EIA and make a decision on the application.

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, which stipulates that no activity may commence prior to an Environmental Authorisation being granted by the Department.

Yours faithfully



Mr Sabelo Malaza

Chief Director: Integrated Environmental Authorisations

Department of Environmental Affairs

Letter Signed by: Mr Coenrad Agenbach

Designation: Deputy Director: Strategic Infrastructure Developments

Date: 01/02/2017

cc:	A Human	City of Cape Town Metropolitan Municipality	Email: andre.human@capetown.gov.za
	F Abrahams	Western Cape DEA&DP	Email: fernel.abrahams@westerncape.gov.za

A. EIA INFORMATION REQUIRED FOR GAS POWER FACILITIES

1. General site information

The following general site information is required:

- Descriptions of all affected farm portions
- 21 digit Surveyor General codes of all affected farm portions
- Copies of deeds of all affected farm portions
- Photos of areas that give a visual perspective of all parts of the site
- Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.)
- Plant design specifications including:
 - Type of technology
 - Structure height
 - Surface area to be covered (including associated infrastructure such as roads)
 - Structure orientation
 - Laydown area dimensions (construction period and thereafter)
 - Generation capacity
- Generation capacity of the facility as a whole at delivery points

This information must be indicated on the first page of any Scoping or EIA document. It is also advised that it be double checked as there are too many mistakes in the applications that have been received that take too much time from authorities to correct.

2. Sample of technical details for the proposed facility

Component	Description / dimensions
Height of stacks	
Area of gas facility	
Area occupied by inverter / transformer stations / substations	
Capacity of on-site substation	
Area occupied by both permanent and construction laydown areas	
Area occupied by buildings	
Length of internal roads	
Width of internal roads	
Proximity to grid connection	
Length of water pipeline	
Size and number of storage vessels for gas and other fuels	
Height of fencing	
Type of fencing	

3. Site maps and GIS information

Site maps and GIS information should include at least the following:

- All maps/information layers must also be provided in ESRI Shapefile format
- All affected farm portions must be indicated
- The exact site of the application must be indicated (the areas that will be occupied by the application)
- A status quo map/layer must be provided that includes the following:

- Current use of land on the site including:
 - Buildings and other structures
 - Agricultural fields
 - Grazing areas
 - Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas
 - Critically endangered and endangered vegetation areas that occur on the site
 - Bare areas which may be susceptible to soil erosion
 - Cultural historical sites and elements
- Rivers, streams and water courses
- Ridgelines and 20m continuous contours with height references in the GIS database
- Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs
- High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries
- Buffer zones (also where it is dictated by elements outside the site):
 - 500m from any irrigated agricultural land
 - 1km from residential areas
- Indicate isolated residential, tourism facilities on or within 1km of the site
- A slope analysis map/layer that include the following slope ranges:
 - Less than 8% slope (preferred areas for facility and infrastructure)
 - between 8% and 12% slope (potentially sensitive to facility and infrastructure)
 - between 12% and 14% slope (highly sensitive to facility and infrastructure)
 - steeper than 18 % slope (unsuitable for facility and infrastructure)
- A site development proposal map(s)/layer(s) that indicate:
 - Foundation footprint
 - Permanent laydown area footprint
 - Construction period laydown footprint
 - Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible)
 - River, stream and water crossing of roads and cables indicating the type of bridging structures that will be used
 - Substation(s) and/or transformer(s) sites including their entire footprint.
 - Cable routes and trench dimensions (where they are not along internal roads)
 - Connection routes to the distribution/transmission network (the connection must form part of the EIA even if the construction and maintenance thereof will be done by another entity such as ESKOM)
 - Cut and fill areas of plant site, along roads and at substation/transformer sites indicating the expected volume of each cut and fill
 - Borrow pits
 - Spoil heaps (temporary for topsoil and subsoil and permanently for excess material)
 - Buildings including accommodation

With the above information authorities will be able to assess the strategic and site impacts of the application.

4. Regional map and GIS information

The regional map and GIS information should include at least the following:

- All maps/information layers must also be provided in ESRI Shapefile format
- The map/layer must cover an area of 20km around the site

- Indicate the following:
 - roads including their types (tarred or gravel) and category (national, provincial, local or private)
 - Railway lines and stations
 - Industrial areas
 - Harbours and airports
 - Electricity transmission and distribution lines and substations
 - Pipelines
 - Waters sources to be utilised during the construction and operational phases
 - A visibility assessment of the areas from where the facility will be visible
 - Critical Biodiversity Areas and Ecological Support Areas
 - Critically Endangered and Endangered vegetation areas
 - Agricultural fields
 - Irrigated areas
 - An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams

5. Important stakeholders

Comments must be requested from Eskom regarding grid connectivity and capacity. Request for comment must be submitted to:

Mr John Geeringh
Eskom Transmission
Megawatt Park D1Y38
PO Box 1091
JOHANNESBURG
2000

Tel: 011 516 7233
Fax: 086 661 4064
John.geeringh@eskom.co.za

3. Minutes of the pre-application meeting with DEA (15TH September)

Purpose:

Pre-Application Meeting and Site visit with DEA

Date of the meeting:

15/09/2016

Location:

SAREBI Meeting Room, Atlantis, Western Cape

List of attendees:

Affiliation	Name of representative	Email address	Telephone
Department of Environmental Affairs (DEA)	Milicent Solomons	msolomons@environment.gov.za	0123999382
DEA	Mmamohale Kabasa	mkabasa@environment.gov.za	0123999420
DEA	Muhammad Essop	messop@environment.gov.za	0123999406
Department of Environmental Affairs and Development Planning (DEA&DP)	Taryn Dreyer	Taryn.dreyer@westerncape.gov.za	0214832707
GreenCape	Mike Mulcahy	mike@green-cape.co.za	0218110250
Council for Scientific and Industrial Research (CSIR)	Paul Lochner	PLochner@csir.co.za	0218882486
CSIR	Kelly Stroebel	kstroebel@csir.co.za	0218882432

Meeting Notes:

1. Welcome and adoption of the agenda (Milicent Solomons)
 - Purpose of the meeting subject to all the emails and discussions prior to this meeting.
 - Clarification of the roles of the DEA members at the meeting with regards to the application: Mmamohale is the reviewing officer of the application, supervised by Muhammad and reporting to Milicent.
2. Background to the project and context (Mike Mulcahy)
 - GreenCape has been working in Atlantis since 2011 as part of the Atlantis Revitalization Framework. It is currently working on establishing an SEZ funded by the Department of Trade and Industry.
 - Aim is to try to find areas in which Atlantis can be competitive and to revitalize the area, in order to look for niche activities where Atlantis will have an advantage.
 - A big opportunity within the Atlantis SEZ is to explore gas-to-power. LNG gas-to-power work is under ministerial direction.
 - GreenCape commissioned CSIR to undertake an EIA.

- Advantages of the sites proximity to Ankerlig which is looking into switching from diesel to gas-to-power.
 - The logic behind this project, is that Ankerlig may be too small, and an additional project such as this can justify the expenses behind building the pipeline infrastructure and port infrastructure at Saldanha.
 - It is expected that there will be a procurement for gas sometime within the first quarter of next year, announced by the Minister of Energy, and Saldanha has been shortlisted.
 - The implications of a project such as Ankerlig converting to gas, is that the average price of electricity is expected to drop, which has massive net benefits for the country.
 - If one can use gas procurement to co-locate projects and consequently reduce the price of electricity, this will be in the best interests of The Department of Energy and National Treasury.
3. Presentation on the review of the EIA process and the way forward (Kelly Stroebel and Paul Lochner)
- Paul Lochner: Purpose of the presentation to confirm the process to be followed based on the letter dated 30th August 2016 from Mr. Malaza.
 - Milicent Solomons: One of the issues is the approved EA and the location of the gas-to-power facility. The use of the words "site" and "footprint" are used interchangeably. Where is the footprint of the gas-to-power facility on this site?
 - Kelly Stroebel: The EA from 2012 did not include a site layout, as the entire 38.65 ha site was to be cleared. The gas-to-power facility will use that same precedent, where the entire site is to be cleared (no project layout as yet).
 - Milicent Solomons: So to confirm- it will be either the manufacturing facility on that site, or the gas-to-power facility, not both?
 - Paul Lochner: Correct. At the moment they have the EA for the manufacturing facility, however, if there is an opportunity to do gas-to-power, then that would be the better option for that site.
 - Mike Mulcahy: It is worth noting that this process falls in line with the City of Cape Towns Accelerated Land Disposals process, to sell/lease these 2 sites with all the necessary approvals in an accelerated manner.
 - Milicent Solomons: This is an issue of contention which will be addressed by DEA legal services in order to find the best way to deal with the two EA's on site.
 - Muhammed Essop: Was listed activity 38 (GNR 544, 2010) included in this BAR?
 - Taryn Dreyer: This was for the upgrade of the existing substation.
 - Milicent Solomons: Please provide the documentation of the Biodiversity Offset in the DSR.
 - Milicent Solomons: In order to do a comprehensive EIA, use the impacts addressed in the previous 2012 specialist studies for the context of this EIA. There is no need to re-do the specialist studies. Any activity relating to the clearing of land etc. needs to be included in the scope of the project.
 - Muhammed Essop: Obtain a statement from the specialists who conducted the previous studies to say that the study was done for "X", but they fact that is now being considered under the circumstances of "Y" does not change the impact. Attach this statement to the studies, and note them in the Appendix as "as amended".
 - Milicent Solomons: Submit the 2015 application (copy) and then an amendment to the application form.

- Milicent Solomons: Public Participation done to date is still valid, please provide all PPP information from the whole process done to date.
- Muhammad Essop: Please provide a hard copy to all Departments within DEA directly. One hard copy and one soft copy to our Directorate will be sufficient. Please only release the scoping report once the Department has received the application for EA.
- Milicent Solomons: Send through HWC's previous comments on the 2012 process in terms of the absence of heritage resources on site to them to confirm that their comments are still valid for this application.
- Muhammad Essop: Please ensure that the electronic copy of the DSR is comprised of separate PDF's for each Appendix.
- All: Confirmation of the process to be followed as per slide 12 of the CSIR presentation.

Outcomes of meeting : Way forward

- a) Milicent Solomons to send through contact details for the following people in the Department:
 - Mrs. Deborah Ramalope (Air Quality)
 - Dr. Thuli Khumalo (Climate Change)
 - Mrs. Wilma Loets (Biodiversity)
- b) Milicent Solomons to correspond with CSIR and GreenCape with regards to the outcome of the DEA Legal advice regarding the 2 EA's on the same Development Footprint, and what the way forward is for the Client as the EA holder (Scoping and EIA process to continue while this decision is being made).
- c) DEA committed to do a detailed review of the Scoping Report during the Draft commenting phase and provide comments to CSIR.
- d) CSIR to ensure the DSR and FSR contain all legal requirements outlined in Appendix 2 of the NEMA EIA Regulations (4 December, 2014).
- e) CSIR to do the following:
 - Courier documents to Department: each department e.g. Air Quality to receive its own copy with a cover letter.
 - Use the 2015 Project Announcement documentation i.e. newspaper advertisements, site notices and letters to I&AP's.
 - When releasing DSR, send through a comprehensive cover letter to I&AP's highlighting that the application is continuing, providing details on the process which has taken place and the way forward.
 - Submit 1 x copy of the original application form and 1 x copy of an amendment to this application form including listing notices pertaining to the clearance of vegetation.
 - Amend the 2012 specialist studies with a cover statement and approval from specialists.
 - Electronic copies of the report to contain each appendix as a separate PDF.
 - Send DSR out for 30-day public comment period after the Department has received the Application for EA.
 - Send 1 x hard copy and 3 x CD's of the DSR to Adri la Meyer at DEA&DP.

- Include information regarding the Biodiversity Offset as an Appendix to the DSR.
- Include the finalized minutes of this meeting in the DSR.
- Commit to submit an Application and DSR to the Department around 6th October 2016.

Pre-application meeting was then followed by a site visit to CA1183-4-1.

4. Environmental authorization for the site (2012)

From: To: *00218755515 16/01/2013 15:41 #580 P.001/024



**DIRECTORATE: LAND MANAGEMENT
REGION 2**

EIA REFERENCE NUMBER: 16/3/1/1/A1/2/3036/12

ENQUIRIES: MS. T. MAART

DATE OF ISSUE: 16 JAN 2013

The Municipal Manager
City of Cape Town
13th Floor Tower Block, Civic Centre
12 Hertzog Boulevard
CAPE TOWN
8001

For attention: Mr. A.A. Human

Tel: (021) 400 2366
Fax: (021) 419 5303

Dear Sir

APPLICATION FOR ENVIRONMENTAL AUTHORISATION AND EXEMPTION IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT 107 OF 1998) AND THE ENVIRONMENTAL IMPACT ASSESSMENT AMENDMENT REGULATIONS, 2010: THE PROPOSED GREEN TECHNOLOGY MANUFACTURING CLUSTER INDUSTRIAL DEVELOPMENT AND ASSOCIATED INFRASTRUCTURE ON PORTION 4 AND PORTION 1 OF FARM 1183, ATLANTIS.

With reference to your application for the abovementioned, find below the outcome with respect to this application.

ENVIRONMENTAL AUTHORISATION AND EXEMPTION

DECISION

By virtue of the powers conferred on it by the National Environmental Management Act, 1998 (Act No. 107 of 1998) and the Environmental Impact Assessment Amendment Regulations, 2010, ("NEMA EIA Regulations") the competent authority herewith **grants environmental authorisation and exemption** to the applicant to undertake the list of activities specified in section B below with respect to Alternative 1 described in the Final Basic Assessment Report ("BAR") dated October 2012.

7th Floor, 1 Dorp Street, Cape Town, 8001
tel: +27 483 2707/2596 fax: +27 21 483 4372

Private Bag X9086, Cape Town, 8000
www.westerncape.gov.za/eadp

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The applicant is herewith exempted from the following provisions of the NEMA EIA Regulations:

Regulation 10(2)(d) of Government Notice No. R.543, which reads as follows:

10(2) *The applicant must, in writing, within 12 days of the date of the decision of the application*

(d) *publish a notice –*

(i) informing interested and affected parties of the decision;

(ii) informing interested and affected parties where the decision can be accessed; and

(iii) drawing the attention of interested and affected parties to the fact that an appeal may be lodged against the decision in terms of Chapter 7 of these Regulations, if such appeal is available under the circumstances of the decision,

in the newspapers contemplated in regulation 54(2)(c) and (d) and which newspaper was used for the placing of advertisements as part of the public participation process.

The granting of this environmental authorisation and exemption (hereinafter referred to as the "environmental authorization") is subject to compliance with the conditions set out in section E below.

A. DETAILS OF THE APPLICANT FOR THIS ENVIRONMENTAL AUTHORISATION

The Municipal Manager
City of Cape Town
c/o Mr. A. A. Human
13th Floor Tower Block, Civic Centre
12 Hertzog Boulevard
CAPE TOWN
8001

Tel: (021) 400 2366

Fax: (021) 419 5303

The abovementioned juristic person is the holder of this environmental authorisation and is hereinafter referred to as "the applicant".

B. LIST OF ACTIVITIES AUTHORISED

Government Notice No. R544 of 18 June 2010 –

Activity Number: 38

Activity Description:

The expansion of facilities for the transmission and distribution of electricity where the expanded capacity will exceed 275 kilovolts and the development footprint will increase.

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Government Notice No. R545 of 18 June 2010-

Activity Number: 15

Activity Description:

Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more;

except where such physical alteration takes place for:

- (i) linear development activities; or
- (ii) agriculture or afforestation where activity 16 in this Schedule will apply.

Government Notice No. R546 of 18 June 2010-

Activity Number: 12

Activity Description:

The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.

- (a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004;
- (b) Within critical biodiversity areas identified in bioregional plans;
- (c) Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line or even in urban areas.

Activity Number: 13

Activity Description:

The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for:

- (1) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list.
- (2) the undertaking of a linear activity falling below the thresholds mentioned in Listing 1 in terms of GN R.544 of 2010.
 - (a) In Eastern Cape, Free State, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape and Western Cape:
 - (i) In an estuary;
 - (ii) Outside urban areas, the following:
 - (aa) A protected area identified in terms of NEMPAA, excluding conservancies;
 - (bb) National Protected Area Expansion Strategy Focus areas;
 - (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority;

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- (dd) Sites or areas identified in terms of an International Convention;
- (ee) Core areas in biosphere reserves;
- (ff) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere reserve;
- (gg) Areas seawards of the development setback line or within 1 kilometre from the high-water mark of the sea if no such development setback line is determined.
- (iii) In urban areas, the following:
 - (aa) Areas zoned for use as public open space;
 - (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose;
 - (cc) Areas seawards of the development setback line;
 - (dd) Areas on the watercourse side of the development setback line or within 100 metres from the edge of a watercourse where no such setback line has been determined.

The abovementioned list is hereinafter referred to as "the listed activities".

The applicant is herein authorised to undertake the following alternative related to the listed activities:

The removal of indigenous vegetation and the transformation of undeveloped land to accommodate the construction of industrial buildings, facilities and associated infrastructure for the manufacturing of various renewable energy infrastructure such as turbine blades, turbine towers, turbine assemblers, Photovoltaic (PV) panel assembly plants and inverters. The City of Cape Town intends to lease the land to companies within the renewable energy sector which produce renewable energy infrastructure.

The proposal will entail the utilisation of the entire site for industrial development, which is approximately 38,65 ha in extent. The buildings (coverage, height etc.) that will be located on the proposed site will be in accordance with the existing zoning of the site and of the Atlantis Industrial Area. The relevant municipal building regulations and planning policies will be adhered to in this regard.

A landscaping plan will be compiled by a suitably qualified and experienced horticulturalist and be submitted along with the applications for building approval.

An appropriate off-site biodiversity offset site will be secured by the applicant in order to compensate for the loss of intact endangered and critically endangered indigenous vegetation located on the proposed site.

All services (i.e. potable water, sewage disposal, electricity, solid waste disposal) will connect to the existing Municipal infrastructure. However, should the proposed development require additional electricity, the proposed development will also entail the upgrading of the existing electrical substation on site.

Industrial effluent will be treated in a bioretention facility to remove heavy and noxious elements. The bioretention facility will then discharge the treated industrial

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effluent into a dedicated municipal waste-water system specifically provided for effluent which is not suitable for recharging the ground water aquifer. The bioretention facility will be located in such a way that treated effluent will gravitate into the dedicated municipal pipeline for industrial effluent.

The preferred access onto the local road network will be at the northern end of the site, leading onto Neil Hare Road.

C. PROPERTY DESCRIPTION AND LOCATION

The listed activities will take place on Portion 4 and Portion 1 of Farm CA 1183, Atlantis industrial area, Neil Hare Road, Atlantis.

The SG 21 digit codes are:

C01600000000118300004
C01600000000118300001

Co-ordinates:

33° 35' 59.82" South
18° 28' 12.77" East

hereinafter referred to as "the site".

D. DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Doug Jeffery Environmental Consultants (Pty) Ltd.
c/o Ms. J. Theron
P.O. Box 44
KLAPMUTS
7625

Tel: (021) 875 5272
Fax: (021) 875 5515

E. CONDITIONS OF AUTHORISATION

1. This environmental authorisation is valid for a period of **five years** from the date of issue. The holder must commence with all the listed activities within the said period or this environmental authorisation lapses and a new application for environmental authorisation must be submitted to the competent authority, unless the holder has lodged a valid application for the amendment of the validity period of this environmental authorisation, before the expiry of this environmental authorisation. In such instances, the validity period will be automatically extended ("the period of administrative extension") from the day before this environmental authorisation would otherwise have lapsed, until the amendment application for the extension of the validity period is decided. The listed activities, including site preparation, may not commence during the period of administrative extension.
2. The listed activities, including site preparation, may not commence within 20 (twenty) calendar days of the date of issue of this environmental

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authorisation. In the event that an appeal notice and subsequent appeal is lodged with the competent authority, the effect of this environmental authorisation may be suspended until such time as the appeal is decided.

3. The applicant must in writing, within 12 (twelve) calendar days of the date of this decision and in accordance with regulation 10(2)–
 - 3.1 notify all registered interested and affected parties of –
 - 3.1.1 the outcome of the application;
 - 3.1.2 the reasons for the decision as included in Annexure 1;
 - 3.1.3 the date of the decision; and
 - 3.1.4 the date of issue of the decision;
 - 3.2 draw the attention of all registered interested and affected parties to the fact that an appeal may be lodged against the decision in terms of Chapter 7 of the Environmental Impact Assessment Amendment Regulations, 2010 detailed in section F below;
 - 3.3 draw the attention of all registered interested and affected parties to the manner in which they may access the decision; and
4. A minimum of seven calendar days notice, in writing, must be given to the competent authority before commencement of construction activities.
 - 4.1. The notice must make clear reference to the site details and EIA Reference number given above.
 - 4.2. The notice must also include proof of compliance with the following conditions described herein:

Conditions: 2, 13 and 18
5. The holder is responsible for ensuring compliance with the conditions by any person acting on his behalf, including an agent, sub-contractor, employee or any person rendering a service to the holder.
6. Any changes to, or deviations from the scope of the description set out in section B above must be accepted or approved, in writing, by the competent authority before such changes or deviations may be implemented. In assessing whether to grant such acceptance/approval or not, the competent authority may request such information as it deems necessary to evaluate the significance and impacts of such changes or deviations and it may be necessary for the holder to apply for further authorisation in terms of the applicable legislation.
7. The applicant must notify the competent authority in writing, within 24 hours thereof if any condition herein stipulated is not being complied with.

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8. The draft Environmental Management Programme ("EMP") submitted as part of the application for environmental authorisation is hereby approved, on condition that the following amendments are made to the EMP, and must be implemented.

8.1. The recommendations provided in the Palaeontological Assessment Report dated July 2012 as compiled by Mr. Graham Avery (attached as Appendix A), must be included in the EMP.

8.2. The manner and frequency for updating the EMP must be as follows:

An application for an amendment to the EMP must be submitted to the competent authority if any further amendments are to be made to the EMP, other than those mentioned above, and this may only be implemented once the amended EMP has been authorised by the competent authority.

The EMP must be included in all contract documentation for all phases of implementation.

9. A copy of the environmental authorisation and the EMP must be kept at the site where the listed activities will be undertaken. Access to the site referred to in section C above must be granted and the environmental authorisation and EMP must be produced, to any authorised official representing the competent authority who requests to see it for the purposes of assessing and/or monitoring compliance with the conditions contained herein. The environmental authorisation and EMP must also be made available for inspection by any employee or agent of the applicant who works or undertakes work at the site.

10. The applicant must submit an application to the competent authority for amendment of the environmental authorisation where any detail with respect to the environmental authorisation must be amended, added, substituted, corrected, removed or updated. Further, the rights granted by this environmental authorisation are personal rights (i.e. not attached to a property, but granted to a natural or juristic person). As such, only the holder may undertake the activities authorised by the competent authority. Permission to transfer the rights and obligations contained herein must be applied for in the following manner:

10.1. The applicant must submit an originally signed and dated application for amendment of the environmental authorisation to the competent authority stating that he wishes the rights and obligations contained herein to be transferred, and including (a) confirmation that the environmental authorisation is still in force (i.e. that the validity period has not yet expired or the activities were lawfully commenced with); (b) the contact details of the person who will be the new holder; (c) the reasons for the transfer; (d) an originally signed letter from the proposed new holder acknowledging the rights and obligations contained in the environmental authorisation and indicating that he

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has the ability to implement the mitigation and management measures and to comply with the stipulated conditions.

- 10.2. The competent authority will issue an amendment to the new holder either by way of a new environmental authorisation or an addendum to the existing environmental authorisation if the transfer is found to be appropriate.
11. Non-compliance with a condition of this environmental authorisation or EMP may result in suspension of this environmental authorisation and may render the holder liable for criminal prosecution.
12. Notwithstanding this environmental authorisation, the holder must comply with any other statutory requirements that may be applicable to the undertaking of the listed activities.
13. The holder must appoint a suitably experienced environmental control officer ("ECO"), or site agent where appropriate, for the construction phase of implementation before commencement of any land clearing or construction activities to ensure compliance with the EMP and the conditions contained herein.
14. An integrated waste management approach, which is based on waste minimisation and incorporates reduction, recycling, re-use and disposal, where appropriate, must be employed. Any solid waste must be disposed of at a landfill licensed in terms of the applicable legislation.
15. No surface or ground water may be polluted due to any actions on the site. The applicable requirements with respect to relevant legislation pertaining to water must be met.
16. The applicable requirements with respect to relevant legislation pertaining to occupational health and safety must be adhered to.
17. The off-site biodiversity offset must be secured within **1 (one) year** of the commencement of construction. The applicant must engage with CapeNature in this regard.
 - 17.1. A Conservation Environmental Management Plan must be compiled for the selected off-site offset once secured in order to ensure the required maintenance and management takes effect;
 - 17.2. A copy of the Conservation Environmental Management Plan must be submitted to this Directorate once the offset has been secured for auditing; and
 - 17.3. The Conservation Environmental Management Plan must include *inter alia* the following:
 - 17.3.1. Roles and responsibilities of all parties concerned;

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17.3.2. Appropriate environmental control measures and procedures to ensure that site is adequately managed.

18. A landscaping plan must be compiled by a suitably qualified and experienced horticulturalist and be submitted along with the relevant applications for building approval.
19. Should any heritage remains be exposed during excavations or any actions on the site, these must immediately be reported to the Provincial Heritage Resources Authority of the Western Cape, Heritage Western Cape (in accordance with the applicable legislation). Heritage remains uncovered or disturbed during earthworks must not be further disturbed until the necessary approval has been obtained from Heritage Western Cape. Heritage remains include: archaeological remains (including fossil bones and fossil shells); coins; indigenous and/or colonial ceramics; any articles of value or antiquity; marine shell heaps; stone artifacts and bone remains; structures and other built features; rock art and rock engravings; shipwrecks; and graves or unmarked human burials.

A qualified archaeologist must be contracted where necessary (at the expense of the applicant and in consultation with the relevant authority) to remove any human remains in accordance with the requirements of the relevant authority.

F. APPEALS

Appeals must comply with the provisions contained in Chapter 7 of the Environmental Impact Assessment Amendment Regulations, 2010.

1. An appellant must –

- 1.1. submit a notice of intention to appeal to the Minister, within 20 (twenty) calendar days of the date of the decision;
- 1.2. submit the appeal within 30 (thirty) calendar days after the lapsing of the 20 (twenty) calendar days contemplated in regulation 60(1), for the submission of the notice of intention to appeal; and
- 1.3. within 10 (ten) calendar days of having lodged the notice of intention to appeal, provide each person and organ of state registered as an interested and affected party in respect of the application, or the applicant, with –
 - 1.3.1. a copy of the notice of intention to appeal form; and
 - 1.3.2. a notice indicating where and for what period the appeal submission will be made available for inspection by such person, organ of state, or applicant, on the day of lodging it with the Minister, and that a responding statement may be made on the

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appeal within 30 (thirty) calendar days from the date the appeal submission was lodged with the Minister.

2. A person, organ of state or applicant who submits a responding or answering statement in terms of regulation 63 must within 10 (ten) calendar days of having submitted the responding or answering statement, serve a copy of the statement on the other party.
3. If the person, organ of state or applicant fails to meet a timeframe with respect to the requirements as detailed above, the person, organ of state or applicant must immediately submit a written explanation to the Ministry providing a concise explanation for the non-compliance.
4. All notice of intention to appeal and appeal forms must be submitted by means of one of the following methods:
 - By post: Western Cape Ministry of Local Government, Environmental Affairs and Development Planning
Private Bag X9186
CAPE TOWN
8000
 - By facsimile: (021) 483 4174; or
 - By hand: Attention: Mr J. de Villiers
Room 305 A
3rd Floor Leeusig Building (Entrance at: Utilitas Building, 1 Dorp Street, Cape Town, 8001)
5. A prescribed notice of intention to appeal form and appeal form as well as assistance regarding the appeal processes is obtainable from the office of the Minister at: Tel. (021) 483 3721, E-mail Jaap.DeVilliers@westerncape.gov.za or URL <http://www.westerncape.gov.za/eadp>.

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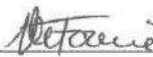
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G. DISCLAIMER

The Western Cape Government, the Local Authority, committees or any other public authority or organisation appointed in terms of the conditions of this environmental authorisation shall not be responsible for any damages or losses suffered by the holder, developer or his/her successor in any instance where construction or operation subsequent to construction is temporarily or permanently stopped for reasons of non-compliance with the conditions as set out herein or any other subsequent document or legal action emanating from this decision.

Your interest in the future of our environment is appreciated.

Yours faithfully



MR. ZAAHIR TOEFY

DIRECTOR: LAND MANAGEMENT (REGION 2)

DATE OF DECISION: 16-01-2013

Copied to: (1) Ms. J. Theron/Mr. D. Jeffery (EAP)
(2) Mr. R. Smart (CapeNature)
(3) Mr. M. Theron (City of Cape Town: ERM)

Fax: (021) 875 5515
Fax: (021) 866 1523
Fax: (086) 588 8945

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NEAS EIA REFERENCE NUMBER:	WCP/EIA/0000949/2012
EXEMPTION REFERENCE NUMBER:	16/3/1/4/A1/2/3055/12
NEAS EXEMPTION REFERENCE NUMBER:	WCP/EIA/EX/0000207/2012

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ANNEXURE 1: REASONS FOR THE DECISION

In reaching its decision, the competent authority, *inter alia*, considered the following:

- a) The information contained in the application form dated 30 May 2012 and received by the competent authority on 01 June 2012, the final BAR received by the competent authority on 01 November 2012, the EMP submitted together with the final BAR, and the additional information received by the competent authority on 06 November 2012 and 27 November 2012;
- b) Relevant information contained in the Departmental information base, including, the Guidelines on Public Participation, Alternatives and Exemptions (dated October 2011);
- c) The objectives and requirements of relevant legislation, policies and guidelines, including section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998);
- d) The comments received from interested and affected parties and the responses provided thereon, as included in the final BAR dated October 2012;
- e) The sense of balance of the negative and positive impacts and proposed mitigation measures; and
- f) The site visit conducted on

Date: 07 December 2012

Attended by: Ms. W. Gaisford of the Western Cape Government: Environmental Affairs and Development Planning, Mr. C. Dorse of the City of Cape Town ("CoCT"), Mr. K. Wiseman of the CoCT and Ms. J. Bodenstein of the CoCT.

All information presented to the competent authority was taken into account in the consideration of the application for environmental authorisation. A summary of the issues which, according to the competent authority, were the most significant reasons for the decision is set out below.

1. Exemption

Exemption from regulation 10(2)(d) was granted as all registered interested and affected parties ("I&AP's") were notified of the exemption application, as required. All concerns that were raised by I&APs were adequately responded to in this regard.

As such, the exemption application was regarded as appropriate by the competent authority in this instance based on the adequate public participation process.

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2. Public Participation

The public participation process included:

- identification of and engagement with interested and affected parties;
- fixing a notice board at the site and any alternative site where the listed activities are to be undertaken on 23 July 2012;
- giving written notice to the owners and occupiers of land adjacent to the site and any alternative site where the listed activities are to be undertaken, the municipality and ward councillor, and the various organs of state having jurisdiction in respect of any aspect of the listed activities on 19 July 2012; and
- the placing of a newspaper advertisement in the 'Cape Times', 'Die Burger' and 'Weskus Nuus-News' on 24 July 2012.

The Department is satisfied that the public participation process that was followed met the minimum legal requirements and all the comments raised and responses thereto were included in the comments and response report.

3. Alternatives

A site selection investigation was undertaken to determine which sites within the City of Cape Town (which are also owned by the City of Cape Town) were suitable for the proposed activity. One of the biggest contributing factors in selecting the proposed site, which is located within the Atlantis Industrial Area, as the only viable site, in comparison to other industrial areas such as Montague Gardens and Epping, was the large portions of land required in order to accommodate the large buildings and lay-down areas for turbine blades. The land available within areas such as Montague Gardens and Epping were thus not considered feasible in this regard.

Alternative 1 (Herewith authorized)

This entails the removal of indigenous vegetation and the transformation of undeveloped land to accommodate the construction of industrial buildings and facilities and associated infrastructure for the manufacturing of various renewable energy infrastructure such as turbine blades, turbine towers, turbine assemblers, Photovoltaic (PV) panel assembly plants and inverters. The City of Cape Town intends to lease the land to companies within the renewable energy sector which produce renewable energy infrastructure.

The proposal will entail the utilisation of the entire site for industrial development, which is approximately 38,65 ha in extent. The buildings (coverage, height etc.) that will be located on the proposed site will be in accordance with the existing zoning of the site and of the Atlantis Industrial Area. The relevant municipal building regulations and planning policies will be adhered to in this regard.

A landscaping plan will be compiled by a suitably qualified and experienced horticulturalist and be submitted along with the relevant applications for building approval.

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An appropriate off-site biodiversity offset site will be secured by the applicant in order to compensate for the loss of intact endangered and critically endangered indigenous vegetation located on the proposed site.

All services (i.e. potable water, sewage disposal, electricity, solid waste disposal) will connect to the existing Municipal infrastructure. However, should the proposed development require additional electricity, the proposed development will also entail the upgrading of the existing electrical substation on site.

Industrial effluent will be treated in a bioretention facility to remove heavy and noxious elements. The bioretention facility will then discharge the treated industrial effluent into a dedicated municipal waste-water system specifically provided for effluent which is not suitable for recharging the ground water aquifer. The bioretention facility will be located in such a way that treated effluent will gravitate into the dedicated municipal pipeline for industrial effluent.

The preferred access onto the local road network will be at the northern end of the site, leading onto Neil Hare Road.

The proposed site as located in Atlantis is considered the only viable site alternative within the City of Cape Town and is therefore the preferred site alternative.

Design and Layout Alternatives

It is envisaged that the entire site (in accordance with local planning policies) will be utilized for the proposed development. The buildings (coverage, height etc.) to be located on site will be in accordance with the existing zoning of the site and the location in which the site is. It is not considered feasible to design layout alternatives at this stage as it would depend on the investors who are successful in terms of the bidding process to lease the land and the types of technology that will be manufactured, in accordance with the types of renewable energy alternatives.

Technology Alternative 1 (Herewith authorized)

A combination of the Technological Alternatives below will form part of the 'green' manufacturing hub in Atlantis and therefore all three are considered as viable technology alternatives.

Wind technology

There are currently no companies in South Africa that manufacture utility scale wind turbine blades. The proposed development therefore provides an opportunity for one or two manufacturers of wind turbine towers.

Photo Voltaic technology

There are currently three PV manufacturers in South Africa. These are all located in Cape Town and currently employ approximately 250 people. There is an opportunity for these companies (or a new company) to set up a factory to supply the new demand.

Inverters

It is anticipated that there will be 1 inverter manufacturer established. There is one current inverter manufacturer who employs approximately 35 people and would need to scale up tenfold to meet the projected demand.

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Technology Alternative 2

This alternative will entail the utilization of only one of the above technologies. This alternative is not regarded as feasible since the benefits would be limited to one particular renewable energy sector. This alternative is therefore not regarded as feasible in this regard.

"No-Go" Alternative

The "no-go" alternative will result in the status quo of the land being maintained. Since the proposed site is zoned 'General Industrial' and is located within the Atlantis Industrial Area and within the existing approved Urban Edge, the "no-go" alternative is not warranted in this regard.

4. Impact Assessment and Mitigation measures

4.1. Activity Need and Desirability

The site is zoned "General Industrial" and is located in the Atlantis Industrial Area. According to the City of Cape Town Spatial Development Framework, dated May 2012 ("SDF") the site is earmarked for industrial development. The proposed development therefore adheres to the SDF of the local municipality, particularly key strategy 1: "Plan for employment and improve access to economic opportunities".

Historically, Atlantis was a de-centralized zone for manufacturing. The Atlantis Industrial Area will benefit from the creation of an established "Green Technology Manufacturing Cluster" as it has the potential to attract large investments in the area. The planned roll-out of renewable energy in South Africa has the potential to result in significantly high investments.

4.2. Regional/ Planning Context

The site is zoned "General Industrial" and is located in the Atlantis Industrial Area. Furthermore, the proposed site is located within the Urban Edge of Atlantis and is in line with the principles of the City of Cape Town's SDF.

4.3. Surrounding Environment

The eastern boundary of the proposed site is flanked by a railway line, whereas the western boundary is marked by a water-main servitude, which extends along most of the boundary length until the southern side meets Gideon Basson Road. At this point, the boundary continues along the western side of a retention pond and joins Neil Hare Road. The Ankerlig Power Station is located to the north/north-west of the proposed site.

4.4. Services/ Bulk Infrastructure

In terms of potable water, the proposed site is serviced by a 150 mm diameter pressurized pipe-line located along the western boundary of the site. The proposed development will therefore connect to the existing municipal infrastructure.

In terms of sewage, there are two parallel municipal gravity pipelines in the adjacent road network. Effluent is divided into two categories, namely, domestic effluent (generated from toilets, showers, hand basins and kitchen sinks) and industrial effluent (which may include noxious effluents (by-product from manufacturing process). Industrial effluent will be treated on site in a bioretention

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facility to remove heavy and noxious elements. The bioretention facility will then discharge into an existing separate municipal waste-water system specifically provided for effluent which is not suitable for recharging the ground water aquifer. As such, the bioretention facility will be located so that treated effluent can gravitate into the dedicated municipal pipeline for industrial effluent. Buildings which generate domestic effluent and which require connection to the existing municipal sewerage reticulation will be situated close to the adjacent road to ensure domestic effluent can gravitate into the dedicated municipal pipeline for conveyance to the existing treatment works for domestic wastewater. The site is serviced by a 300 mm gravity pipeline adjacent to the western and south section of the eastern boundary. Buildings requiring connection into the municipal pipeline will be situated close to the municipal sewer lines to ensure domestic waste water can gravitate into the municipal pipeline without pumping.

In terms of storm water management, the proposed storm water system will be designed in accordance with the City of Cape Town and Department of Water Affairs' requirements.

In terms of electricity requirements, the proposed site will be supplied by the City of Cape Town: Utility Services-Electricity Division. The power supply network capacity in the area is currently limited. However, the municipality has confirmed that they could provide up to 2MVA to the site. An amount in excess of 2 MVA could be accommodated, provided the existing network is upgraded. Should the proposed development require any additional electricity, the existing electrical substation on site will be upgraded accordingly.

In terms of access to the site, the preferred access onto the local road network will be at the northern end of the site onto Neil Hare Road.

4.5. Biophysical Impacts

A small excavated pond is located towards the middle of the site and a larger retention pond is located in the south-eastern corner of the site. Both ponds are covered with bulrush (*Typha capensis*) and are surrounded by alien vegetation. The possible presence of a wetland in terms of the City of Cape Town wetland layer mapping was investigated and found to be a grassy area with alien vegetation. The existing retention pond to the west of Gideon Basson Road will remain as is and will therefore not be affected by the proposed development.

The Atlantis dune plume and Witzand Aquifer Nature Reserve ("WANR") is located within approximately 2.5km to the west of the proposed site, but the natural system extends from the WANR to the proposed site. There are strict guidelines set out by the Atlantis Water Resource Management Scheme concerning the disposal of storm water and effluent from sites within the Atlantis Industrial Zone. The purpose of these guidelines is to ensure quality of potential waste water (storm water and effluent), which is used to artificially recharge the Atlantis Aquifer, is of a quality which minimize contamination of ground water resource. Unsuitable effluent should alternatively be disposed of appropriately to prevent contamination of the ground water. A bioretention facility will be constructed on the site to treat effluent in order to remove heavy and noxious elements. The "bioretention" facility will then discharge treated industrial effluent into a separate existing municipal waste-water system specifically provided for effluent which is not suitable for recharging the

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ground water aquifer. As such, the bioretention facility will be located in order for treated effluent to gravitate into the dedicated municipal pipeline for industrial effluent. This will therefore ensure that the purposes of the guideline are met, and potential negative impacts of the proposed development on the Atlantis Aquifer are prevented.

4.6. Biodiversity

The site is currently undeveloped and is covered in parts with Cape Flats Dune Strandveld, which is classified as Endangered, and Atlantis Sand Fynbos, which is classified as Critically Endangered, according to the National Environmental Management: Biodiversity Act of 2002: National list of ecosystems that are threatened and in need of protection (dated 11 December 2011).

According to the Botanical Impact Assessment Report dated July 2012 and compiled by Dr. D.J. McDonald or Bergwind Botanical Surveys and Tours CC, the proposed development would impact on two vegetation types, which includes a large portion, and several smaller portions, of Endangered, good quality Cape Flats Dune Strandveld within the northern half of the site (with high numbers of the Endangered mesemb *Ruschia indecora* present). The second portion of vegetation occurs along the southern boundary in a relatively narrow strip, comprising Critically Endangered, medium quality, Atlantis Sand Fynbos. This area contains approximately 80 individuals of Endangered Malmesbury Pincushion (*Leucospermum parile*). The transitional area where the soil interface gives rise to a changeover and interchange of species between the vegetation types is of high conservation importance since such ecotones usually drive speciation and are important in terms of ecological processes.

In terms of direct impacts, the proposed development will result in the loss of intact vegetation and species of importance. These impacts on the two classes of vegetation and habitat due to the proposed construction are considered according to two identified potential impacts which are: Loss of vegetation type – including intact vegetation, ecologically important species and species of conservation concern; and loss of ecological processes associated with the loss of intact vegetation, ecologically important species and species of conservation concern.

4.7. Visual

The proposed development may result in visual impacts on the surrounding environment as a result of new buildings to be constructed. Mitigation measures have been included in the final BAR and EMP to ensure potential visual impacts are minimized. In addition, the site is located in the Atlantis Industrial Area and other industrial and manufacturing facilities exist on sites in the area.

4.8. Noise

The proposed development may result in potential noise impacts during the construction and operational phases of the proposed development. However, since the proposed site is located in an existing industrial area (Atlantis Industrial Area), the significance of the potential noise impacts are deemed to be low. The proposed development will however be required to conform to the relevant legislation pertaining noise.

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4.9. Heritage / Archaeological / Built Environment

The site is located within the designated Atlantis Industrial Area. No heritage resources have been identified. However, according to the Palaeontological Assessment Report dated July 2012 as compiled by Mr. Graham Avery, the proposed development is located in an area where paleontological remains may occur. Excavations for foundations and infrastructure will be monitored by an appropriate palaeontologist. Conditions have been included in the environmental authorisation to ensure the recommendations provided in the Palaeontological Assessment Report are implemented.

4.10. Socio-economic

Despite notable industrial potential, Atlantis has limited commercial (mainly manufacturing) and service economic activity that has experienced severe limitations given the impacts of the recent economic crisis. Furthermore, Atlantis has been hard hit by the global and domestic economic crisis, with a loss of business and jobs. Rising unemployment is further compounded by high food price inflation, the hikes in electricity and fuel prices, and this has had severe social implications in an already economically and socially distressed area. The proposed development will therefore provide job opportunities and increase economic growth in the greater Atlantis area.

4.11. Offsets

The Botanical Impact Assessment Report dated July 2012 and compiled by Dr. D.J. McDonald or Bergwind Botanical Surveys and Tours CC concluded that: *"The position of the intact vegetation (i.e. in the center of the site) means that the development alternative is only likely if a biodiversity offset is offered to compensate for the loss. The proposed offset of 1:1 ha for Endangered Cape Flats Dune Strandveld pertains to most of the site, whereas the ratio 2:1 ha for Critically Endangered Atlantis Sand Fynbos would apply to the strip of land along the southern boundary. The offset option is thus considered the only feasible mitigation option available."* As such, an appropriate off-site biodiversity offset will be secured by the applicant as required in terms of condition 17 of this environmental authorisation.

4.12. Cumulative

In terms of biodiversity, the cumulative loss of vegetation within the Atlantis area has led to the extensive loss of the two vegetation types, namely Atlantis Sand Fynbos and Cape Flats Dune Strandveld. As such, the loss of intact vegetation on the proposed site will therefore result in a high cumulative impact without mitigation. However, since an appropriate off-site biodiversity offset will be secured to mitigate the loss of the aforementioned intact vegetation, the cumulative impacts will be reduced to an acceptable level in this regard. The Botanical Impact Assessment Report dated July 2012 and compiled by Dr. D.J. McDonald or Bergwind Botanical Surveys and Tours CC concluded that: *"The position of the intact vegetation (i.e. in the centre of the site) means that the development alternative is only likely if a biodiversity offset is offered to compensate for the loss. The proposed offset of 1:1 ha for Endangered Cape Flats Dune Strandveld pertains to most of the site, whereas the ratio 2:1 ha for Critically Endangered Atlantis Sand Fynbos would apply to the strip of land along the southern boundary. The offset option is thus considered the only feasible mitigation option available."*

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increased demand for water supply, electricity supply, sewage removal and disposal, and solid waste removal and disposal services is a potential cumulative impact applicable to the proposed development. The anticipated cumulative increase in demand for municipal services in the area has been taken into account by the Local Authority and confirmation of available unallocated supply was obtained.

Cumulative impacts on the Atlantis aquifer also have the potential to be significant. As such, mitigation measures have been included in the Basic Assessment Report and the EMP to ensure adequate storm water management and disposal of industrial effluent is exercised. As such, cumulative impacts will be minimal in this regard.

4.13. Impact Assessment and significance

In terms of botanical impacts, the proposed development will result in the loss of intact indigenous vegetation and the ecological process associated with intact indigenous vegetation and species of concern. These impacts were assessed and are deemed to be of high significance during both the construction and operational phase of the proposed development. This determination is based on the extent and duration of the impacts. As such, a biodiversity offset is regarded as the only feasible mitigation measure in this regard.

In terms of noise impacts during the construction phase, the proposed development was assessed as medium-high as a result of construction related activities. These potential impacts will however be reduced to low-medium after mitigation. Mitigation measures have been incorporated in the EMP in this regard. In terms of noise impacts during the operational phase, the impacts were assessed as low significance since the proposed site is located within an industrial area and noise will be in keeping with the surrounding noise in the industrial area.

In terms of the potential visual impacts associated with the proposed development, the impacts prior to mitigation were assessed as of medium significance, but low after mitigation. A landscaping plan and signage master plan will be compiled and has been incorporated into conditions of this environmental authorisation.

National Environmental Management Act Principles

The National Environmental Management Principles (set out in section 2 of the NEMA, which apply to the actions of all organs of state, serve as guidelines by reference to which any organ of state must exercise any function when taking any decision, and which must guide the interpretation, administration and implementation of any other law concerned with the protection or management of the environment), *inter alia*, provides for:

- the effects of decisions on all aspects of the environment to be taken into account;
- the consideration, assessment and evaluation of the social, economic and environmental impacts of activities (disadvantages and benefits), and for decisions to be appropriate in the light of such consideration and assessment;
- the co-ordination and harmonisation of policies, legislation and actions relating to the environment;
- the resolving of actual or potential conflicts of interest between organs of state through conflict resolution procedures; and

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- the selection of the best practicable environmental option.

The development will result in both negative and positive impacts.

Negative Impacts:

Loss of intact critically endangered and endangered indigenous vegetation and species of high conservation;
Loss of ecological process associated with the intact indigenous vegetation and species of conservation concern;
Potential pollution of the Atlantis aquifer;
Noise during the construction and operational phase of the proposed development;
Visual Impacts; and
Increased service infrastructure requirements.

The Department is satisfied that all the negative impacts of significance specified above will be addressed by the conditions contained in the EA and the mitigation measures contained in the EMP.

Positive impacts:

Socio-Economic benefits such as job creation, growth of the local, provincial and regional economies;
Diversity in the manufacturing industry through investment in the renewable energy sector; and
Creation of a 'Green Technology Manufacturing Cluster'.

In view of the above, the NEMA principles, compliance with the conditions stipulated in this environmental authorisation, and compliance with the EMP, the competent authority is satisfied that the proposed listed activities will not conflict with the general objectives of integrated environmental management stipulated in Chapter 5 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) and that any potentially detrimental environmental impacts resulting from the listed activities can be mitigated to acceptable levels.

-----END-----

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APPENDIX A

RECOMMENDATIONS OF THE PALAEOLOGICAL ASSESSMENT FOR THE PROPOSED
GREEN TECHNOLOGY MANUFACTURING CLUSTER INDUSTRIAL DEVELOPMENT AND
ASSOCIATED INFRASTRUCTURE ON PORTION 4 AND PORTION 1 OF FARM 1183, ATLANTIS.

DATED JULY 2012 AND PREPARED BY GRAHAM AVERY

From:

To: *00218755515

16/01/2013 15:47

#500 P.022/024

**Palaeontological Assessment:
Proposed Development Farms
CA1183 (Portions 1&4) and CA 4
(Portion 93), 3318CB Melkbosstrand**

Prepared by

Graham Avery
(Sole Proprietor)

Archaeozoology, Stone Age Archaeology and Quaternary Palaeontology

July, 2012

From:

To: *00218755515

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Klein Springfontein

A temporary exposure in the 'Duinefontein Dune Field' near the R27 yielded many fossils of terrestrial mammals, reptiles and birds, which were collected by GA and RG Klein and lodged in the Cenozoic Section of Iziko Museum's Natural History Collections Department.

Koeberg Nuclear Power Station

Excavations for the foundations of the Koeberg Nuclear Power Station yielded 14 m of terrestrial Middle Pleistocene deposits underlain by a further 14 m of highly fossiliferous marine deposits, dated to approximately 5 Ma, that extended to Malmesbury bedrock (Rogers 1979; Rogers 2006). Unique early Pliocene avian and marine mammal species, including a probable new species of *Arctocephalus* (the same genus the South African Fur Seal falls into), have been described from the site, e.g. (Avery and Klein 2011; Simpson 1975).

Human Burials

Later Stone Age people inhabited the area as evidenced by surface scatters (above) and San and/or Khoekhoe burials may be encountered at any time or level e.g. (Pfeiffer and Van der Merwe 2004; Pfeiffer, et al. 1999).

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If possible, geotechnical information, together with the proposed depths of excavations for foundations and/or infrastructure, should be provided prior to the commencement of construction. This may enable a better estimation of the time(s) when monitoring will take place and even the extent of recovery work.

Protocols for dealing with palaeontological monitoring/mitigation must be included in the Environmental Management Plan (EMP). Any such material is likely to be fragile and due care must be exercised.

Any material recovered will be lodged in the collections of Iziko South African Museum.

Funds must be available *a priori* to cover costs.

Heritage Permits Required

The primary heritage legislation that needs to be considered is The South African Heritage Resources Act 25 of 1999 and regulations (details at www.sahra.org.za). All heritage material, including burials, is included.

Clearance in terms of the National Heritage Act of 1999 will be required before the development can proceed. Locally, a permit will be required from Heritage Western Cape; in the event of a burial being exposed, SAHRA is the organization to contact along with the South African Police Services, but no bones should be further moved until an archaeologist or palaeontologist has assessed them.

Although not required by the Act, it is suggested that, to obviate possible delays should fossil material be encountered, a permit be applied for before any excavation is initiated. This would enable the monitor to readily recover material, should it be encountered during construction activities.

References

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1966 Interesting association of bones from the Elandsfontein fossil site. *Actes du V Congres Panafricain de prehistoire et de l'Etude du Quaternaire*.

4. Information regarding the gas pipeline from DEA&DP (November 2016)



Dr Hildegard Fast
Energy Security Game Changer Lead
Department of Economic Development & Tourism
Hildegard.Fast@westerncape.gov.za
021 483 0848

Department of Environmental Affairs
Environmental Impact Assessments

To Whom It May Concern

RE: Investigations into Preferred Gas Pipeline Routes between Saldanha Bay and Atlantis

The Western Cape Government, through the Department of Economic Development and Tourism, is actively facilitating the importation of Liquefied Natural Gas (LNG) through Saldanha Bay. Since 2012, we have commissioned numerous studies into the various technical aspects relating to LNG demand and infrastructure requirements.

Owing to the significant demand for natural gas in Atlantis and Cape Town as a whole, one of the key infrastructure requirements will be a gas transmission pipeline between Saldanha Bay and Atlantis.

The Western Cape Government has undertaken preliminary EIA screening on preferred pipeline routes between Saldanha and Atlantis. This study is entitled "Environmental Screening and Safety Study for the proposed LNG terminal at Saldanha and associated pipeline infrastructure to Atlantis and Cape Town," which was completed in 2014 by CSIR (https://www.westerncape.gov.za/dept/edat/documents/public_info/T/20448?toc_page=4). No fatal flaws were identified for the preferred route, which loosely follows the R27 road corridor.

We are aware of significant work which has been undertaken by iGas in this space, including ground-truthing vegetation studies on preferred routes, alongside relevant geo-technical studies. We are keen to take this work further, and have already discussed cooperation on further studies with iGas.

The Western Cape Government is an active partner in Operation Phakisa's A1 Pipeline Working Group (A1 is the first phase of the pipeline and extends from Saldanha Bay to Atlantis). Much of the relevant regulatory and planning discussion is taking place in this

Working Group, consistent with gas-to-power off-take in the West Coast corridor (to the plant boundary of the site earmarked for the GTP plant).

Please feel free to contact me for any further information.

Regards,

A handwritten signature in black ink, appearing to be 'Hildegard Fast', written over a faint, stylized outline of a fish or similar shape.

(Dr) Hildegard Fast
Deputy Director-General: Energy Security Game Changer
Department of Economic Development and Tourism

25 / 11 / 2016

5. Important Information regarding powerline capacity from GreenCape and Eskom



To whom it may concern,

RE: Eskom transmission availability in Atlantis

This letter is written in response to a request from DEA about the ability and route for electricity infrastructure upgrades in Atlantis. This request was made as it relates to an EIA for 1500MW of LNG to power.

1.1. **Eskom planning**

Attached is correspondence with the Eskom officials responsible for Ankerlig. Copied into this correspondence is GreenCape, the Western Cape Government and the advisor to the Western Cape Government. (Prof Jim Petrie). Attached to this document is the Eskom planning that take a view to 2022. GCCA 2022.

1.2. **Eskom current availability**

The current grid capacity study is also made available. GCCA 2016.

The meetings, engagements and conversations are well underway with Eskom. As with many long terms plans there is a degree of uncertainty. The uncertainty in the development of the LNG to power project at Ankerlig is mitigated in the following ways.

- There is currently available capacity for part of the full requirement
- There are existing plan to upgrade the evacuation capacity to meet the future requirements
- According to the GGCA 2022, these upgrade will be complete at about the same time that any LNG to power facility will be required to connect.

The understanding given to the project team, as a result of these conversations, correspondence and studies, is that the requirements for evacuation capacity is well understood and the required upgrades are already planned for.

Regards


Mike Mulcahy
GreenCape: CEO
22/11/16

GreenCape Sector Development Agency
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Company Registration No. 2012/039750/08
Refer to the GreenCape website for director details

In partnership with:



11/28/2016

Search results - milko@green-cape.co.za - GreenCape Sector Development Agency Mail

Jim Petrie

3:11 PM (16 hours ago)

to Vincent, Karabo, Ahmed, Hildegard.Fast, me

Dear Vincent

I refer to your email below.

Can you please advise when we might receive written confirmation of the Tx strategic development planning we discussed with yourself and Ahmed some months ago? This is now a matter of some urgency for the WCG as we continue to promote gas development projects in the sub-region.

I ask for the following reasons:

1. There is some commentary in the IPP Office's PIM document around LNG importation into Saldanha suggesting that Eskom does not have the transmission infrastructure capacity to evacuate ANY gas-to-power from the West Coast region. This is distinctly at odds with the information we received from Ahmed and yourself in August (before the PIM was released).
2. We have received some feedback from DEA around gas-to-power in Atlantis (whether this is via a reconfigured Ankerlig, or a new IPP) seeking clarification on power evacuation routes from Eskom.

Would it be possible for Eskom to commit (in plain language for DEA) that it foresees no problems with evacuating new power output from the region (up to "X" MWe) with its current infrastructure, and that Eskom's strategic plans envisage being able to evacuate an additional "Y" MWe over a certain time period?

This would be most helpful. For starters, it will demonstrate Eskom's continued commitment to new power generation options in this sub-region, and provide the necessary stimulus to assist in gas delivery for Ankerlig.

I note the correspondence between Hildegard and yourself relating to our wider stakeholder engagement with Transnet and PetroSA. We look forward to Eskom's participation at the next group meeting on 2nd Dec (organised by Webber Wentzel).

Kind regards,.

Jim

Jim Petrie, C. Eng., F IChemE
LNG Adviser to Western Cape Government, South Africa
Emeritus Professor, University of Sydney
Honorary Professor, University of Cape Town

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SA mobile: +27 72 6423058
Aus mobile: +61 402 003039

From: Vincent M Chauke [mailto:ChaukeMV@eskom.co.za]
Sent: 11 August 2016 14:55
To: Jim Petrie <Jim.petrie@sydney.edu.au>
Cc: Hildegard Fast (Hildegard.Fast@westerncape.gov.za) <Hildegard.Fast@westerncape.gov.za>; Karabo Rakgolola <RakgolK@eskom.co.za>; Ahmed Hansa <HansaA@eskom.co.za>
Subject: RE: Eskom planning around gas in the Western Cape
Importance: High

Good day Prof Jim,

Please find below, links to information that will assist regarding the Western Cape grid requirement/capacity planning,

1. The [Grid Connection Capacity Assessment of the 2022 Transmission Network \(GCCA-2022\)](#) document will help you to establish the available capacity across the national grid for the connection of new generation at the substations on the Eskom transmission network that may be in service by 2022 based on both approved and proposed new transmission infrastructure projects. The GCCA-2022 includes all of the projects that are expected to be completed by 2022 as contained in the Transmission Development Plan (TDP) for the period 2015-2024 (issued in October 2014). This is to provide developers and investors with an indication of the potential available capacity for the connection of new generation at or within the

<https://mail.google.com/mail/u/0/#search/jim>

1/2

11/28/2016

Search results - mike@green-cape.co.za - GreenCape Sector Development Agency Mail

supply areas of the transmission substations on the Eskom transmission network by 2022 based on the 2014 TDP.

You may also find additional information related to your query in the current version of the TDP (2016-2025) (released in October 2015).

Should you require additional information to that contained in the above, kindly contact the Grid Access Unit (GAU) with regards to a formal application.

Note: The content that was shared with you is still being reviewed internally and we should forward you a copy in due course.

2. The current technology being installed for dual fuel conversion only allows for LNG hence we interested in the LNG options.

Regards

Vincent Chauke
Senior Manager (Acting)
Project Development Department

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Printed 28/11/16

Email proof of request to arrange site visit (EAP to DEA) as per comment (xxii) on the DEIAR
– 21/04/2017

From: Kelly Stroebe
To: Mmamohale Kabasa
CC: MEssop @environment.gov.za
Date: 24/04/2017 15:39
Subject: Re: 14/12/16/3/3/2/981
Attachments: 00206B9F7B84170424122941_1.pdf

Good Afternoon Mmamohale,

With regards to point **(xxii)** in the comments on the DEIR received today (attached), CSIR would just like to find out when DEA would propose a site visit? Would a site visit be more beneficial after the submission of the FEIR?

Kindly confirm and we can make arrangements for this second site visit.

Could you also please confirm that DEA is still satisfied with one hard copy and two CD's of the FEIR.

Kind Regards,

Kelly Stroebe
Environmental Assessment Practitioner (EAP)
CSIR Stellenbosch

kstroebel@csir.co.za
Tel. : 021 888 2432
PO Box 320, Stellenbosch, 7599

>>> Lydia Kutu <LKutu@environment.gov.za> 24/04/2017 12:32 >>>
Good day.

Please find herein the attached letter for the above mentioned.

I hope you find all in order.

Thank you.

Kind Regards,
Lydia Kutu
Please consider the environment before you print this email. Only print if it is essential. A message from the Department of Environmental Affairs.

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Letter from DEA acknowledging extension for FEIAR



environmental affairs

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PER E-MAIL / MAIL

Dear Ms Stroebe

ACKNOWLEDGEMENT OF NOTIFICATION FOR AN EXTENSION IN TERMS OF REGULATION 23(1)(b) AND 23 (2) FOR THE PROPOSED 1500 MW ATLANTIS GAS POWER FACILITY ON PORTION 1 OF PORTION 4 OF THE CAPE FARM 1183 WITHIN THE ATLANTIS INDUSTRIAL ZONE OF THE CITY OF CAPE TOWN METROPOLITAN MUNICIPALITY IN THE WESTERN CAPE PROVINCE

The Department's Acceptance of Scoping Letter dated 01 February 2017, the comment letter on the Draft Environmental Impact Assessment Report dated 21 April 2017 and your notification of extension letter dated 05 May 2017 and received by the Department on the 09 May 2017 refer.

The Department confirms having received the notification for extension on the 09 May 2017. Based on the information provided by you, the Department herewith extends the timeframe. Please note that should you fail to meet any of the timeframes stipulated in Regulation 23 of the Environmental Impact Assessment Regulations (2014), as amended, your application will lapse.

Kindly quote the abovementioned reference number in any future correspondence in respect of the application. Please note that a listed activity may not commence prior to an environmental authorization being granted by the Department.

Yours sincerely

Mr Sabelo Malaza
Chief Director: Integrated Environmental Authorisations
Department of Environmental Affairs
Letter signed by: Ms Azrah Essop
Designation: Environmental Officer: EIA Coordination, Strategic Planning and Support
Date: 10 May 2017



DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape

VERSION 2 OF MAY 2017

APPENDIX T:

Traffic Impact Study

CSIR STELLENBOSCH

ATLANTIS GAS-TO-POWER FACILITY TRAFFIC IMPACT STATEMENT

MAY 25, 2017

CONFIDENTIAL





ATLANTIS GAS-TO- POWER FACILITY TRAFFIC IMPACT STATEMENT

CSIR STELLENBOSCH

VERSION 1.0
CONFIDENTIAL

PROJECT NO.: 23443
DATE: MAY 2017

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1 INTRODUCTION

1.1 BACKGROUND AND PURPOSE OF STUDY

WSP Group Africa (Pty) Ltd has been appointed by the CSIR Stellenbosch to undertake a Traffic Impact Statement (TIS) for Erf 277, Atlantis, City of Cape Town, Western Cape Province.

The proposed land use is a 1500 MW Gas-to-Power facility. It should be noted that the development site in question has already been rezoned to industrial zoning. Erf 277 has been identified in the Environmental Impact Assessment (EIA) process as the preferred location of development. The other erf considered previously for the Gas-to-Power facility, namely Erf 171, is not addressed in this TIS.

The purpose of the TIS is to investigate the traffic impact of the proposed development on the surrounding road network and to propose mitigating measures if required. Due to the appropriate zoning of the erf for the intended development, and the low expected traffic generation, a full Traffic Impact Assessment is not required by the City of Cape Town. The CV's of the author and reviewer are included in Appendix B. The details of the specialist and the declaration of interest is included in Appendix C.

1.2 STUDY AREA

The location of the erf and study area is shown on the Locality map in Figure 1.



Figure 1: Locality Plan

1.3 BASE YEAR ROAD NETWORK

1.3.1 CURRENT ROAD NETWORK

The existing road network is detailed in Table 1.

Table 1: Base year road network description

STREET NAME	CLASSIFICATION	JURISDICTION	TYPE	NMT	STREET LIGHTING
Gideon Basson Street	Local Street (Class 5)	City of Cape Town	2-lane undivided	No	Yes
Neil Hare Road	Local Distributor (Class 4)	City of Cape Town	2-lane undivided	Unsurfaced sidewalks: both sides	Yes
Charel Uys Drive	Secondary Arterial (Class 3)	City of Cape Town	2-lane undivided	Surfaced sidewalks - both sides	Yes
Dassenberg Road (R307)	Primary Arterial (Class 2)	City of Cape Town & Provincial Roads (MR00223)	2-lane undivided	Unsurfaced sidewalks: both sides	No

1.3.2 FUTURE ROAD NETWORK

At the time of writing this report there are no known planned changes to the existing road infrastructure in the study area that will have an effect on the future development. There are also no planned road links in the study area that will have an impact on trip distribution or traffic volumes in the study area.

2 SCOPE & METHODOLOGY

2.1 EXTENT OF STUDY

- The total trip generation of the proposed development is less than 50 vehicle trips per hour (total in and out) during the weekday AM and PM peak period of the construction phase, operational phase and the decommissioning phase.
 - The impact of the development trips generated can be considered to be negligible with no capacity analysis required.
 - The COTO Site Traffic Assessment Manual requires that a Traffic Impact Study be prepared when more than 50 peak hour trips are produced.
 - A full Traffic Impact Study is therefore not warranted and a Traffic Impact Statement was undertaken.
-

2.2 BACKGROUND TRAFFIC VOLUMES

No traffic counts were undertaken. The background traffic volumes is expected to be low.

2.3 LATENT RIGHTS

No known latent rights exist within the immediate study area that will have an impact on the local intersection performance. A cumulative impact assessment is hence not applicable to the development in question.

3 DEVELOPMENT TRIP GENERATION

3.1 DEVELOPMENT ZONING

The current zoning is General Industrial 1 and will not change with the proposed Gas-to-Power facility.

3.2 DEVELOPMENT OPERATIONS

It is planned that gas will ultimately be piped to the development site. However, the pipeline is not expected to be operational when the facility is completed. Gas will therefore be transported to the site with fuel tankers in the interim. A total of 50 fuel tankers per week will undertake these deliveries.

The electricity generated on the site will be transmitted by electricity lines into the national grid. The development operations (staff, maintenance, etc.) will have negligible trip generation.

3.3 TRIP GENERATION RATES

Typical industrial trip generation rates are not applicable to the development. The trip generation for a large industrial site of ±38.65ha to which a typical trip rate per 100 square metre Gross Leasable Area (GLA) is calculated, will be significantly higher than what is expected to occur on this site in practice.

The trip generation for the proposed Gas-to-Power facility was calculated based on information received for the following three phases of the development: Construction Phase, Operational Phase and Decommissioning Phase. The facility is expected to become operational by 2020. It is expected to generate electricity for a minimum period of 20 years.

3.3.1 CONSTRUCTION PHASE

The current estimate is that the construction phase will be approximately 30-32 months. The construction activities on site will occur from 6am to 6pm from Monday to Saturday and from 6am to 3pm on Sundays. It is hence indicated that construction activities will commence before and end after the typical commuter peak hour.

During the construction phase, heavy vehicle and construction traffic trips will not be concentrated during only the weekday AM and PM peaks. These trips normally arrive and depart throughout a typical construction day. The number of vehicle trips is unknown at this stage.

The number of construction workers is unknown. It can however be assumed that the majority of construction workers will travel via public transport and/or NMT.

From the above, it is deduced that less than 50 peak hour trips will be generated and the effect during the weekday peak hours will be negligible.

3.3.2 OPERATIONAL PHASE

Approximately 200 unskilled and 20 skilled staff members will be on-site daily during the operational phase. It is expected that the unskilled labour would arrive per public transport mode and/or NMT mode, with only a small percentage (assume 5%) arriving by private vehicle. As a worst case scenario it can be assumed that the skilled staff would all arrive with individual private vehicles.

Until such time as the gas pipeline to transport the gas to site has is completed, the gas will be transported by approximately 50 fuel tankers on a weekly basis.

From the above, it is deduced that less than 50 weekday Am and PM peak hour trips will be generated and the effect of these on the road network will hence be negligible.

3.3.3 DECOMMISSIONING PHASE

The decommissioning phase traffic is assumed to be similar to the construction phase traffic. Less than 50 peak hour trips will be generated and the effect will be negligible.

4 NON-MOTORISED & PUBLIC TRANSPORT ASSESSMENT

4.1 PUBLIC TRANSPORT ASSESSMENT

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of the public transport be included in a TIS.

Niel Hare Road is a bus route. Dassenberg Road and Charel Uys Drive are bus, taxi and MyCiti routes. The development site is hence well served by Public Transport.

The development will attract public transport trips, and these can be accommodated on the existing services in the study area. Public transport lay-by's should be considered at the Neil Hare Road / Gideon Basson Street intersection if access is taken from Gideon Basson Street. Otherwise, the lay-by's should be considered at the new access position to/from Neil Hare Road. The provision of these lay-by's must be approved by the City of Cape Town's Transport and Urban Development Authority (TDA).

4.2 NON-MOTORISED TRANSPORT (NMT)

Gideon Basson Street, Niel Hare Road and Dassenberg Road have unpaved sidewalks. Charel Uys Drive has paved sidewalks.

It is proposed that 2.0 m wide paved sidewalks are implemented on both sides of Gideon Basson Street, to accommodate NMT trips if access is taken from Gideon Basson Street. Otherwise, the sidewalks should be on both sides of the new access road off Neil Hare Road.

5 PHYSICAL ASPECTS OF THE DEVELOPMENT

5.1 SITE ACCESS

It is proposed that access to site is taken from Gideon Basson Street, as it is an existing access intersection with sufficient sight distance.

Alternatively a new access road could be constructed along the southern border of the site to/from Neil Hare Road, pending confirmation of sufficient access spacing and sight distance. Sufficient spacing should be obtained to/from the Atlantis Foundries Business Park site further east and to/from the other properties further west. The development environment is seen as intermediate, hence the spacing criteria on Neil Hare Road (Class 4 Road) is 180m between two unsignalised full accesses.

These access options are acknowledged by the City of Cape Town as per their correspondence included in Appendix A.

Taking into account the low expected trip generation of the development, one access to the development without turning lanes will be sufficient and capacity analysis is not required. Stop-control is proposed on the development access.

The existing kerb radii of the Neil Hare Road / Gideon Basson Street intersection is 10m. The recommended kerb radius for intersections in industrial areas is 12m as per UTG10 Guidelines. To accommodate the gas tankers accessing the site it is recommended that the kerb radii at the access intersection be 12m. The existing Gideon Basson/Neil Hare Road intersection will therefore have to be upgraded.

Should access control be implemented sufficient stacking distance should be provided on the access road. This should be investigated at Site Development Plan (SDP) stage.

5.2 PARKING

Parking requirements will be finalised at SDP stage, and should be in line with the proposed trip generation. Parking is proposed for at least the 20 full-time staff and for 10 unskilled workers, totalling 30 parking bays. Some additional bays should be provided for maintenance vehicles and visitors.

5.3 VEHICLE CIRCULATION

The SDP should include sufficient circulation and turning space for all vehicles, including the gas tankers.

6 ENVIRONMENTAL IMPACT ASSESSMENT OF TRAFFIC

6.1 INTRODUCTION

The Environmental Impact Assessment (EIA) uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the “EIA Regulations”).

As required by the EIA Regulations (2014), the determination and assessment of impacts will be based on the following criteria:

- Nature of the Impact
- Significance of the Impact
- Consequence of the Impact
- Extent of the impact
- Duration of the Impact
- Probability if the impact
- Degree to which the impact:
 - can be reversed;
 - may cause irreplaceable loss of resources; and
 - can be avoided, managed or mitigated.

Following international best practice, additional criteria have been included to determine the significant effects. These include the consideration of the following:

- Magnitude: to what extent environmental resources are going to be affected;
- Sensitivity of the resource or receptor (rated as high, medium and low) by considering the importance of the receiving environment (international, national, regional, district and local), rarity of the receiving environment, benefits or services provided by the environmental resources and perception of the resource or receptor); and
- Severity of the impact, measured by the importance of the consequences of change (high, medium, low, negligible) by considering inter alia magnitude, duration, intensity, likelihood, frequency and reversibility of the change.

It should be noted that the definitions given are for guidance only, and not all the definitions will apply to all of the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

6.2 METHODOLOGY

Impacts are assessed in terms of the following criteria:

- The nature, a description of what causes the effect, what will be affected and how it will be affected

Table 2: Nature of Impact

NATURE OR TYPE OF IMPACT	DEFINITION
Beneficial / Positive	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Adverse / Negative	An impact that is considered to represent an adverse change from the baseline, or introduces a new undesirable factor.
Direct	Impacts that arise directly from activities that form an integral part of the Project (e.g. new infrastructure).
Indirect	Impacts that arise indirectly from activities not explicitly forming part of the Project (e.g. noise changes due to changes in road or rail traffic resulting from the operation of Project).
Secondary	Secondary or induced impacts caused by a change in the Project environment (e.g. employment opportunities created by the supply chain requirements).
Cumulative	Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.

- The physical extent, wherein it is indicated whether:

Table 3: Extent of Impact

SCORE	DESCRIPTION
1	The impact will be limited to the site;
2	the impact will be limited to the local area;
3	the impact will be limited to the region;
4	the impact will be national; or
5	the impact will be international.

- The duration, wherein it is indicated whether the lifetime of the impact will be:

Table 4: Duration of Impact

SCORE	DESCRIPTION
1	of a very short duration (0 to 1 years)
2	of a short duration (2 to 5 years)
3	medium term (5–15 years)
4	long term (> 15 years)
5	permanent

- The magnitude of impact on ecological processes, quantified on a scale from 0-10, where a score is assigned:

Table 5: Magnitude of Impact

SCORE	DESCRIPTION
0	small and will have no effect on the environment.
2	minor and will not result in an impact on processes.
4	low and will cause a slight impact on processes.
6	moderate and will result in processes continuing but in a modified way.
8	high (processes are altered to the extent that they temporarily cease).
10	very high and results in complete destruction of patterns and permanent cessation of processes.

- The probability of occurrence, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale where:

Table 6: Probability of Impact

SCORE	DESCRIPTION
1	very improbable (probably will not happen).
2	improbable (some possibility, but low likelihood).
3	probable (distinct possibility).
4	highly probable (most likely).
5	definite (impact will occur regardless of any prevention measures).

- the significance, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high;
- the status, which is described as either positive, negative or neutral;
- the degree to which the impact can be reversed;
- the degree to which the impact may cause irreplaceable loss of resources; and
- the *degree* to which the impact can be mitigated.

The significance is determined by combining the criteria in the following formula:

$$S = (E+D+M)*P$$

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

Table 7: Significance Weightings per Impact

OVERALL SCORE	SIGNIFICANCE RATING	DESCRIPTION
< 30 points	Low	where this impact would not have a direct influence on the decision to develop in the area
31-60 points	Medium	where the impact could influence the decision to develop in the area unless it is effectively mitigated
> 60 points	High	where the impact must have an influence on the decision process to develop in the area

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the Project's actual extent of impact, and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures, and is thus the final level of impact associated with the development of the Project. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this EIA Report.

6.3 ENVIRONMENTAL IMPACT ASSESSMENT OF TRANSPORT

Refer to Table 8 for the Construction Phase Impact Assessment of the facility.

Table 8: Impact Assessment: Construction Phase

POTENTIAL IMPACT		EXTENT (E)	DURATION (D)	MAGNITUDE (M)	PROBABILITY (P)	SIGNIFICANCE (S=(E+D+M)*P)
Noise, dust and exhaust pollution due to vehicle trips on-site	Nature of impact:	Vehicle and tyre noise, dust & exhaust pollution				
	Without Mitigation	1	2	0	5	15 Low
	Degree to which impact can be reversed:	Temporary, no long term effect				
	Degree of impact on irreplaceable resources:	n/a				
	Mitigation Measures	None				
	With Mitigation	n/a				
Noise and exhaust pollution due to additional vehicle trips on local access roads	Nature of impact:	Vehicle and tyre noise, dust & exhaust pollution				
	Without Mitigation	2	2	0	5	20 Low
	Degree to which impact can be reversed:	Temporary, no long term effect				
	Degree of impact on irreplaceable resources:	n/a				
	Mitigation Measures	None				
	With Mitigation	n/a				
Noise and exhaust pollution due to additional vehicle trips on Dassenberg Road	Nature of impact:	Vehicle and tyre noise, dust & exhaust pollution				
	Without Mitigation	2	2	0	5	20 Low
	Degree to which impact can be reversed:	Temporary, no long term effect				
	Degree of impact on irreplaceable resources:	n/a				
	Mitigation Measures	None				
	With Mitigation	n/a				

Refer to Table 9 for the Operational Phase Impact Assessment of the facility.

Table 9: Impact Assessment: Operational Phase

POTENTIAL IMPACT										
	EXTENT (E)		DURATION (D)		MAGNITUDE (M)		PROBABILITY (P)		SIGNIFICANCE (S=(E+D+M)*P)	
Noise, dust and exhaust pollution due to vehicle trips on-site	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution							
	Without Mitigation		1	4	0	5	25	Low		
	Degree to which impact can be reversed:		Temporary, no long term effect							
	Degree of impact on irreplaceable resources:		n/a							
	Mitigation Measures		None							
	With Mitigation		n/a							
Noise and exhaust pollution due to additional vehicle trips on local access roads	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution							
	Without Mitigation		2	4	0	5	30	Low		
	Degree to which impact can be reversed:		Temporary, no long term effect							
	Degree of impact on irreplaceable resources:		n/a							
	Mitigation Measures		None							
	With Mitigation		n/a							
Noise and exhaust pollution due to additional vehicle trips on Dassenberg Road	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution							
	Without Mitigation		2	4	0	5	30	Low		
	Degree to which impact can be reversed:		Temporary, no long term effect							
	Degree of impact on irreplaceable resources:		n/a							
	Mitigation Measures		None							
	With Mitigation		n/a							

Refer to Table 10 for the Decommissioning Phase Impact Assessment of the facility.

Table 10: Impact Assessment: Decommissioning Phase

POTENTIAL IMPACT								
	EXTENT (E)	DURATION (D)	MAGNITUDE (M)	PROBABILITY (P)	SIGNIFICANCE (S=(E+D+M)*P)			
Noise, dust and exhaust pollution due to vehicle trips on-site	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution					
	Without Mitigation		1	2	0	5	15	Low
	Degree to which impact can be reversed:		Temporary, no long term effect					
	Degree of impact on irreplaceable resources:		n/a					
	Mitigation Measures		None					
	With Mitigation		n/a					
Noise and exhaust pollution due to additional vehicle trips on local access roads	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution					
	Without Mitigation		2	2	0	5	20	Low
	Degree to which impact can be reversed:		Temporary, no long term effect					
	Degree of impact on irreplaceable resources:		n/a					
	Mitigation Measures		None					
	With Mitigation		n/a					
Noise and exhaust pollution due to additional vehicle trips on Dassenberg Road	Nature of impact:		Vehicle and tyre noise, dust & exhaust pollution					
	Without Mitigation		2	2	0	5	20	Low
	Degree to which impact can be reversed:		Temporary, no long term effect					
	Degree of impact on irreplaceable resources:		n/a					
	Mitigation Measures		None					
	With Mitigation		n/a					

6.4 SUMMARY OF IMPACT ASSESSMENT FINDINGS

The overall significance of the vehicle traffic impact during the Construction, Operational and Decommissioning Phases of the facility, as detailed above, is Low. The impacts would hence not have a direct influence on the decision to undertake the development.

During construction an Environmental Management Plan (EMP) is normally implemented. Apart from the EMP, no other mitigating measures are recommended for the expected trip generation of the facility.

7 CONCLUSIONS & RECOMMENDATIONS

7.1 CONCLUSIONS

- This TIS is for Erf 277, Atlantis, City of Cape Town.
- The proposed development is a Gas-to-Power facility.
- The total trip generation of the proposed development is less than 50 trips per hour (total in and out) during the weekday AM and PM peak period for the construction, operation and the decommissioning phase.
- The impact of the development trips generated can be considered to be negligible with no capacity analysis required.
- The Gas-to-Power facility is expected to become operational in 2020. It is expected to generate electricity for a minimum period of 20 years.
- Access is proposed from the existing Gideon Basson Street. Alternatively a new access road could be constructed along the southern border of the site off Neil Hare Road, pending confirmation of sufficient access spacing and sight distance.
- Stop-control is proposed on the development access road off Neil Hare Road.
- Public transport lay-by's should be considered at the Neil Hare Road / Gideon Basson Street intersection if access is taken from Gideon Basson Street. Otherwise, the lay-by's should be considered at the new access position to/from Neil Hare Road.
- It is proposed that 2.0 m wide paved sidewalks are implemented on both sides of Gideon Basson Street, to accommodate NMT trips if access is taken from Gideon Basson Street. Alternatively, the sidewalks should be on both sides of the new access road off Neil Hare Road.
- To accommodate tankers accessing the site it is recommended that the kerb radii at the chosen access intersection be 12.0 m.
- An environmental impact assessment significance rating was performed on the transport impacts.
- The overall significance of the transport impact during the Construction, Operation and Decommissioning Phase of the facility is Low.
- During construction an Environmental Management Plan (EMP) is normally implemented.
- Apart from the EMP, no other mitigating measures are recommended for the expected trip generation of the facility.

7.2 RECOMMENDATIONS

It is recommended that this TIS is accepted as part of the EIA application.

REFERENCES

- South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Volume 1, Version 1.0, Committee for Transport Officials (COTO), August 2012.

APPENDIX

A CITY OF CAPE TOWN CORRESPONDENCE



30 November 2016

The Director
Council for Scientific and Industrial Research (CSIR)
P.O. Box 320
STELLENBOSCH
7599

Attention: Ms K. Stroeel

[e-mail: kstroebel@csir.co.za]
Tel: 021 888 2490
Fax: 021 888 2432

Dear Madam

ERF 171 (Previously Remainder Cape Farm 1183 and Ptn 4 of CFM 93) AND ERF 277 (Previously Ptn 1 & 4 of Cape Farm 1183), ATLANTIS: REVISED DRAFT SCOPING REPORT FOR THE PROPOSED ATLANTIS GAS-TO-POWER PROJECT

The abovementioned Scoping report, dated October 2016, refers.

Below please find the consolidated comment of the City of Cape Town on the above mentioned report:

1. City of Cape Town: Spatial Planning & Urban Design (Ms L Steenkamp / L. Kruger-Fountain)
 - 3.1 The Spatial Planning & Urban Design department's previous comment has sufficiently been included in the revised draft scoping report.
2. City of Cape Town: Transport for Cape Town (Mr J Massyn)
 - 2.1 City of Cape Town: Transport for Cape Town (TCT) indicated in the City's previous comment that the proposed access off Neil Hare Road on the northern end of the site, which necessitates a level crossing across the railway line, is not supported. TCT indicated that access should be taken off Neil Hare Road on the southern boundary or Gideon Basson Road. This comment by TCT was included in the revised scoping report's comments and responses table, but no response from the EAP is recorded against this comment.
 - 2.2 In addition Chapter 2 (page 2-7) states that the access from the north is preferable whilst it also states that the access from the south is more viable. Conversely it is again stated in the Services Report (Appendix I, Section 8.1, page10) that the preferred access to the site is off Neil Hare Road on the northern end of the site. The aforementioned contradictions are confusing and it should be clarified which access will be used.
 - 2.3 TCT reiterates that only the access to the site should be taken from the south off Neil Hare Road or Gideon Basson Road. The primary reason for a southern access point being that it will eliminate the railway crossing.

3. City of Cape Town: Specialized Health Services: Air Quality Branch (Ms L. Matthys)

The revised draft scoping report has sufficiently incorporated the initial comments submitted by the Air Quality Branch. As such the Branch is satisfied with the initial impacts identified by the EAP and included in the proposed Plan of Study for the EIA.

4. City of Cape Town: Economic Development (Mr C. Hewett)

The Department indicated that it is satisfied with the EAP's response to its comments on the initial draft scoping report (DSR), as outlined in chapter 5 of the revised DSR.

It is worth to note that the department is fully supportive of renewable energy generation in Atlantis. The City of Cape Town established a green technology manufacturing and renewable energy hub in Atlantis in 2011, in response to the Department of Energy's Renewable Energy Independent Power Producer Programme (REIPPP). Localisation of manufacturing and the resultant job creation is one of the key priorities of government through the REIPP programme.

5. City of Cape Town: Environmental Resource Management (Mr M. Theron)

5.1 It has come to the City of Cape Town's attention that the Surveyor General's office converted all Cape Farms in Atlantis Industrial (which are zoned Industrial) to Atlantis Industrial Erven. The City's Corporate GIS system has recently converted all Cape Allotment (CA) or farm numbers, to the new erf numbers. As such the erf numbers reflected in the revised draft scoping report are outdated.

5.1.1 Option 1's new erf number is 171 (was previously *Remainder CFM 1183 and Portion 4 of CFM 93*); and

5.1.2 Option 2's new erf number is 277 (was previously *Portion 1 and 4 of CFM 1183*)

5.2 Chapter 1, Introduction, Locality Map (pg 1-3): Specify the property erf numbers on the plans. Site 1 (Erf 171) and Site 2 (Erf 277) for ease of reference.

5.3 All other comment on, and/or errors to the previously DSR, raised by the Environmental Resource Management department have adequately been addressed in the revised DSR.

The City therefore concurs with the proposed Plan of Study for the EIA phase, as well as the Terms of References for the specialist studies.

The abovementioned comment must be included in the draft EIR. Kindly submit the draft Environmental Impact Assessment Report (once available) to this office in the form of 1 x hard copy and 1 x CD version.

Yours faithfully



PAT TITMUSS

REGIONAL MANAGER: ENVIRONMENTAL & HERITAGE MANAGEMENT: Northern Region (Blaauwberg District)

Morné Theron

Senior Environmental Professional
Environmental & Heritage Management Branch
Environmental Management Department

T + 27 21 444 0601
E morne.theron@capetown.gov.za

24 April 2017

The Director
Council for Scientific and Industrial Research (CSIR)
P.O. Box 320
STELLENBOSCH
7599

Attention: Ms K. Stroebel

[e-mail: kstroebel@csir.co.za]
Tel: 021 888 2490
Fax: 021 888 2432

Dear Madam

ERF 171 (Previously Remainder Cape Farm 1183 and Ptn 4 of CFM 93) AND ERF 277 (Previously Ptn 1 & 4 of Cape Farm 1183), ATLANTIS: DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT FOR THE PROPOSED ATLANTIS GAS-TO-POWER PROJECT
[DEA Reference: 14/12/16/3/3/2/981]
[City Reference: B21/1/2/2/234]

The abovementioned draft EIR report, dated March 2017, as compiled by CSIR, refers.

1. A copy of the City of Cape Town comment, dated 30 November 2016, on the revised draft scoping report has not been included in the draft EIR (Appendix G). Please include in the final EIR? It is however noted that the content of the aforementioned omitted comment was recorded in the Issues and Responses Trail (Appendix H).
2. During the BID it was requested that the Koeberg Nuclear Power Station Traffic Evacuation Model (TEM) proforma table must be populated and included in the various scoping and environmental impact assessment reports (also refer to Section 1.1 of the Issues and Responses Trail (Appendix H)).
 - 2.1 On page 3-21 of the draft Scoping Report, dated October 2016, and again on page 3-21 of the draft EIR the anticipated population increase is stated as 200 construction workers and 20 permanent workers. These figures of 200 (temporary) and 20 (permanent) anticipated population increases were tested in the TEM and it was confirmed that the current road network can accommodate the safe evacuation of the population within the prescribed timeframes.
 - 2.2 Yet on page 7-13 of the draft EIR these figures are contradicted by suddenly stating that between 90 and 150 skilled and 400 and 460 unskilled employment opportunities are expected to be created during the construction phase. The draft EIR further continues to state that 20 skilled and 40 unskilled employment opportunities will be created during the operational phase. Therefore the worst-case scenario amounts to 610 temporary construction phase jobs and 60 permanent operational phase jobs will be generated. There is a huge difference between a 200 (temporary) and 20 (permanent) anticipated population increase, versus a 610 (temporary) and 60 (permanent) anticipated population increase. Please be consistent throughout the report and provide the correct figures in order to re-run the TEM model.

Until such time as the correct TEM figures have been provided the City cannot confirm whether the proposed development can be safely evacuated.

3. It is acknowledged that the preferred road access onto the local road network will be at the southern end of the site onto Neil Hare Road or Gideon Basson. On page 6-56 reference is made to the proposed access road shown in Figure 6.11. The incorrect figure is stated. Indeed there is no figure in the document that illustrates the preferred access road. Please correct in order to clarify any future confusion.
 - 3.1 The City of Cape Town: TDA: Asset Management & Maintenance (former TCT) consistently indicated through the preceding EIA phases that a proposed access off Neil Hare Road on the northern end of the site, which necessitates a level crossing across the City owned railway line, is not supported. Yet it is noticed that the EAP persists to include this road access as an alternative option. It is questioned why this is done and why the option is not omitted in its entirety?
 - 3.2 It is requested that the preferred road access be included as a proposed conditions of the EA within section 7 of the final EIR, and/or as a mitigation measure in the EMPr.
4. Part B.6, item 12.14 (Page 64) of the draft EMPr refers to '*outsiders moving into the Kenhardt area*'. It must be assumed that this is a copy-and-paste mistake as the Kenhardt areas does not relate to Atlantis. Please remove.

Yours faithfully



Pat Titmuss

Regional Manager: Environmental & Heritage Management – Northern Region

Copy: Director: Integrated Environmental Authorizations
 Department of Environmental Affairs
 Private Bag X447
 PRETORIA, 0001

Attention: Mr Lerato Mokoena

[via e-mail: lmokoena@environment.gov.za]

APPENDIX

B CV'S



LIESEL MAAKAL, Senior Traffic/ Transportation Engineer

TRANSPORT AND INFRASTRUCTURE



YEARS WITH THE FIRM

1 year

YEARS TOTAL

11 years

PROFESSIONAL QUALIFICATIONS

Professional Engineer

AREAS OF PRACTICE

Traffic and transportation engineering

LANGUAGES

English

Afrikaans

CAREER SUMMARY

Mrs Maakal is a professional engineer with over 11 years' experience in the traffic and transportation engineering sector. She has extensive experience in traffic signal, pavement and conceptual geometric design, traffic impact studies, capacity and economic analysis, traffic and access management, transportation planning, intelligent transportation systems and road signage.

Relevant expertise includes project management, proposal preparation, training facilitation and acting as an external examiner.

Countries of work experience include South Africa and United Kingdom.

Career highlights include serving on the 2012 South African Institute of Civil Engineers Transportation Division Committee.

EDUCATION

MSc Civil Engineering (Transportation), University of Stellenbosch	2004
BEng Civil Engineering, University of Stellenbosch	2002

ADDITIONAL TRAINING

Certificate in Road Safety Audits, South African Road Federation	2014

PROFESSIONAL MEMBERSHIPS

Professional Engineer, Engineering Council of South Africa (20120190)	2012
Member, South African Institute of Civil Engineers (202839)	2014
Member, Chartered Institution of Highways & Transportation, United Kingdom (000065881)	2006

PROFESSIONAL EXPERIENCE

- Penhill Greenfields Traffic Impact Study, Cape Town, South Africa (Current): Senior Traffic and Transport Engineer - Traffic impact study for large residential development. Client: Western Cape Government. Fee Value: ZAR 780,000.
- Erf 404, Ficksburg, Free State, South Africa (Current): Project Leader - Traffic impact study for residential development. Client: Confidential. Fee Value: ZAR 23,000.
- Seloshesha Extension 2 Traffic Impact Study, Thaba Nchu, Free State, South Africa (Current): Project Leader - Traffic impact study for retail development. Client: Confidential. Fee Value: ZAR 28,000.
- Erf 373, Ficksburg, Free State, South Africa (2016): Project Leader - Traffic impact study for retail development. Client: Confidential. Fee Value: ZAR 23,000.
- Saldanha Bay Industrial Development Zone, Western Cape, South Africa (2016): Project Leader - Traffic impact study for new access. Client: Saldanha Bay Industrial Development Zone. Fee Value: ZAR 60,000.

LIESEL MAAKAL, Civil Engineer

- Upgrading of MR168, Stellenbosch, South Africa (2016): Senior Traffic and Transport Engineer - Traffic signal designs, pavement design, noise calculation and economic evaluation in HDM-4, and preliminary design report. Client: Western Cape Provincial Government. Project Value: Undisclosed.
- Shoprite Checkers Traffic Impact Assessments, South Africa (2016): Project Leader - Traffic impact assessments and related traffic signal designs for multiple sites. Client: Shoprite Checkers South Africa. Fee Value: ZAR 20,000 – ZAR 100,000 each.
- Upgrading of TR28/1 between Botrivier and Hermanus, Cape Town, South Africa (2015): Technical and Project Manager - Traffic signal designs, pavement design, noise calculation and economic evaluation in HDM-4, and preliminary design report. Client: Western Cape Provincial Government. Project Value: Undisclosed.
- Portion 32 of Cape Farm 168, near Fisantekraal, Traffic Impact Statement, South Africa (2015): Project Leader - Traffic impact statement, including realignment of proposed Class 4 road. Client: Pinetop Estates. Fee Value: ZAR 50,000.
- Tyger Valley Centre Parking Study, South Africa (2015): Senior Traffic and Transport Engineer - Parking study review on existing parking demand to forecast future required parking provision. Client: Tyger Valley Centre. Fee Value: ZAR 50,000
- Transportation Engineering Services, Cape Town, South Africa (2013): Technical and Project Manager - Traffic signal design, traffic calming assessments, transport system management requests, signage investigations and design, area transport planning, speed limit reviews and outdoor evaluations. Client: City of Cape Town. Fee Value: ZAR 4.2 m.
- Transport Operational Plan for Mangaung Municipality, Bloemfontein, South Africa (2010): Engineer - Data sourcing, demand and supply calculations for public transport, event monitoring and reporting. Client: Mangaung Municipality. Fee Value: ZAR 3 m.
- Tshwane Proposed Freight Hub Demand Models, Pretoria, South Africa (2009): Engineer - Traffic movement analysis, including potential attraction from coastal ports. Client: Confidential. Fee Value: ZAR 50,000
- Access Management Pro-Forma, South Africa (2008): Engineer - Evaluating access application. Client: South African Roads Agency Limited. Project Value: Undisclosed.
- Interchange Configurations for New N14 Interchange, Krugersdorp, South Africa (2007): Engineer - Investigation of different interchange configurations. Client: Confidential. Project Value: Undisclosed.
- Bus Priority Projects, London, United Kingdom (2006): Transportation Consultant - Site visits, compiled drawings of existing road markings and sidewalk furniture. Reviewed route speed cushions, road markings, bus lane width and sidewalk height to design standards, waiting and loading restrictions, bus turning movements and investigated footway parking. Produced project plan. Authority liaison, and junction widening scheme design. Client: Local Authority. Project Value: Undisclosed.
- European Streetwise Project, Surrey, United Kingdom (2005): Graduate Consultant - Project reporting compilation, minute taking, representative at 5th European Congress and Exhibition in Germany. Liaison between client,

LIESEL MAAKAL, Civil Engineer

authorities and partners. Client: European Commission. Project Value: Undisclosed.

AWARDS

Awarded scholarship by the Institute for Transport Technology 2000

PUBLICATIONS AND PRESENTATIONS

Presentations

- L O'Connor, R Harris. *The Effects and Impacts of Galileo on Road Transport*. European Transport Conference, Strasbourg, France, 2005

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

TRANSPORT AND INFRASTRUCTURE



YEARS WITH THE FIRM

5 years

YEARS TOTAL

16 years

PROFESSIONAL QUALIFICATIONS

Professional Engineer

AREAS OF PRACTICE

Traffic and transportation engineering

LANGUAGES

English

Afrikaans

CAREER SUMMARY

Mr Bredenhann is a professional engineer with over 16 years' work experience, specialising in the traffic and transportation engineering sector. He has extensive experience in traffic and transportation impact assessments and statements for a multitude of land uses, formal review of traffic impact assessments, transportation planning, micro and macro network and capacity analysis, transportation planning and design, road safety audits, traffic signal timing design, road signs and markings audits, multi-modal transport assessments, non-motorised transport analysis and design and transport management plans.

Relevant expertise includes project management, proposal preparation, preparation of tender documentation and bid adjudication, public transport planning and operational management, procedure development for the monitoring of integrated rapid transit operations and public transport scheduling development.

Countries of work experience include South Africa, Uganda and the United Kingdom.

EDUCATION

BEng (Hons) Traffic and Transportation Engineering, University of Pretoria	2010
BEng Civil Engineering, University of Johannesburg (RAU)	1996

ADDITIONAL TRAINING

Certificate in Road Safety Audits, South African Road Federation	2015

PROFESSIONAL MEMBERSHIPS

Professional Engineer, Engineering Council South Africa (20150149)	2015
Associate Member, South African Institute of Civil Engineering (201300003)	2013

PROFESSIONAL EXPERIENCE

- Port of Saldanha Bay Traffic Study, Saldanha Bay, Western Cape, South Africa (Current): Project Leader - Traffic study with specific focus on measures to improve efficiency and operation of all multi-purpose terminal traffic. Client: Transnet Port Terminals. Fee Value: ZAR 210,000.
- Biotherm Solar and Wind Power Plants, Northern and Western Cape, South Africa (Current): Lead Transportation Engineer - Traffic impact assessments in support of environmental impact assessments. Client: Biotherm. Project Value: ZAR 100,000. Fee Value: ZAR 45,000.
- Penhill Residential Development, Cape Town, South Africa, (Current): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layout, liaison with client and authorities. Undertake transport impact assessment for the 192 ha residential development of approximately 10,000 units. Client: Western Cape Provincial Government Department of Human Settlements. Project Value: ZAR 33 m. Fee Value: ZAR 780,000.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

- R27 Section 9 Road Safety Audit, Northern Cape, South Africa (Current): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Project Value: ZAR 100,000. Fee Value: ZAR 100,000.
- Athlone Power Station Redevelopment, Cape Town, South Africa (Current): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layouts. Liaison with client, stakeholders and authorities. Develop and draft traffic impact assessment, including revisions, and Council approval for 35 ha mixed-use redevelopment of Athlone Power Station site as Transit Oriented Development. Client: City of Cape Town. Project Value: ZAR 2 m. Fee Value: ZAR 100,000.
- N8 Section 13 Compulsory Truck Stop, Free State Province, South Africa (Current): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Project Value: ZAR 7,9 m. Fee Value: ZAR 50,000.
- Bishop Lavis Urban Node Regeneration, Cape Town, Western Cape, South Africa (Current): Project Member - Transport scoping report and traffic impact assessment for proposed upgrades of urban node and sports fields. Client: City of Cape Town. Fee Value: ZAR 275,000.
- Deep Freeze Macassar Upgrading Informal Settlement Programme, South Africa (Current): Project Member - Transport scoping report and traffic impact assessment for proposed redevelopment of settlement. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 380,000.
- McDonald's Traffic Impact Assessments, South Africa (Current): Project Member - Ongoing traffic impact assessments and transportation input to multiple sites' conceptual design. Client: McDonald's South Africa. Fee Value: ZAR 16,000 - ZAR 90,000 each.
- Monwood Upgrading Informal Settlement Programme, South Africa (Current): Project Member - Transport scoping report and traffic impact assessment for proposed redevelopment of settlement. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 1.4 m.
- Conradie Better Living Model Exemplar Project, Cape Town, South Africa (2016): Lead Traffic Engineer and Transportation Planner - Transportation input to development framework and layouts. Liaison with client, stakeholders and authorities. Develop and draft traffic impact assessment, including revisions, and Council approval for 22 ha high-density residential and mixed-use Transit Oriented Development. Client: Provincial Government of Western Cape. Project Value: ZAR 2.5 m. Fee Value: ZAR 2.5 m.
- N7 Section 4 Road Safety Audit, Western Cape, South Africa (2016): Lead Road Safety Auditor - Stage 3 road safety audit. Client: South African National Roads Agency. Fee Value: ZAR 100,000.
- Public Transport Shelter and Stop Survey and Design, South Africa (2016): Project Member - Survey planning, implementation programming and contract administration. Client: City of Cape Town. Fee Value: ZAR 5.1 m.
- Botleng, Delmas Shopping Centre, South Africa (2015): Project Member - Traffic impact assessment for proposed development. Client: Nonya Properties. Fee Value: ZAR 45,000.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

- Breswal AH Benoni Shopping Centre, South Africa (2015): Project Member - Traffic impact assessment for proposed development. Client: Nonya Properties. Fee Value: ZAR 40,000.
- Northmead Mall Extensions Traffic Impact Assessment, Ekurhuleni, Gauteng, South Africa (2015): Project Member - Traffic impact assessment for proposed extensions. Client: Bentel Properties. Fee Value: ZAR 50,000.
- Auckland Park Traffic Calming Study, South Africa (2015): Project Member - Traffic calming study for residential suburb. Client: Johannesburg Development Agency. Fee Value: ZAR 24,000.
- Gwigwi Mrwebi Street Johannesburg "Complete Streets" Traffic Study, South Africa (2015): Project Member - Traffic calming study for residential suburb. Client: Atterbury Properties. Fee Value: ZAR 32,000.
- Beach View Hout Bay Traffic Impact Assessment, South Africa (2014): Project Member - Transport scoping report for proposed development. Client: Private. Fee Value: ZAR 65,000.
- AgriProtein Cape Town, Traffic Impact Assessment, South Africa (2014): Project Member - Traffic impact assessment for new development. Client: WSP Environmental. Fee Value: ZAR 40,000.
- Port of Saldanha Bay Traffic Study, South Africa (2014): Project Leader - Traffic study with specific focus on measures to improve Port traffic management and operations, preferred mitigation measures, revised traffic management plan, public transport/ shuttle services, access upgrades, vehicle washing facilities (pollution control), road (link) and intersection upgrades. Client: Transnet Port Terminals. Fee Value: ZAR 286,000.
- Saldanha Bay Local Area Plan, South Africa (2014): Project Member - Transport scoping report and transportation planning. Project in conjunction with lead consultant ARG Designs. Client: Department of Rural Development and Land Reform. Fee Value: ZAR 65,000.
- Signal Hill People Mover, South Africa (2014): Project Leader - Technical feasibility and risk assessments of proposed mechanical people mover between Strand Street quarry and Signal Hill summit. Client: SANParks. Fee Value: ZAR 1 m.
- Nando's Restaurants, South Africa (2014): Project Member - Traffic impact assessments and transportation input to conceptual design of multiple sites. Client: Nando's South Africa. Fee Value: ZAR 50,000.
- Central Johannesburg College Traffic Impact Assessment, South Africa (2014): Project Member - Traffic impact assessments with specific focus on non-motorised transport environment. Client: Stauch Vorster Architects. Fee Value: ZAR 1 m.
- Landdrooskop Road upgrade, South Africa (2014): Project Member - Tender document preparation and adjudication, resident engineer, inspection, payment certificates and closeout report. Client: CapeNature. Fee Value: ZAR 1,4 m.
- NATREF CF2 Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for implementation of refinery upgrades. Client: Nema Consulting. Fee Value: ZAR 90,000.
- Carletonville Police Station Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for new station. Client: Maluleke Luthuli Development Planners. Fee Value: ZAR 55,000.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

- First in Spec Biofuels, Traffic Impact Assessment, Coega, South Africa (2013): Project Member - Traffic impact assessment for new development. Client: First in Spec Biofuels. Fee Value: ZAR 50,000.
- National Port Masterplan, South Africa (2014): Project Member - Transport assessment and road and rail masterplanning. Responsible for Port Nolloth, Port of Saldanha Bay, Port of Cape Town and Port of Mossel Bay. Client: Transnet Ports Authority. Fee Value: ZAR 1.8 m.
- Mfuleni Urban Node Regeneration, South Africa (2014): Project Leader - Transport scoping report and traffic impact assessment for proposed regeneration of urban node. Project in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 300,000.
- Tableview Beachfront Traffic Study, South Africa (2013): Project Member - Transport study and assessment including proposals for rationalisation of road network. Client: City of Cape Town. Fee Value: ZAR 180,000.
- Paarden Eiland Milnerton South Local Area Spatial Development Framework, South Africa (2013): Project Leader - Transport scoping report and input to design framework for Local Area Spatial Development Framework. Project undertaken in conjunction with lead consultant ARG Designs. Client: City of Cape Town. Fee Value: ZAR 350,000.
- SAPREF CF2 Traffic Impact Assessment, South Africa (2013): Project Member - Traffic impact assessment for implementation of refinery upgrades. Client: Shell and BP South Africa Petroleum Refineries. Fee Value: ZAR 75,000.
- Polokwane South Shopping Centre Traffic Impact Assessment, South Africa (2012): Project Member - Traffic impact assessment. Client: Moolman Group Properties. Fee Value: ZAR 80,000.
- Kwa-Guqa Shopping Centre, Emalahleni Traffic Impact Assessment, South Africa (2012): Project Member - Traffic impact assessment. Client: Moolman Group Properties. Fee Value: ZAR 80,000.
- Transport Planning and Traffic Study Pearl Marina, Uganda (2013): Project Leader - High-level transport masterplan and traffic impact assessment for proposed 400,000 m² GLA mixed-use luxury residential and commercial development (12 km east of Entebbe, Uganda on undeveloped peninsula site with a shoreline on Lake Victoria). Client: Centum Investment Company Limited, Kenya. Fee Value: ZAR 40,000.
- Wits Gold DRM Transport Management Plan, South Africa (2013): Project Leader - Detailed transport management plan as part requirement of environmental impact assessment process for proposed new gold mine. Client: GCS Water and Environmental Consultants. Fee Value: ZAR 80,000.
- Integrated Rapid Transit (MyCITI) Milestone Zero, Operational Support, South Africa (2012): Project Leader - Operational support contractual monitoring, reporting of transgressions and potential penalties, development of procedures, rollout of electronic control and ticketing system. Client: City of Cape Town. Fee Value: ZAR 12 m.
- Closeout Reports for Reconstruction and Development Programme Housing Projects, Eastern Cape, South Africa (2011): Project Member - 26 detailed closeout reports of completed and ongoing housing projects undertaken on behalf of Department for districts and local municipalities. Client: Department of Human Settlements: Eastern Cape Province. Fee Value: ZAR 600,000.

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

- Johannesburg Inner City Pedestrian Malls Project, Johannesburg, South Africa (2010): Project Leader - Traffic impact assessment to determine feasibility of converting four road sections in Johannesburg's inner city to full or partial pedestrian malls. Study included SATURN modelling conducted by sub-consultant, GOBA. Client: Johannesburg Development Agency. Fee Value: ZAR150,000.
- Rural Transport Business Plan Development, North West Province, South Africa (2010): Project Member - Evaluation of identified transport projects in various regions, and formulation of business plans to assist implementation. Client: National Department of Transport. Fee Value: ZAR 200,000.
- Eveleigh Extension 22, Boksburg, South Africa (2012): Project Leader - Traffic impact assessment to address various traffic-related objections raised in rezoning application. Client: Bentel Property Group. Fee Value: ZAR 70,000.
- Johannesburg Inner City Traffic and Transportation Study, Johannesburg, South Africa (2010): Project Coordinator - Multi-modal transport assessment and travel demand management measures. Client: Johannesburg Development Agency. Fee Value: ZAR 600,000.
- Traffic Engineering Support for City Council of Ekurhuleni, South Africa (2009): Project Leader - Land use applications, traffic safety investigations, traffic impact studies, security access restrictions, directional and tourism signage. Client: Ekurhuleni Metropolitan Municipality. Fee Value: ZAR 1.4 m.
- Gautrain, South Africa (2010): Project Member - Traffic monitoring, site visits, secretary of Gautrain coordination committee of Ekurhuleni Metropolitan Municipality. Undertook revised traffic impact assessment of Rhodesfield and Metrorail Station. Client: Gauteng Department of Public Transport Roads and Works. Fee Value: ZAR 500,000.
- Traffic Engineering Support for City Council of Tshwane, South Africa (2009): Project Leader - Assessment of traffic impact studies with emphasis on public transport and land-use aspects Client: City of Tshwane. Fee Value: ZAR 1.2 m.
- 2010 FIFA World Cup, Johannesburg and Pretoria, South Africa (2009): Project Member - Parking, freight planning, fan parks, pedestrian accommodation, traffic impact studies, traffic safety and transportation planning. Client: City of Tshwane. Fee Value: ZAR 300,000.
- Project Management of Johannesburg Roads Agency Capital Expenditure, Johannesburg, South Africa (2007): Senior Engineer - Identification of projects, budget allocation and oversight of capital spending. Tender documentation, bid adjudication and final inspection at completion. Directional Signage and Tourism Signage. Applications were received, assessed on site where necessary, and processed. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Management of JRA traffic safety, South Africa (2007): Project Leader - Traffic safety investigations and training of technicians. Liaison and site meetings with councillors, clients and applicants where applicable. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Gautrain Passenger Rail, South Africa (2007): Senior Engineer - Traffic related aspects of Gautrain project. Client: Johannesburg Roads Agency. Project Value: Undisclosed.
- Network planning, Johannesburg, South Africa (2006): Engineer - Macro and micro network analysis of existing and proposed road network in vicinity of

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

project. Trip generation, trip distribution, trip allocation of proposed project. Generating GIS maps consisting of aerial photographs and existing and future road networks. Client: Waterfall City Development and Riverglen Estate Development. Fee Value: ZAR 200,000.

- Carletonville Bypass, Carletonville, South Africa (2006): Engineer - Network study and planning of bypass route to Carletonville. Feasibility study, generating GIS maps, recommendations and final report. Client: Gauteng Department of Roads and Transport Fee Value: ZAR 50,000.
- Cradle of Humankind, North West Province, South Africa (2005): Engineer - Network study and route planning through Cradle of Humankind. Addendums to existing route determinations and/ or basic planning of affected routes. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 30,000.
- Strategic Major Road Network, Johannesburg, South Africa (2005): Engineer - Network study and route planning affected by possible re-alignment of K77. Determining possible extensions of route into Johannesburg CBD to ensure network continuity. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 26,000.
- Road Safety Audits, Eastern Cape Province, South Africa (2005): Engineer - Road safety audits of three provincial routes in Eastern Cape including fieldwork, road safety audits and assessments, remedial measures' reports including schedules of quantity, report writing and generating GIS maps of roads, highlighting all safety deficiency locations. Client: Province of Eastern Cape, Department of Transport. Fee Value: ZAR 65,000.
- Security Access Restrictions in Greater Johannesburg, South Africa (2005): Engineer - Traffic impact studies for various suburban areas in Greater Johannesburg who wish to apply for Security Access Restrictions (SARS) in terms of Johannesburg Road Agency SARS policy. Assessment of Security Access Restrictions Applications. Client: Various. Fee Value: ZAR 300,000.
- Pennyville Extension 1, Johannesburg, South Africa (2005): Engineer - Traffic impact studies for new township in Soweto, specific emphasis on pedestrian movement, safety, and future inter-modal facility adjacent to site as part of Johannesburg Metro's SPTN network. Client: Bigen Africa/ Pennyville Zamamphilo Relocation. Fee Value: ZAR 110,000.
- Union Buildings, Pretoria, South Africa (2005): Engineer - Studies for upgrades to Union Buildings. Specific emphasis on pedestrian accommodation, parking requirements and VIP visitors during special events. Client: Office of the President. Fee Value: ZAR 20,000.
- New Road/ N1 Freeway Single Point access interchange, Johannesburg, South Africa (2005): Engineer - Traffic impact study undertaken to determine level of service, deficiencies and general operation of New Road/ N1 Freeway Single Point access interchange. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 50,000.
- BP Freeway Service Area at Beyers Naude/ N1 Freeway Access Interchange, Johannesburg, South Africa (2005): Engineer - Traffic impact study to determine transgressions, operation, accident hotspots, feasibility and deficiencies of BP Freeway Service Area at Beyers Naude/ N1 freeway access interchange. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 50,000.
- Residential Development and Killarney Mall Extension on Riviera Road and Oxford Road, Johannesburg, South Africa (2004): Engineer - Traffic impact

CHRISTO BREDENHANN, Senior Traffic/ Transportation Engineer

study, SIDRA analysis of intersections, recommendations for required upgrades and temporary measures required during construction phase. Client: David Lieberman Architects. Fee Value: ZAR 77,000.

- Randburg - Sandton Link, Johannesburg, South Africa (2004): Engineer - Investigation of east-west linkage between areas. Evaluation of previous traffic impact study and confirmation of current status. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 24,000.
- Left-in Left-out Access Study, Gauteng, South Africa (2004): Engineer - Report on investigation of left-in/ left-out only accesses on arterial routes, CORSIM modelling of possibilities and recommendations of most suitable options. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 25,000.
- Mafikeng Airport Feasibility Study, Mafikeng, South Africa (2004): Engineer - Feasibility study to determine airport's economic survivability. Analysis of historical landing data and revenue streams. Client: Price Waterhouse Coopers. Fee Value: ZAR 35,000.
- Roundabouts Design Guide, Gauteng, South Africa (2004): Engineer - Investigation and design guide for roundabouts on provincial roads, including ARNDT modelling of approach speeds, volumes and geometry. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 64,000.
- N1 Toll Study, Pretoria, South Africa (2004): Engineer - Investigation of queue lengths, level of service and operation of carousel and Pumulani Plazas, analysis of historical data, queuing analysis and recommendations to improve operation. Client: Bakwena. Fee Value: ZAR 48,000.
- Building Lines Policy, Gauteng, South Africa (2003): Engineer - Generation of final Gauteng Department of Roads and Transport policy document regarding building lines adjacent to provincial roads. Client: Gauteng Department of Roads and Transport. Fee Value: ZAR 80,000.
- London Transport Underground Optimisation, United Kingdom (1998): Project Member - Transport traffic surveys and optimisation project for London underground system. Client: London Transport. Fee Value: ZAR 550,000.

APPENDIX

C DECLARATION OF INTEREST



environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

- (1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and
- (2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Atlantis Gas to Power Traffic Impact Statement

Specialist:	Traffic Engineer		
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Project Consultant:			
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E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, Liesel Maakal , declare that --

General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;

I will comply with the Act, Regulations and all other applicable legislation;

I have no, and will not engage in, conflicting interests in the undertaking of the activity;

I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;

all the particulars furnished by me in this form are true and correct; and

I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

WSP

Name of company (if applicable):

25 May 2017

Date:



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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Scoping and Environmental Impact Assessment for the
proposed Atlantis Gas-to-Power facility on Portion 1 of
Portion 4 of Cape Farm 1183, Western Cape



PART B

Environmental Management Programme

VERSION 2 OF MAY 2017





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1 INTRODUCTION

This Environmental Management Programme (EMPr) is prepared as part of the requirements of the National Environmental Management Act (Act 107 of 1998, as amended) (NEMA) Environmental Impact Assessment (EIA) Regulations promulgated in Government Gazette 38282 and Government Notice (GN) R982, R983, R984 and R985 on 8 December 2014. This EMPr is being submitted to the National Department of Environmental Affairs (DEA) as part of the Application for Environmental Authorisation (EA) for the proposed construction of a 1500 MW liquefied natural gas-to-power facility and associated infrastructure on Cape Farm 1183-4-1 (now ERF 277) in the Atlantis Industrial area approximately 40 km's north of Cape Town in the City of Cape Town Metropolitan Municipality, Western Cape Province (Figure 1). The proposed project is referred to as the Atlantis gas-to-power project and has been assigned the following DEA Reference Number: 14/12/16/3/3/2/981. The Project Applicant for this proposed Atlantis gas-to-power project is The City of Cape Town Metropolitan Municipality (hereinafter referred to as CoCT).

This EMPr is being made available to Interested and Affected Parties (I&APs), stakeholders and Organs of State, as part of the EIA Report, for a 30-day review period. Comments received from stakeholders during this aforementioned review period will be incorporated into the EMPr, where applicable. Following the incorporation of comments from I&APs, stakeholders and Organs of State, this EMPr is intended as a "living" document and should continue to be updated regularly, as needed.

1.1 PROJECT DESCRIPTION

The proposed project will make use of OCGT/CCGT gas-to-power technology to generate electricity from liquefied natural gas (LNG). The Applicant is proposing to develop a facility up to a possible maximum installed capacity of 1500 MW. Once a Power Purchase Agreement (PPA) is awarded, the proposed facility will generate electricity for a minimum period of 20 years. The Eskom Omega-Sterrekus Substation (located approximately 13 km from the project site) will be used to connect the proposed gas-to-power facility to the national grid.

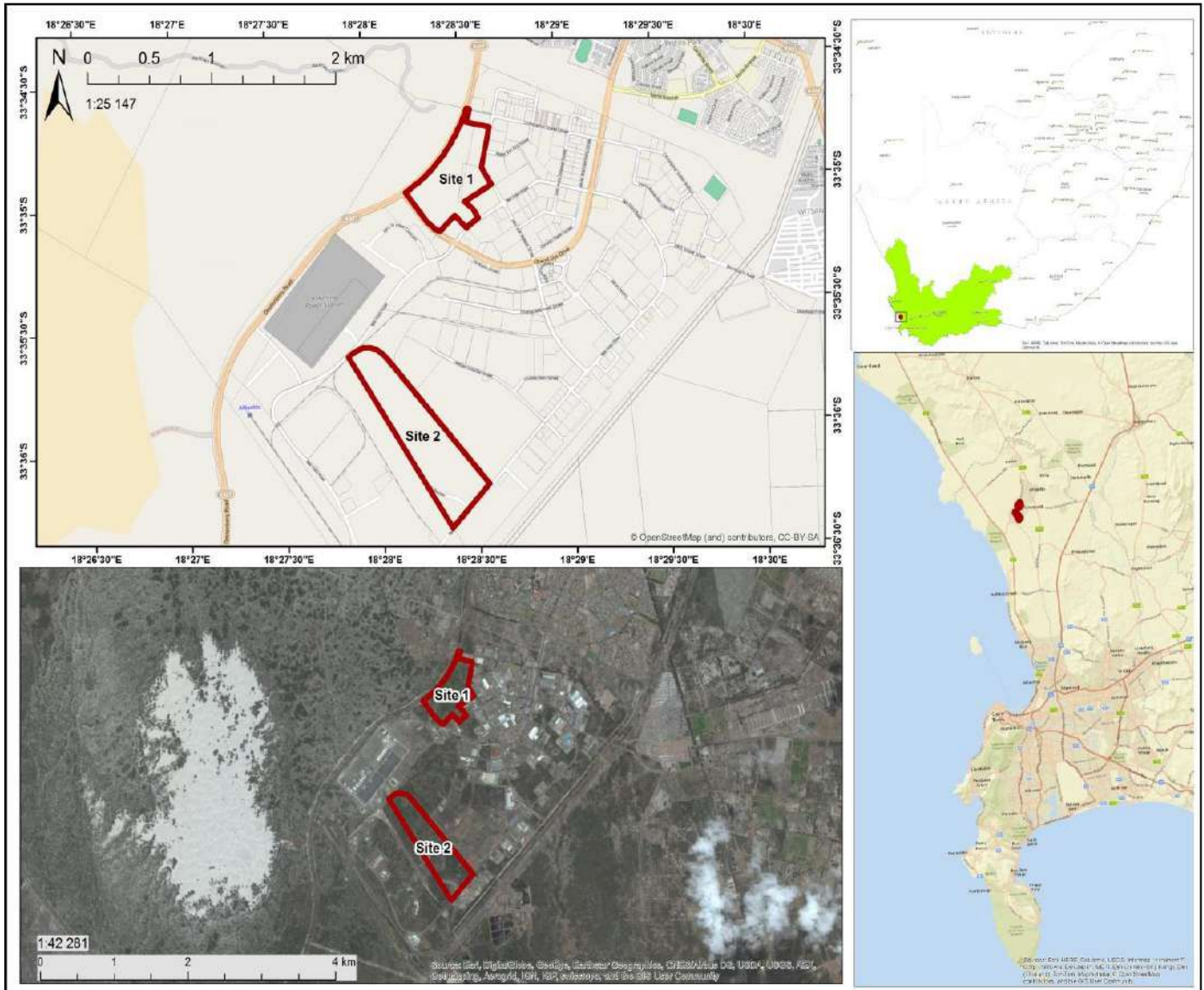


Figure 1: Locality of the three proposed gas-to-power facility

The preferred site for the proposed project includes approximately 38.65 ha of land (as shown in Figure 1), of which the entire site will be cleared. An environmental sensitivity map has been produced (and included in Chapter 7 of the EIA Report and Appendix B of this EMPr). This map shows the sensitivities on and around the site within the larger 38.65 ha buildable area that was identified. It is important to note that due to the successful implementation of a biodiversity offset for this site (Appendix R), **no CI species will be avoided** and the entire site will be cleared (this is also due to the lack of heritage features on site). The one avoidance however, will be the artificial wetland present in the corner of the site. Based on the boundaries of the Development Envelope and the constraints of the environmental sensitivities, a site layout has also been preliminary determined for this project (Appendix A of this EMPr). It is important to note that should the layout change subsequent to the issuing of an EA (should such authorisation be granted), any alternative layout or revisions to the layout occurring **within the boundaries of the Development Envelope** would not be regarded as a change to the scope of work or the findings of the impact assessments undertaken during the EIA Phase. This is based on the understanding that the specialists have assessed the larger area and have identified sensitivities, which have been avoided in the siting of the proposed infrastructure. The Development Envelope is considered to be a “box” in which the

project components can be constructed at whichever location without requiring an additional assessment or change in impact significance. Any changes to the layout **within the boundaries of the Development Envelope** following the issuing of the EA (should it be granted) will therefore be considered to be non-substantive.

The proposed **Atlantis gas-to-Power** project will consist of the following main components:

- A Gas Turbine or Gas Engine hall;
 - Up to 4 Combustion turbine and generator sets producing approximately 400 MW each (max 1500 MW) or multiple Combustion engine and generator sets producing approximately 20 MW each (max 800 MW).
- Heat recovery steam generators;
- Dry cooling radiator systems; and
- Building Infrastructure:
 - Offices;
 - Operational and maintenance control centre;
 - Warehouse/workshop;
 - Ablution facilities;
 - On-site substation building; and
 - Guard House.
- Associated Infrastructure
 - Associated electrical infrastructure at the Eskom Substation/connection points (including but not limited to transmissions lines to the substation)
 - Gas pipelines for the reticulation of natural gas on site (not transmission to site)
 - Access roads;
 - Internal roads;
 - Fencing;
 - Maintenance and cleaning area;
 - Stormwater channels;
 - Water pipelines; and
 - Temporary work area during the construction phase (i.e. laydown area).

The proposed project can be divided into the following three main phases:

- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

Activities will be undertaken during each phase which may cause an environmental impact. These activities have therefore been considered by the appointed specialists, and considered during the EIA and management and mitigation measures required to address all the impacts included within this EMPr. The construction phase will take place subsequent to the issuing of an EA from the DEA and a successful BID in terms of the IPPPP (i.e. the issuing of a PPA from the DOE). The construction phase is expected to extend 14- 20 months (however the construction period is subject to the final requirements of Eskom and the IPPPP Request for Proposal provisions at that point in time).

The main activities that will form part of the construction phase are:

- Transportation of personnel, construction material and equipment to the site, and personnel away from the site;
- Construction of the site camp and laydown areas, as well as dedicated access routes from the laydown areas to the working areas;
- Vegetation clearing in the areas required for building infrastructure and brush cutting in the gas-to-power field area where the panels will be installed;
- Excavations for infrastructure and associated infrastructure;
- Establishment of a laydown area for equipment;
- Construction of internal access roads, where required;
- Stockpiling of soil and cleared vegetation; and
- Construction of each of the above mentioned project components and additional infrastructure.

The following main activities will occur during the operational phase:

- Generation of a maximum of 1500 MW of electricity to add to the national grid; and
- Maintenance of the gas-to-power facility.

The projected operations are expected to provide several services and added economic spin offs. The facility is expected to generate electricity for a minimum period of 20 years.

Should it be decided not to extend the operational lifespan of the project beyond 20 years, the project will be decommissioned. The main aim of decommissioning is to return the land to its original, pre-construction condition. Should the unlikely need for decommissioning arise (i.e. if the facility becomes outdated or the land needs to be used for other purposes), the decommissioning procedure will involve removing the components and associated infrastructures, and covering the concrete foundations with soil to a depth sufficient for the re-growth of natural vegetation. Whether all components of the facility will be removed still needs to be agreed upon with the landowner (some components may be useful for the landowner and therefore it could be decided that those remain on site). Any other supporting infrastructure no longer in use will be removed from the site and either disposed of at a registered disposal facility or recycled if possible.

It should be noted that a detailed project description (based on the conceptual design) is provided in Chapter 2 of the EIA Report.

1.2 AUTHORS OF THE EMPr

This EMPr has been compiled by the Environmental Assessment Practitioners (Paul Lochner, Rudolph du Toit and Kelly Stroebel) and the various specialists on the team (as indicated in Table 1). The details and expertise of the Environmental Assessment Practitioners and the specialists are provided in Appendix A of the EIA Report.

Table 1: The EIA Management Team

NAME	ORGANISATION	ROLE/ SPECIALIST STUDY UNDERTAKEN
Environmental Assessment Practitioners		
Paul Lochner	CSIR	Technical Advisor and Quality Assurance (EAPSA) Certified
Rudolph du Toit	CSIR	Project Leader
Kelly Stroebel	CSIR	Project Manager (<i>Cand. Sci. Nat.</i>)
Specialists		
Mr Mark Zunckel	uMoyo-Nilu Consulting (Pty) Ltd	Air Quality and Climate Change Specialist Study & AEL application
Dr Brian Williams	SafeTech	Noise Impact Study
Mr. Mike Oberholzer	Riscom (Pty) Ltd	Risk Assessment
Dr. Graham Avery	N/A	Palaeontology Study
Dr. Lita Webley	ACO Associates	Archaeology Assessment
Dr. David McDonald	Bergwind Botanical Surveys and Tours	Terrestrial Ecology Study
Mr Chris van Rooyen	Chris van Rooyen Consulting	Avifauna (birds) Assessment

1.3 IMPACTS IDENTIFIED DURING THE EIA PROCESS

Based on the specialist studies (as shown in Table 1), the following main direct potential impacts, as indicated in Table 2, have been identified and appropriate management and mitigation measures included within the EMPr (where required) as per the recommendations made in the specialist studies to ensure the potential impacts are suitably addressed and managed during all phases of the project. Indirect and cumulative impacts are noted in Section 4 to 12 of this EMPr.

It should be noted that other impacts for which specialist studies were not undertaken but where mitigation or management actions may be required, are also included in the EMPr.

Table 2: Impacts Identified in the EIA

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
Ecological/Biodiversity Impact Assessment	Construction Phase: - Habitat loss - Species loss - Loss of ecological processes - Soil erosion - Spread of alien plants Operational Phase: - Fencing out potential grazers and fauna - Proliferation of aliens Decommissioning Phase: - Damage of vegetation and habitat types	Pre-Construction and Construction Phases: - Only acceptable mitigation measure is the Biodiversity Offset which is in place for the entire Atlantis SEZ (Appendix R). - An initial pre-construction clearance of all exotic vegetation on site should be undertaken to reduce the possibility of further exotic weed invasion. Continued exotic weed control measures should be implemented during the construction phase and may be incorporated into an exotic weed control plan for the site. Operational Phase: - Conduct regular (daily) inspections of the fence line to address any animals that may be affected by the electric fence (i.e. tortoise). - Adopt “dry” cleaning methods, such as dusting and sweeping the site before washing down. Decommissioning Phase: - Conduct monitoring of the land conditions and redress of exotic weeds found present	Negative: High	Negative: Low

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
		on site.		
Risk Impact Assessment	Operational Phase: Loss of containment of diesel, LNG, hydrogen, ammonia and chlorine resulting in the formation of combustible liquids/gases/toxic clouds that could result in a explosion/fire which could destroy assets as well as injuring or killing people.	Operational Phase: - Proper engineering designs and layouts to minimise off-site impacts. - Spill containment is a legal requirement.	Negative: Moderate	Negative: Low
Heritage Impact Assessment (Archaeology and Palaeontology)	Construction Phase - Damage to or destruction of archaeological and palaeontological resources. - Alteration of cultural landscape and sense of place. Operational Phase: - Impacts to the cultural and natural landscape. Decommissioning Phase: - Alteration of the cultural and natural landscape	Construction Phase: - The construction team should be informed of the possibility of encountering graves and should be encouraged to report any suspicious-looking stone features prior to disturbance; - The potential grave should be avoided with a buffer of at least 5 m or else tested and, if necessary, exhumed prior to construction; - The built elements of the facility should be painted in an earthy colour to minimise visual contrast in the landscape; and - If any paleo/archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution.	Negative: Low	Negative: Very Low
Air Quality Impact Assessment	Construction Phase: - Increase in traffic generation. - Impact on air quality due to dust generation, noise and	Construction and Decommissioning Phases: Loads on vehicles carrying dusty construction materials	Negative: Low	Negative: Low

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
	release of air pollutants from vehicles and construction equipment. Operational Phase: - Air Emissions to the receiving environment as a result of the 1500 MW CCGT operation (gas-to-power) - SO₂ - NO₂ - PM₁₀ - Benzene - CO Decommissioning Phase: - Impact on air quality due to dust generation, noise and release of air pollutants from vehicles and construction equipment.	should be covered - Loading and unloading bulk construction should be in areas protected from the wind on in calm conditions - Vehicles carrying dusty materials should be cleaned before leaving the site - Limit access to construction site to construction vehicles only - Impose vehicle speed restrictions on the construction site - Maintain high moisture content on exposed surface and roads by spraying with water - Maintenance programme for construction vehicles to ensure optimum performance reduced emissions Operational Phase: - No mitigation measures proposed by the specialist for operations. - Abide by National Ambient Air Quality Standards (NAAQS) (GN 1210 of 24 Dec 2009 and GN 486 of 29 June 2012).		
Avifauna Impact Assessment	Construction and Decommissioning Phases: - Displacement of Red List species as a result of habitat loss or transformation - Construction of facility: Displacement of Red List species as a result of disturbance Operational Phase - Mortality of Red List species	Construction and Decommissioning Phases: - Construction activity should be restricted to the immediate footprint of the infrastructure. - Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of Red List species. - Measures to control noise should be applied according	Negative: Moderate	Negative: Low

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
	due to collision with power line earth wire/conductor	to current best practice in the industry. - An avifaunal walk-through of the final power line route must be conducted to identify Red List species that may be breeding within the power line corridor to ensure that the impacts to breeding species (if any) are adequately managed Operational Phase - High risk sections of power line must be identified by a qualified avifaunal specialist during the walk-through phase of the project, once the alignment has been finalized. If power line marking is required, bird flight diverters must be installed on according to Eskom guidelines (APPENDIX 2 of the specialist study).		
Noise Impact Assessment	Construction and Decommissioning Phases: - Noise emissions resulting from construction and decommissioning activities. Operational Phase - Noise emissions resulting from the operational activities	Construction and Decommissioning Phases: - Ensuring that all operators of construction equipment receive proper training in the use of the equipment and that the equipment is serviced regularly. - All blasting and piling driving, if required, should only occur during the day. - All reverse noise emitting warning devices on mobile vehicles should be set as low as possible. - An environmental noise monitoring survey should be conducted during the construction phase to assess the impact and recommend further actions if required. Operational Phase	Negative: Low	Negative: Low

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
		- All buildings should be designed to acoustically contain as much of the noise emissions as possible. - Ensuring that all equipment that produces a high noise impact is placed inside buildings that have been designed to reduce noise emissions. - All buildings containing high noise emissions should be housed in buildings that have solid walls (at least 200mm thick) of at least a sound reduction index (Rw) of Rw55-60. - All ventilation outlets are properly attenuated. - All air intakes are fitted with attenuators - All exhaust stacks are fitted with attenuators - All access doors to the high noise buildings are kept closed when not in use.		
Traffic Impact Assessment	<u>Construction and Decommissioning Phases:</u> - Noise dust and exhaust pollution due to vehicle trips on site - Noise dust and exhaust pollution due to additional vehicle trips on local access roads - Noise and exhaust pollution due to additional vehicle trips on Dassenberg Road <u>Operational Phase</u> - Noise dust and exhaust pollution due to vehicle trips on site - Noise dust and exhaust pollution due to additional vehicle trips on local access roads - Noise and exhaust pollution	<u>Construction, operational and decommissioning phases</u> - If abnormal loads need to be transported by road to the site, a permit needs to be obtained from the Western Cape Department of Public Works, Roads and Transport. - Ensure that the requirements for use of the entrance road are addressed and considered in the design, as and where applicable. - The deterioration of the riding quality of the road pavements could be mitigated by routine maintenance surface treatment (if required). - Implement clear and visible signage and signals indicating movement of vehicles at the	Negative: Low	Negative: Very Low

Specialist Study	Main Impacts	Main Mitigation Measures	Overall Impact Significance Before Mitigation or Enhancement	Overall Impact Significance After Mitigation or Enhancement
	due to additional vehicle trips on Dassenberg Road Increased traffic congestion due to the potential trucking in of gas (should pipeline not be operational).	intersection with the entrance road to ensure safe entry and exit. - Implement management strategies for dust generation e.g. apply dust suppressant on the entrance road, exposed areas and stockpiles. - Construction vehicles must have their lights on at all times. Lights to be properly set to not blind train drivers (SPAD). - Postpone or reduce dust-generating activities during periods with strong wind. Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased.		

2 APPROACH TO PREPARING THE EMP_r

2.1 COMPLIANCE WITH RELEVANT LEGISLATION

In terms of legal requirements, a crucial objective of the EMP_r is to satisfy the requirements of Appendix 4 of the NEMA EIA Regulations promulgated in Government Gazette 38282 and GN R982 on 8 December 2014, and Section 24N of the NEMA. These regulations regulate and prescribe the content of the EMP_r and specify the type of supporting information that must accompany the submission of the report to the authorities. An overview of where the requirements are addressed in this EMP_r is presented in Tables 3 and 4.

Table 3: Compliance with Section 24N of NEMA

Requirements of Section 24N of NEMA	Where it is included in this EMP _r ?
2) The environmental management programme must contain- a) information on any proposed management, mitigation, protection or remedial measures that will be undertaken to address the environmental impacts that have been identified in a report contemplated in subsection 24(1A), including environmental impacts or objectives in respect of: (i) planning and design; (ii) pre-construction and construction activities; (iii) the operation or undertaking of the activity in question; (iv) the rehabilitation of the environment; and (v) closure, if applicable;	Section 1.3 and the columns detailing the impact description, mitigation and management objectives, and mitigation and management actions in Sections 4 to 12 of this EMP _r .
b) details of- (i) the person who prepared the environmental management programme; and (ii) the expertise of that person to prepare an environmental management programme;	Section 1.2 and Appendix A of the EIA Report
c) a detailed description of the aspects of the activity that are covered by the environmental management programme;	Section 1 and Section 1.1
d) information identifying the persons who will be responsible for the implementation of the measures contemplated in paragraph (a);	Columns in Section 4 to 12 of the EMP _r regarding the monitoring responsibility, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3.
e) information in respect of the mechanisms proposed for monitoring compliance with the environmental management programme and for reporting on the compliance;	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMP _r .
f) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of any listed activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and	Sections 4 to 12 of this EMP _r , as applicable to the post-construction, rehabilitation phase and the decommissioning phase.
g) a description of the manner in which it intends to- (i) modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) remedy the cause of pollution or degradation and migration of pollutants; and (iii) comply with any prescribed environmental management standards or practices.	The columns detailing the mitigation and management objectives, mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMP _r .
3) The environmental management programme must, where appropriate- a) set out time periods within which the measures contemplated in the	The columns detailing the mitigation and management actions, and the monitoring

Requirements of Section 24N of NEMA	Where it is included in this EMPr?
environmental management programme must be implemented; b) contain measures regulating responsibilities for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation which may occur inside and outside the boundaries of the operations in question; and c) develop an environmental awareness plan describing the manner in which- (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment.	methodology, frequency and responsibility in Sections 4 to 12 of this EMPr. Section 11 of this EMPr includes an Environmental Awareness Plan.
5) The Minister, the Minister responsible for mineral resources or an MEC may call for additional information and may direct that the environmental management programme in question must be adjusted in such a way as the Minister, the Minister responsible for mineral resources or the MEC may require.	Not applicable at this stage.
6) The Minister, the Minister responsible for mineral resources or an MEC may at any time after he or she has approved an application for an environmental authorisation approve an amended environmental management programme.	Not applicable at this stage.
7) The holder and any person issued with an environmental authorisation- a) must at all times give effect to the general objectives of integrated environmental management laid down in section 23; b) must consider, investigate, assess and communicate the impact of his or her prospecting or mining on the environment; c) must manage all environmental impacts (i) in accordance with his or her approved environmental management programme, where appropriate; and (ii) as an integral part of the prospecting or mining, exploration or production operation, unless the Minister responsible for mineral resources directs otherwise; d) must monitor and audit compliance with the requirements of the environmental management programme; e) must, as far as is reasonably practicable, rehabilitate the environment affected by the prospecting or mining operations to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and f) is responsible for any environmental damage, pollution, pumping and treatment of polluted or extraneous water or ecological degradation as a result of his or her operations to which such right, permit or environmental authorisation relates.	Throughout the EMPr
8) Notwithstanding the Companies Act, 2008 (Act No. 71 of 2008), or the Close Corporations Act, 1984 (Act No. 69 of 1984), the directors of a company or members of a close corporation are jointly and severally liable for any negative impact on the environment, whether advertently or inadvertently caused by the company or close corporation which they represent, including damage, degradation or pollution.	Section 3 details the responsibility of the Project Applicant.

Table 4: Compliance with Appendix 4 of the 2014 NEMA EIA Regulations

Requirements of Appendix 4 of the 2014 NEMA EIA Regulations (Government Gazette Government Gazette 38282 and GN R982 on 8 December 2014)	Where it is included in this EMPr?
1. (1) An EMPr must comply with section 24N of the Act and include: a) details of: (i) the EAP who prepared the EMPr; and (ii) the expertise of that EAP to prepare an EMPr, including a curriculum vitae;	Section 1.2 and Appendix A of the EIA Report
b) a detailed description of the aspects of the activity that are covered by the EMPr as identified by the project description;	Section 1 and Section 1.1
c) a map at an appropriate scale which superimposes the proposed activity, its associated structures, and infrastructure on the environmental sensitivities of the preferred site, indicating any areas that any areas that should be avoided, including buffers;	Appendix A, Appendix B and Appendix C of this EMPr.
d) a description of the impact management objectives, including management statements, identifying the impacts and risks that need to be avoided, managed and mitigated as identified through the environmental impact assessment process for all phases of the development including: (i) planning and design; (ii) pre-construction activities; (iii) construction activities; (iv) rehabilitation of the environment after construction and where applicable post (v) closure; and (vi) where relevant, operation activities;	Section 1.3 and the columns detailing the impact description, mitigation and management objectives, and mitigation and management actions in Sections 4 to 12 of this EMPr.
e) a description and identification of impact management outcomes required for the aspects contemplated in paragraph (d);	The columns detailing the mitigation and management objectives in Sections 4 to 12 of this EMPr.
f) a description of proposed impact management actions, identifying the manner in which the impact management objectives and outcomes contemplated in paragraphs (d) and (e) will be achieved, and must, where applicable, include actions to: (i) avoid, modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation; (ii) comply with any prescribed environmental management standards or practices; (iii) comply with any applicable provisions of the Act regarding closure, where applicable; and (iv) comply with any provisions of the Act regarding financial provisions for rehabilitation, where applicable;	The columns detailing the mitigation and management actions in Sections 4 to 12 of this EMPr.
g) the method of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring methodology in Sections 4 to 12 of this EMPr.
h) the frequency of monitoring the implementation of the impact management actions contemplated in paragraph (f);	The columns detailing the monitoring frequency in Sections 4 to 12 of this EMPr.
i) an indication of the persons who will be responsible for the implementation of the impact management actions;	The columns detailing the monitoring responsibility in Sections 4 to 12 of this EMPr.
j) the time periods within which the impact management actions contemplated in paragraph (f) must be implemented;	The columns detailing the mitigation and management actions, and the monitoring methodology and frequency in Sections 4 to 12 of this EMPr.

Requirements of Appendix 4 of the 2014 NEMA EIA Regulations (Government Gazette Government Gazette 38282 and GN R982 on 8 December 2014)	Where it is included in this EMPr?
k) the mechanism for monitoring compliance with the impact management actions contemplated in paragraph (f);	The columns detailing the mitigation and management actions, and the monitoring methodology, frequency and responsibility in Sections 4 to 12 of this EMPr.
l) a program for reporting on compliance, taking into account the requirements as prescribed by the Regulations;	Section 4 to 12 of the EMPr, including the requirements for monitoring and reporting on compliance and the responsible parties noted in Section 3.
m) an environmental awareness plan describing the manner in which: (i) the applicant intends to inform his or her employees of any environmental risk which may result from their work; and (ii) risks must be dealt with in order to avoid pollution or the degradation of the environment; and	Section 11 of this EMPr.
n) any specific information that may be required by the competent authority.	Section 2.2 and the management objectives and management actions in Sections 4 to 11.

2.2 COMPLIANCE WITH DEA REQUIREMENTS

The Scoping Report was submitted to the DEA in December 2016, in accordance with Regulation 21 (1) of the 2014 NEMA EIA Regulations, for decision-making in terms of Regulation 22 of the 2014 NEMA EIA Regulations. The DEA accepted the Scoping Report and Plan of Study for EIA on 1 February 2017, which marked the end of the Scoping Phase. The acceptance letter is included in Appendix S of the EIA Report.

The requirements listed in the acceptance letter from the DEA, stipulated certain plans that must be included in the EMPr. The EMPr is therefore structured in such a way to comply with the requirements of the DEA and to ensure that the mitigation and management measures that have been identified during the EIA Process are included in the respective plans. The requirements listed within the acceptance letter are detailed in Table 5.

It is important to note that other project specific aspects (such as the findings and recommendations of the specialist studies), in addition to those covered by the plans required by the DEA, have been included in Section 12 of the EMPr.

Table 5: DEA Requirements for the EMPr

DEA Requirements	Relevant Section in the EMPr
All recommendations and mitigation measures recorded in the EIA Report and the specialist studies conducted.	Recommended mitigation measures and monitoring actions as noted in the EIA Report and specialist studies have been included in this EMPr, where relevant.
The final site layout map	Refer to Appendix A of this EMPr for the site layout map. Refer to Section 1.1 of this EMPr for a description of the approach followed to determine the site layout.
Measures as dictated by the final site layout map and micro-siting.	Refer to Appendix A of this EMPr for the site layout map. Refer to Section 1.1 of this EMPr

DEA Requirements	Relevant Section in the EMPr
	for a description of the approach followed to determine the site layout.
An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA Process.	Refer to Appendix B of this EMPr for an environmental sensitivity map. Refer to Section 1.1 of this EMPr for a description of the approach followed to identify the environmental sensitivities.
A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	Refer to Appendix C of this EMPr for a combined environmental sensitivity and layout map. Refer to Section 1.1 of this EMPr for a description of the approach followed to identify the environmental sensitivities and to determine the site layout.
An alien invasive management plan to be implemented during the construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	Refer to Section 4 of this EMPr.
A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	Refer to Section 2.3 motivating for the exclusion of this plan.
A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of habitat converted at any one time and to speed up the recovery to natural habitats.	Refer to Section 5 of this EMPr which includes rehabilitation.
An open space management plan to be implemented during the construction and operation of the facility.	Refer to Section 5 of this EMPr.
A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimise impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	Refer to Section 6 of this EMPr.
A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	Refer to Section 7 of this EMPr.
A fire management plan to be implemented during the construction and operation of the facility.	Refer to Section 10 of this EMPr. It should be noted that this has been combined with an Environmental Awareness Plan.
An erosion management plan for monitoring and rehabilitating erosion events associated with the facility. Appropriate erosion mitigation must form part of this plan to prevent and reduce the risk of any potential erosion.	Refer to Section 8 of this EMPr.
An effective monitoring system to detect any leakage or spillage of all hazardous substances during their transportation, handling, use	Refer to Section 9 of this EMPr.

DEA Requirements	Relevant Section in the EMPr
and storage. This must include precautionary measures to limit the possibility of oil and other toxic liquids from entering the soil or storm water systems	
Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments, and other environmental sensitive areas from construction impacts including the direct or indirect spillage of pollutants.	Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchments have been included throughout the EMPr, as well as section 12.
Air Quality Management Plan	Refer to section 11 of this EMPr.
Emergency Preparedness Response Plan	Please refer to section 9 and 12 with regards to the safety of personnel on site. Please also refer to section 2.3 for a motivation as to why a separate plan is not drawn up at this stage of the process.

2.3 CONTENTS OF THE EMPr

Where applicable, each section of the EMPr is divided into the following four phases of the project cycle:

- Design Phase;
- Construction Phase;
- Operational Phase; and
- Decommissioning Phase.

The EMPr includes the findings and recommendations of the EIA Process and specialists studies. However, the EMPr is considered a “living” document and must be updated with additional information or actions during the design, construction, operational and decommissioning phases if applicable.

The EMPr follows an approach of identifying an over-arching goal and objectives, accompanied by management actions that are aimed at achieving these objectives. The management actions are presented in a table format in order to show the links between the goal and associated objectives, actions, responsibilities, and monitoring requirements and targets.

The management plans for the design, construction, operational and decommissioning phases consist of the following components:

- **Impact:** The potential positive or negative impact of the development that needs to be enhanced, mitigated or eliminated.
- **Objectives:** The objectives necessary in order to meet the goal; these take into account the findings of the specialist studies.
- **Mitigation/Management Actions:** The actions needed to achieve the objectives of enhancing, mitigating or eliminating impacts; taking into consideration factors such as responsibility, methods, frequency, resources required and prioritisation.
- **Monitoring:** The key monitoring actions required to check whether the objectives are being achieved, taking into consideration methodology, frequency and responsibility.

Plans which have been **omitted** from the EMPr and reasons therefore:

Plan requested by the Competent Authority (1 February 2017) that has been omitted:	Motivation as to why these have been omitted
Plant Rescue and Protection Plan	Please refer to the Botanical Specialist Study in Appendix J which highlights the following: The position of the intact vegetation (i.e. in the center of the site, Figure 4) means that the development alternative is only likely if a biodiversity offset is offered to compensate for the loss. The proposed offset of 1:1 ha for ENDANGERED Cape Flats Dune Strandveld pertains to most of the site, whereas the ratio 2:1 ha for CRITICALLY ENDANGERED Atlantis Sand Fynbos would apply to the strip of land along the southern boundary. The offset option is thus considered the only feasible mitigation option available. Plant search and rescue is not a supported mitigation measure for this project. Please refer to the biodiversity offset report attached as Appendix R.
Emergency preparedness response plan	Please see section 9 detailing the design needed for containment of hazardous materials. This also explains the monitoring required to ensure a loss of containment does not take place. An emergency preparedness plan will be prepared for the operation phase in the unlikely event of an explosion or emergency. This plan will be drawn up in the engineering and design phase of the project, as important spatial and project specifics are needed in order to draft this plan. All facilities of this nature require such a plan to be drawn up and implemented (including MHI facilities as part of that process). Thus it is not possible to draw up such a plan during the EIA phase of a project.

2.4 GOAL FOR ENVIRONMENTAL MANAGEMENT

The overall goal for environmental management for the Atlantis gas-to-power project is to construct and operate the project in a manner that:

- Minimises the ecological footprint of the project on the local environment;
- Minimises impacts on fauna, flora and freshwater ecosystems;
- Facilitates harmonious co-existence between the project and other land uses in the area; and
- Contributes to the environmental baseline and understanding of environmental impacts of gas-to-power in a South African context.

3 ROLES AND RESPONSIBILITIES

For the purposes of the EMPr, the generic roles that need to be defined are those of the:

- Project Developer;
- Environmental Control Officer;
- Construction Manager (Lead Contractor); and
- Facility Manager.

It is acknowledged that the specific titles for these functions will vary from project to project. The intent of this section is to give a generic outline of what these roles typically require. It is expected that this will be appropriately defined at a later stage.

3.1 PROJECT DEVELOPER

The Project Developer (i.e. GreenCape which is a sector development agency of the City of Cape Town) is the 'owner' of the project and, as such, is responsible for ensuring that the conditions of the EA issued in terms of NEMA (should the project receive such authorisation) are fully adhered to, as well as ensuring that any other necessary permits or licenses are obtained and complied with. It is expected that the Project Developer will appoint the Environmental Control Officer and the Lead Contractor, and possibly an Environmental Manager (or Health, Safety and Environmental Manager).

3.2 ENVIRONMENTAL CONTROL OFFICER

An independent Environmental Control Officer (ECO) must be appointed to monitor the compliance of the proposed project with the conditions of EA (should such authorisation be granted by the DEA) during the construction and decommissioning phases (and possibly the operational phase, depending on the requirements of the DEA). The ECO must also monitor compliance of the proposed project with environmental legislation and recommendations of the EMPr, as well as oversee the implementation of the EMPr during the phases of the project, monitor environmental impacts, undertake record-keeping.

The ECO will be responsible for updating the EMPr as and when necessary, and compiling a monitoring checklist based on the EMPr. The roles and responsibilities of the ECO should include the following:

- The ECO must undertake periodic environmental audits during the relevant phases of the proposed project in order to monitor and record environmental impacts and non-conformances, and to monitor site activities to ensure adherence to the specifications contained in the EMPr, using a monitoring checklist. The timeframes for environmental audits will be indicated in the EA (should such authorisation be granted by the DEA).
- Environmental compliance/audit reports must be compiled and submitted by the ECO to the Competent Authority (i.e. DEA and/or Provincial Department of Environmental Affairs and Development Planning) on a regular basis (i.e. at intervals as indicated in the EA (should such authorisation be granted by the DEA)).
- The ECO must maintain a diary of site visits and audits, a copy of the Environmental Authorisation (should such authorisation be granted by the DEA) and relevant permits for reference purposes, a non-conformance register, a public complaint register, and a copy of previous environmental audits undertaken.

- Prior to the commencement of construction, the ECO must meet on site with the Contractor to confirm the construction procedure and designated construction areas and work activity zones.
- Reporting of any non-conformances within 48 hours of identification of such non-conformance to the relevant agents.
- Conducting an environmental inspection on completion of the construction period and 'signing off' the construction process with the Contractor.
- Ensure that records are kept of all monitoring activities and results.
- Conducting an environmental inspection on completion of decommissioning and 'signing off' the site rehabilitation process.

The Lead Contractor and sub-contractors may have their own Environmental Officers, or designate Environmental Officer functions to certain personnel.

3.3 LEAD CONTRACTOR

The Lead Contractor will be responsible for the following:

- Ensure that all appointed contractors and sub-contractors are aware of the EMP and their respective responsibilities;
- Prior to the commencement of construction, the Lead Contractor must meet on site with the ECO in order to confirm the construction procedure and designated construction areas and work activity zones.
- Ensure that each sub-contractor employs an Environmental Officer (or employs a designated suitably qualified individual to fulfil the role of an Environmental Officer) to monitor and report on the daily activities on-site during the construction period;
- Implementation of the overall construction programme, project delivery and quality control for the construction for the gas-to-power project;
- Overseeing compliance with the Health, Safety and Environmental Responsibilities specific to the project management related to project construction;
- Promoting total job safety and environmental awareness by employees, contractors and sub-contractors and stress to all employees and contractors and sub-contractors the importance that the project proponent attaches to safety and the environment;
- Ensuring that safe, environmentally acceptable working methods and practices are implemented and that sufficient plant and equipment is made available properly operated and maintained, to facilitate proper access and enable any operational to be carried out safely;
- Ensuring that all appointed contractors and sub-contractors repair, at their own cost, any environmental damage as a result of a contravention of the specifications contained in the EMP, to the satisfaction of the Project Developer's ECO;

3.4 FACILITY MANAGER

The Facility Manager will be responsible for the following:

- Operation of the 1500 MW gas-to-power facility;
- Required maintenance of the facility; and
- Overall compliance with the EMP and EA.

4 ALIEN INVASIVE VEGETATION MANAGEMENT PLAN

Impact	Mitigation/ Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
4.1. Impacts due to establishment of alien invasive plants	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	4.1.1. Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. 4.1.2. Appoint a specialist or contact relevant authorities to seek guidance on the removal of the alien vegetation on site. 4.1.3. Compile and finalise an alien weed eradication programme.	▪ Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. ▪ Appoint a suitable specialist to compile an alien invasive vegetation eradication plan. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase. ▪ Once-off during the design phase. ▪ Once-off during the design phase.	▪ Project Developer (GreenCape) ▪ Project Developer (GreenCape) ▪ ECO
B. CONSTRUCTION PHASE					
4.2. Impacts due to the establishment of and increased spread of alien invasive plants	Avoid establishment and reduce the spread of alien invasive plants due to the project activities.	4.2.1. Appoint a specialist or contractor to undertake a sweep and survey of the final development footprint site, with an alien invasive eradication team to remove exotic vegetation prior to the commencement of construction. 4.2.2. Establish an ongoing monitoring programme for the construction phase to detect and quantify any alien species that may become established and identify the problem species (as per Conservation of Agricultural Resources Act (Act 43 of 1983) (CARA) and National Environmental Management: Biodiversity Act (Act 10 of 2004) (NEM: BA)). 4.2.3. Ensure all alien management is undertaken according to standard best practice i.e. cut-stump and herbicide.	▪ Appoint a suitable vegetation contractor to inspect the site and remove any exotic weeds prior to the commencement of construction. ECO to ensure that this is taken into consideration and implemented. ▪ Prepare monitoring programme which will monitor the presence of alien invasive species on the site. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.	▪ Prior to the commencement of construction ▪ Once-off	▪ Project Developer (GreenCape), ECO and Specialist Contractor ▪ ECO and Contractor

Impact	Mitigation/ Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		4.2.4. Ensure proper management of soil stockpiles. Do not import soil stockpiles from areas with alien plants to ensure proper management of stockpiles.	Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species.	On-going	ECO and Contractor
		4.2.5. Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstate the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	On-going	ECO and Contractor
		4.2.6. Keep clearance and disturbance of indigenous vegetation to a minimum.	Monitor and manage vegetation clearing by undertaking visual inspections to ensure minimal disturbance and to restrict activities to within demarcated areas.	On-going	ECO and Contractor
		4.2.7. Ensure that the footprint required for the proposed project activities (such as temporary stockpiling, earthworks, storage areas, site establishment etc.) is kept at a minimum.	Verify that the proposed project area is determined and outlined prior to the commencement of the construction phase by undertaking visual inspections.	Once-off prior to construction and as required during the construction process.	ECO and Contractor
		4.2.8. Ensure that alien invasive vegetation found on site, within the proposed project footprint, is immediately controlled and removed promptly, in a scheduled manner throughout the construction phase. The removal of alien vegetation on site during the construction phase should use registered control methods and take into consideration the Alien and Invasive Species Regulations published in terms of Section 97(1) of the NEM: BA, if applicable.	Monitor the presence of alien invasive plants during the construction phase via visual inspections and take action to remove and control these species. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area. Any alien invasive should be cleared from site.	On-going	ECO and Contractor

Impact	Mitigation/ Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		4.2.9. The removed alien invasive vegetation should be immediately disposed at a suitable waste disposal facility and should not be kept on site for prolonged periods of time, as this will enhance the spread of these species.	▪ Monitor the removal of the alien vegetation found on site via visual inspections.	▪ As necessary during the construction phase.	▪ ECO
		4.2.10. All construction machinery and plant equipment delivered to site for use during the construction phase should be cleaned in order to limit the introduction of alien species.	▪ Clean machinery and equipment prior to the construction phase. ▪ ECO to conduct visual inspections to verify that machinery and equipment are cleaned, and report any non-compliance.	▪ Prior to the commencement of construction. ▪ As necessary during the construction phase.	▪ ECO and Contractor
C. OPERATIONAL PHASE					
4.3. Impacts due to establishment of alien invasive plants. Exotic weed invasion may result in the ousting of natural vegetation and alteration of ecological processes on site, with incremental impacts on the adjacent veld types.	Reduce the establishment and spread of alien invasive plants. To remove exotic weeds as and when they may arise and thereby prevent alteration of local and adjacent habitat forms.	4.3.1. Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	▪ Annual audit of project area and immediate surroundings. If any alien invasive species are detected then the distribution of these should be mapped (GPS co-ordinates of concentrations of plants). The results should be interpreted in terms of the risk posed to sensitive habitats within and surrounding the project area.	▪ Annual	▪ Operations and Maintenance Contractor
		4.3.2. Immediately control any alien plants that become established using registered control methods. Use of herbicides and undertake manual removal of alien vegetation on site where this may arise. Regular address and redress of weeds identified on site by a suitable contractor. The clearance of exotic weed to be undertaken bi-annually at a minimum and on a needs basis at an intermittent level.	▪ Monitor the use of herbicide sprays and manual removal of alien vegetation by undertaking visual inspections and reporting any non-compliance. ▪ Maintain register of weed spraying activities and ensure that herbicide use is recorded.	▪ Bi-annually	▪ Project Developer (GreenCape) and Environmental Manager
		4.3.3. Ensure all alien management is undertaken according to standard best practice i.e. cut-stump and herbicide.			

Impact	Mitigation/ Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
D. DECOMMISSIONING PHASE					
4.4. Exotic weed invasion of the decommissioned site resulting in ecological change	To prevent the excessive growth and propagation of exotic weeds on disturbed lands that formed a portion of the facility.	4.4.1. All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	Final external audit of area to confirm that area is rehabilitated to an acceptable level.	Once off	Lead Contractor with advice from specialist
		4.4.2. Exotic weed control measures to be instituted through weed control programme. Regular redress of exotic weed through the use of herbicide and manual removal.	- Compile weed eradication programme for a period of 12 months after the decommissioning exercise. - Appoint contractor to undertake the weed eradication programme. - Monitor newly disturbed areas where infrastructure has been removed to detect and quantify any aliens that may become established after decommissioning and rehabilitation. - Final external audit of area to confirm that area is free of alien invasive plants after 5 years.	- Weed eradication exercise to be undertaken every 6 months for a period of 12 months following decommissioning. - Prior to the commencement of the decommissioning phase. - Once-off - Once-off	- Project Developer (GreenCape) - Project Developer (GreenCape) - Facility Manager and Specialist/ Contractor - Facility Manager and Specialist/ Contractor

5 PLANT RESCUE AND PROTECTION PLAN INCLUDING RE-VEGETATION AND HABITAT REHABILITATION PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
5.1. The ousting of fauna through anthropogenic activities, disturbance of refugia and general change in habitat, with impacts on terrestrial and aquatic ecology as a result of the final site layout and routes of the access roads.	Avoidance of unnecessary disturbance to the site and surrounds, and to establish buffers where required.	5.1.1. Avoid of major drainage lines during the design and layout of the proposed facility. An Ecologist should be appointed to review the layout plan in relation to existing drainage lines and comment accordingly. Ensure that sensitive habitat and features (as defined in the Ecological Impact Assessment, Appendix J of the EIA Report) are considered in the design. 5.1.2. Incorporate minor drainage lines into design and avoid unnecessary disturbance, where applicable. 5.1.3. Consider the most applicable access road to site. 5.1.4. Appoint a specialist or suitable contractor to identify any plant species on site that may require “rescue” as well as any exotic weeds/vegetation that require removal. Appoint a specialist team flush game from the construction area. 5.1.5. Consideration of the siting and layout of the temporary construction site and worker camp.	▪ Review the site plan with the ECO and possibly an ecologist (if required). ▪ Appoint a specialist to oversee the final development footprint area and undertake search and rescue, game sweep and alien removal. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off, prior to the commencement of construction. ▪ Appoint specialist once-off, prior to the commencement of construction. ▪ Once-off during the planning and design phase.	▪ Project Developer (GreenCape) and ECO ▪ Project Developer (GreenCape) ▪ Project Developer (GreenCape)
5.2. Destruction of indigenous vegetation.	Ensure compliance with relevant Provincial and National legislation in respect of habitat and vegetation forms.	5.2.1. Ensure the necessary permits or licences are identified and applied for as applicable for removal of protected, indigenous vegetation. 5.2.2. Await response and provision of permit (as required) from the relevant Authorities prior to the removal of the indigenous species (if required). Once these permits are obtained, search and rescue must be undertaken for the indigenous species.	▪ Review the findings of the Ecological Impact Assessment and consider legislative requirements in respect of loss of indigenous vegetation etc. ▪ Contact the Provincial Department to discuss if any protected species need to be relocated or rescued. ▪ Appoint a suitable Search and Rescue Specialist/Contractor to undertake Search and Rescue. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed	▪ Once-off, prior to the commencement of construction ▪ Once-off, prior to the commencement of construction ▪ Once-off during the planning and design phase.	▪ Project Developer (GreenCape) and ECO ▪ Project Developer (GreenCape), Specialist/ Contractor and ECO ▪ Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			minutes of meetings or signed reports.		
5.3. Loss of Species of Special Concern (SSC) and protected species and their habitats.	Minimise fragmentation and loss of SSC and protected species and their habitats through the careful siting and layout planning for the project.	5.3.1. Avoid the removal of listed SSC and protected species as far as possible.	Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during the planning and design phase	Project Developer (GreenCape)
5.4. Impact on avian behaviour and avian species as a result of collision with infrastructure of the proposed gas-to-power facility	Allocation of Bird Flight Diverters (BFDs) to powerlines.	5.4.1. Establish BFDs across powerlines at appropriate points.	- Identify appropriate points within infrastructure for the establishment of BFDs. - Verify that this is undertaken by reviewing the signed approved designs.	- Once-off - Once-off	- Project Developer (GreenCape) and ECO - ECO
B. CONSTRUCTION PHASE					
5.5. Excessive loss of natural vegetation in and outside the development footprint area and veld degradation	Minimise loss of natural vegetation. Prevent impacts on natural vegetation in sensitive habitats and SSC.	5.5.1. Sensitive habitats and areas outside of the project development area should be clearly demarcated as no go areas during the construction phase to avoid accidental impacts.	- Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. - ECO must monitor activities and record and report non-compliance - Strict control and proper education of staff to prevent misconduct. If ECO is absent, there should be a designated EO present to deal with any urgent issues.	Daily	ECO and Contractor
		5.5.2. The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area.	Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas.	Weekly	ECO
		5.5.3. Unnecessary impacts on surrounding natural vegetation must be avoided during construction. All construction vehicles should remain on properly and clearly demarcated roads.	- Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. - Include periodical site inspection in environmental performance reporting that specifically records occurrence of off-road vehicle tracks in specific areas.	Daily	ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		5.5.4. Undertake rehabilitation of disturbed areas as soon as possible after construction. Stockpile the shallow topsoil layer separately from the subsoil layers. Reinstall the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site during the pre-construction phase.	Undertake following the construction phase and report any non-compliance.	Daily	ECO and Contractor
		5.5.5. The collection, hunting or harvesting of any plants, fuel wood or animals at the site during construction should be strictly forbidden and the staff educated to prevent this from happening.	- Strict control over the behaviour of construction workers, restricting activities to within demarcated areas for construction. - Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Daily - Once-off training and ensure that all new staff are inducted. - Monthly	- ECO and Contractor - Contractor/ ECO - ECO
		5.5.6. Fires should only be allowed within fire-safe demarcated areas. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on site for the duration of the construction phase.	- Strict control over the behaviour of construction workers, restricting activities to within demarcated areas. - Ensure fire safety requirements are well understood and respected by workers (by providing basic fire safety training).	Daily	ECO and Contractor
		5.5.7. Existing access roads/servitudes must be used and should be located along the boundaries of existing disturbed areas, if possible.	Compile plan pre-construction.	Prior to construction commencing	Project Developer (GreenCape) and ECO
5.6. Impact on indigenous vegetation, and on SSC and their habitats	To reduce negative impacts on and loss of indigenous vegetation and protected trees. Minimise impacts on SSC and protected trees.	5.6.1. Appoint a specialist to undertake a second review and site visit of the final layout of the development footprint, possibly during the late summer period, in order to identify any plant species on site that may require "rescue" as well as any exotic weeds/vegetation that require removal.	Appoint an Ecologist to oversee the final development footprint area through a reconnaissance survey.	Prior to the commencement of construction	Project Developer (GreenCape), Specialist and ECO
		5.6.2. Identification of roadways and areas where extensive vegetation loss will result is required. Upon consideration, the avoidance of unnecessary	- Review how larger vegetation will be dealt with by contractors. - Vegetation should be subject to	Ongoing	ECO and Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		5.6.3. clearance of vegetation on site should be undertaken through minor deviations to the design. Ensure that the footprint required for the proposed project activities is kept at a minimum.	redress when given a height that aligns with the lower limit of the PV array or when adjudged to affect construction.		
		5.6.4. A plant rescue operation must be initiated to confirm that no other species are located within the development site.	ECO must undertake a final walkthrough of the site prior to commencement of construction to ensure no SCC will be impacted on	Once-off	ECO and Contractor
		5.6.5. Clearing of vegetation should be kept to a minimum, keeping the width and length of the earthworks to a minimum.	Monitor activities and record and report non-compliance.	Daily	ECO and Contractor
		5.6.6. Avoid the removal of listed SSC or protected species as far as possible. Should any of the listed/protected species need to be removed, the requisite permits must be obtained prior to the removal of the species.	Monitor activities and record and report non-compliance.	Daily	ECO and Contractor
5.7. Disturbance of terrestrial fauna and flora on site due to construction workers and activities.	To advise construction staff of the requirements in respect of management of flora and fauna on site during the construction phase.	5.7.1. Conduct an Environmental Awareness Training and induction for all construction staff and personnel.	- Carry out Environmental Awareness Training with a discussion on the management of terrestrial fauna and flora on site. - Conduct audits of the signed attendance registers.	- Prior to construction and as required by the ECO. Ensure that all new staff are inducted. - Monthly	- ECO and Contractor - ECO
5.8. Impact on fauna as a result of construction activities.	To identify any faunal mortalities and record the details (such as the reason, spatial extent etc.) in order to avoid repetition of fatality.	5.8.1. Establish a recording method in order to monitor the construction activities, including species presence within site, mortalities and sightings.	- Establish database of species, sightings etc. - Construction personnel should advise on the findings and presence of fauna on site.	Daily to monthly	ECO
	To remove species that may be found present in the construction footprint and laydown area.	5.8.2. Appoint a specialist to conduct an inspection of the final project area and sweep or inspect the site for any fauna, once the fencing is complete (i.e. the established site should be flushed to ensure any large wildlife is not contained within the fenced area). Appoint a small team to flush game during the early evening. Game should be flushed by	- Team to flush game as required. - ECO to monitor flushing process and record any incidents or non-compliance.	Once off prior to commencement and thereafter if required.	ECO and Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		driving a team through the gated facility towards the exit.			
		5.8.3. The Contractor or Contractors Environmental Officer should monitor trenches at the start and end of each working day to check if any small animals are trapped.	▪ Monitor activities and record and report non-compliance.	▪ As required during construction	▪ ECO and Contractor
		5.8.4. No animals (including snakes) shall be killed on site. An expert or a suitable specialist should be appointed to remove and relocate any poisonous snakes during the construction phase.	▪ Monitor activities and record and report non-compliance.	▪ As required during construction	▪ ECO and Contractor
5.9. Increased ELP, leading to changes in nocturnal behavioural patterns amongst fauna	The avoidance of electrical light pollution through prudent positioning of external lighting.	5.9.1. Placement of lighting, particularly security lighting, to avoid excessive influence on surrounding areas. Placement of lighting to be judiciously considered at time of implementation.	▪ Review lighting plans and identify important habitat zones to be avoided.	▪ Prior to the installation of lighting.	▪ Project Developer (GreenCape), Contractor and ECO
C. OPERATIONAL PHASE					
5.10. Vegetation management on site	Manage vegetation throughout the site to avoid conflict with operations of the proposed gas-to-power facility. Excessive growth of vegetation on site may affect operations of the PV facility, while excessive clearance of vegetation on site has concomitant impacts on the land in question. Management of vegetation at an optimum level of growth and height is required.	5.10.1. Identify protocol for pruning of vegetation and clearance where required. 5.10.2. Identify level of pruning and vegetation management required.	▪ Identify means of pruning and clearance of vegetation. For example, brushcutter, grazing etc.	▪ Ongoing and as required	▪ Environmental Manager
5.11. Loss of SSC and their habitats	Control loss of natural vegetation during the operational phase. Prevent impacts on natural vegetation in sensitive habitats	5.11.1. Unnecessary impacts on surrounding natural vegetation must be avoided. All operational and maintenance vehicles to remain on the roads and no driving off road allowed. No unauthorized persons should be allowed onto the site.	▪ Strict control over the behaviour of operation workers, restricting activities to within demarcated areas for operation. Strict control and proper education of staff to prevent misconduct.	▪ Monthly	▪ Environmental Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	and SSC.	5.11.2. All hazardous materials should be stored in the appropriate manner to prevent impacts on vegetation. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill.	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	Environmental Manager
		5.11.3. A storm-water management plan must be implemented during the operational phase. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	- Verify that the stormwater management plan is being implemented and signed off prior the commencement of operations. - Undertake regular inspections of the stormwater infrastructure (i.e. by implementing walk through inspections).	- Prior to commencement of operations. - Weekly/Monthly	- Environmental Manager - Facility Manager
		5.11.4. Undertake maintenance of rehabilitated areas in accordance with the rehabilitation and landscaping plan.	Monitor topsoil removal and rehabilitation activities, and record and report non-compliance.	Weekly or Monthly	Facility Manager and Environmental Manager
		5.11.5. Continue with on-going monitoring programme to detect and quantify any alien species that may become established and identify the highly invasive species during the operation phase.	Monitor the presence of alien invasive species on the development site.	Reporting frequency depends on legal compliance framework	Facility Manager and Environmental Manager
5.12. Faunal and avifaunal road mortality as a result of increased vehicles travelling to and within the site.	Minimise loss of fauna as a result of road mortalities.	5.12.1. The operational personnel and staff should be made aware of the presence of fauna within the proposed project area. The operational personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings.	- Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Once-off training and ensure that all new staff are inducted. - Monthly	- Facility Manager - Environmental Manager
		5.12.2. To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the offices must be kept clean on a daily basis.	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	ECO and Contractor
D. DECOMMISSIONING PHASE					

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
5.13. Rehabilitation of flora on site	Re-vegetation of the disturbed site is aimed at approximating as near as possible the natural vegetative conditions prevailing prior to operation.	5.13.1. All damaged areas shall be rehabilitated upon completion of the contract. 5.13.2. All natural areas must be rehabilitated with species indigenous to the area. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction. 5.13.3. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas.	Conduct a final external audit to confirm that area is rehabilitated to an acceptable level.	Once off	Project Developer (GreenCape) with feedback and input from an appropriate specialist. with advice from specialist

6 OPEN SPACE MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
6.1. Loss of vegetation and habitat fragmentation	Entire site will be utilized in accordance with the specialist recommendation due to the presence of a biodiversity offset as the only mitigation measure.	6.1.1. Entire site to be utilized due to the presence of a biodiversity offset, this offset to be audited annually to ensure conservation of the CI species that are being removed from site. 6.1.2. Should it be determined during the planning phase that the entire site does not need to be cleared, then clearing of vegetation should be restricted to the development footprint apart from alien invasive species.	▪ Ensure that gas-to-power design and layout is uniform and well-adapted to the surrounding environment and that no unnecessary areas are cleared of vegetation.	▪ Once-off during design	▪ Project Developer (GreenCape)
6.2. Impacts due to establishment of alien invasive plants	Ensure the appropriate removal of alien invasive vegetation from the proposed project area and prevent the establishment and spread of alien invasive plants due to the project activities.	6.2.1. Ensure compliance with relevant Environmental Specifications for the control and removal of alien invasive plant species. 6.2.2. Appoint a specialist or contact relevant authorities to seek guidance on the removal of the alien vegetation on site. 6.2.3. Compile and finalise an alien weed eradication programme.	▪ Appoint a suitable specialist/ Contractor or contact the relevant authorities to seek guidance on the removal of the planted alien invasive species. ▪ Appoint a suitable specialist to compile an alien invasive vegetation eradication plan. ▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the design phase. ▪ Once-off during the design phase. ▪ Once-off during the design phase.	▪ Project Developer (GreenCape) ▪ Project Developer (GreenCape) ▪ ECO
6.3. Permanent barriers to animal movement and habitat fragmentation	The reduction in the impact that barrier will have on animal movement within the area	6.3.1. Fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the planning and design phase	▪ Project Developer (GreenCape)
		6.3.2. All remaining areas that are not impacted upon by the proposed development footprint should remain unfenced to allow for movement corridors between the remainder of the farm.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ Once-off during the planning and design phase	▪ Project Developer (GreenCape)
		6.3.3. BFDs should be installed on the overhead cables	▪ Identify appropriate points within infrastructure for the establishment of	▪ Once-off	▪ Project Developer (GreenCape) and

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		where known flight paths of birds occur.	BFDs. Verify that this is undertaken by reviewing the signed approved designs.	Once-off	ECO ECO
B. CONSTRUCTION PHASE					
6.4. Permanent barriers to animal movement and habitat fragmentation	The reduction in the impact that barrier will have on animal movement within the area	6.4.1. BFDs should be installed on the overhead cables where known flight paths of birds occur.	- The flight paths and birds observed in the area should be monitored by the ECO during the construction phase to determine where these measures should be installed. - Verify whether these have been installed by inspecting the site prior to commencement of the operational phase.	- Daily - Once-off	- ECO and Contractor - ECO
		6.4.2. Fencing should allow for the passage of small and medium sized mammals and all forms of mesh fencing should be avoided.	This should be monitored by the ECO to determine whether this is effective.	Daily	ECO and Contractor
6.5. Loss of vegetation and habitat fragmentation	Entire site will be cleared in accordance with the specialist recommendation due to the presence of a biodiversity offset as the only mitigation measure.	6.5.1. Entire site to be cleared due to the presence of a biodiversity offset, this offset to be audited annually to ensure conservation of the CI species that are being removed from site.	Ensure that gas-to-power design and layout is uniform and well-adapted to the surrounding environment and that no unnecessary areas are cleared of vegetation.	Once-off during design	Project Developer (GreenCape)
C. OPERATIONAL PHASE					
6.6. Increased risk of alien plant invasion	Ensure that the site is kept free from alien invasive species.	6.6.1. Continuously monitor the site and remove alien invasive species that are found.	Monitor the presence of alien invasive species on the development site.	Reporting frequency depends on legal compliance framework	Facility Manager and Environmental Manager
6.7. Increased animal road mortality	Minimise loss of fauna as a result of road mortalities.	6.7.1. Create awareness during staff induction programmes. Staff must be made aware of the general speed limits as well as the potential animals that may cross and how to react in these situations.	Conduct staff awareness training programmes.	Once-off training and ensure all new staff are inducted.	Facility Manager and Environmental Manager
6.8. Permanent barriers to animal movement and	Avoid or reduce bird collisions with or due to infrastructure	6.8.1. The impact on birds must be monitored by environmental staff member during the first six	Record any evidence of bird collisions, injury or other bird-related incidents (with GPS	Weekly for the first month, thereafter,	Project Developer

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
habitat fragmentation	related to the project	months of the operational phase.	coordinates). ▪ Where necessary, a bird specialist should oversee the recording and reporting of incidents, help with species identification, assess the significance of any impacts, and if required, suggest mitigation.	monthly	(GreenCape)
		6.8.2. Annual monitoring by an avifaunal specialist. This should be based on a minimum of 3-5 days observations.	▪ Monitor the flight paths of birds occurring on site, noting which birds are seen.	▪ Annually	▪ Project Developer (GreenCape)
		6.8.3. Any avian mortality or injury at the facility should be duly recorded and reported.	▪ Record any bird fatalities and undertake the necessary reporting to relevant authority.	▪ When required	▪ Project Developer (GreenCape)
D. DECOMMISSIONING PHASE					
6.9. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.	To manage impacts on the surrounding environment during the operational phase.	6.9.1. Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Developer (GreenCape)
		6.9.2. Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of native species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Developer (GreenCape)
		6.9.3. Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape.	▪ Final external audit of area to confirm that area is rehabilitated to an acceptable level	▪ Once off	▪ Project Developer (GreenCape)

7 TRAFFIC MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
7.1. Increased traffic generation	Manage impact that additional traffic generation will have on road network	7.1.1. If abnormal loads need to be transported by road to the site, a permit needs to be obtained from the Western Cape Department of Public Works, Roads and Transport.	- Ensure that the permits are applied for and obtained prior to commencement. - Verify that this has been undertaken by reviewing approved permits.	- Once-off during the design phase - Once-off during the design phase.	- Contractor - ECO
		7.1.2. Ensure that the requirements for use of the entrance road are addressed and considered in the design, as and where applicable.	Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during the design phase.	Project Developer (GreenCape) and ECO
		7.1.3. Provide a Transport Traffic Plan to SANRAL (if required).	- Ensure that the plan is compiled and submitted prior to commencement. - Verify that this has been undertaken by reviewing approved plans.	- Once-off during the design phase - Once-off during the design phase.	- Contractor - ECO
7.2. Accelerated degradation of road structure due to construction and operational traffic.	Limit the deterioration of the road condition due to construction and operational traffic.	7.2.1. The deterioration of the riding quality of the road pavements could be mitigated by routine maintenance surface treatment (if required).	- Ensure that the maintenance plan is compiled and submitted prior to commencement. - Verify that this has been undertaken by reviewing approved plans.	- Once-off during the design phase - Once-off during the design phase.	- Contractor - ECO
		7.2.2. Any abnormal loads transported to site but have the required permits to transport the loads.			
		7.2.3. The City of Cape Town’s by-laws in terms of transporting hazardous good to site must be adhered to.			
B. CONSTRUCTION PHASE					
7.3. Increased traffic generation during the construction phase resulting in a reduction	Reduce the amount of road based traffic during the construction phase.	7.3.1. Well maintained vehicles should be used together with well-trained drivers during the construction phase. Vehicle maintenance and driver competency should be monitored. Proof	Carry out random checks of driver licenses and conduct random visual inspections of construction vehicles	Random visual inspection of vehicles weekly.	Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
of road based level of service		of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. The Contractors must ensure that construction vehicles are roadworthy, properly serviced and maintained, and respect the vehicle safety standards implemented by the Project Developer.	for roadworthiness.		
		7.3.2. Plan trips so that it occurs during the day but avoid construction vehicle movement on the regional road during peak time (06:00-10:00 and 16:00-20:00).	Monitor and management of traffic generated and when trips are made.	During construction	Contractor and ECO
		7.3.3. During the construction phase, suitable parking areas should be designated for trucks and vehicles.	Monitor the placement of the designated parking area for trucks and vehicles via visual inspections and record and report any non-compliance.	Once-off prior to construction and as required during the construction phase.	Project Developer (GreenCape) and ECO
		7.3.4. The use of public transport (buses and/or minibus taxis) to convey construction personnel to the site should be encouraged i.e. MyCiti.	Contractor may record arrival and departure times as well as number of workers using MyCiti.	Once a month on a randomly selected day.	Appointed Contractor
		7.3.5. It is recommended that vehicles are not overloaded during the construction phase in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading. The inspections should also verify if the trucks are covered with appropriate material (such as tarpaulin) if and where possible.	Perform visual inspection of vehicles during the construction phase.	Random visual inspection of vehicles weekly.	Appointed Contractor
7.4. Increased level of road accidents (involving pedestrians, animals, other motorists on the surrounding tarred/gravel road network)	Minimise the impact of the construction activities on the local traffic and avoid accidents with pedestrians, animals and other drivers on the surrounding tarred/gravel	7.4.1. Well maintained vehicles should be used together with well-trained drivers during the construction phase. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to	Carry out random checks of driver licenses and conduct random visual inspections of construction vehicles for roadworthiness.	Random visual inspection of vehicles weekly.	Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
due to increased traffic during construction.	roads. Reduce number of road accidents due to increased traffic during construction.	ensure that vehicles are roadworthy and hence, do not pose a safety risk. The Contractors must ensure that construction vehicles are roadworthy, properly serviced and maintained, and respect the vehicle safety standards implemented by the Project Developer.			
		7.4.2. Road kill monitoring programme (inclusive of wildlife collisions record keeping) should be established and fences should be installed, if needed, to direct animals to safe road crossings.	Appropriate monitoring should be undertaken and fences installed, if needed to direct animals to safe road crossings.	Weekly	Contractor and ECO
		7.4.3. Adhere to all speed limits applicable to all roads used. All heavy load vehicles should maintain a speed limit of 40 km/hour in the proposed section of the entrance road.	- Ensure that speed limits are adhered to. - Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	- Daily - Random during the construction phase	- Contractor and ECO - ECO
		7.4.4. Implement clear and visible signage and signals indicating movement of vehicles at the intersection with the entrance road to ensure safe entry and exit.	- Implement clear signalisation. - Carry out random inspections to verify whether proper construction signage is being implemented.	- On-going - Random during the construction phase	- Contractor and ECO - ECO
7.5. Accelerated degradation of road structure due to construction traffic.	Limit the deterioration of the road condition due to construction traffic.	7.5.1. Construction activities will have a higher impact than the normal road activity and therefore the main access roads to site should be inspected on a weekly basis for structural damage.	Ensure that the main access road to site maintains current condition through photographic surveys and monitoring.	Weekly	Contractor and ECO
		7.5.2. Implement management strategies for dust generation e.g. apply dust suppressant on the entrance road, exposed areas and stockpiles.	Ensure dust management measures are in place to adequately decrease the generation of dust.	On-going	Contractor and ECO
		7.5.3. It is recommended that vehicles are not overloaded during the construction phase in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading. The inspections should also verify if the trucks	Perform visual inspection of vehicles during the construction phase.	Random visual inspection of vehicles weekly.	Appointed Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		are covered with appropriate material (such as tarpaulin) if and where possible.			
		7.5.4. Make provision for the repairing of subgrade deterioration (i.e. pot holes, dust holes) that could possibly result due to loading of heavy construction vehicles on the entrance road.	▪ Make provision for repairs required to road	▪ Agree to with Transnet	▪ Contractor and ECO
7.6. Impact on air quality due to dust generation, noise and exhaust emissions from construction vehicles and equipment.	Limit the release of noise, pollutants and dust emissions	7.6.1. Implement management strategies for dust generation e.g. apply dust suppressant on the entrance road, exposed areas and stockpiles.	▪ Ensure dust management measures are in place to adequately decrease the generation of dust.	▪ On-going	▪ Contractor and ECO
		7.6.2. Construction vehicles must have their lights on at all times. Lights to be properly set to not blind train drivers (SPAD).	▪ Ensure lights are on and properly set.	▪ On-going	▪ Contractor and ECO
		7.6.3. Postpone or reduce dust-generating activities during periods with strong wind. Earthworks may need to be rescheduled or the frequency of application of dust control/suppressant increased.	▪ Ensure dust management measures are in place to decrease the dust generated	▪ On-going	▪ Contractor and ECO
		7.6.4. Avoid using old and unmaintained construction equipment (which generate high sound levels) and ensure equipment is well maintained.	▪ Manage the air pollutants form construction vehicles through checking the condition of vehicles	▪ On-going	▪ Contractor and ECO
C. OPERATIONAL PHASE					
7.7. Increased level of road accidents (involving pedestrians, animals, other motorists on the surrounding tarred/ gravel road network) due to increased traffic during the operational phase.	Minimise the impact of the operational activities on the local traffic and avoid accidents with pedestrians, animals and other drivers on the surrounding tarred/ gravel roads. Reduce number of road	7.7.1. Well maintained vehicles should be used together with well-trained drivers during the operational phase, as required. Vehicle maintenance and driver competency should be monitored. Proof of driver competency as well as the vehicle checks should be verified and undertaken to ensure that vehicles are roadworthy and hence, do not pose a safety risk. Vehicles must be roadworthy, properly serviced and maintained.	▪ Carry out random checks of driver licenses and conduct random visual inspections of vehicles for roadworthiness.	▪ Random visual inspection of vehicles weekly.	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	accidents due to increased traffic during the operational phase.	7.7.2. Adhere to all speed limits applicable to all roads used. All heavy load vehicles should maintain a speed limit of 40 km/hour in the proposed section of the Transnet Service Road.	- Ensure that speed limits are adhered to. - Carry out random visual inspections to verify speed limits and general awareness of vehicle drivers.	- Daily - Random during the operational phase	- Facility Manager - Facility Manager
		7.7.3. Implement clear and visible signage and signals indicating movement of vehicles at the intersection with the entrance road to ensure safe entry and exit.	- Implement clear signalisation. - Carry out random inspections to verify whether proper construction signage is being implemented.	- Ongoing - Random during the operational phase	- Facility Manager - Facility Manager
		7.7.4. The use of public transport (buses and/or minibus taxis) or carpooling to convey operational personnel to the site should be encouraged.	Monitor the requirements	On-going	Facility Manager
		7.7.5. Adhere to requirements made within Transport Traffic Plan.	Monitor the requirements as set out in the Plan as ensure that it is adhered to	On-going	Facility Manager
		7.7.6. Limit access to the site to personnel.	Maintain a register of visitors and staff that enter site and restrict access to personnel.	On-going	Facility Manager
7.8. Accelerated degradation of road structure due to operational traffic.	Limit the deterioration of the road condition due to operational phase traffic.	7.8.1. The main access roads to site should be inspected on a weekly basis for structural damage.	Ensure that the main access road to site maintains current condition through photographic surveys and monitoring.	Weekly	Facility Manager
		7.8.2. Implement management strategies for dust generation e.g. apply dust suppressant on the entrance road, exposed areas and stockpiles.	Ensure dust management measures are in place to adequately decrease the generation of dust.	On-going	Facility Manager
		7.8.3. It is recommended that vehicles are not overloaded during the operational phase (where applicable) in order to reduce impacts on the road structures, particularly the access roads leading to the site. Random visual inspection of vehicles should be undertaken in order to monitor for overloading (where	Perform visual inspection of vehicles during the construction phase.	Random visual inspection of vehicles weekly.	Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		applicable).			
		7.8.4. Make provision for the repairing of subgrade deterioration (i.e. pot holes, dust holes) that could possibly result due to overloading of vehicles (where applicable) on the entrance road.	▪ Make provision for repairs required to road.	▪ Agree to with Transnet	▪ Project Developer (GreenCape)
		7.8.5. Implement requirements of the Road Maintenance Plan.	▪ Adhere to requirements of the Road Maintenance Plan.	▪ On-going	▪ Facility Manager
D. DECOMMISSIONING PHASE					
7.9. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

8 STORM WATER MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
8.1. Impact of the project if a detailed storm water management plan is not correctly prepared.	To limit the effect of uncontrolled storm water run-off from developed areas onto natural areas	8.1.1. Prepare a detailed stormwater management plan outlining appropriate treatment measures to address runoff from disturbed portions of the site, such that they do not: - result in concentrated flows into natural watercourses i.e. provision should be made for temporary or permanent measures that allow for attenuation, control of velocities and capturing of sediment upstream of natural water courses; - result in any necessity for concrete or other lining of natural water courses to protect them from concentrated flows of the development; - divert flows out of their natural flow pathways, thus depriving downstream watercourses of water.	- Check compliance with specified conditions. - Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	- Once-off during design followed by regular control - During the design phase	- Contractor - ECO
B. CONSTRUCTION PHASE					
8.2. Diversion and impedance surface water flows – Changes to the hydrological regime and increased potential for erosion. Diversion and	Prevent interference with natural run-off patterns, diverting flows and increasing the velocity of surface water flows.	8.2.1. The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	- Compile a Method Statement for Stormwater Management during the construction phase. - Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	- Prior to the construction phase. - Once-off prior to the commencement of the construction phase.	- Contractor - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
increased velocity of surface water flows – reduction in permeable surfaces		8.2.2. Stormwater and any run-off generated by the hard surfaces should be discharged into retention swales or areas with rock rip-rap (or similar). These could be used to enhance the sense of place, if they are planted with indigenous vegetation.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		8.2.3. Place energy dissipation structures in a manner that allows the management of flows prior to being discharged into the natural environment, thus not only preventing erosion, but supporting the maintenance of natural base flows within these systems i.e. hydrological regime (water quantity and quality) is maintained.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		8.2.4. Reinforce soil slopes to minimise erosion during rehabilitation (as needed, and once construction in a specific area has ceased).	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction phase	▪ ECO
		8.2.5. Any irrigation of the development area for landscaping or dust control purposes should be controlled, such that it does not result in any measurable increase in moisture being passed into natural drainage lines.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		8.2.6. Drainage along the sides of the roads should be designed so that it does not result in concentrated flows into watercourses.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or bi-weekly	▪ ECO
		8.2.7. Perform periodic inspections and maintenance of soil erosion measures and stormwater control structures.	▪ Monitor activities and record and report non-compliance.	▪ As needed during the construction phase	▪ ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
8.3. Pollution of the surrounding environment as a result of the contamination of stormwater. Contamination could result from the spillage of chemicals, oils, fuels, sewage, solid waste, litter etc.	To prevent contaminated stormwater from entering into and adversely impacting on freshwater ecosystems and reducing the water quality. To reduce sedimentation of nearby water systems. To apply best practice principles in managing risks to storm water pollution.	8.3.1. The appointed Contractor should compile a Method Statement for Stormwater Management during the construction phase.	- Compile a Method Statement for Stormwater Management during the construction phase. - Inspect and verify if a Method Statement for Stormwater Management has been compiled by the Contractor via audits prior to the commencement of the construction phase.	- Prior to the construction phase. - Once-off prior to the commencement of the construction phase.	- Contractor - ECO
		8.3.2. Provide secure storage for fuel, oil, chemicals and other waste materials to prevent contamination of stormwater runoff. Fuels and chemicals (i.e. any hazardous materials and dangerous goods) used during the construction phase must be stored safely on site and in bunded areas. Fuel and chemical storage containers must be inspected to ensure that any leaks are detected early.	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents. Monitor if spillages have taken place and if they are removed correctly.	Weekly	ECO
		8.3.3. All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation. No stockpiling should take place within a watercourse.	Monitor the excavations and stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	Daily	ECO
		8.3.4. Stockpiles must be located away from river channels i.e. greater than 32 m.			
		8.3.5. Littering and contamination of water resources during construction must be prevented by effective construction camp management.	Monitor via site audits and record non-compliance and incidents (i.e. by implementing walk through inspections).	Weekly	Contractor and ECO
		8.3.6. Emergency plans must be in place to deal with potential spillages (especially those leading to any watercourses) – see conditions of the Risk Assessment.	Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	Weekly or Bi-weekly	ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		8.3.7. Ensure that the temporary site camp and ablution facilities are established at least 32 m away from the banks of the major drainage lines.	▪ Monitor the placement of the site camp via visual inspections, and record and report any non-compliance.	▪ Once-off prior to construction and as required during the construction phase.	▪ ECO
		8.3.8. Ensure that there is no ad-hoc crossing of channels by vehicles during the construction phase. Access routes across the site should be strictly demarcated and selected with a view to minimise impacts on drainage lines.	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		8.3.9. Ensure that no waste materials or sediments are left in the surrounding drainage lines (as a result of the construction).	▪ Check compliance with specified conditions of the Stormwater Management Plan and Method Statement.	▪ Weekly or Bi-weekly	▪ ECO
		8.3.10. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	▪ Monitor via site audits and record non-compliance and incidents (i.e. by implementing walk through inspections).	▪ Weekly	▪ Contractor and ECO
C. OPERATIONAL PHASE					
8.4. Stormwater discharge into the surrounding environment during operations	To minimise the contamination of stormwater by uncontrolled release of contaminated or grey water.	8.4.1. An operational phase Stormwater Management Plan should be designed and implemented, with a view to prevent the passage of concentrated flows from hardened surfaces and onto natural areas.	▪ Compile a Stormwater Management Plan for the operational phase. ▪ Inspect and verify if a Stormwater Management Plan has been compiled prior to the commencement of the operational phase.	▪ Continuously during operational phase. ▪ Once-off prior to the commencement of the operational phase.	▪ Project Developer (GreenCape)
	To protect soil resources and prevent soil erosion.	8.4.2. All release points into the natural environment must have appropriate energy dissipaters to minimise scouring/erosion.	▪ Monitor activities and record and report non-compliance. ▪ Monitor the placement of energy dissipaters via visual inspections, and record and report any non-compliance.	▪ On-going	▪ Project Developer (GreenCape)
		8.4.3. As far as reasonably possible, separate “clean” and “dirty” storm water. As far as reasonably possible, capture and contain “dirty”	▪ Monitor via site audits and record non-compliance and incidents (i.e. by	▪ Weekly or as required during operations.	▪ Project Developer

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		stormwater for appropriate disposal/discharge.	implementing inspections).		(GreenCape)
		8.4.4. Regular inspections of stormwater infrastructure should be undertaken to ensure that it is kept clear of all debris and weeds.	Undertake regular inspections of the stormwater infrastructure (i.e. by implementing walk through inspections).	Weekly/Monthly	Project Developer (GreenCape)
D. DECOMMISSIONING PHASE					
8.5. The proposed gas-to-power facility would be expected to run for a minimum period of 20 years, after which it would either be decommissioned, alternatively upgraded or an application submitted to obtain a new license. Should the plant be decommissioned, the gas-to-power field would be rehabilitated to its original (pre-development) state. In the (unlikely) event that none of the mitigation measures outlined for the construction and operational phases of the proposed project had been implemented, the period of time for recovery to take place would be extended. In the event that decommissioning occurs, and assuming implementation of mitigation measures, the hydrological regime should fully recover over time to present day conditions.					

9 EROSION MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. CONSTRUCTION PHASE					
9.1. Increased wind erosion and resultant deposition of dust	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	9.1.1. Sand, stone and cement should be stored in demarcated areas, and covered or sealed to prevent wind erosion and resultant deposition of dust on the surrounding indigenous vegetation.	▪ Undertake regular inspections of the via site audits to verify that sand, stone and cement are stored and handled as instructed.	▪ Daily	▪ ECO and Contractor
		9.1.2. All stockpiles must be protected from erosion and stored on flat areas where run-off will be minimised. Erosion and sedimentation into water bodies must be minimised through effective stabilisation.	▪ Monitor the stockpiling process throughout the construction phase via visual site inspections. Record non-compliance and incidents.	▪ Daily	▪ ECO
9.2. Excessive loss of natural vegetation within the development footprint area	Prevent loss of natural vegetation through erosion.	9.2.1. Stockpile the shallow topsoil layer separately from the subsoil layers (especially if the excavation exceeds 0.5 m). Reinstatement the topsoil layers (containing seed and vegetative material) when construction is complete to allow the plants to rapidly re-colonise the bare soil areas.	▪ Rehabilitate disturbed areas and monitor the presence of alien invasive species on site.	▪ Daily (stockpiling) and once-off for the reinstatement of the top soil layer	▪ ECO and Contractor
		9.2.2. Re-seed with locally-sourced seed of indigenous grass species that were recorded on site pre-construction.	▪ Re-seed with seeds of indigenous grass species.	▪ Once off	▪ ECO with advice from specialist (if required)
		9.2.3. Topsoil stockpiles not used in three months after stripping must be seeded to prevent dust and erosion.	▪ Regular monitoring for erosion to ensure that no erosion problems are occurring at the site. All erosion problems observed should be rectified as soon as possible.	▪ Weekly initially and thereafter monthly	▪ ECO and Contractor

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
9.3. Erosion of surface soils, rilling and gulleys.	Measures to be implemented that address or avoid the loss of surface soils and exacerbates gully formation.	9.3.1. Identify cause of erosion and possible means of redress (i.e. implement erosion control measures, where applicable), such as the use of geofabric, stone gabions and re-vegetation or similar measures. 9.3.2. Erosion control measures should seek to reduce surface flow velocity and allow for settlement on site of silt laden surface waters. Washaways, excessive loss of soils and gulleys can be considered to be indicative of excessive erosion.	Monitor the erosion on site during construction, as well as the implementation and effectiveness of erosion control on site (such as the use of geofabric, stone gabions and re-vegetation or similar measures).	Ongoing and as required during erosion events.	ECO and Project Developer (GreenCape)
B. OPERATIONAL PHASE					
9.4. Increased wind erosion and resultant deposition of dust.	Prevent wind erosion and resultant deposition of dust on surrounding indigenous vegetation.	9.4.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	Include periodic site inspections in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records occurrence or non-occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	Monthly	Project Developer (GreenCape)
C. DECOMMISSIONING PHASE					
9.5. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area. Rehabilitation must be executed in such a manner that surface run-off will not cause erosion of disturbed areas. Monitoring: Final external audit of area to confirm that area is rehabilitated to an acceptable level (once off event to be conducted by ECO).					

10 “LOSS OF CONTAINMENT” OF HAZARDOUS SUBSTANCES MONITORING SYSTEM

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
10.1. Design flaws which could impact on the loss of containment of diesel, LNG, hydrogen, ammonia, chlorine.	Ensure compliance with SANS codes, i.e. SANS 10087, SANS 10089, SANS 10108, etc. in design of facility.	10.1.1. Completion of a recognised process hazard analysis (such as a HAZOP study, FMEA, etc.) on the proposed facility prior to construction to ensure design and operational hazards have been identified and adequate mitigation put in place	- Check compliance with specified conditions. - Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.2. Incorporation of applicable guidelines or equivalent international recognised codes of good design and practice into the designs		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.3. Compliance with IEC 61508 and IEC 61511 (Safety Instrument Systems) standards or equivalent to ensure that adequate protective instrumentation is included in the design and would remain valid for the full life cycle of the tank farm: Including demonstration from the designer that sufficient and reliable instrumentation would be specified and installed at the facility		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.4. Demonstration by the owner or their contractor that the final designs would reduce the risks posed by the installation to internationally acceptable guidelines		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.5. Signature of all terminal designs by a professional engineer registered in South Africa in accordance with the Professional Engineers Act, who takes responsibility for suitable designs		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.6. Completion of an emergency preparedness and response document for on-site and off-site scenarios prior to initiating the MHI risk assessment (with input from local authorities		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
		10.1.7. Permission not being granted for increases to the product list or product inventories without redoing part of or the full EIA		Once-off during design followed by	ECO and Project Developer

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
				regular control	(GreenCape)
		10.1.8. Final acceptance of the facility risks with an MHI risk assessment that must be completed in accordance to the MHI regulations and that the risk assessment covers the entire facility		Once-off during design followed by regular control	ECO and Project Developer (GreenCape)
B. CONSTRUCTION PHASE					
10.1. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of concrete and cement.	To control concrete and cement batching activities in order to reduce spillages and resulting contamination of soil, groundwater and the vegetation and/or fauna.	10.1.1. If any concrete mixing takes place on site, this must be carried out in a clearly marked, designated area at the site camp on an impermeable surface (such as on boards or plastic sheeting and/or within a bunded area with an impermeable surface).	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Project Developer (GreenCape), Contractor and ECO
		10.1.2. Bagged cement must be stored in an appropriate facility and at least 10 m away from any water courses, gullies and drains.	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Project Developer (GreenCape), Contractor and ECO
		10.1.3. A washout facility must be provided for washing of concrete associated equipment. Water used for washing must be restricted.	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Project Developer (GreenCape), Contractor and ECO
		10.1.4. Hardened concrete from the washout facility or concrete mixer can either be reused or disposed of at an appropriate licenced disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	- Monitor the handling and storage of sand, stone and cement as instructed. - Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	- Daily - Monthly	- Project Developer (GreenCape), Contractor and ECO - ECO
		10.1.5. Empty cement bags must be secured with adequate binding material if these will be temporarily stored on site. Empty cement bags must be collected from the construction area at the end of every day. Sand and aggregates containing cement must be kept damp to prevent the generation of dust.	Monitor the handling and storage of sand, stone and cement as instructed.	Daily	Project Developer (GreenCape), Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		10.1.6. Any excess sand, stone and cement must be removed from site at the completion of the construction period and disposed at a licenced waste disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	- Monitor the handling and storage of sand, stone and cement as instructed. - Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	- Daily - Monthly	- Project Developer (GreenCape), Contractor and ECO - ECO
10.2. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils.	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	10.2.1. Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the site camp. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	Weekly	Contractor and ECO
		10.2.2. Monitor and inspect construction equipment and vehicles to ensure that no fuel spillage takes place. Ensure that drip trays are provided for construction equipment and vehicles as required.	- Monitor the construction equipment and vehicles and monitor the occurrence of spills and the management process thereof. - Record all spills and lessons learnt.	- Daily - During spill events	- Contractor and ECO - ECO
		10.2.3. Contractor to compile a Method Statement for refuelling activities under normal and emergency situations. If on-site servicing and refuelling is required in emergency situations, a designated area must be created at the construction site camp for this purpose. Drip trays or similar impervious materials must be used during these procedures.	- Verify if a Method Statement is compiled by reviewing approved and signed off reports. - Monitor the refuelling/servicing process and record the occurrence of any spillages.	- Once-off prior to commencement of construction. - During emergency refuelling and servicing activities.	- ECO - ECO
		10.2.4. Spilled fuel, oil or grease must be retrieved and	Monitor the handling and	Daily (or during	Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		contaminated soil removed, cleaned and replaced.	storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	spills)	
		10.2.5. Contaminated soil to be collected by the Contractor (under observation of the ECO) and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Daily (or during spills)	Contractor and ECO
		10.2.6. A Spill Response Method Statement must be compiled by the Contractor for the construction phase in order to manage potential spill events.	- Compile a Spill Response Method Statement. - Audit signed and approved Spill Response Method Statement.	- Once-off (and thereafter updated as required during the construction phase). - Once-off (and thereafter as required during the construction phase).	- Contractor and Project Developer (GreenCape) - ECO
		10.2.7. The Contractor must ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events.	Monitor via site audits and record incidents and non-compliance.	Daily/Weekly	ECO and Contractor
		10.2.8. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	Ensure that a well-maintained portable bioremediation kit is available on site and that construction personnel and contractors are aware of its location and instructions	Daily	Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		10.2.9. In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e. GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination. 331).	- Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e. GN 331) in order to determine if the soil is significantly contaminated or not. - If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	During spill events	Project Developer (GreenCape)
		10.2.10. The Contractor must record and document all significant spill events.	Monitor documentation and records of significant spill events via audits and record non-compliance and incidents.	During spill events	ECO
C. OPERATIONAL PHASE					
10.3. Contamination of soil and risk of damage to vegetation and/or fauna through spillage of fuels and oils	To control and eliminate fuel and oil spillages which may result in soil contamination and damage to vegetation and/or fauna.	10.3.1. Monitor and inspect maintenance equipment and vehicles to ensure that no fuel spillage takes place.	Implement specifications for maintenance equipment use as specified by the maintenance Contractor.	Monthly	Project Developer (GreenCape)
		10.3.2. Spilled fuel, oil or grease is retrieved during operations where possible and contaminated soil removed, cleaned and replaced.	Monitor the handling and storage of fuels and oils via site audits and monitor if spillages have taken place and if so, are removed correctly. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		10.3.3. Contaminated soil to be collected by the Contractor and disposed of at a registered waste facility designated for this purpose. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	Monitor the correct removal of contaminated soil. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Project Developer (GreenCape)
		10.3.4. A Spill Response Plan must be compiled for the operational phase in order to manage potential spill events.	- Compile a Spill Response Plan. - Audit signed and approved Spill Response Method Statement.	- Once-off (and thereafter updated as required). - Once-off (and thereafter as required).	- Project Developer (GreenCape) - Facility Manager
		10.3.5. Ensure that adequate spill containment and clean-up equipment are provided on site for use during spill events. Portable bioremediation kit (to remedy chemical spills) is to be held on site and used as required.	Ensure that a well-maintained portable bioremediation kit is available on site and that operational personnel are aware of its location and instructions.	Weekly	Facility Manager
10.4. Loss of containment of diesel, LNG, hydrogen, ammonia, chlorine resulting in explosions, fires or toxic clouds causing human death or injury.	To minimize the risk of a loss of containment of these chemicals	10.4.1. In case of a spillage of hazardous chemicals where contamination of soil occurs, depending on the degree and level of contamination, excavation and removal to a hazardous waste disposal facility could be necessary. If the spillage is widespread and the soil is considered to be significantly contaminated, a specialist will need to be immediately appointed to address the spillage. This will usually entail the collection of samples of the contaminated soil followed by analysis in terms of the 2014 National Norms and Standards for the Remediation of Contaminated Land and Soil Quality (i.e. GN 331). If the soil is determined to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant, including notifying the Minister of Environmental Affairs of the significant contamination.	- Ensure that a suitably qualified specialist is appointed to collect and analyse the contaminated soil samples in terms of the 2014 Norms and Standards (i.e. GN 331) in order to determine if the soil is significantly contaminated or not. - If the contaminated soil is considered to be significantly contaminated, then compliance with Part 8 of the NEMWA should be achieved by the Applicant.	During events spill	Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		10.4.2. Ensure that adequate containment structures are provided for the temporary storage of liquid dangerous goods and hazardous materials on site (such as chemicals, oil, fuel, hydraulic fluids, lubricating oils etc.). Appropriate bund areas must be provided for the storage of these materials at the facility. Bund areas should contain an impervious surface in order to prevent spillages from entering the ground. Bund areas should have a capacity of 110 % of the volume of the largest tank in the bund (tanks include storage of fuel/diesel).	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	Weekly	Facility Manager
10.5. Impacts due to management solid and liquid wastes disposed of on the site during operational phase.	Prevent environmental impacts as a result of the operational phase such as pollution.	10.5.1. All operation waste to be removed from the site by an appointed service provider.	Waste removal and disposal to be monitored throughout operation.	Monthly	Facility Manager
		10.5.2. All liquid waste or spills (used oil, paints, lubricating compounds and grease from vehicles passing through the entrance facility) to be packaged and disposed appropriately at a registered landfill site.	Monitor the correct removal of liquid waste or spills. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	During spills	Project Developer (GreenCape)
		10.5.3. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided in order to avoid spillages.	Monitor the storage and handling of dangerous goods and hazardous materials on site via site audits and record non-compliance and incidents.	Weekly	Facility Manager
D. DECOMMISSIONING PHASE					
10.6. No specific impacts are associated with the decommissioning phase other than those from the operational phase that will still be relevant for the duration of the decommissioning phase due to on-going occupation of the area.					

11 ENVIRONMENTAL AWARENESS AND FIRE MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
11.1. Potential impacts resulting from the lack of overall compliance with the conditions of the EA (issued by the DEA)	Ensure compliance with all environmental conditions of approval (issued by DEA as part of the EA).	11.1.1. Audit the implementation of the EMPr requirements.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Weekly	▪ Project Developer (GreenCape)
		11.1.2. Establish clear and transparent reporting of the activities undertaken with regard to all recommendations included in the EMPr.	▪ Audit report on compliance with actions and monitoring requirements.	▪ Weekly	▪ Project Developer (GreenCape)
B. CONSTRUCTION PHASE					
11.2. Potential risk of fire due to construction activities or behaviour of staff on site during the construction phase	Prevent fire on site resulting of workers smoking or starting fires (i.e. cooking, heating purposes).	11.2.1. Designate smoking areas, as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Ad-hoc checks to ensure workers are smoking or cooking in designated areas only.	▪ Daily	▪ ECO and Contractor
		11.2.2. Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Ongoing. ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ ECO and Contractor ▪ Contractor/ ECO ▪ ECO
		11.2.3. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the construction phase.	▪ Ensure fire safety requirements are well understood and respected by construction personnel. Provide basic fire safety training.	▪ On-going	▪ ECO and Contractor
		11.2.4. Ensure that cooking takes place in a designated area shown on the site map. Ensure that no firewood or kindling may be gathered from the site or surrounds.	▪ Check compliance with specified conditions using a report card, and allocate fines when necessary.	▪ On-going	▪ ECO and Contractors

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		11.2.5. Fire-fighting equipment must be made available at various appropriate locations on the construction site.	- Ensure fire safety requirements are well understood and respected by workers. - Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	- On-going - Bi-annually	- ECO and Contractor - Contractor
11.3. Inappropriate behaviour of civil contractors and sub-contractors during the construction phase	Prevent unnecessary impacts on the surrounding environment by ensuring that contractors are aware of the requirements of the EMP.	11.3.1. Ensure that the EMP and the EA (should it be granted by the DEA), are included in all tender documentation and contractors and sub-contractors contracts.	Check compliance with specified conditions using a report card, and allocate fines when necessary.	On-going	ECO and Contractors
	Ensure that contractors and sub-contractors do not induce impacts on the surrounding environment as a result of unplanned pollution on site.	11.3.2. Contractors and sub-contractors must use the ablution facilities situated in a designated area within the site; and no bathing/washing should be permitted outside the designated area.	Check compliance with specified conditions using a report card, and allocate fines when necessary.	On-going	ECO and Contractors
	Ensure that actions by on-site contractors and sub-contractors and workers are properly managed in order to minimise impacts to surrounding environment	11.3.3. All litter will be deposited in a clearly labelled, closed, animal-proof disposal bin in the construction area; particular attention needs to be paid to food waste.	Check compliance with specified conditions using a report card, and allocate fines when necessary.	On-going	ECO and Contractors
		11.3.4. No person other than a qualified specialist or personnel authorised by the Project Developer, will disturb or remove plants outside the demarcated construction area.	Check compliance with specified conditions using a report card, and allocate fines when necessary.	On-going	ECO and Contractors
		11.3.5. No person other than a qualified specialist or personnel authorised by the Project Developer, will disturb animals on the site.	Check compliance with specified conditions using a report card, and allocate fines when necessary.	On-going	ECO and Contractors
		11.3.6. Educate workers on site about suitable behaviour on site and initiate environmental awareness. Staff must be informed that no trapping, snaring or feeding of any animal will be allowed.	- Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Once-off training and ensure that all new staff are inducted. - Monthly	- Contractor/ ECO - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
11.4. Inappropriate planning and of site camp establishment.	Ensure that environmental issues are taken into consideration in the planning for site establishment.	11.4.1. All construction activities, materials, equipment and personnel must be restricted to the actual construction area specified (as required to undertake the construction work). The construction area must be demarcated by the Contractor.	Monitor compliance and record non-compliance and incidents.	Before construction	ECO
		11.4.2. The Contractor should install and maintain Construction Site Information Boards in the position, quantity, design and dimensions specified by the Project Developer.	Monitor compliance and record non-compliance and incidents.	Before construction	ECO
		11.4.3. General building materials should be stored in appropriate designated areas on site such that there will be no runoff from these areas towards sensitive systems. The site camp must be removed after construction.	Monitor compliance and record non-compliance and incidents.	Before construction	ECO
11.5. Increased animal road mortality	Reduction in animal mortality	11.5.1. The construction staff should be made aware of the presence of fauna and within the proposed project area. The construction personnel and staff must also be made aware of the general speed limits on site and must be alert at all times for potential crossings, and should be trained on how to react in these situations.	- Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Once-off training and ensure that all new staff are inducted. - Monthly	- Contractor/ ECO - ECO
		11.5.2. To ensure that animals are not attracted to the site (and potentially resulting in increased road mortality), the waste collection bins and skips should be covered with suitable material, where appropriate, and the site camp must be kept clean on a daily basis.	Monitor the activities via visual inspections, and record and report any non-compliance.	Daily	Contractor and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		11.5.3. Establish a monitoring programme to record the number of faunal road mortalities and collisions. If it is established that the number of collisions and faunal fatalities increase within an area, particularly with regards to smaller species (reptiles), then measures such as exclusion fences within these areas only should be installed.	- Appropriate monitoring and recording should be undertaken. - Exclusion fences should be installed, if needed to direct animals to safe road crossings.	- Weekly - As required	- ECO - ECO and Contractor
11.6. Increased energy consumption during the construction phase.	Reduce energy consumption where possible.	11.6.1. Encourage the use of energy saving equipment at the site camp site (such as low voltage lights and low pressure taps) and promote recycling. Construction personnel must be made aware of energy conservation practices as part of the Environmental Awareness Training programme.	- Contractor to monitor energy usage via audits. - Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Monthly - Once-off training and ensure that all new staff are inducted. - Monthly	- Contractor - Contractor/ECO - ECO
11.7. Impact on the regional water balance as a result of increased water usage.	Reduce water usage during the construction phase.	11.7.1. Water conservation should be practiced as follows: - Cleaning methods utilised for cleaning vehicles, floors, etc. should aim to minimise water use (e.g. sweep before wash-down). - Ensure that regular audits of water systems are conducted to identify possible water leakages.	Monitor via site audits and record non-compliance and incidents.	Monthly	ECO
		11.7.2. Avoid the use of potable water for dust suppression during the construction phase and consider the use of alternative approved sources, where possible.			
		11.7.3. Make construction personnel aware of the importance of limiting water wastage, as well as reducing water use.	- Carry out Environmental Awareness Training with a discussion on water usage and conservation. - Conduct audits of the signed attendance registers.	- Once-off training and ensure that all new staff are inducted. - Monthly	- Contractor/ECO - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
C. OPERATIONAL PHASE					
11.8. Potential risk of fire due to behaviour of staff on site during the operational phase	Ensure appropriate and efficient fire prevention during the operational phase.	11.8.1. Designate smoking areas as well as areas for cooking, where the fire hazard could be regarded as insignificant.	▪ Random inspections during a month to ensure workers are smoking or starting fires in designated areas only.	▪ Monthly	▪ Facility Manager
		11.8.2. Educate workers on the dangers of open and/or unattended fires.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. ▪ Carry out Environmental Awareness Training. ▪ Conduct audits of the signed attendance registers.	▪ Ongoing ▪ Once-off training and ensure that all new staff are inducted. ▪ Monthly	▪ Facility Manager ▪ Facility Manager ▪ Facility Manager
		11.8.3. Open fires must be prohibited. Appropriate fire safety training should also be provided to staff that are to be on the site for the duration of the operational phase.	▪ Ensure fire safety requirements are well understood and respected by operational personnel. Provide basic fire safety training.	▪ On-going	▪ Project Developer (GreenCape)
		11.8.4. Ensure that adequate fire-fighting equipment is available and easily accessible on site.	▪ Ensure fire safety requirements are well understood and respected by workers. ▪ Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company.	▪ On-going ▪ Bi-annually	▪ Facility Manager ▪ Project Developer (GreenCape)
11.9. Increased energy consumption during the operational phase.	Reduce energy consumption where possible.	11.9.1. Encourage the use of energy saving equipment at the facility (such as low voltage lights and low pressure taps) and promote recycling. Operational personnel must be made aware of energy conservation practices as part of the environmental awareness training programme.	▪ Monitor energy usage via site investigations. ▪ Conduct training for all operational personnel.	▪ Monthly ▪ As and when required and ensure that all new staff are inducted.	▪ Facility Manager ▪ Project Developer (GreenCape)
11.10. Impact on the regional water balance as a result of increased water	Reduce water usage during operations. <i>Note: no water will be used for the operations of</i>	11.10.1. Water conservation to be practiced in line with Energy Saving Policies as follows: ▪ Cleaning methods utilised for cleaning	▪ Record water usage during the operational phase, conduct audits and record non-compliance and incidents.	▪ Monthly	▪ Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
usage.	the gas-to-power facility, only for domestic purposes.	vehicles, floors, the offices etc. should aim to minimise water use (e.g. sweep before wash-down). - Where possible, encourage the re-use of water. - Ensure that regular audits of water systems are conducted to identify possible water leakages.			
		11.10.2. Consider installing water saving devices (e.g. dual flush toilets, automatic shut-off taps, etc.). 11.10.3. Carry out environmental awareness training with a discussion on water usage and conservation, and make operational personnel aware of the importance of limiting water wastage.	Conduct training for all operational personnel.	As and when required during operations and ensure that all new staff are inducted.	Facility Manager
11.11. Non respect of waste management practices	Minimise the production of general waste.	11.11.1. Control and implement waste management plans. Ensure that relevant legislative requirements are respected.	Control of waste management practices throughout operation phase.	Monthly	Facility Manager
	Ensure compliance with relevant waste management legislation.	11.11.2. Determine specific areas on site for temporary management of waste.			
	Minimise pollution of the environment.	11.11.3. Promote waste reduction, re-use, and recycling opportunities on site during the operation phase.	Monitor waste generation and collection throughout operation.	Monthly	Facility Manager
		11.11.4. Ensure an adequate and sustainable use of resources.			
11.12. Excessive generation of waste water on site during the operation phase	Maintain reasonable levels of waste water generation	11.12.1. Waste water must be collected and disposed of at a suitable licenced disposal facility. Proof of disposal (i.e. waste disposal slips or waybills) should be retained on file for auditing purposes.	- Waste water generation to be monitored throughout the operational phase. - Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	Quarterly	Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
D. DECOMMISSIONING PHASE					
11.13. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

12 AIR QUALITY MANAGEMENT PLAN

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
E. CONSTRUCTION PHASE					
11.14. Emissions from construction vehicles and generation of dust as a result of earthworks, demolition, as well as the delivery and mixing of construction materials.	Reduce dust emissions during construction activities.	11.14.1. Ensure that cleared (excavated) areas and unpaved surfaces are sprayed with water (obtained from an approved source) to minimise dust generation. Approved soil stabilisers may be utilised to limit dust generation.	- Monitor dust suppression mechanisms and record non-compliances. - Maintain an incidents/ complaints register, in which any complaints from the public must be logged. The date, time, nature of complaint, name of complainant and corrective actions must be logged for all complaints. Complaints must be investigated and, if appropriate, acted upon.	- Weekly - During complaints/incidents	EHS Manager, ECO and Contractor
		11.14.2. Implement traffic control measures on the construction site to limit vehicle-entrained dust from unpaved roads. Ensure that construction vehicles travelling on unpaved roads do not exceed a speed limit of 40 km/hour.	Monitor traffic control measures and report non-compliances.	Weekly	EHS Manager and Contractor
F. OPERATIONAL PHASE					
11.15. Emissions from the facility operations such	Maintain levels of emissions to an acceptable standard	11.15.1. Ensure that the proposed facility is operated in such a manner that the emissions levels are	Monitor via site audits and record non-compliance and incidents.	Monthly	EHS Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
as: SO ₂ NO ₂ PM ₁₀ Benzene CO		kept within the ambient air quality standards as laid out in the Air Quality specialist study. Note: No mitigation measure for facility operations were provided by the specialist, however it is the opinion of the EAP that continuous monitoring of air emissions takes place.	Compile regular air quality reports.		
G. DECOMMISSIONING PHASE					
11.16. Ensure that the construction mitigation and management measures are adhered to during the decommissioning phase.					

13 Specific Project Related Environmental Impacts

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
A. DESIGN PHASE					
A.1. VISUAL IMPACTS					
12.1. Potential visual intrusion of construction activities on existing views of sensitive visual receptors	Reduce visual intrusion of construction activities project wide.	12.1.1. Ensure plans are in place to minimise fire hazards and dust generation.	▪ Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	▪ During design cycle and before construction commences.	▪ Project Developer (GreenCape)
		12.1.2. Ensure plans are in place to rehabilitate temporary cleared areas as soon as possible.			▪ ECO
		12.1.3. Clearance of the area for the gas-to-power facility should be phased in such a way that the exposed area is always at a minimum.	▪ Ensure that this is taken into consideration prior to the commencement of construction by reviewing signed minutes of meetings	▪ Once-off during the design phase.	▪ Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			or signed reports.		
	Reduce visual intrusion of the gas-to-power energy facility	12.1.4. A maintenance plan for buildings and structures should be in place. 12.1.5. Colours of buildings and structures should blend in with the landscape background where this is technically feasible and where it will not affect the functionality of the structures. 12.1.6. Materials, coatings and paints should be chosen based on minimal reflectivity. 12.1.7. Grouped structures should be painted in the same colour where this will not affect the functionality of the structures, to reduce visual complexity and contrast. 12.1.8. Appropriate coloured materials should be used for structures to blend in with the backdrop of the project. 12.1.9. Appropriate colours for smooth surfaces often need to be two to three shades darker than the background colour to compensate for shadows that darken most textured natural surfaces.	Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	During design cycle and before construction commences.	Project Developer (GreenCape) and ECO
12.2. Potential impact of night lighting of the Gas-to-power Facility on the nightscape of the region.	Reduce the impact of night lighting of structures and buildings associated with the gas-to-power energy facility on the surrounding nightscape and visual receptors.	12.2.1. A lighting plan for the proposed Gas-to-power plant that documents the design, layout and technology used for lighting purposes should be prepared, indicating how nightscape impacts will be minimised and that also demonstrates that project lighting is effectively shielded from surrounding and adjacent properties must be prepared with the design plans of the plant. The plan should minimize light spill onto neighbouring properties and glare which can affect visual receptors in the surrounding landscape. 12.2.2. The lighting plan should also minimize contribution to light pollution (night glow) of the regional nightscape. 12.2.3. The lighting plan should include a process for	- A lighting specialist should be contracted to design the lighting plan for the project. The plan should provide for temporary lighting during the construction and decommissioning phases of all components of the project. - Ensure that this is taken into consideration during the planning and design phase by reviewing signed minutes of meetings or signed reports.	- During design cycle and before construction commences. - Once-off during the design phase.	- Project Developer (GreenCape) - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		promptly addressing and mitigating complaints about potential lighting impacts. 12.2.4. Lighting of the facility should not exceed, in number of lights and brightness, the minimum required for safety and security. 12.2.5. Uplighting and glare (bright light) should be minimised using appropriate screening. 12.2.6. Low-pressure sodium light sources should be used to reduce light pollution. 12.2.7. Light fixtures should not spill light beyond the project boundary. 12.2.8. Timer switches or motion detectors (within safety requirements) should be used to control lighting in areas that are not occupied continuously.			
A.2. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.3. Impacts to archaeology and graves (note that none are expected).	Achieve a layout that minimizes the potential later impacts to archaeological resources and/or graves.	12.3.1. Ensure that project layout avoids as many known archaeological resources and/or graves as possible.	Take cognizance of the archaeological sites and graves reported in the HIA when designing facility layout.	Once-off	Project Developer (GreenCape)
12.4. Impacts to the natural and cultural landscape (note that none are expected).	Reduce the degree of visual contrast in the landscape.	12.4.1. Plan to use an earth-coloured paint on the built elements of the facility.	Include earth-coloured paint in the design specifications for the facility.	Once-off	Project Developer (GreenCape)
A.3. SOCIAL IMPACTS					
12.5. In-migration of potential job seekers into the Atlantis area	Proactively manage the in-migration of potential employment seekers and in so doing mitigate impacts on existing social structures.	12.5.1. Develop and implement a Workforce Recruitment Plan 12.5.2. Reserve employment, where practical, for local residents 12.5.3. Clearly define and agree upon the Project Affected People (PAP) 12.5.4. Develop a database of PAP and their relevant skills	- Mitigation measures (12.5.1); (12.5.4) and (12.5.5) requires the drafting of a document which would in each instance serve as the method through which the mitigation actions are monitored. - Mitigation measures (12.5.2) and (12.5.3) requires clear statements	Once-off during the design phase.	Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		and experience 12.5.5. Develop and implement a Stakeholder Engagement Plan	regarding for whom work would be reserved (i.e. mitigation measure (12.5.2)) and who the PAP is (i.e. mitigation measure (12.5.3)).		
12.6. Economic Development Plan	Draft an Economic Development Plan to align local investment with bona fide local needs.	12.6.1. The proponent should engage with local NGOs, CBOs and local government structures to identify and agree upon relevant skills and competencies required in the Atlantis community. 12.6.2. Such skills and competencies should then be included in the Economic Development Plan. 12.6.3. Where possible, align Economic development Plan with Local Municipality's IDP. 12.6.4. Delivery on the Economic development Plan must be contractually binding on the proponent.	Mitigation measures 12.6.1; 12.6.4; 12.6.3 and 12.6.5 require the drafting of a document (i.e. the Economic development Plan) which would in each instance serve as the method through which the mitigation actions are monitored.	Once-off during the design phase.	Project Developer (GreenCape)
B. CONSTRUCTION PHASE					
B.1. ECOLOGICAL IMPACTS (TERRESTRIAL, AQUATIC AND AVIFAUNA)					
12.7. Changes in edaphics (soils) on account of excavation and import of soils, resulting in changes in soil state, compaction, and alteration of plant communities and fossorial species in and around these points etc.	Avoidance of undue disturbance to soils	12.7.1. Ripping of compact soils to be considered according to site specifics and impact (i.e. either manual or machine driven ripping of compact soils to loosen surface material and improve percolation).	If deemed applicable, Monitor the manual or machine driven ripping of compact soils.	Intermittent and upon identification of excess compaction or option of ripping is considered necessary (i.e. when and where extensive compaction arises)	Contractor and Project Developer (GreenCape)
12.8. Alteration of surface water quality leading to changes in water chemistry.	To manage construction activities that may impact on surface and subsurface water quality	12.8.1. Avoidance of significant earthworks with concomitant risk of increasing silt mobility. 12.8.2. Conduct judicious excavation and clearance. 12.8.3. Undertake stabilisation of disturbed soils.	- Undertake site and visual inspections and reporting any non-compliance. - Containment of hazardous waste and hazardous materials.	Ongoing	Contractors, Project Developer (GreenCape) and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.8.4. Implement the use of surface flow attenuators or energy dissipaters (if required). 12.8.5. Management of potential liquid material that may be classified as hazardous. 12.8.6. Management of hazardous waste. 12.8.7. Avoid significant sculpting of land and maintenance of the general topography of site.			
12.9. Alteration of surface drainage patterns on account of construction activities leading to change in plant communities and general habitat structure	Limit alteration of surface drainage, leading to changes in plant communities and general habitat structure, patters due to construction activities.	12.9.1. Avoidance of major drainage features during construction. The proposed project footprint must be demarcated to reduce unnecessary disturbance beyond the proposed project area. Demarcate as no-go areas. 12.9.2. Undertaking and completion of earthworks and road construction outside of the high rainfall period (if possible). 12.9.3. Avoidance of significant sculpting of land and maintenance of the general topography of the site. 12.9.4. Maintenance of a high level of housekeeping on site during the construction phase. 12.9.5. Inspection of drainage features immediately outside of the footprint of the proposed facility and undertake removal of solid waste and litter on a regular basis.	- Carry out visual inspections to ensure strict control over the behaviour of staff in order to restrict activities to within demarcated areas. - Monitor the construction period to verify if this is being undertaken (where possible). - Carry out visual inspections to ensure minimal impact on soils and erosion. - Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. - Monitor the condition of drainage features immediately outside of the footprint of the plant and the condition of the construction area throughout the construction phase via visual site inspections. Record non-compliance and incidents.	- Ongoing - Ongoing - Ongoing - Ongoing - Ongoing	- ECO - Contractor, Project Developer (GreenCape) and ECO - Contractor, Project Developer (GreenCape) and ECO - ECO - Contractor, Project Developer (GreenCape) and ECO
B.2. VISUAL IMPACTS					
12.10. Potential visual intrusion of construction activities on existing views of sensitive	Prevent unnecessary visual clutter and focusing attention of surrounding visual receptors on the proposed development.	12.10.1. Preparation of the gas-to-power area (i.e. clearance of vegetation, grading, contouring and compacting) and gas-to-power field construction should be phased in a way that makes practical sense in order to minimise the area of soil exposed and the shortest	- Ensure that this is taken into consideration prior to the commencement of construction. - Conduct site inspections to monitor the phasing of construction to verify	- Once-off during the construction phase. - Weekly	- Project Developer (GreenCape) - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
visual receptors		duration of exposure.	unnecessary soil disturbance and clearing and report any non-compliance.		
		12.10.2. Parking areas should be demarcated and strictly controlled so that vehicles are limited to specific areas only.	- Carry out visual inspections to ensure the construction area and parking area is demarcated clearly, and record and report any non-compliance. - Carry out visual inspections to ensure strict control over the parking of construction vehicles and access routes in order to restrict activities to within demarcated areas.	- Weekly - Weekly	- ECO - ECO
		12.10.3. Night time construction should be avoided where possible.	Construction operation times to be monitored and managed (as well as included in the tender contract).	Weekly	ECO
		12.10.4. Night lighting of the construction sites should be minimised within requirements of safety and efficiency.	Complaints about night lights should be investigated and documented in a register.	Weekly or bi-weekly	Contractor and ECO
	Reduce the visual impact of construction activities project wide	12.10.5. Maintain good housekeeping on site to avoid litter and minimize waste.	- Carry out site visits and inspections of the construction sites and ensure good housekeeping is maintained. Record and report any non-compliance. - Carry out site visits and record and report any non-compliance. - Complaints about night lights should be investigated and documented in a register. Investigate any complaints about night lights and document it in a register. - Visit sites requiring rehabilitation. - Carry out site visits and record and report any non-compliance. - Carry out site visits and record and	- Daily - Daily - Daily and as complaints arise. - Daily - Daily - Daily	Construction Manager and ECO
		12.10.6. Monitor construction sites for strict adherence to demarcated boundaries.			
		12.10.7. Monitor adherence to lighting plan.			
		12.10.8. Monitor adherence to rehabilitation plan.			
		12.10.9. Monitor adherence to erosion control plan.			
		12.10.10. Monitor adherence to dust and fire control plans.			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			report any non-compliance.		
B.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.11. Construction vehicles and activities could result in damage to or destruction of archaeological sites and/or graves.	Minimise the chances of significant archaeological sites and/or graves being disturbed.	12.11.1. Ensure that all heritage resources requiring mitigation are mitigated prior to the start of construction.	Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas.	Weekly	ECO
		12.11.2. Ensure that no activity takes place outside of the authorized construction footprint.			
		12.11.3. The Contractor and ECO must be informed of the possibility of archaeological resources and graves (i.e. ensure that all personnel are aware of the potential of encountering graves and what to do if this occurs (i.e. to report any suspicious stone features prior to disturbance)).	- Carry out Environmental Awareness Training to ensure that the Contractors are informed of the possible type of heritage features that may be encountered during the construction phase. - Conduct audits of the signed attendance registers. - Appoint a professional archaeologist to examine the construction footprint. - Conduct an audit to verify that the necessary permits are obtained by the archaeologist, if required.	- Once-off training and ensure that all new staff are inducted. - Monthly - Once-off six months prior to construction. - As required/ necessary during the construction phase.	- Contractor/ ECO - ECO
		12.11.4. Alternatively commission an archaeologist to examine the final development footprint at least six months prior to the commencement of construction.			
		12.11.5. If archaeological sites and potential graves cannot be avoided, the buffers as stipulated in the HIA should be implemented during the construction phase.	Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas and outside of the buffer area.	Weekly	ECO
		12.11.6. If any of the graves or potential graves found on site cannot be avoided then an archaeologist should be contracted to conduct a test excavation to determine the status of the feature. If it is determined to be a grave, then exhumation would need to occur (if necessary) with the permission of SAHRA (and in accordance with any requirements that SAHRA might impose at the time).	- Appoint a professional archaeologist to conduct a test excavation to determine if the sites are graves. - Conduct an audit to verify that the necessary permits are obtained by the archaeologist for the test excavation, if required.	As potential graves are encountered	Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.11.7. If any concentrations of archaeological material, graves or stone features are uncovered during the proposed construction, work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist. Such heritage is the property of the state and may require excavation and curation in an approved institution. Sufficient time should be allowed to remove/collect such material.	- Monitor excavations and construction activities for archaeological materials via visual inspections and report the finds accordingly. - Contact the heritage authorities and the identified archaeologist if any heritage features are uncovered.	- Daily or during excavations. - As required/ necessary during the construction phase.	- Contractor and ECO - Project Developer (GreenCape)
B.4. PALAEONTOLOGICAL HERITAGE IMPACTS					
12.12. Loss of legally-protected palaeontological heritage resources at or beneath ground surface within development footprint (fossils, fossil sites and contextual geological data).	Reporting, conservation, recording and judicious sampling of scientifically important fossil material exposed during the construction phase of development.	12.12.1. Reporting chance fossil finds to SAHRA for possible professional mitigation.	- Monitoring of all substantial excavations into sedimentary bedrocks for fossil material (e.g. vertebrate bones & teeth, fossilized wood, shells) - Safeguarding of chance fossil finds, preferably <i>in situ</i>.	- Throughout the construction phase - Throughout the construction phase	- ECO - ECO
		12.12.2. Recording and sampling of fossil material and associated geological data (only necessary for chance fossil finds made during the proposed development).	- Application by a qualified palaeontologist for fossil collection permit from SAHRA. - Palaeontologist to undertake field study of fossil finds in situ on site. Photography and sampling of important finds. - Curation of fossils collected in an approved repository (museum/university collection).	Following alert of chance fossil finds on site (It is important to note that there is no need for on-site palaeontological monitoring unless new fossil finds are made during development).	- Qualified palaeontologist appointed and commissioned by the Project Developer. - Qualified palaeontologist appointed and commissioned by the Project Developer - Qualified palaeontologist appointed and commissioned by the Project Developer

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
B.5. SOILS AND AGRICULTURAL POTENTIAL IMPACTS					
12.13. Soil erosion due to alteration of the land surface characteristics	To reduce erosion on site and downstream of the site as a result of run-off from the site, or due to wind erosion.	12.13.1. Implement an effective system of run-off control, where it is required, that collects and safely disseminates run-off water from all hardened surfaces and prevents potential down slope erosion.	▪ Include periodic site inspection in environmental performance reporting that inspects the effectiveness and integrity of the run-off control system and specifically records the occurrence of any erosion on site or downstream. Corrective action must be implemented to the run-off control system in the event of any erosion occurring.	▪ Monthly during the construction phase.	▪ ECO
B.6. SOCIAL IMPACTS					
12.14. Influx of job seekers into the Atlantis area.	Control influx of job seekers into the Atlantis area with the aim of protecting local social structures.	12.14.1. Implement the Workforce Recruitment Plan. 12.14.2. Ensure employment is reserved, where practical, for local residents. 12.14.3. Actively use the database of PAP and their relevant skills and experience to guide local employment. 12.14.4. Implement the Stakeholder Engagement Plan.	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database; ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Three times during each 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO
12.15. Outsiders moves into the Atlantis area	Limit incidences of in social deviance in the Atlantis area.	12.15.1. Implement the Workforce Recruitment Plan 12.15.2. Ensure employment is reserved, where practical, for local residents 12.15.3. Actively use the database of PAP and their relevant skills and experience to guide local employment 12.15.4. Implement the Stakeholder Engagement Plan	▪ Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database; ▪ Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	▪ Three times during each 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	▪ Construction Manager and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
12.16. Expectations created regarding possible employment	Prevent frustration resulting from miscommunication of employment opportunities and project-related benefits in the local community.	12.16.1. Implement the Stakeholder Engagement Plan	Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	Construction Manager and ECO
12.17. Local spending	Ensure the generation of socio-economic benefits as a result of the multiplier effect.	12.17.1. Procure goods and services, where practical, within the study area 12.17.2. Obtain regularly required goods and services from as large a selection of local service providers as possible	Verify purchase of local goods and services through proof of purchase.	Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	Construction Manager and ECO
12.18. Local employment	Ensure optimum employment creation while taking cognizance of the local levels of experience and education.	12.18.1. Implement the Workforce Recruitment Plan	Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database.	Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	Construction Manager and ECO
12.19. Economic Development Plan	Ensure contribution to local employment, local spending and human capacity development is being made.	12.19.1. Implement the Economic Development Plan	Verify that the Economic development Plan is being implemented.	Three times during the estimated 14 month construction period (i.e. at 3 months, 6 months, and 9 months).	Construction Manager and ECO
B.7. GEOHYDROLOGY IMPACTS					
12.20. Potential impact on groundwater as a result of the construction of storage yards and temporary labour accommodation camps (i.e.	To prevent unnecessary infiltration of polluted surface water	12.20.1. Waste water from labour accommodation site camps or yards must be collected in a designated container and disposed of at a suitable disposal point off site (i.e. a licenced waste disposal facility). A suitable waste contractor must be appointed to collect waste from site on a regular basis for correct disposal. Proof of disposal (waybills or waste disposal slips) must be retained and kept on file for auditing	- Monitor the placement of structures, storage yards, accommodation camps and infrastructure during the construction phase to ensure existing wind pumps / boreholes are not damaged. - Waste removal and disposal to be monitored. Monitor via site audits and	- Once off prior to the commencement of construction. - Weekly - Four times per annum for the construction period, i.e. at 3 months, 6 months, 9 months	- Project Developer (GreenCape) - Project Developer (GreenCape) and ECO - Project

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
wastewater from construction activities disposed of on the site leading to environmental impacts (e.g. groundwater pollution))		purposes. 12.20.2. Other non-hazardous solid waste (e.g. refuse) to be disposed of at a licensed landfill. A suitable waste contractor must be appointed to collect waste from site on a regular basis for correct disposal. Proof of disposal (waybills or waste disposal slips) must be retained and kept on file for auditing purposes. 12.20.3. Avoid using old or damaged construction equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.20.4. Any engines that stand in one place must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and construction vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. Vehicle and washing areas must also be on paved surfaces and the by-products correctly managed.	record non-compliance and incidents. Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents. - Construction vehicles need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. - Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance.	and 12 months. Weekly	Developer (GreenCape) and ECO Project Developer (GreenCape) and ECO
12.21. Potential impact on groundwater as a result of stormwater outflows	To prevent unnecessary infiltration of polluted storm water	12.21.1. Ensure the storm water runoff is not contaminated. All reasonable measures must be taken to prevent the contamination of storm water outflows.	- Monitor the quality of the storm water - ECO to verify that measures are in place to reduce the contamination of storm water and to monitor the quality of storm water by undertaking site visits and visual inspections.	- If possible do this during or shortly after a storm event, at the start of the rain season. - Weekly	- Project Developer (GreenCape) and ECO. - ECO
12.22. Potential impact on groundwater quality as a result of accidental spillages or fuel leakages.	To reduce the potential of groundwater pollution.	12.22.1. Avoid using old or damaged construction equipment and vehicles and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.22.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and construction	- Construction vehicles need to be monitored throughout the construction phase. Monitor via site audits and record non-compliance and incidents. - Monitor the placement and designation of the area for refuelling at the site camp via visual inspections.	- Four times per annum for the construction period, i.e. at 3 months, 6 months, 9 months and 12 months. - Weekly - Weekly	- Project Developer (GreenCape) and ECO - Project Developer (GreenCape) and ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the construction site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit. 12.22.3. If spillages occur during refuelling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.	Monitor the usage of spill containment measures and record and report non-compliance. Monitor the refuelling/ servicing process and record the occurrence of any spillages.		Project Developer (GreenCape) and ECO
B.8. WASTE MANAGEMENT					
12.23. Pollution of the surrounding environment (including drainage lines) as a result of the handling, temporary stockpiling and disposal of general waste.	Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of general waste.	12.23.1. General waste (i.e. construction waste, building rubble, discarded concrete, bricks, tiles, wood, glass, window panes, air conditioners, plastic, metal, excavated material, packaging material, paper and domestic waste etc.) generated during the construction phase should be stockpiled temporarily (i.e. once-off) on site in a designated area within suitable waste collection bins and skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate.	- Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance. - Monitor the temporary storage and handling of general waste on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area).	- Once-off prior to the commencement of the construction phase and as required as the construction phase process evolves. - Daily	- ECO and Contractor - ECO
	Minimise the production of waste. Prevent environmental problems (e.g. pollution / change in soil pH) due to solid and liquid wastes disposed of on the site. Ensure compliance with waste	12.23.2. Should the on-site stockpiling of general waste exceed 100 m ³ and a period of 90 days, then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.	- Record the amount of general waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-compliance and incidents. - Monitor the duration and amounts of general waste that is temporarily stockpiled at the designated area on	- Daily - Weekly - Monthly	- Contractor - ECO - Project Developer (GreenCape).

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
	management legislation.		site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area). Audit compliance with the Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e. only if required).		
		12.23.3. Ensure that the designated stockpiling area for general waste (i.e. skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of general waste on site via site audits and record non-compliance and incidents.	Daily	ECO
		12.23.4. Ensure that general waste generated during the construction phase is removed from the site on a regular basis, and safely disposed of at an appropriate, licenced waste disposal facility by an approved waste management Contractor. Waste disposal slips or waybills should be kept on file as proof of disposal. As a general principle, waste manifests must be obtained to prove legal disposal of waste.	- Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the general waste at an appropriate, licenced waste disposal facility. - Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	- Once-off prior to the construction phase. - Weekly	- Project Developer (GreenCape)/ Contractor - ECO
		12.23.5. Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	- Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. - Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Daily - Once-off training and ensure that all new staff are inducted. - Monthly	- ECO and Contractor - ECO and Contractor - ECO
		12.23.6. Sufficient general waste disposal bins must also be provided for use by construction personnel throughout the site. These bins must be emptied on	Monitor general waste generation by construction staff and collection via audits throughout the construction	Daily or Weekly	ECO and Contractor.

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		a regular basis.	phase.		
		12.23.7. Ensure that all general waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	At the end of the construction phase.	ECO and Contractor.
		12.23.8. Promote waste reduction, re-use, and recycling opportunities on site during the construction phase.	- Monitor waste generation and collection throughout construction. - Investigate if any complaints have been expressed by the surrounding community regarding waste handling.	Weekly or bi-weekly	ECO and Contractor
		12.23.9. Ensure an adequate and sustainable use of resources.	Monitor waste generation and collection throughout construction.	Weekly or bi-weekly	ECO and Contractor
		12.23.10. Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.	Control of waste management practices throughout construction phase	Weekly or bi-weekly	ECO and Contractor
12.24. Pollution of the surrounding environment as a result of the handling, temporary stockpiling and disposal of hazardous waste.	Reduce environmental impacts such as soil, surface water and groundwater contamination as a result of incorrect storage, handling and disposal of hazardous waste.	12.24.1. Hazardous waste (i.e. empty tins, oils, fuel spillages, spilled materials and chemicals etc.) generated during the construction phase should be stockpiled temporarily (i.e. once-off) on site in a designated area in suitable waste collection bins and leak-proof storage skips (or similar). Waste collection bins and skips should be covered with suitable material, where appropriate. Hazardous waste must be stored separately from all other general waste. The designated stockpiling area must be labelled correctly.	- Monitor the strategic placement of the temporary, designated waste stockpiling area at the site camp via visual inspections, and record and report any non-compliance. - Monitor the temporary storage and handling of hazardous waste on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area).	- Once-off prior to the commencement of the construction phase and as required as the construction process evolves. - Daily	- ECO and Contractor - ECO
		12.24.2. Should the on-site stockpiling of hazardous waste exceed 80 m ³ , then the National Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) must be adhered to.	Record the amount of hazardous waste that is temporarily stockpiled at the designated area on site, as well as the duration and record non-	- Daily - Weekly - Monthly	- Contractor - ECO - Project

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			compliance and incidents. - Monitor the duration and amounts of hazardous waste that is temporarily stockpiled at the designated area on site via site audits and record non-compliance and incidents (i.e. conduct visual inspections of the temporary waste storage area). - Audit compliance with the Norms and Standards for the Storage of Waste (published on 29 November 2013 under GN 926) if the storage amounts are exceeded (i.e. only if required).		Developer (GreenCape).
		12.24.3. Ensure that the designated stockpiling area for hazardous waste (i.e. leak proof skips and waste collection bins) is inspected on a daily basis to verify its condition and integrity, particularly after rainfall events.	Monitor the temporary, designated waste stockpiling area at the site camp, as well as the handling of hazardous waste on site via site audits and record non-compliance and incidents.	Daily	ECO
		12.24.4. Ensure that all hazardous waste is removed from the site on a regular basis, and safely disposed at an appropriate, licenced hazardous waste disposal facility by an approved waste management Contractor.	- Ensure that a suitable Waste Management Contractor is appointed to remove and dispose the hazardous waste at an appropriate, licenced hazardous waste disposal facility. - Monitor waste disposal slips and waybills via site audits and record non-compliance and incidents.	- Once-off prior to the construction phase. - Weekly	- Project Developer (GreenCape)/ Contractor - ECO
		12.24.5. Ensure that the construction site is kept clean at all times and that construction personnel are made aware of correct waste disposal methods. Littering must be prevented through effective site camp management.	- Monitor the condition of the site camp throughout the construction phase via visual site inspections. Record non-compliance and incidents. - Carry out Environmental Awareness Training. - Conduct audits of the signed attendance registers.	- Daily - Once-off training and ensure that all new staff are inducted. - Monthly	- ECO and Contractor - ECO and Contractor - ECO

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.24.6. Ensure that all hazardous waste emanating from the construction phase is removed from site prior to the commencement of the rehabilitation and operational phases.	Undertake a final inspection at the end of the construction phase in order to verify and ensure that all general waste is removed from site and correctly disposed, prior to the commencement of the rehabilitation and operational phases.	At the end of the construction phase.	ECO and Contractor.
		12.24.7. All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.	Waste removal and disposal to be monitored throughout construction	Weekly or bi-weekly	ECO and Contractor
		12.24.8. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	Waste removal and disposal to be monitored throughout construction	Weekly or bi-weekly	ECO and Contractor
		12.24.9. Waste water from construction and painting activities must be collected in a designated container and disposed of at a suitable disposal point off site.	Waste removal and disposal to be monitored throughout construction	Weekly or bi-weekly	ECO and Contractor
		12.24.10. Control and implement waste management plans provided by contractors. Ensure that relevant legislative requirements are respected.	Control of waste management practices throughout construction phase	Weekly or bi-weekly	ECO and Contractor
C. OPERATIONAL PHASE					
C.1. VISUAL IMPACTS					
12.25.Potential visual intrusion of the proposed Gas-to-power Energy Facility on the views of sensitive visual receptors.	Reduce visual intrusion of the gas-to-power energy facility on the views of sensitive visual receptors as well as its impact on the surrounding landscape	12.25.1. Monitor effectiveness of the rehabilitation plan for temporarily cleared areas and erosion scarring. 12.25.2. Monitor building and façade maintenance. Painted features should be maintained and repainted when colour fades or paint flakes.	- Carry out visual inspections during site audits to verify the effectiveness of the rehabilitation, and record and report any non-compliance. - Carry out an inspection of gas-to-power energy facility to ensure that it is being maintained in a good condition.	- Monthly - Annually	- Project Developer (GreenCape) and Environmental Manager - Project Developer (GreenCape) and Environmental Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.25.3. Maintain re-vegetated surfaces until a self-sustaining stand of vegetation is established and visually adapted to the undisturbed surrounding vegetation. No new disturbance should be created during operations without approval from the Environmental Manager. 12.25.4. Restoration of disturbed land should commence as soon after disturbance as possible. 12.25.5. Road maintenance activities should avoid damaging or disturbing vegetation. 12.25.6. Dust and noxious weed control should be part of maintenance activities.	- Carry out visual inspections during site audits to verify the effectiveness of the rehabilitation and the progress of rehabilitation, and record and report any non-compliance. - Ensure that all vegetation removal outside of the project footprint is approved by the Environmental Manager. - Monitor the road maintenance process to ensure limited damage to vegetation. Record and report any non-compliance. - Monitor the presence of alien vegetation on site. - Monitor dust suppression mechanisms and record non-compliances. Maintain an incidents/ complaints register, in which any complaints from the public must be logged. The date, time, nature of complaint, name of complainant and corrective actions must be logged for all complaints. Complaints must be investigated and, if appropriate, acted upon.	- Weekly during the rehabilitation phase - Throughout the operational phase - During road maintenance activities. - Throughout the operational phase - During complaints/incidents	- Environmental Manager - Project Developer (GreenCape) and Environmental Manager - Project Developer (GreenCape) and Environmental Manager - Project Developer (GreenCape) and Environmental Manager - Project Developer (GreenCape) and Environmental Manager
12.26. Potential impact of night lighting of the proposed Gas-to-power Energy Facility on the nightscape of the region.	Reduce the impact of night lighting of the proposed facility on the surrounding nightscape and sensitive visual receptors.	12.26.1. Monitor the effectiveness of the lighting plan to minimize light spill and glare.	- Visit surrounding neighbouring farmsteads and ensure that residents in the surrounding landscape are not affected by glaring lights from the plant. - Complaints about night lights should be investigated and documented in a register. Investigate any complaints about night lights and document it in a register.	- Once off at the end of the construction phase or the start of the operational Phase. - As complaints arise.	- Project Developer (GreenCape) and Environmental Manager - Project Developer (GreenCape) and Environmental Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.26.2. Lights should be switched off when not in use whenever it is in line with safety and security.	Carry out visual inspections during site audits to monitor lighting, and record and report any non-compliance.	Weekly	Project Developer (GreenCape) and Environmental Manager
C.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.27. Maintenance vehicles and activities could result in damage to or destruction of archaeological sites and/or graves.	Minimise the chances of significant archaeological sites and/or graves being disturbed.	12.27.1. Ensure that no activity takes place outside of the authorized operational footprint.	Carry out visual inspections to ensure strict control over the behaviour of operational staff in order to restrict activities to within demarcated areas.	Weekly	Environmental Manager
C.4. SOCIAL IMPACTS					
12.28. Influx of job seekers into the Atlantis area.	Control influx of job seekers into the Atlantis area with the aim of protecting local social structures.	12.28.1. Implement the Workforce Recruitment Plan 12.28.2. Ensure employment is reserved, where practical, for local residents 12.28.3. Actively use the database of PAP and their relevant skills and experience to guide local employment 12.28.4. Implement the Stakeholder Engagement Plan	- Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database; - Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	Once a year during the operational phase.	Environmental Manager/ Officer
12.29. Outsiders moves into the Atlantis area	Limit incidences of in social deviance in the Atlantis area.	12.29.1. Implement the Workforce Recruitment Plan 12.29.2. Ensure employment is reserved, where practical, for local residents 12.29.3. Actively use the database of PAP and their relevant skills and experience to guide local employment 12.29.4. Implement the Stakeholder Engagement Plan	Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database;	Once a year during the operational phase.	Environmental Manager/ Officer

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.		
12.30. Expectations created regarding possible employment	Prevent frustration resulting from miscommunication of employment opportunities and project-related benefits in the local community.	12.30.1. Implement the Stakeholder Engagement Plan	Verify that Stakeholder Engagement Plan is being implemented with written proof of such engagement with the PAP.	Once a year during the operational phase.	Environmental Manager/ Officer
12.31. Local spending	Ensure the generation of socio-economic benefits as a result of the multiplier effect.	12.31.1. Procure goods and services, where practical, within the study area 12.31.2. Obtain regularly required goods and services from as large a selection of local service providers as possible	Verify purchase of local goods and services through proof of purchase.	Once a year during the operational phase.	Environmental Manager/ Officer
12.32. Local employment	Ensure optimum employment creation while taking cognizance of the local levels of experience and education.	12.32.1. Implement the Workforce Recruitment Plan	Verify that local labour is, as far as practically possible, being used, by cross-referencing the Workforce Recruitment Plan with current recruitment practices, as well as cross-referencing employed personnel with PAP database.	Once a year during the operational phase.	Environmental Manager/ Officer
12.33. Economic Development Plan	Ensure contribution to local employment, local spending and human capacity development is being made.	12.33.1. Implement the Economic Development Plan	Verify that the Economic development Plan is being implemented.	Once a year during the operational phase.	Environmental Manager/ Officer
C.5. GEOHYDROLOGY IMPACTS					
12.34. Potential impact on groundwater as a result of stormwater outflows	To prevent unnecessary infiltration of polluted storm water	12.34.1. Ensure the storm water runoff is not contaminated. All reasonable measures must be taken to prevent the contamination of storm water outflows	Monitor the quality of the storm water. Facility Manager to verify that measures are in place to reduce the contamination of storm water and to monitor the quality of storm water by undertaking site visits and visual inspections.	If possible do this during or shortly after a storm event, at the start of the rain season.	Project Developer (GreenCape)
12.35. Potential impact on	To reduce the potential of	12.35.1. Avoid using old or damaged equipment and vehicles	Vehicles need to be monitored	Monthly during	Project

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
groundwater quality as a result of accidental spillages or fuel leakages.	groundwater pollution.	and ensure that they are well maintained and regularly serviced in order to ensure no leakages. 12.35.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the facility for refuelling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit. 12.35.3. If spillages occur during refuelling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.	throughout the operational phase. Monitor via site audits and record non-compliance and incidents. - Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance. - Monitor the refuelling/ servicing process and record the occurrence of any spillages.	operations. - Weekly - Weekly	Developer (GreenCape) - Project Developer (GreenCape) - Project Developer (GreenCape)
C.6. WASTE MANAGEMENT					
12.36. Pollution of the surrounding environment as a result of the handling, temporary storage and disposal of solid waste (general and hazardous).	Reduce soil and groundwater contamination as a result of incorrect storage, handling and disposal of general and hazardous waste.	12.36.1. Sufficient waste collection bins and skips (or similar) should be provided at the facility. Waste collection bins and skips should be covered with suitable material and correctly labelled, and should be kept in a designated, demarcated area, where access control is monitored and managed.	Monitor waste generation and collection throughout the operational phase.	Weekly	Facility Manager
		12.36.2. Segregation of hazardous waste from general waste to be in place. Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.	- On-site inspection of waste segregation. - Control of waste management practices throughout operational phase.	- Weekly - Weekly	- Facility Manager - Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		12.36.3. General waste and hazardous waste should be removed from the site on a regular basis and disposed of at an appropriate, licenced waste disposal facility. Hazardous waste should be removed by an approved waste management Contractor. General solid waste could be removed from the site by municipal services. Waste disposal slips or waybills should be kept on file for auditing purposes as proof of disposal, as applicable	- Inspection of the waste storage area. - Monitor via site audits and record non-compliance and incidents. Facility Manager to monitor and audit disposal slips.	- Daily - Monthly	Facility Manager
		12.36.4. Ensure that the facility is kept clean at all times and that operational personnel are made aware of correct waste disposal methods.	- Conduct training for all operational personnel. - Monitor the state of facility via site audits and record non-compliance and incidents.	- Once-off during operations and ensure that all new staff are inducted. - Daily	Facility Manager
		12.36.5. No solid waste may be burned or buried on site.	Monitor via site audits and record non-compliance and incidents.	Daily	Facility Manager
		12.36.6. Waste amounts shall be recorded on a monthly basis.	Waste amounts to be documented.	Monthly	Facility Manager
		12.36.7. All operational waste (concrete, steel, rubbles etc.) to be removed from the site and waste hierarchy of prevention, as the preferred option, followed by reuse, recycling, recovery must be implemented, where possible.	Waste removal and disposal to be monitored	Monthly	Facility Manager
		12.36.8. Other non-hazardous solid waste (e.g. packaging material) to be disposed of at a licensed landfill.	Waste removal and disposal to be monitored	Monthly	Facility Manager
		12.36.9. All liquid waste (used oil, paints, lubricating compounds and grease) to be packaged and disposed of by appropriate means.	Waste removal and disposal to be monitored	Monthly	Facility Manager
		12.36.10. Adequate containers for the cleaning of equipment and materials (paint, solvent) must be provided as to avoid spillages.	Waste removal and disposal to be monitored	Monthly	Facility Manager
		12.36.11. Waste water from operations and painting activities	Waste removal and disposal to be	Monthly	Facility Manager

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		must be collected in a designated container and disposed of at a suitable disposal point off site.	monitored		
C.7. NOISE MANAGEMENT					
12.37 Potential noise impact from operations of the gas-to-power facility	Prevent unnecessary impacts on the surrounding environment by ensuring that the noise is mitigated.	12.36.12. All buildings should be designed to acoustically contain as much of the noise emissions as possible. 12.36.13. Ensuring that all equipment that produces a high noise impact is placed inside buildings that have been designed to reduce noise emissions. 12.36.14. All buildings containing high noise emissions should be housed in buildings that have solid walls (at least 200mm thick) of at least a sound reduction index (Rw) of Rw55-60. 12.36.15. All ventilation outlets are properly attenuated. 12.36.16. All air intakes are fitted with attenuators 12.36.17. All exhaust stacks are fitted with attenuators 12.36.18. All access doors to the high noise buildings are kept closed when not in use.	Compile environmental noise monitoring survey to manage the noise impacts of the facility during operation.	Once-off post construction and thereafter monthly	ECO
C8. EMERGENCIES AND PREPAREDNESS					
12.38 Potential impact on the health of operating personnel resulting in potential health injuries	To ensure that there are no adverse effects on the health of operating personnel.	12.36.19. Operational personnel must wear basic PPE (e.g. gloves, goggles etc.) as necessary during the operational phase.	- Medical investigations or surveillance to be undertaken for the operating personnel. - Keep a register of the medical records for the operating personnel.	- Once-off for every operating person. - Once every five years for the life of the installation.	Project Developer (GreenCape)
12.39 Potential impact on the safety of operating personnel due to gas leaks which could lead to explosions.	To ensure that there are no adverse effects on the safety of operating personnel and the public outside the terminal.	12.36.20. Scheduled inspections should be implemented in order to assure and verify the integrity of the components of the facility (and associated infrastructure), in line with best practise standards (based on international standards). 12.36.21. Portable fire extinguishers and fire water hydrants (i.e. appropriate fire-fighting equipment) should be provided at the facility as required. Mobile fire-	- Draw up a schedule for inspections and maintenance. - Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company. - Draw up a schedule of safety audits. - Comply with the permit to work system.	- Once initially and revise as reliability of equipment is assessed. - Annually	Project Developer (GreenCape)

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
		fighting equipment should be provided at several locations as a safety precaution 12.36.22. Adhere to safety audit and inspection standards			
12.40 Accidents to the public and operational staff (e.g. explosions)..	Ensure operating personnel or the public are not affected or injured by possible explosions due to gas leaks	12.36.23. Suitable safety warning signs should be fixed at potential leak locations at the facility prior to commissioning the handling of gas. 12.36.24. Minimise flanges and joints, and provide flange guards, on the gas pipelines. 12.36.25. Scheduled inspections should be implemented in order to assure and verify the integrity of gas pipes (and associated infrastructure), in line with best practise standards (based on international standards). 12.36.26. Operational personnel must wear basic PPE (e.g. gloves, goggles etc.) as necessary during the operational phase. 12.36.27. Portable fire extinguishers and fire water hydrants (i.e. appropriate fire-fighting equipment) should be provided at the facility as required. Mobile fire-fighting equipment should be provided as a safety precaution.	- Investigation of all safety incidents and keeping records of all accidents and incidents that nearly occur. - Monitor activities and record and report non-compliance by undertaking site audits. - Carry out site inspections to ensure that the equipment used for “hot work” procedures are maintained, using a checklist, to be drawn up by Management. - Monitor activities and record and report non-compliance by undertaking site audits. - Monitor activities and record and report non-compliance by undertaking site audits. - Assurance of functionality of fire extinguishers via inspections and certification by an accredited fire service company. - Comply with the permit to work system.	- As incidents occur - Monthly - annually	Project Developer (GreenCape)
D. DECOMMISSIONING PHASE					
D.1. ECOLOGICAL IMPACTS (TERRESTRIAL, AQUATIC AND AVIFAUNA)					
12.37.Exotic weed invasion of abandoned site resulting in ecological change	To prevent the excessive growth and propagation of exotic weeds on disturbed lands that formed portion of the facility	12.37.1. Exotic weed control measures to be instituted through weed control programme. 12.37.2. Regular redress of exotic weed through use of herbicide and manual removal.	- Compile weed eradication programme for period of 12 months post the decommissioning exercise. - Appoint contractor to undertake weed eradication programme.	Weed eradication exercise to be undertaken every 6 months for a period of 12 months following decommissioning	Project Developer (GreenCape)
D.2. VISUAL IMPACTS					

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
12.38. Potential visual intrusion of decommissioning activities on existing views of sensitive visual receptors.	Prevent unnecessary visual clutter and focusing attention of surrounding visual receptors on the proposed development.	12.38.1. Disturbed and transformed areas should be contoured to approximate naturally occurring slopes to avoid lines and forms that will contrast with the existing landscapes.	Conduct visual inspections to ensure that landscaping is following the rehabilitation plan.	Weekly	ECO
		12.38.2. Edges of re-vegetated areas should be feathered to reduce form and line contrasts with surrounding undisturbed landscape.			
		12.38.3. Stockpiled topsoil should be reapplied to disturbed areas and these areas should be re-vegetated using a mix of indigenous species in such a way that the areas will form as little contrast in form, line, colour and texture with the surrounding undisturbed landscape.	Site visits to ensure that stockpiled topsoil (or appropriate soil for vegetation when stockpiled topsoil is exhausted) is used.	Weekly	ECO
		12.38.4. Night lighting of decommissioning sites should be minimised within requirements of safety and efficiency.	Complaints about night lights should be investigated and documented in a register.	Weekly or bi-weekly	Contractor and ECO
		12.38.5. Working at night should be avoided where possible.	Operation times for decommissioning activities to be monitored and managed (as well as included in the tender contract).	Weekly	ECO
	Reduce the visual impact of decommissioning activities project wide.	12.38.6. Maintain good housekeeping on site to avoid litter and minimize waste.	- Carry out site visits and inspections of the sites and ensure good housekeeping is maintained. Record and report any non-compliance. - Carry out site visits and record and report any non-compliance. - Complaints about night lights should be investigated and documented in a register. Investigate any complaints about night lights and document it in a register. - Visit sites requiring rehabilitation. - Carry out site visits and record and	- Daily - Daily - Daily and as complaints arise. - Daily - Daily - Daily	Construction Manager and ECO
		12.38.7. Monitor sites for strict adherence to demarcated boundaries.			
		12.38.8. Monitor adherence to lighting plan.			
		12.38.9. Monitor adherence to rehabilitation plan.			
		12.38.10. Monitor adherence to erosion control plan.			
		12.38.11. Monitor adherence to dust and fire control plans.			

Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
			report any non-compliance. ▪ Carry out site visits and record and report any non-compliance.		
D.3. HERITAGE IMPACTS (ARCHAEOLOGY AND CULTURAL LANDSCAPE)					
12.39. Construction vehicles and activities could result in damage to or destruction of archaeological sites and/or graves.	Minimise the chances of significant archaeological sites and/or graves being disturbed.	12.39.1. Ensure that no activity takes place outside of the authorized construction footprint.	▪ Carry out visual inspections to ensure strict control over the behaviour of construction staff in order to restrict activities to within demarcated areas.	▪ Weekly	▪ ECO
12.40. Scarring of the landscape once infrastructure has been removed.	Ensure that the landscape within the development footprint has a similar appearance to that around it.	12.40.1. Ensure removal of all foundations, construction materials and foreign matter. 12.40.2. Ensure rehabilitation of the site in accordance with environmental guidelines.	▪ Follow the relevant environmental guidelines.	▪ Throughout the decommissioning phase.	▪ ECO
D.4. SOCIAL IMPACTS					
12.41. Decommissioning of the proposed development	Minimize job losses	12.41.1. The proponent should comply with relevant South African labour legislation when retrenching employees. 12.41.2. GreenCape must implement appropriate succession training of locally employed staff earmarked for retrenchment during decommissioning. 12.41.3. All project infrastructures should be decommissioned appropriately and thoroughly to avoid misuse.	▪ Verify that retrenchment practices are compliant with south African labour legislation ▪ Verify that Scatec implemented succession training of locally employed staff before the plant is decommissioned ▪ Verify that decommissioned infrastructure does not pose any significant risk to the environment or the people living in the environment.	▪ Once-off during the decommissioning phase (for mitigation measures (12.53.1) and (12.53.2) and once-off after decommissioning is completed (for mitigation measure (12.53.3)).	▪ Contractor and ECO
D.5. GEOHYDROLOGY IMPACTS					
12.42. Potential impact on groundwater quality as a result of	To reduce the potential of groundwater pollution.	12.42.1. Avoid using old or damaged equipment and vehicles and ensure that they are well maintained and	▪ Vehicles need to be monitored throughout the decommissioning phase. Monitor via site audits and	▪ Four times per annum for the decommissioning	▪ Project Developer and

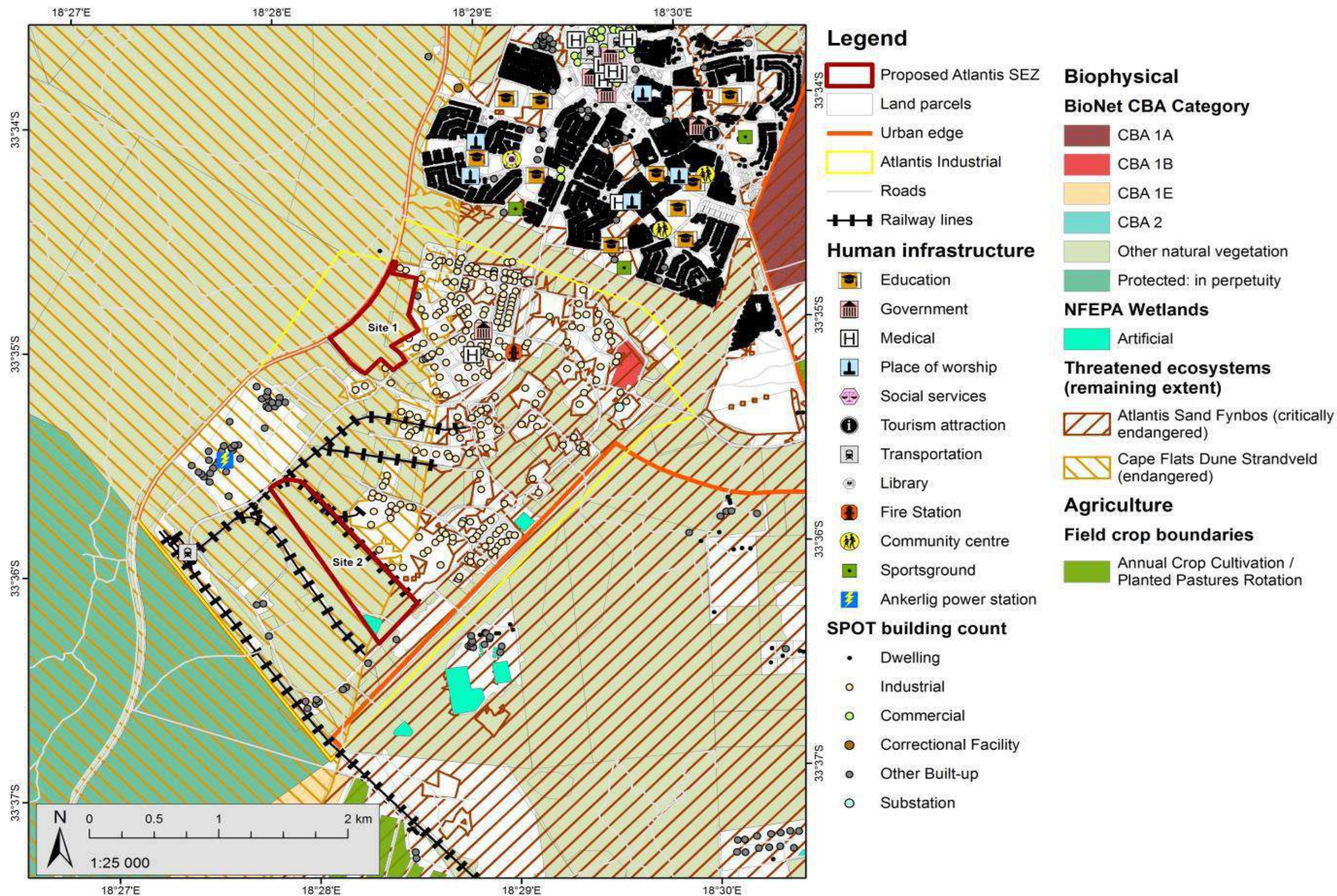
Impact	Mitigation/Management Objectives	Mitigation/Management Actions	Monitoring		
			Methodology	Frequency	Responsibility
accidental oil spillages or fuel leakages.		regularly serviced in order to ensure no leakages. 12.42.2. Any engines that stand in one place for an excessive length of time, must have drip trays, fuel storage tanks should be above ground on an impermeable surface (within a bunded area) and vehicles and equipment should also be refuelled on an impermeable surface. A designated area should be established at the site camp for refuelling activities and drip trays or similar impervious materials must be used during these procedures. If liquid product is being transported it must be ensured this does not spill during transit. 12.42.3. If spillages occur during refuelling, they should be contained and removed as rapidly as possible, with correct disposal of the spilled material. Proof of disposal (waste disposal slips or waybills) should be obtained and retained on file for auditing purposes. During the operational phase, the same principles should be adhered to. Emergency measures and plans must be put in place and rehearsed in order to prepare for accidental spillage.	record non-compliance and incidents. - Monitor the placement and designation of the area for refuelling at the site camp via visual inspections. Monitor the usage of spill containment measures and record and report non-compliance. - Monitor the refuelling/ servicing process and record the occurrence of any spillages.	period, i.e. at 3 months, 6 months, 9 months and 12 months. - Weekly - Weekly	ECO. - Project Developer (GreenCape) and ECO - Project Developer (GreenCape) and ECO
D.6. WASTE MANAGEMENT					
12.43. Generation of waste due to disassembly of the gas-to-power facility.	Avoid substantial negative impacts at the decommissioning phase due to insufficient planning.	12.43.1. Suitable receptacles must be provided for the temporary storage of various waste types such as scrap metal and concrete, until it is removed to the nearest licensed landfill.	Audit the implementation of mitigation measures recommended for the decommissioning phase.	During the decommissioning phase	ECO
		12.43.2. Waste separation is encouraged and therefore receptacles should be labelled to reflect the different waste types.	Audit the implementation of mitigation measures recommended for the decommissioning phase.	During the decommissioning phase	ECO

14 APPENDIX A - SITE LAYOUT MAP



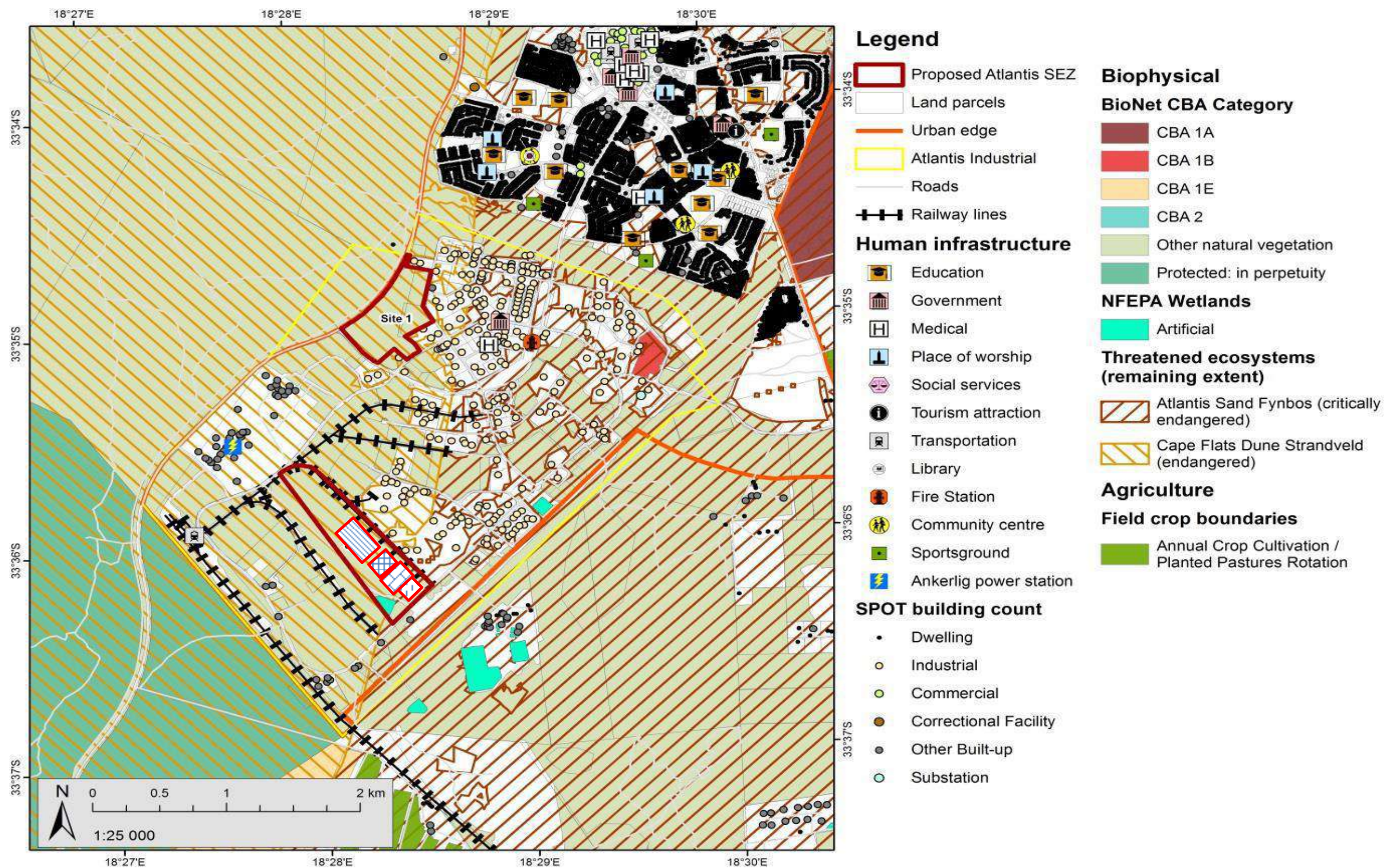
Provisional Scale Layout Map for the Atlantis gas-to-power facility on Portion 1 of Portion 4 of Cape Farm 1183

15 APPENDIX B - ENVIRONMENTAL SENSITIVITY MAP



Sensitivity Map for the Atlantis gas-to-power project

16 APPENDIX C - COMBINED LAYOUT AND SENSITIVITY MAP



Sensitivity Map overlain with the proposed site layout for the Atlantis gas-to-power project