PROPOSED UPGRADE OF THE HANS HOHEISEN WILDLIFE RESEARCH STATION, MPUMALANGA

NEAS Ref: DEA/EIA/0001347/2012
Reference: 14/12/16/3/3/3/48

ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

DRAFT ENVIRONMENTAL IMPACT REPORT

Prepared for submission to:

The Department of Environmental Affairs

Prepared by:

NuLeaf
PLANNING & ENVIRONMENTAL

On behalf of:

The University of Pretoria

July 2013

APPLICATION INFORMATION

NEAS Reference Number	DEA/EIA/0001347/2012
Reference	14/12/16/3/3/3/48
Title	Proposed Upgrade of the Hans Hoheisen Wildlife Research Station, Mpumalanga
Environmental Assessment Practitioner*	Nuleaf Planning and Environmental Pty Ltd[1]
Authors	Mandy van der Westhuizen
Sub Consultants	Dr Markus Hofmeyr (BVSc): Independent Opinion on the potential disease risk of the proposed facility. Ben Orban (PriSciNat): Environmental Baseline Study
Client / Proponent	University of Pretoria
Report Status	Draft
Review Period	23 July 2013 – 23 August 2013

[1] V&L Landscape Architects was originally appointed to undertake the Environmental Authorisation Application Process for this project and facilitated the process to the submission of the Final Scoping Report to DEA in March 2013. Subsequent to this, NuLeaf Planning and Environmental assumed responsibility for the Environmental Authorisation Application process, and is currently the Environmental Assessment Practitioner for this process. The facilitator of the process, Mrs Mandy van der Westhuizen, has remained unchanged, although she now represents NuLeaf Planning and Environmental.

INVITATION TO COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT

This Document, the Draft Environmental Impact Report has been made available for public review from 23 July 2013 – 23 August 2013.

Soft copies have been made available for download off the Internet. Notifications and a link to the download has been emailed to all registered I&AP's and Stakeholders. Digital copies of the report on CD are available upon request.

Hard copies and digital copies of the report have been forwarded to all Compliance organisations.

Please submit your comments to:

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Comments may be sent by fax or via email by no later than 23 August 2013.

EXECUTIVE SUMMARY

Introduction:

The Draft Environmental Impact Report for the proposed upgrade of the Hans Hoheisen Wildlife Research Station has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2012 (as amended).

The aim of the report has been to determine the significance of the potential issues (i.e. positive and negative impacts) identified during the Scoping Phase. Specialist Investigations have been undertaken, and the direct, indirect and cumulative impacts likely to result from the proposed development are assessed. Practical and appropriate mitigation has been proposed and detailed in an Environmental Management Programme and a recommendation has been made by the Practitioner as to whether or not the proposed development should be supported, and granted Environmental Authorisation.

Project Description:

The Hans Hoheisen Wildlife Research Station (HHWRS) is situated on portion 2 of the Farm Kempiana 90 KU, Mpumalanga. Regionally the site is located adjacent to the Kruger National Park, and is situated on the western boundary thereof in the vicinity of Orpen Gate and Orpen Rest Camp. The Manyeleti Nature Reserve lies to the south east and the Timbavati Nature Reserve to the south west. The Timbavati River bypasses the site less than 1km to the west.

The site currently comprises 37 ha of land, various buildings, and services. The property has been used by the University of Pretoria as an animal research facility since the 1970's. Due to a lack of funding, however, the facility fell into a state of disrepair during the 1990's.

The intention of the project is to refurbish, launch, and manage the Hans Hoheisen Wildlife Research Station as a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a transfrontier conservation area (TFCA), the Greater Limpopo Trans Frontier Park and local communities.

The proposed project, for which Environmental Authorisation is required, includes the following basic activities:

- Footprint expansion, consisting of:
  - Expansion of offices;
  - New staff accommodation, guest housing and camp site;
  - New student accommodation;
  - New bomas, cages and enclosures;
  - Upgraded roads and services.

- Establishment of Waste Facilities, including:
  - Waste storage;
  - Waste treatment and
  - Incineration.

The Research Station will be developed and will ultimately operate according to the following five zones:

- Public Access zone;
- Accommodation zone;
- Restricted Access – Animal Enclosure Zone;
- Restricted Access - Bio-safety Zone
- Restricted Access - Industrial Zone

Service Infrastructure will be upgraded to accommodate the facility upgrades. The following is of relevance:

- The site is currently linked to Eskom power, which is brought to site via overhead cables. Where required the bulk reticulation infrastructure and the wiring in the existing buildings will be maintained, replaced and / or upgraded.
- Bulk water for the existing facility is abstracted from a borehole on site. The existing borehole will continue to be used to supply water for the upgraded facility, and reticulation infrastructure will be extended to the new sections of the HHWRS as required. A second borehole will be maintained as a backup source. As the water requirement will be in excess of this permitted quantity, the proponent will require a Water Use License.
- The access point in the far south of the facility will serve as the main access control point to the property. The gate immediately to the north of this will give controlled access to students and residents into residential zone. The northern two access points will be strictly controlled access into the Restricted Access/Bio-safety Zone.
- Storm water from building roofs and other hard surfaces will be managed on site and dispersed into the surrounding landscape as quickly as possible. Concentrated flow and point discharge of storm water will be avoided. All storm water will be managed according to principles of sustainability.
- General and domestic liquid waste includes both grey water and sewage emanating from offices, labs and accommodation, but excludes hazardous waste streams. The general and domestic liquid waste will be kept separate from the hazardous waste water.
- In terms of domestic sewage, a septic tank and soak away system currently services the facility. The existing septic tanks be expanded and upgraded to accommodate all domestic sewage produced at the facility. Liquid effluent emanating from the septic tanks will be treated either via soak-aways (existing system) or a reed bed system. The discharge of purified effluent into the environment will require a Water Use License.
- Recyclable solid waste will be sorted and stored on site. Recyclables will either be taken to a buy back centre or collected under contract by a reputable salvage / recycling company. Other (non-recyclable) waste will be disposed of under contract at a registered waste disposal site.
- Hazardous waste emanating from the facility includes water and medical waste from the laboratories, animal bedding from cages and enclosures, runoff water from bomas, enclosures and cages and animal tissue and carcasses from the necropsy room

Solid waste will either be incinerated by means of an on-site incinerator (organic), or transported off site for disposal (medical).

Liquid waste will be collected and treated in a closed black-water system to remove pathogens. The treated effluent will then be discharged into evaporation ponds. An Atmospheric Emissions License will be required to allow for the operational requirements of the incinerator.

The construction phase of the proposed upgrades is expected to last approximately 3-5 years, depending on the availability of funding.

The operation phase will commence upon completion of construction and the occupation of the facility by the operator. The facility is currently operational. It is anticipated that certain section will be shut down to allow for construction, while others remain operational.

It is anticipated that a combination of full time and part time staff will occupy the facility, in addition to visiting academics and researchers. Only approved research staff will be housed on the premises. Visitors to the facility will be subject to a system of temporary access permits.

Project Alternatives:

No site, design or layout alternatives have been assessed.

In terms of Technology Alternatives, a Cursory Investigation of Alternative Technologies for the Treatment of Hazardous Waste Streams was undertaken determine the suitability of each alternative for this facility, and within this environment. In response to this above investigation, the following alternatives are found to be feasible in terms of potential treatment technologies for hazardous waste streams:

- Biological Treatment (primary) and Evaporation Ponds (secondary): water and liquid waste from laboratories, clinics, pens and boma's;
- Incineration (primary) and off-site disposal (secondary): Animal carcasses and animal bedding.
- Off-site incineration and disposal (Onderstepoort): Empty drug and chemical containers, including sharps.

Only the feasible technology alternatives have been assessed in the Impact Assessment.

The No Development alternative will result in the maintenance of the status quo, and thus the retention of the existing facility remaining as it is.

Requirements for Environmental Authorisation:

This application is for an Integrated Environmental Authorisation and Waste Management License in terms of:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010 and
- The National Environmental Management: Waste Act, 1998 (Act No. 59 of 2008) and Government Notice *718 of 2009.*

With respect to the listed activities identified for this project, a full Scoping and EIA process is required.

Public Participation:

A prior Application for Environmental Authorisation for this project was submitted under the previous EIA regulations in 2010. The identification of I&AP's and stakeholders the advertising of

the project and even a public meeting was undertaken as part of that process. In the in interim, however, this application lapsed, and the file was closed by the DEA in August 2011.

This report represents a new process, but because the nature of the project as well as the identified Authorities and Stakeholders are the same as for the lapsed application, it was argued that some of the 2010 process would be valid for this process.

In this regard, an application for exemption from certain aspects of public participation was submitted to Department of Environmental Affairs (DEA) on 17 October 2012. This application was approved on 23 March 2013.

The following broad steps were followed as part of the Public Participation process:

- Relevant authorities for a project of this nature, and in this location include National, Provincial and Local Authorities who exercise control through statutory and non-statutory instruments. These authorities were contacted and invited to register and participate in the process.
- Identified Stakeholders and potentially Interested and Affected Parties were invited to register and participate in the process.
- Site Notices informing of the process (in terms of the previous EIA Regulations, and Previous lapsed Application) were placed at the main entrance to the facility.
- An advertisement informing of the process (in terms of the previous EIA Regulations, and Previous lapsed Application) was placed in the legal section of the Lowvelder newspaper.
- A Public Meeting was held on the 12th April 2010 at the Hans Hoheisen Wildlife Research Station.
- An Issues and Responses document has been drawn up, in which all comments and inputs received from both Authorities and from I&AP's have been recorded. This document, which is included in Appendix A includes comments stemming from both the lapsed and the current application to date.
- A draft of the Scoping Report was circulated on (14 January 2013) to all registered stakeholders and I&AP's for comment prior to the finalisation of the report and submission to DEA for consideration. Feedback on the DSR was received only from the Mpumalanga Department of Economic Development, Environment and Tourism. No other comments were received.
- The DSR was finalised and submitted to DEA as a Final Scoping Report in March 2013. Approval of the FSR was obtained in May 2013.

Description of the Receiving Environment:

The following is of relevance in terms of the receiving environment:

- Historic use of the site has resulted in disturbance to the soil horizons and structure of some sections of the site. The presence of hardened surfaces, infrastructure and human habitation within the site has resulted in a disturbance of soil structure in certain areas. There are some sections of the site that exhibit characteristics of an undisturbed geology and soils state. The site constitutes sections where Gabbroid based geology gives rise to vertic clay soils that may exhibit signs of low erodability and poor drainage.
- The major hydrological feature is the Timbavati River, which meanders across the study area. This river bypasses the site less than 1km to the north-west. The site straddles a local watershed between tributaries, which runs roughly from north to south mid-way across the

property. A small tributary of the Timbavati River appears to originate within the site and drain due west. This drainage line lies beyond any existing or proposed development.

- The veld type is considered to be Mixed Lowveld Bushveld, or Arid Lowveld, and can be described variously as dense bush on the uplands, open tree savanna in the bottom lands, and dense riverine woodland on the riverbanks and drainages. No Red List threatened plant species were identified in the study area; however, four protected tree species are present, including *Combretum imberbe*, *Balanites maughamii*, *Philenoptera violacea* and *Sclerocarya birrea* subsp. *Caffra*. The latter is most dominant and is found in all habitat units.
- The Hans Hoheisen Wildlife Research Station is effectively part of the Kruger National Park, and therefore theoretically supports those species occurring naturally within the region. The presence of certain threatened and / or protected birds, snakes, lizards and spiders could be expected in this environment, but the sensitivity of the habitat was ultimately determined to be 'low'. No resident faunal communities have been observed within the site, but the possibility exists that certain protected species may occur. These include sedentary fauna such as the Plated Lizard and Golden Baboon Spider.
- A number of different types of granite and gabbro underlie the Lowveld region. These rocks include amongst others potassic granite and granodiorite with Timbavati gabbro in the HHWRS, giving rise to soil profiles that typically indicates relatively poor and shallow soil forms with poor agricultural potential. It should be noted, however, that such agricultural potential is theoretical only, as this land is not available for agricultural use, being located in such close proximity to the KNP and occupied historically and currently as a research facility.
- The facility was built and commissioned in the 1970's, meaning that none of the buildings or structures present on the site are older than 60 years. No graves were observed on the site, nor have any been documented during the operational lifespan of the facility. Similarly, no archaeological, paleontological or historical finds have been observed or documented on the site during the past 40 years.
- A number of renowned hospitality and tourism facilities operate in the vicinity, with the Orpen Rest Camp located less than 1km to the north east, while Ngala Tented Camp and Mr Pirow lie to the Southwest of the facility.
- The site lies within the greater Kruger National Park area, and therefore falls under the local jurisdiction of Mpumalanga Tourism and Parks Authority. Within this context, there is no local resident population or populated place other than within the above mentioned tourist operations surrounding the facility.
- The visual quality of the study area is high, generally as a result of the lack of development and the large areas given over to conservation within the region. The nature reserves and the Kruger National Park, which borders the site, are generally well managed, and the Bushveld vegetation is good condition. The height and density of the vegetation also possesses a high Visual Absorption Capacity, and as such, easily conceals visual disturbance beyond.
- A combined output of the sensitivity ratings (fauna and flora) for each habitat type concluded that the whole of the HHWRS study area is rated as having a low sensitivity from an ecological perspective.
- An Independent Opinion on the Potential Disease risk of the proposed upgrades (to both humans and animals) at the Hans Hoheisen Wildlife Research Station concluded that as the project is being managed by experienced staff from the University of Pretoria (UP), Faculty of Vet Sciences, a basic understanding of disease risk management is inherent.

The potential disease risk will be limited for the project expansion if the required mitigation steps are taken, many of which are already in place.

Anticipated Impacts:

A number of potential impacts are likely to result from both the construction and operational phase of the proposed upgraded facility. These include the following:

Construction Phase - Direct Impacts:

Ground water

- Depletion of ground water due to over use and waste.
- Contamination of ground water due to:
    - Disposal or discharge of sewage and
    - Spills and disposal of hazardous substances and hydrocarbons.

Surface water

- Disturbance to the hydrological function of the drainage line due to storm water runoff.
- Sediment discharge into the drainage line due to storm water runoff from denuded / construction areas.
- Contamination of the surface water resource due to:
    - Disposal or discharge of sewage;
    - Disposal of construction waste and litter;
    - Spills and disposal of hazardous substances and hydrocarbons;
    - Storm water runoff and
    - Grey water, cement slurry and wash water discharge.

Soils

- Soil pollution due to:
    - Disposal or discharge of sewage;
    - Spills and disposal of hazardous substances and hydrocarbons and
    - Grey water, cement slurry and wash water discharge.
- Soil erosion due to the removal of stabilising vegetation during construction.
- Soil compaction due to uncontrolled movement and access across the site by construction personnel. This in turn could lead to loss of vegetation and erosion.

Air

- Air pollution by emissions from construction vehicles and equipment.
- Dust liberated by general construction activities and movement of construction vehicles to the site and over the site.
- Smoke from fires used for cooking and heating as well as from uncontrolled fires.

Biodiversity (flora)

- Removal of exotic and invasive species (positive impact).
- Removal and destruction of vegetation.
- Removal of protected plant species.
- Bush encroachment and invasion of denuded areas.

Biodiversity (fauna)

- Loss of habitat and habitat fragmentation due to vegetation clearing.

- Disturbance / displacement of fauna due to construction noise and activities of construction personnel on site.
- Disturbance / displacement of protected species due to construction noise and activities of construction personnel on site.
- Persecution and hunting of fauna (including protected species such as the baboon spider) by construction personnel.

Agricultural potential
- Loss of potentially arable land due to construction activities.

Heritage
- Damage to and / or destruction of archaeological, paleontological or historical artefacts unearthed during construction.

Socio economics
- Short term employment opportunities in construction (positive impact).
- Opportunity for skills development and on-site training (positive impact).
- Increase in opportunistic crime as a result of an increase in the number of people in the area (as a result of influx of job seekers, and loitering and wandering construction workers).
- Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (as a result of loitering and wandering construction workers).
- Increased incidence of fires and the potential resulting loss of property, life and biodiversity (due to activities such as welding and cooking fires).
- Noise, dust and safety impacts for other road users in the area.

Aesthetics
- Potential visual impact of construction activities sensitive visual receptors in close proximity to the site (specifically on nearby tourism operations and access roads).

Construction Phase - Indirect Impacts:

Socio economics
- Impact on tourism income due to construction related disturbances (Orpen, Ngala Tented Camp and Mr Pirow).

Aesthetics
- Impact on tourism income due to visual impact of construction activities (Orpen, Ngala Tented Camp and Mr Pirow).

Construction Phase - Cumulative Impacts:

Ground water:
- Depletion of ground water resources due to accumulated use by increasing numbers of users.

Biodiversity (Flora and Fauna)
- Cumulative loss of habitat and habitat fragmentation due to vegetation clearing and alteration of habitat.

Socio-Economics:
- Unrepaired damage to roads could result in a long-term issue for road users in the area.

Operational Phase - Direct Impacts:

Ground water

- Depletion of ground water due to over use and waste.
- Contamination of ground water due to:
    - Animal faeces and urine (from boma's and open air facilities);
    - Sewage spills and leaks (from septic tanks and pipelines);
    - Leaks and spills from treated effluent in evaporation dams and grey water systems;
    - Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
    - Run-off from roads and hard surfaces;
    - Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents and fuels).

Surface water

- Disturbance to the hydrological function of the drainage line due to storm water run-off.
- Sediment discharge into the drainage line due to storm water runoff from un-rehabilitated areas.
- Contamination of the surface water resource due to:
    - Animal faeces and urine (storm water runoff and wash water from boma's and open air facilities);
    - Sewage spills and leaks (from septic tanks and pipelines);
    - Leaks and spills from treated effluent in evaporation dams and grey water systems;
    - Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
    - Run-off from roads and hard surfaces;
    - Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents, fuels);
    - Litter and disposal of general waste.

Soils

- Soil pollution due to:
    - Animal faeces and urine (from boma's and open air facilities);
    - Sewage spills and leaks (from septic tanks and pipelines);
    - Leaks and spills from treated effluent in evaporation dams and grey water systems;
    - Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
    - Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents and fuels);
- Soil erosion due to uncontrolled storm water and run-off;
- Soil compaction due to trampling by animals within the enclosures. This in turn could lead to loss of vegetation and erosion.

Air

- Air pollution by emissions from the incinerator.
- Air pollution by emissions from operational vehicles, including waste removal contractors.

Biodiversity (flora)

- Bush encroachment and invasion of poorly rehabilitated areas.
- Structural changes in the vegetation due to bulk feeders being held in the enclosures.

- Introduction of foreign vegetation species into the protected area through the importing of feedstocks (such as Lucerne).

Biodiversity (fauna)

- Disturbance / displacement of fauna due to operational activities and personnel present on site.
- Disturbance / displacement of protected species due to operational activities and personnel present on site.
- Animal mortality / fatality (including protected species such as the baboon spider) due to daily operations and facility vehicles (including delivery and waste collection vehicles).
- Potential spread of pathogens under investigation within and beyond the facility.
- Disease risk to fauna in adjacent areas.

Land use and infrastructure

- Upgrade of the facility and infrastructure of the HHWRS (positive impact).

Socio economics

- Long term employment opportunities at the facility (positive impact).
- The establishment of a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities (positive impact).
- Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (as a result of staff and visitors to the facility).
- Increased incidence of fires and the potential resulting loss of property, life and biodiversity (due to the increase in operations and activities on site).
- Olfactory impact, especially on nearby tourism operations, as a result of:
    - Incineration of animal waste in the incinerator.
    - Animal faeces and
    - The water treatment/evaporation ponds.
- Noise impact, especially on nearby tourism operations, as a result of:
    - concentrations of animals in boma's;
    - staff operating the facility and on site vehicles;
    - loud music and voices from off duty staff at the staff accommodation and
    - barking dogs.
- Disease risk to humans.

Aesthetics

- The visibility of the facility to, and potential visual impact on, observers travelling along the R531, a main tourist access road to the Kruger National Park and Manyeleti Nature Reserve.
- The visibility of the facility to, and potential visual impact on tourist camps and lodges within the study area.
- The potential visual impact of ancillary infrastructure (i.e. smoke stack) and smoke emissions on observers in close proximity to the proposed facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.

Operational Phase - Indirect Impacts:

Socio economics

- The support of the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas (positive impact).
- Assistance with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases (positive impact).
- The provision of information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM (positive impact).
- Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to visual impacts (including lighting) of the facility.
- Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to odours emanating from the facility due to:
    - Incineration of animal waste in the incinerator;
    - The accumulation of animal faeces and
    - The water treatment/evaporation ponds.
- An increase in blowflies as a result of the concentration of animals and the accumulation of faeces. Linked to this is the spread of pathogens and bacteria by these flies.

Aesthetics

- The potential visual impact of the facility on the visual character of the landscape and sense of place of the region.

Operational Phase - Cumulative Impacts:

Ground water

- Depletion of ground water resources due to accumulated use by increasing numbers of users.

Aesthetics

- Cumulative visual impact of lighting as a result of additional development within a greater conservation area (i.e. specifically on nearby tourism operations and access roads).

Environmental Impact Statement

Alternative 1 (preferred alternative)

The proposed upgrades to the Hans Hoheisen Wildlife Research Station will result in a number of positive impacts that are of national, and even international significance in the field of veterinary research.
These **positive impacts**, which are of a **long term** nature, are of **high significance**. The anticipated positive impacts may be summarized as follows:

- The establishment of a research platform to support research involving the diseases of wildlife, humans, and livestock;
- An opportunity to support the management of diseases at the interface (wildlife / livestock / humans);
- An opportunity to assist with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases;

- An opportunity to provide information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries.

In terms of potential **negative impacts**, the construction phase is expected to represent the most risk and to be the most environmentally disruptive. This phase is, however of a short term nature, and provided all impacts are mitigated as recommended, and the provisions of construction management as detailed in the EMPr are followed, almost all negative impacts may be mitigated to a **low or negligible significance**.

There are two exceptions in this regard, for which the post mitigation significance is **moderate**:
The first is the removal of protected plant species within the development footprint.
The second is the increased incidence of fires and the resulting loss of property, life and diversity.
Positive impacts resulting from the construction phase include short term employment opportunities in construction and opportunity for skills development and on-site training. Regardless of the fact that these will be short lived, their significance is considered **high**.

Anticipated **negative impacts** associated with the operation of the facility are almost exclusively of **low or negligible significance** (post mitigation). Negative impacts of **moderate significance** (post mitigation) include the following:

- Soil compaction due to trampling by animals within the enclosures, which could lead to loss of vegetation and erosion.
- Air pollution, by emissions from the incinerator.
- Related to the above, is olfactory impact, especially on nearby tourism operations, as a result of incineration of animal waste in the incinerator.
- Noise impact, especially on nearby tourism operations, as a result of concentrations of animals in boma's.
- The visibility of the facility to observers travelling along the R531 and on tourist camps and lodges within the study area.
- The direct and indirect visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility. Associated with this impact is the potential loss of income for tourist operations.
- The indirect impact of visual, olfactory and noise on tourism income for nearby tourism operations (including Orpen, Ngala Tented Camp and Mr Pirow).
- Last, is the indirect impact of blowflies as a result of the concentration of animals and the accumulation of faeces.

The above post mitigation impacts are largely socio-economic in nature and relate to the impact on local tourism operations and lodges. Of importance is that tourists expect and rely on a pleasing experience, which is easily threatened by physical, visual, olfactory and auditory intrusions that are not inherent to this natural environment.

Notwithstanding the above, the post-mitigation impacts of moderate significance are not considered to be fatal flaws to the proposed development. The reason being that the types of impacts cannot be scientifically quantified, and as such, the anticipated significance reflects a worst case scenario. In addition, the recommended mitigation requires that open lines of communication be established and maintained between the HHWRS and local land owners and tourism operators. In this way, issues that threaten, inconvenience or irritate either party may be tables, discussed and resolved.

Overall, therefore, it is the opinion of the author that the anticipated positive impacts associated with the planning, construction, operation and decommissioning of the proposed facility outweigh the anticipated negative impacts. Neither the integrity of the environment, or the lives and livelihood of neighbouring land owners and other local residents will be compromised in an unacceptable manner.

Bearing in mind that all significant negative impacts can be mitigated and managed, it is recommended that the development as detailed in Alternative 1 be accepted.

No Go Alternative

The No Development Alternative would result in none of the direct negative impacts associated with the construction and operation and decommissioning of the proposed HHWRS, as the status quo of the receiving environment would remain unaltered.
Although this may be seen as a positive outcome, it should be borne in mind that at the same time, none of the long term positive impacts, which are all of **high significance,** would be realized either.
Overall, therefore, it is the opinion of the author that the anticipated negative impacts associated with this alternative outweigh the anticipated positive impacts.

Recommendation of the Practitioner

Planning Phase

In terms of general project planning, the provisions contained in the EMPr (*Appendix 3)* must be followed. Specific reference is made to the following, however:

- Register boreholes to be used for potable water extraction as per DWA requirements.
- Apply for a Water Use Licence for the abstraction of the operational requirement of water as per DWA requirements.
- Ensure that water storage facilities are designed according to the demand requirements.
- Apply for an Air Emissions License for the Incinerator as per the requirements of DEA (Air Quality).
- Ensure that the incinerator is designed according to the demand requirements.
- Ensure that facility sewage system is designed according to the demand requirements.
- Ensure that the effluent treatment system is designed according to the demand requirements.
- Ensure that the treatment system for hazardous liquid waste is designed according to the demand requirements.
- Develop an Operational and Maintenance Program for liquid laboratory waste, addressing day to day maintenance and management actions, as well as emergency procedures.
- Develop an Operational Waste Management & Overflow Response Plan and reporting procedure to addresses mandatory provisions that must be set in place and implemented during day to day operation of, or should any accidental or other malfunction of the system result in spillage and or pollution of the environment.
- Develop operational guidelines for implementing Clean Technologies (solvents, detergents fertilisers and pesticides).
- Develop a Code of Conduct for the operational phase and ensure that all personnel subscribe to this.
- Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. Establish test

boreholes within a 2km radius at the onset of operations and test these to establish baseline data.

Construction Phase

In terms of construction, the provisions contained in the EMPr (Appendix F) must be followed. Specific reference is made to the following, however:

- Draw up a Construction Operations Plan indicating how the construction site will operate in terms of access, activities, phasing, etc. (during project planning).
- A vegetation / tree specialist should walk the final site layout to identify and mark all protected trees/plants that could be impacted upon prior to the start of any construction activities.
- Draw up a plan (during project planning) indicating the mapped positions of vegetation specimens to be conserved and which should be removed and replaced. Avoid the requirement to remove protected trees wherever possible. Demarcate specimens to be retained with danger tape and / or fencing as required. This barrier to be at least 2m from the stem of the specimen.
- A faunal specialist should walk the final site layout to identify all possible burrows that could be impacted upon. Where possible, relocate specimens to outside of the development areas.
- The contractor should contact all of the adjacent farm owners prior to the commencement of the construction phase and ensure that he/she has the contact numbers so that they can be contacted in the event of a fire.
- All appointed contractors must ensure that the EMPr (Appendix 3) and any accompanying documentation are adhered to, and that all instructions are carried out.
- The function of ensuring compliance with the EMPr must be delegated to a person with knowledge of environmental and construction matters (i.e. an Environmental Control Officer (ECO)). This ECO should be appointed for the full duration of construction period, as well as post rehabilitation, for at least a year, to ensure environmental compliance and optimal environmental outcomes.

Operational Phase

An Operational Management Plan must be drawn up, which will address all environmental operational aspects of the development. The Operational Management must include, but will not be limited to the operational aspects discussed in the EMPr (*Appendix 3*). Specific reference is made to the following, however:

- Monitor the consumption of water on a monthly basis and keep up to date records.
- Undertake ground water quality testing yearly, at the same time of year and keep up to date records.
- Set up a schedule of medical and hazardous waste collection by specialist contractor, for incineration at the Onderstepoort facility in Pretoria and at the nearest registered waste disposal facility respectively.
- Regularly check the facility sewage system (preferably monthly) to ensure it is functionally sound. If necessary, employ the services of a professional, suitably qualified independent body

- Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound.
- Regularly check the treatment system for hazardous liquid waste (preferably monthly) to ensure that the system is functionally sound.
- Undertake monthly wastewater monitoring to ensure that the output quality of the water complies with the minimum standards as prescribed by DWA.
- The operator should ensure that he / she has the contact details all of the adjacent farm owners so that they can be contacted in the event of a fire.
- Respect the high quality of the visual environment, and endeavour to maintain these through responsive operations, such as programming of deliveries, incineration and other potentially visually disruptive activities to times that are not important for tourism.
- Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved.

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DEFINITIONS AND TERMINOLOGY

Environmental Management Programme	An Environmental Management Programme in relation to identified or specified activities envisaged in Chapter 5 of the Act and described in Regulation 34.
Environmental Impact Assessment	An application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application"
Environmental Control Officer	A person appointed by the project manager, developer, engineer or contractor to oversee compliance to the EMP. This person can be an internal appointment or an external consultant/specialist depending on the authorities' requirements.
Project Manager / Engineer	Designated project manager / engineer for the construction project.
Proponent / Client / Developer	Person or company responsible for proposing the project.
Contractor	Person and/or company appointed to complete project.
I&AP	An Interested and Affected Party contemplated in Section 24(4)(d) of the Act, and which in terms of that section includes – (a) Any person, group of persons or organisation interested in or affected by an activity; and (b) Any organ of State that may have jurisdiction over any aspect of the activity.
The Act	The National Environmental Management Act, 1998 (Act No. 107 of 1998)"

ABBREVIATIONS AND ACRONYMS

EA	Environmental Authorisation
EMPr	Environmental Management Programme
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
DEA	Department of Environmental Affairs
DWAF	Department of Water Affairs and Forestry
DME	Department of Minerals and Energy
SAHRA	South African Heritage Resources Agency
ECO	Environmental Control Officer
I&AP	Interested and Affected Party
EAP	Environmental Assessment Practitioner as defined in Section 1 of the Act Environmental Assessment Practitioner

1. INTRODUCTION

The Draft Environmental Impact Report for the proposed upgrade of the Hans Hoheisen Wildlife Research Station has been undertaken in accordance with the EIA Regulations published in Government Notice 33306 of 18 June 2012 (as amended).

The aim of the report has been to determine the significance of the potential issues (i.e. positive and negative impacts) identified during the Scoping Phase. Specialist Investigations have been undertaken, and the direct, indirect and cumulative impacts likely to result from the proposed development are assessed. Practical and appropriate mitigation has been proposed and detailed in an Environmental Management Programme and a recommendation has been made by the Practitioner as to whether or not the proposed development should be supported, and granted Environmental Authorisation.

1.1 PROJECT DESCRIPTION

1.1.1 CONTEXT

The Hans Hoheisen Wildlife Research Station (HHWRS) is situated on Portion 2 of the Farm Kempiana 90 KU, Mpumalanga. Regionally the site is located adjacent to the Kruger National Park (KNP), and is situated on the western boundary thereof in the vicinity of Orpen Gate and Orpen Rest Camp.

The Manyeleti Nature Reserve lies to the south east and the Timbavati Nature Reserve to the south west. The Timbavati River bypasses the site less than 1km to the west. Refer to Map 1.

1.1.2 PROJECT COMPONENTS AND ACTIVITIES

The Hans Hoheisen Wildlife Research Station currently comprises 37ha of land, various buildings, and services on the property.

The property has been used by the University of Pretoria (UP) as an animal research facility since the 1970's. Due to a lack of funding, however, the facility fell into a state of disrepair during the 1990's. The proposed project includes the following basic activities:

- Footprint expansion, consisting of:
    - Expansion of offices;
    - New staff accommodation, guest housing and camp site;
    - New student accommodation;
    - New boma's, cages and enclosures;
    - Upgraded roads and services.

- Establishment of Waste Facilities, including:
    - Waste Storage;
    - Waste Treatment and
    - Incineration.

The Research Station will ultimately consist of the following five zones, which will cover approximately 37ha. *(Refer to Map 3).*

a) Public Access Zone

The Public Access Zone acts as a primary buffer for the Restricted Access Zone and will be accessed immediately from the entrance gate. While it is the lowest security level zone, it

will still have strictly regulated access control. The following infrastructure is to be included within this zone:

- An access road controlled by access gate (existing infrastructure);
- 6 visitors accommodation units for VIP use (new infrastructure);
- General Office Space, clean lab and auditorium (existing infrastructure);
- A canteen / cafeteria (new infrastructure);
- Landscaping features such as berms for visual buffering (new infrastructure);
- New / upgraded parking area (new infrastructure); and
- Helicopter landing pad (existing infrastructure) and associated buildings (new infrastructure).

b) Accommodation Zone

The Accommodation Zone is restricted to personnel and visiting scientists and includes all accommodation facilities on the property. The following infrastructure is to be included within this zone:

- An access road (existing and new infrastructure) controlled by access gate (new infrastructure);
- Student / Scientist Accommodation (2 existing and 2 new buildings);
- Visiting Scientist's permanent tented and park home facility (new infrastructure); and
- Permanent Staff Accommodation (3 existing and 1 new structure).

c) Restricted Access – Animal Enclosure Zone

The following infrastructure is to be included within this zone:

- Animal holding pens, cages and boma's (new infrastructure).

d) Restricted Access - Bio-safety Zone

This zone will operate as a quarantine facility and will operate as a Bio-Security Level 2 or 3 Facility *(Refer to Appendix B.2)*.

There are international rules and protocols, which govern the design and operation of such facilities, and these, will apply both in design and during operation. The following infrastructure is to be included within this zone:

- An access road (existing and new infrastructure) controlled by access gate (new infrastructure);
- Laboratories (existing infrastructure);
- Necropsy room (new infrastructure);
- Offices (existing and new infrastructure);
- Predator cages and boma's (new and existing infrastructure);
- Solid waste temporary storage room (new infrastructure);
- Liquid Waste reticulation and treatment tanks (new infrastructure); and
- Animal holding pens and cages (new and existing infrastructure).

e) Restricted Access - Industrial Zone

The following infrastructure is to be included within this zone:

- Incinerator or other hazardous solid waste disposal technology (new infrastructure);
- Water treatment works (new infrastructure); and
- Transformer and storage (existing and new infrastructure).

1.1.3 SERVICES AND INFRASTRUCTURE

The design team will reference various documents during the planning and design of basic services for the proposed upgrades to the HHWRS. The following documents will be used as prescribed:

- Guidelines for the Provision of Engineering Services and Amenities;
- Guidelines for Human Settlements, Planning and Design – CSIR (Red Book); and
- South African Bureau of Standards (SABS 1200/SANS 1200).

a) Electricity

The site is currently linked to Eskom power, which is brought to site via overhead cables. Existing monthly electricity consumption averages at around 8300kWh[2]. It is anticipated that the existing infrastructure will be sufficient to cope with the new requirement, which is not expected too much exceed the existing use.

Where required the bulk reticulation infrastructure and the wiring in the existing buildings will be maintained, replaced and/or upgraded. A stand-by Generator with change-over panel will be installed, as voltage fluctuation is a major problem and protection equipment must be installed.

In line with the principles of environmental sustainability, the development will be designed to take cognisance of restrictions in power supply through National Demand Management. To this end the following principles will be considered:

- Energy efficient architecture and building design for new and renovated structures;
- The consideration of alternative (renewable) sources of electricity for certain applications and
- The management of demand and usage through design and operations.

b) Water

Bulk water for the existing facility is abstracted from a borehole on site. A second borehole is maintained as a backup source. The following statistics are of relevance:

- Borehole depth: 75,4m
- Static water level: 36,3m
- Dynamic water level: 46,3m

[2] Emailed correspondence: Dr. Paul van Dam, Faculty Manager Hans Hoheisen Wildlife Research Station (13 November 2012)

- Pump inlet: 68m
- Required delivery rate: 4 000 litres per hour
- Maximum yield allowed: 4 000 litres for 8 hours = 32 000 litres per day[3].

The existing borehole will continue to be used to supply water for the upgraded facility, and reticulation infrastructure will be extended to the new sections of the HHWRS as required. Existing water tanks and reticulation will be expanded and upgraded to incorporate demands of new infrastructure. Borehole yield capacities will be tested to ensure existing boreholes can meet the expected water needs of the facility, and make sure that the borehole equipment does not exceed the capacity of the boreholes.

Water will be pumped from the boreholes to a central storage facility comprising six 10 000 litre tanks. Water storage will allow for enough holding capacity for approximately 48 hours. A fire pump system with fire hydrants will be installed in the technical / experimental area and a booster pump will be installed on the water supply to the necropsy room

Where necessary, the bulk reticulation infrastructure and the piping in the existing buildings will be maintained, replaced or upgraded. Existing water pipelines (steel and other) will be tested and replaced with uPVC pipes as required.

The quality of water from the boreholes is *poor*, and results in excessive calcification of geysers and pipes. This water is also corrosive. Potable water (i.e. that which is to be used for domestic purposes such as human consumption and laboratory use) is therefore purified by use of a reverse osmosis plant installed at the central storage facility. Potable water subscribes to all necessary health standards. All water for irrigation, livestock, cleaning purposes and fire fighting remains untreated. This existing reverse osmosis plant will remain in place, and no upgrades are required.

In line with the principles of sustainability, water efficiency will be encouraged. To this end the following principles will be considered:

- Water efficient mechanisms, fittings and fixtures for new and renovated buildings, such as aerated faucets and shower heads, dual flush cisterns etc.;
- Sustainable and water-wise solutions for the irrigation of landscape and gardens, thus reducing the demand for irrigation;
- Sustainable and water-wise solutions for storm water management;
- Sustainable and water wise solutions for the disposal of waste water;
- The consideration of recycled grey water and purified black water for re use in certain applications;
- The harvesting of storm water for re use in certain applications and
- The management of demand and usage through design and operations.

Current abstraction rates for the facility are approximately 30 000 litres per day (or 30m^3 per day), of which about 50% is allocated for potable use, and 50% for irrigation. This equates to about 11 000m^3 per annum for irrigation and potable purposes (assuming the facility operates 7 days a week, 365 days per year).

[3] Emailed correspondence: Dirk Booyse, Hans Hoheisen Wildlife Research Station (13 November 2012)

It is not anticipated that the proposed further development of the facility will necessitate much of an increase in abstraction. In fact, with the implementation of the water wise strategies detailed above, the consumption may well decrease.

Notwithstanding the above, the facility falls into the Quaternary Drainage Area B73F. Under the General Authorisation for water use (amended 2004), 75m^3/ha/annum may be abstracted for this property. Any usage above this quantity will require a Water Use License.

In terms of the permissible water rights, this 37 Ha of land therefore have the rights to abstract 2 775 m³ per annum. As the requirement will be in excess of this permitted quantity, the proponent will require a Water Use License[4].

c) Roads

There are four proposed access control points to the facility *(Refer to Map 3).*

The access point in the far south of the facility will serve as the main access control point to the property. The gate immediately to the north of this will give controlled access to students and residents into residential zone. The northern two access points will be strictly controlled access into the Restricted Access/Bio-safety Zone.

Internal road structures as well as roads used for access into the development will be properly articulated. The roads will have stabilised surfaces and will be designed to accommodate and manage storm water run-off according to sustainable principles (see below).

d) Storm Water

Storm water from building roofs and other hard surfaces will be managed on site and dispersed into the surrounding landscape as quickly as possible. Concentrated flow and point discharge of storm water will be avoided. All storm water will be managed according to principles of sustainability, including (but not limited to) the following:

- Limit the extent of hard impermeable surfaces as much as possible;
- Consider the use of permeable paving wherever possible;
- Where hard surfaces are unavoidable (i.e. such as roads), ensure that that there is no large accumulation of runoff, but that it is channelled off the road at regular intervals so that it can infiltrate into the ground. Equip discharge points with velocity dissipation mechanisms where required; and
- Implement measures that will encourage the spreading, slowing and infiltration of storm water rather that the accumulation thereof. These include landscaped attenuation areas, rain gardens etc.

e) Liquid Waste

General and domestic liquid waste includes both grey water and sewage emanating from offices, labs and accommodation, but excludes hazardous waste streams. The general and

[4] DEA, in its acceptance letter for the Final Scoping Report for the Proposed Upgrades to the Hans Hoheisen Wildlife Research Station (dated 14 May 2013) required that proof of a Water Use License Application (WULA) and an Air Emissions License Application (AELA) for relevant activities be included in this report. Subsequent discussion with Ms. Fiona Grimmet of DEA culminated in an agreement that these applications need not be submitted during this EA process. Rather, the requirement for both a WULA and an AELA would be included as a condition of Environmental Authorisation, should this be granted.

domestic liquid waste will be kept separate from the hazardous waste water, as the latter system will have to deal with animal pathogens and will thus be purpose-designed to ensure effective treatment.

All general and domestic liquid waste and sewage will be treated on a continuous basis as it is produced. It will not be stored. At present, a septic tank and soak away system services the facility. The capacity of the existing system will have to be confirmed, and upgrades and expansions implemented as required. Preliminary indications show that it is capable of dealing with the additional volumes.

It is proposed that the existing septic tanks be expanded and upgraded to accommodate all domestic sewage produced at the facility. Liquid effluent emanating from the septic tanks will be treated either via the existing soak-away system or a reed bed system. The design of the sewage system will ensure that no odours are emitted and that any liquid entering the environment complies with minimum quality standards as specified by the Department of Water Affairs (DWA). The discharge of purified effluent into the environment will require a Water Use License.

In support of the principles of sustainability, consideration will also be given to the separation and accumulation of grey water (i.e. from showers, sinks etc.), and the re-use thereof for selected purposes, such as irrigation.

f) Solid Waste

General and domestic solid waste from offices, labs and accommodation will be accumulated on a regular basis. A sort-at-source approach to recycling will be adopted, and residents and employees will be encouraged to collect recyclables separately.

Recyclable solid waste will be managed by the Southern African Wildlife College, where it will be sorted and stored. Recyclables will either be taken to a buy back centre or collected under contract by a reputable salvage / recycling company. Other (non-recyclable) waste will be disposed of under contract at a registered waste disposal site.

General and domestic waste may be temporarily stored until sufficient quantities are generated to allow for recycling or disposal. In this regard a dedicated temporary storage facility is proposed on the HHWRS site, where solid waste can be safely stored. This will be a purpose designed secure storeroom.

Construction waste (generated during the construction period) will be stored and sorted in a demarcated area on site and when waste quantities are sufficient it will be trucked off site and disposed of at a registered waste disposal site. The nearest registered waste disposal site is the Khensani Dumping Site in Welverdiend, and falls under the jurisdiction of the Bushbuckridge Municipality.

g) Hazardous Waste

Sources:

- Multi-disciplinary laboratories exist at the facility where various laboratory activities will take place. These activities include the determination of the efficacy of scheduled drugs, microbiological procedures, serological procedures and PCR. Empty containers and other solid medical waste form a hazardous waste stream.
- Water from the laboratories forms a hazardous liquid waste stream, as this may contain pathogens, chemicals and body fluids.
- Animals will be held within defined Bio-Safety Zones at HHWRS. Predators will be housed in predator cages, while ungulates will be housed in boma’s and pens. Since

research on specific diseases will form a core function of the station, it is assumed that animal bedding and enclosures may be contaminated with pathogens.

- The soiled bedding from cages and enclosures may be considered a solid hazardous waste stream. All water emanating from boma's, enclosures and cages will form a liquid hazardous waste stream.
- Veterinary research will also be undertaken in a defined necropsy room within the Bio-Safety Zone. Animal tissues containing potential pathogens will be handled in this facility.
- Animal tissue that is no longer required for veterinary research will form a solid hazardous waste stream, and may be potentially contaminated with pathogens. Animal carcasses are also considered to be a hazardous solid waste stream. Washing of equipment and the necropsy room will also generate a potentially hazardous liquid waste stream.
- Any hazardous waste produced during the construction phase will be disposed of at a properly registered hazardous waste site. Permission will be sought from the local municipality in this regard.

Treatment:

The treatment of all hazardous waste will be in accordance of the practices determined by Bio-Security Level Two (2) Operations (BSL2). The method of treatment depends on the nature of the waste generated and the volumes requiring treatment. The context of the facility within a nature area and close to tourism operations also has bearing.

Certain solid wastes (i.e. medical wastes such as drug and chemical containers and sharps) may be temporarily stored without treatment until sufficient quantities are generated to allow for disposal. In this regard a dedicated temporary storage facility is proposed where solid waste can be safely stored. This will be a purpose designed secure storeroom fitted with appropriate waste containment measures to ensure that no pollution of the surrounding environment (i.e. specifically soil, ground water and surface water) occurs during storage or loading.

Pathogen containing wastewater from laboratories and wash water from the clinic and boma will be collected and treated in a closed black water system to remove pathogens before disposal. The system will be designed to be a closed system with no output to the environment. This is done since the physical parameters of effluent water may not be suitable for immediate discharge. The treated effluent will ultimately be discharged into evaporation ponds. Of importance is that effluent released to evaporation ponds will have been treated to a level where it is free from pathogens and odours.

It is important to note that both the animals and diseases being researched at the facility are endemic to the area. In this regard, no new pathogens are likely to be introduced to the system.

The laboratories and quarantine facilities will only deal with pathogens that are classified to a maximum level prescribed by Bio-Safety Level Three (3). All facilities will be designed to ensure that the provisions of the relevant Bio-Safety Level with regards to containment are adhered to.

All hazardous liquid waste will be treated on a continuous basis as it is produced. It will not be stored.

Disposal:

This will be undertaken in accordance with BSL2 Standards and will include the following:

- The incineration of organic waste on the premises and the disposal of the ash residue off site by Contractor;
- The disposal of treated (pathogen free) liquid effluent to evaporation ponds; and
- The off-site disposal of drug and chemical containers and sharps by specialist contractor.

No discharge of liquid effluent to the environment is anticipated. The incinerator will have both primary and secondary combustion chamber. The purpose of the secondary combustion chamber is to ensure complete combustion and eliminate smoke and odours at full operating temperatures. Limited amounts of smoke (and odour) may occur before the incinerator reaches full operating temperature, however this will be for a very short time period.

In terms of Government Notice No. 248 (March 2010), facilities where general and hazardous waste are incinerated with an incinerator with a processing capacity of 10 kg of waste per hour (or larger) would require an Atmospheric Emissions License. The requirement for the proposed incinerator at the HHWRS is expected to include the following:

- Animal bedding: max 1 ton / day; 30 ton / month
- Animal tissue, fluids and solids: max 3 ton / day; 90 ton / month
- Total: max 4 ton / day; 120 ton / month

In order to incinerate a maximum of 4 tons per day, and assuming an 8 hour per day operation, the incinerator would need to process 500 kg of waste per hour. As this requirement is above the threshold listed in GN 33064 (March 2010), an Atmospheric Emissions License will be required in terms of the National Environmental Management Air Quality Act No. 39 of 2004[5].

Incinerator design and operation will conform to minimum standards as defined in appropriate legislation. DWAF Process 39: Waste incineration provides minimum design and operating standards.

Drug and chemical containers (including sharps) will not be incinerated. This waste will be collected and disposed of, as is currently done. The waste will be temporarily stored on site, until sufficient quantities have been collected for disposal. Once sufficient quantities are available for disposal, *Oricol Environmental Services* is contacted for the transportation of the waste to the Onderstepoort Facility in Pretoria. At Onderstepoort, the waste is incinerated.

The University of Pretoria has strict operating procedures in place for the safe handling and disposal of chemicals, medical and biological waste. This Safety Manual, which is applicable to all *University of Pretoria* laboratory facilities, has been included as *Appendix B.3*. In short, all biological waste is autoclaved before it leaves the lab area. The waste is sealed bio-hazard bags, placed in marked bio-hazard boxes sealed with tape.

In addition to the above in-house safety procedures, *Oricol Environmental Services* also specifies strict procedures for the storage and transportation of chemical and medical waste. The disposal procedures for both Laboratory Chemicals and Medical Waste have been included as *Appendix B.4* and *Appendix B.5* respectively.

[5] DEA, in its acceptance letter for the Final Scoping Report for the Proposed Upgrades to the Hans Hoheisen Wildlife Research Station (dated 14 May 2013) required that proof of a Water Use License Application (WULA) and an Air Emissions License Application (AELA) for relevant activities be included in this report. Subsequent discussion with Ms. Fiona Grimmet of DEA culminated in an agreement that these applications need not be submitted during this EA process. Rather, the requirement for both a WULA and an AELA would be included as a condition of Environmental Authorisation, should this be granted.

The flow chart below illustrates the anticipated quantities, and the flow of liquid waste, solid waste and hazardous waste anticipated for the proposed upgraded HHWRS:

Figure 1: Flow of anticipated waste streams

1.1.4 THE CONSTRUCTION PHASE

The Construction Phase of the proposed upgrades is expected to last approximately 3-5 years, depending on the availability of funding. The Construction Phase will consist of the following broad activities:

- Surveys and final planning;
- Handover to contractor;
- Site establishment;
- Construction of structures and infrastructure;
- Site rehabilitation;
- Handover to Operator; and
- Post completion / rehabilitation monitoring.

1.1.5 THE OPERATIONAL PHASE

The facility is currently operational. It is anticipated that certain sections will be shut down to allow for construction, while others will remain operational. Operations in these areas will re-commence upon completion of construction and the occupation of the facility by the operator. The construction period is likely to last between 6 and 18 months.

Occupation:

It is anticipated that a combination of full-time and part-time staff will occupy the facility, in addition to visiting academics and researchers.

Only approved research staff will be housed on the premises. All day staff will reside outside the Greater Kruger National Park. All staff will require permits both from SANParks and from the Hans Hoheisen Wildlife Research Station. Staff without either of these permits will not be allowed access.

Visitors to the facility will be subject to a similar system of temporary access permits.

Inputs:

Feed such as Lucerne will be brought in for herbivorous animals. Carnivore feed brought in from outside will be managed in conjunction with the State Veterinarian. Predator feed is likely to be sourced from the community in the form of donkeys. Alternatively, the option of surplus meat from elephant may be considered if KNP proceeds with elephant management in the form of culling.

Waste:

Animal faeces (from boma's and cages) will be collected on a daily basis so as to minimise the impacts of odours and flies. Herbivore faeces will be composted and then returned to the soil, while carnivore faeces will be disposed of either through incineration or through incorporation into the hazardous liquid waste system.

Research Activities:

The facility is intrinsically linked to the Transfrontier Conservation Area (TFCA) in which it is situated. The facility is also situated within the veterinary cordon.

Predominantly pathogens falling into Bio-Safety Level 1 & 2 will be researched. Although these pathogens are endemic, they are not necessarily prevalent in adjacent areas. It is noteworthy, however, that they also have a very low risk of transmission without direct contact.

A maximum of Bio-Safety Level 2 pathogens will be dealt with under normal operating circumstances. Bio-Safety Level 3 pathogens will only be dealt with in the laboratory under very special circumstances. All facilities and the operation thereof will be fully compliant with the provisions of the relevant Bio-Safety Levels.

All staff will be fully trained on the operating procedures for a Bio-Safety Level 3 Facility. All visitors will be fully briefed on the operating procedures for a Bio-Safety Level 3 Facility.

Security:

The Hans Hoheisen Wildlife Research Station will operate with a high level of security and access control. Since the facility operates as a quarantine station the entire facility is fenced and electrified. Access will be controlled through a single gate, which employs state of the art access control. An alternative exit gate is available for large vehicles, but this will only be utilised by special arrangement.

Security and maintenance of the facility will be on-going for the duration of its operational life.

1.1.6 THE DECOMMISSIONING PHASE

At this stage the decommissioning of the facility is not anticipated.

2. PURPOSE OF THE PROJECT

The intention of the project is to refurbish, launch, and manage the Hans Hoheisen Wildlife Research Station as a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities.

Refurbishing and upgrading the facilities at the Hans Hoheisen Wildlife Research Station (including the accommodation currently on the premises) are being undertaken with the intention of:

- Establishing the Station as a research platform to be utilized by the University of Pretoria in association with local and international partners, and other interested parties;
- To facilitate the development of research programmes and projects that will provide information to:

    - Support the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas, given the impact of these diseases and their control on land-use options for development and poverty reduction, particularly of the rural poor;
    - Assist with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases;
    - Provide information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM; and

The project is to be undertaken in a phased approach. The first phase involving the renovation of existing structures and infrastructure was completed in July 2010. The nature of this refurbishment was such that it fell outside the ambit of the EIA Regulations.

2.1 PROJECT ALTERNATIVES

The role of alternatives is to find the most effective way of meeting the need and purpose of the proposal, either through enhancing the environmental benefits of the proposed activity, and or through reducing or avoiding potentially significant negative impacts. The following alternatives have been identified and a short description is included:

2.1.1 SITE / LOCATION ALTERNATIVES

Due to the fact that the original facility already exists, no site or location alternatives are being considered.

2.1.2 DESIGN / LAYOUT ALTERNATIVES

The proposed design and layout of the HHWRS as indicated on Map 3. (*Refer to Map 3)*.

This layout is largely informed by the presence of existing buildings and infrastructure, which comprise the original facility. The proposed new buildings are positioned to respond to existing building functions and configurations. In this respect, no design or layout alternatives are being considered. Minor changes in response to environmental, budgetary and social issues may be accommodated as the design is finalised and constructed, but the overall layout will not change.

2.1.3 TECHNOLOGY ALTERNATIVES

There are a number of waste types originating and requiring management and disposal at the Hans Hoheisen Wildlife Research Station. For some waste types, specifically the hazardous waste streams, a number of alternatives exist in terms of treatment and disposal. The method of treatment depends on the nature of the waste generated and the volumes requiring treatment. The context of the facility within a nature area and close to tourism operations also has bearing.

A Cursory Investigation of Alternative Technologies for the Treatment of Hazardous Waste Streams was undertaken determine the suitability of each alternative for this facility, and within this environment[6]. This investigation has been included as *Appendix B.8* and addresses the following waste treatment technology alternatives:

- Incineration;
- Alkaline Hydrolysis;
- Chemical Sterilisation;
- Biological Treatment;
- Composting;
- Bio digestion;
- Evaporation dams;
- Release to the environment and
- Removal off-site.

[6] It was anticipated during the Scoping Phase that a Waste Engineering Specialist would be appointed to undertake a specialist comparative assessment of alternative treatment technologies for hazardous waste streams. Subsequent quotes for professional services, however, revealed that this exercise would not be feasible. Discussions were held with Ms Fiona Grimmet from DEA in this regard, and it was agreed that a cursory desktop assessment by the EAP would be sufficient to explore the suitability of each technology alternative, and thus enable the EAP to make an informed assessment and recommendation.

The table below summarises the findings of this assessment, and offers a brief comparison in terms of each treatment methods possible impact on the environment (soil, air and water), its aesthetical / visual impact on the surrounding landscape, the cost implications, size, environmental benefits and possible by-products.

Table 1: COMPARISON OF HAZARDOUS WASTE TREATMENT METHODS					
TREATMENT METHOD	EVALUATION CRITERIA				
	Application	Potential Environmental Impacts	Potential Environmental Benefits	By-product Management & Disposal	Recommendation
Incineration	• Medical waste containers, slides & sharps; • Animal tissue, laboratory liquid waste and body fluids; and • Animal bedding & carnivore faeces	• Emits toxic and other pollutants into the atmosphere. Noxious fumes and emissions • 15m tall chimney required will have a visual impact.	No dangerous chemical used and no dangerous by-products	Ash disposal needs to be separately managed	Suitable for organic matter (animal carcasses and bedding). Not recommended for inorganic material (drug & chemical containers and sharps) due to emissions and odours.
Alkaline Hydrolysis	Animal tissue	No significant impact	Pathogen-free nutrients may be returned to the environment as fertilizer. By-products may also be used for bio-fuel production.	By-products are easily managed and used as fertilizer and/or biogas production.	Not recommended due to capacity and volume limitations.
Chemical Sterilization	Laboratory liquid waste and body fluids	• CFC emissions • Disposing residue liquid into the on-site sewer system poses risk of contaminating surface water with the chemicals which have been used in the process. • Disposed residue liquid may also leach into and	None.	Liquid residue (sterilized) is flushed down the sanitary sewer system as grey water waste	Although suitable for wash water from laboratories, clinic, pens and boma's, this system is outdated and costly and is therefore not recommended.

		intoxicate ground water.			
Biological Treatment	• Laboratory liquid waste and body fluids; and • Boma wash water.	• Greenhouse gases methane, nitrogen and carbon dioxide are released into the atmosphere. Poor management may lead to odour.	No dangerous chemical used and no dangerous by-products.	Sludge by-product needs to be separately managed.	Suitable for wash water from laboratories, clinic, pens and boma's.
Composting	• Herbivorous animal waste; • plant remains and • organic kitchen waste.	• Greenhouse gases methane, nitrogen and carbon dioxide are released into the atmosphere. • Poor management may lead to odour. • Leachates have the potential to pollute surface water bodies. Run-off from composting facilities may cause unacceptable loads of sediment and suspended solids in receiving waters. • Leachates from composting facilities may pollute groundwater	Destroys pathogens, improves soil constitution, reduces soil compaction, increases the water retention of the soil.	Compost may be used as fertiliser and methane may be captured and used as bio-fuel.	Suitable for small volumes of inert organic matter (kitchen waste). Not recommended for animal bedding due to limited capacity.

Bio-Digestor (biogas)	• Manure; and • Animal bedding and carnivore faeces.	• Visual impact varies according to the design chosen which may be above or below ground	Reduces the emission of landfill gas into the atmosphere.	Bio-digestor effluent may be used as fertiliser and methane may be captured and used as bio-fuel.	Suitable for small volumes of inert organic matter (kitchen waste) and grey water. Not recommended for animal bedding due to limited capacity.
Evaporation (dams)	Sterilized liquid effluent / waste water.	• Limited visual impact • Potential to leak and contaminate soil and groundwater • Potential to leak and contaminate surface water • Potential to leak and contaminate soil and groundwater			Suitable as secondary treatment and disposal of waste water
Release to Environment	Waste water, run-off and wash water from bomas, pens and holding areas	• Discharge could potentially contain residue contaminants and contaminate surface water. • Release into the environment would irreversibly intoxicate soil and ground water reserves.			It would be irresponsible to release liquid effluent which is highly likely to be contaminated into the environment. Therefore this process cannot be recommended.

Removal off-site (to registered facility)	• Medical waste, containers and sharps; • Animal tissue, laboratory liquid waste and body fluids; • Animal bedding and carnivore faeces.	Impacts are related to the road transport of the materials to an off-site disposal facility. i.e. fuel emissions, risk of accidental release into the environment due to motor transport accidents etc.	None	None	It is recommended that medical waste limited to containers, slides and sharps are removed off site and couriered to a registered facility

In response to the above assessment, the following alternatives are found to be feasible in terms of potential treatment technologies for **hazardous waste streams**:

- **Biological Treatment (primary) and Evaporation Ponds (secondary):** water and liquid waste from laboratories, clinics, pens and boma's;
- Incineration (primary) and off-site disposal (secondary): Animal carcasses and animal bedding.
- **Off-site incineration and disposal (Onderstepoort):** Empty drug and chemical containers, including sharps.

Empty drug and chemical containers as well as sharps will be collected on site and disposed offsite by specialist contractor.

Composting and bio digestion are not considered suitable for the treatment of large volumes of hazardous organic matter such as will be required at this facility. The application of these technologies is therefore limited to the domestic scope (i.e. kitchen waste and grey water).

The recommended alternatives will be assessed in the Impact Assessment section of this report. The remaining treatment technologies are considered unfeasible and will not be assessed further.

2.1.4 NO DEVELOPMENT ALTERNATIVE

The No Development Alternative will result in the maintenance of the *status quo*, and thus the retention of the existing facility remaining as it is. The potential negative impacts likely to occur as a result of the construction and operation of the proposed development would be avoided, but at the same time, the potential positive impacts will also fail to manifest.

The site currently consists of areas where infrastructure has been in existence for a number of years as well as sections of open natural bush. The facility as it stands is in need of upgrade as much of the infrastructure is in a general state of disrepair.

The No Development Alternative would result in the maintenance of the status *quo*, and the possible further deterioration of the facility over time. At present, it is far from the world-class wildlife-disease research station envisaged. It is, however, ideally situated placed to carryout research involving the diseases of wildlife, humans, and livestock at an interface between a Trans Frontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities.

In this respect, the No Development Option would also result in a lost opportunity in terms of the above research.

2.2 REQUIREMENTS FOR ENVIRONMENTAL AUTHORISATION

This application is for an Integrated Environmental Authorisation and Waste Management License in terms of:

- The National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010 and
- The National Environmental Management: Waste Act, 1998 (Act No. 59 of 2008) and Government Notice 718 of 2009.

Chapter 5 of the National Environmental Management Act, 1998 (NEMA) identifies a list of activities (Government Gazette R386 and R387) for which an EIA must be conducted. The listed activities, which trigger the requirement for Environmental Authorisation, include the following:

Table 2: LISTED ACTIVITIES IN TERMS OF NEMA		
GAZETTE NO:	ACTIVITY REF:	DESCRIPTION OF THE LISTING:
No R544 of 2010	22(iii)	The construction of a road outside of an urban area where no reserve exists, and where the road is wider than 8m.
No R544 of 2010	28	The expansion of existing facilities for any process or activity which requires a permit or license in terms of national or provincial legislation governing the general release of emissions.
No R545 of 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the general release of emissions.
No R545 of 2010	15	The 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.
No R546 of 2010	4(ii)(aa)	In Mpumalanga, the construction of a road wider than 4m with a reserve of less than 13,5m outside of an urban area, within a protected area.
No R546 of 2010	4(ii)(bb)	In Mpumalanga, the construction of a road wider than 4m with a reserve of less than 13,5m outside of an urban area, within an NPAES focus area.
No R546 of 2010	4(ii)(gg)	In Mpumalanga, the construction of a road wider than 4m with a reserve of less than 13,5m outside of an urban area, within 10km of a National Park or within 5km of a protected area.
No R546 of 2010	6(ii)(aa)	In Mpumalanga, the construction of resorts, lodges or other tourism accommodation facilities that sleep 15 people or more outside of an urban area, within a protected area.
No R546 of 2010	6(ii)(bb)	In Mpumalanga, the construction of resorts, lodges or other tourism accommodation facilities that sleep 15 people or more outside of an urban area, within an NPAES focus area.
No R546 of 2010	6(ii)(gg)	In Mpumalanga, the construction of resorts, lodges or other tourism accommodation facilities that sleep 15 people or more outside of an urban area, within 10km of a National Park or within 5km of a protected area.
No R546 of 2010	7(ii)(aa)	In Mpumalanga, the conversion of existing structures to resorts, lodges or tourism accommodation facilities that sleep 15 people or more outside of an urban area, within a protected area.
No R546 of 2010	7(ii)(bb)	In Mpumalanga, the conversion of existing structures to resorts, lodges or tourism accommodation facilities that sleep 15 people or more outside of an urban area, within an NPAES focus area.
No R546 of 2010	7(ii)(hh)	In Mpumalanga, the conversion of existing structures to resorts, lodges or tourism accommodation facilities that sleep 15 people or more outside of an urban area, within

		10km of a National Park or within 5km of a protected area.
No R546 of 2010	13(c)(ii)(gg)	In Mpumalanga, the clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, outside of an urban area, within 10km of a National Park or within 5km of a protected area.
No R546 of 2010	14	In Mpumalanga, the clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, outside of an urban area.
No R546 of 2010	18(ii)(aa)	In Mpumalanga, the expansion of a resort, lodge, hotel or other tourism hospitality facility where the development footprint will be expanded, outside of an urban area, within a protected area.
No R546 of 2010	18(ii)(bb)	In Mpumalanga, the expansion of a resort, lodge, hotel or other tourism hospitality facility where the development footprint will be expanded, outside of an urban area, within an NPAES focus area.
No R546 of 2010	18(ii)(gg)	In Mpumalanga, the expansion of a resort, lodge, hotel or other tourism hospitality facility where the development footprint will be expanded, outside of an urban area, within 10km of a National Park or within 5km of a protected area.
No R546 of 2010	19(ii)(aa)	In Mpumalanga, the widening of a road by more than 4m or the lengthening of a road by more than 1km, outside of an urban area, within a protected area.
No R546 of 2010	19(ii)(bb)	In Mpumalanga, the widening of a road by more than 4m or the lengthening of a road by more than 1km, outside of an urban area, within an NPAES focus area.
No R546 of 2010	19(ii)(gg)	In Mpumalanga, the widening of a road by more than 4m or the lengthening of a road by more than 1km, outside of an urban area, within 10km of a National Park or within 5km of a protected area.

The National Environmental Management: Waste Act, 1998 (Act No. 59 of 2008) identifies a list of activities (Government Notice 718) for which a Waste Management License must be obtained. These listed activities include the following:

Table 3: WASTE MANAGEMENT LICENSE TRIGGERS		
GAZETTE NO:	ACTIVITY REF:	DESCRIPTION OF THE LISTING:
No 718 of 2009	3(2)	The storage including the temporary storage of hazardous waste at a facility that has the capacity to store in excess of 35m^3 of hazardous waste at any one time.
No 718 of 2009	3(3)	The storage including the temporary storage of general waste in lagoons (evaporation ponds)
No 718 of 2009	3(11)	The treatment of effluent, wastewater or sewage with an annual throughput capacity of more than 2 000m^3 but less than 15 000m^3.
No 718 of 2009	3(18)	The construction of facilities for activities listed in Category A of this Schedule (not in isolation to associated activity
No 718 of 2009	3(19)	The expansion of facilities of or changes to existing facilities for any process or activity, which requires an amendment of an existing permit or license or a new

		permit or license in terms of legislation governing the release of pollution, effluent or waste.
No 718 of 2009	4(1)	The storage including the temporary storage of hazardous waste in lagoons (evaporation ponds).
718 of 2009	4(4)	The biological, physical or physico-chemical treatment of hazardous waste at a facility that has the capacity to receive in excess of 500 kg of hazardous waste per day.
No 718 of 2009	4(5)	The treatment of hazardous waste using any form of treatment regardless of the size or capacity of such a facility to treat such waste.
No 718 of 2009	4(6)	The treatment of hazardous waste in lagoons (evaporation ponds).
No 718 of 2009	4(8)	The incineration of waste regardless of the capacity of such a facility.
No 718 of 2009	4(11)	The construction of facilities for activities listed in Category B of this Schedule (not in isolation to associated activity).

With respect to the above listed activities, a Scoping and EIA Process was required to be undertaken for the proposed project:

- The Scoping Phase includes a description of the proposed project and its associated activities, facilities and infrastructure. It also includes an analysis of the receiving biophysical, socio economic and cultural historic environments. With an understanding of the project and its context as a platform, and in consultation with potential interested and affected parties, key stakeholders and relevant authorities, potential issues associated with the proposed project are identified.

- These issues are explored for possible fatal flaws, sensitivities etc. and it is determined where further study and more detailed assessment is required. In this respect, a Plan of Study for EIA is proposed, which forms the scope of work for the EIA phase of the project. Recommendations in terms of Specialist input are also made. A Draft Scoping Report is circulated for public review and comment; where after a Final Scoping Report is submitted to DEA for consideration and decision-making.

- The EIA Phase involves the determination of the significance of the potential issues (i.e. positive and negative impacts) identified during the Scoping Phase. Specialist Investigations are undertaken, and the direct, indirect and cumulative impacts likely to result from the proposed development are assessed.

- Practical and appropriate mitigation is proposed, and detailed in an Environmental Management Programme, which will be appended to the EIA. A public review of the Draft Environmental Impact Report is followed by the submission of the Final EIR to the DEA for consideration and decision-making.

This document represents the Environmental Impact Assessment Report, and has been drawn up in terms of Section 24(5) of the National Environmental Management Act (Act No. 107 of 1998).

2.3 DETAILS OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

Table 4: EAP DETAILS			
Environmental Assessment Practitioner	Nuleaf Planning and Environmental Pty Ltd Mrs Mandy van der Westhuizen		
Postal Address	P O Box 36723 Menlo Park Pretoria	Postal Code	0102
Tel. No.	(012) 346 1289	Fax No.	(012) 346 1292
Cell. No.	083 556 7307	E-mail	mandy@nuleafsa.co.za
Professional Affiliations	Professional Landscape Architect (South African Council for the Landscape Architectural Profession)		
Credentials	BL (Landscape Architecture) 1996		

V&L Landscape Architects was originally appointed by the University of Pretoria to undertake the Application for Integrated Environmental Authorisation and Waste Management License for the proposed upgrade to the Hans Hoheisen Wildlife Research Station on Portion 2 of the Farm Kempiana 90 KU.

V&L facilitated the process to the submission of the Final Scoping Report to DEA in March 2013.

Subsequent to this, NuLeaf Planning and Environmental assumed responsibility for the Environmental Authorisation Application process, and is currently the Environmental Assessment Practitioner for this process. The facilitator of the process, Mrs Mandy van der Westhuizen, has remained unchanged, although she now represents NuLeaf Planning and Environmental.

Mandy van der Westhuizen, the lead practitioner undertaking the assessment, has been involved in a range of projects relating to Environmental Planning, Environmental Management and Environmental Impact Assessment since 1997. She is a registered Professional Landscape Architect with the South Africa Council of the Landscape Architectural Profession.

Originally representing V&L Landscape Architects, and now representing NuLeaf Planning and Environmental, Mandy has always delivered work of the highest quality in the industry.

Neither the author, NuLeaf Planning and Environmental or any specialists contracted in for the purpose of this study will benefit from the outcome of the project decision-making.

2.4 REGULATORY AND LEGAL CONTEXT

2.4.1 RELEVANT LEGISLATION AND GUIDELINES

The following legislation and guideline documents are specifically applicable to this application, and have informed the scope of this document:

- National Environment Management Act (Act No. 107 of 1998);
- National Environmental Management: Waste Act, 1998 (Act No. 59 of 2008);
- National Parks Act (Act No. 57 of 1976);
- National Environmental Management: Protected Areas Act (Act No. 57 of 2003);
- Animal Diseases Act (Act No. 35 of 1984);
- National Water Act (Act No. 36 of 1998);
- National Environmental Management: Air Quality Act (Act No. 39 of 2004);
- National Heritage Resources Act (Act No. 25 of 1999);
- EIA Regulations published under Chapter 5 of NEMA;

- Guidelines published in terms of the NEMA EIA Regulations;
- Government Notices 544, 545 and 546, listing activities which trigger the requirement for environmental authorisation;
- Government Notice 718, listing activities or which a Waste Management License must be obtained; and
- Government Notice No 248, listing activities which result in atmospheric emissions, and which may have a significant detrimental effect on the environment.

In addition to the above, the following legislation, policies and guidelines are also applicable:

- Constitution of the Republic of South Africa (Act No. 108 and 1996);
- Environment Conservation Act (Act No. 73 of 1989);
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004); and
- Conservation of Agricultural Resources Act (Act No. 43 of 1983).

2.4.2 CORRESPONDENCE WITH AUTHORITIES

The first step of the EIA process involves consultation with the relevant authorities involved with the decision making process concerning the authorisation of the proposed project. The main purpose of this is to clarify the requirements of the regulations and procedures to be followed.

Relevant authorities for a project of this nature, and in this location include National, Provincial and Local Authorities who exercise control through statutory and non-statutory instruments, and include the following:

- National Department of Environmental Affairs (DEA): Environmental;
- National Department of Environmental Affairs (DEA): Waste Management;
- National Department of Environmental Affairs (DEA): Air Quality;
- National Department of Water Affairs (DWA);
- National Department of Health (DoH);
- South African National Parks (SANParks);
- Department of Agriculture Forestry and Fisheries (DAFF);
- State Veterinary Department;
- Mpumalanga Department of Economic Development, Environment and Tourism (MDEDET);
- The South African Heritage Resources Agency (SAHRA);
- Mpumalanga Tourism and Parks Authority (MTPA): Veterinary Services; and
- Bushbuckridge Local Municipality (BLM).

A full list of the Authority representatives and copies of the invitations distributed are included in *Appendix A1.*

Of note is that a prior application was submitted under the previous EIA Regulations in 2010. A project application was submitted to DEA (Environmental) as well as to DEA (Waste Management) in February 2010. The application was acknowledged and accepted in March 2010, and issued with the following reference numbers:

- DEA Environmental 12/12/20/1820;
- DEA Waste Management 12/9/11/L319/3.

A Departmental site meeting was held on the 12th April 2010 at the Hans Hoheisen Wildlife Research Station (Copies of the proceedings have been included in *Appendix A6*).

A Draft Scoping Report (DSR) was subsequently circulated to relevant for comment. Due to a number of factors, however, this application subsequently lapsed, and the file was closed by the DEA in August 2011.

In July 2012, a new Application for Integrated Environmental Authorisation and Waste Management License was submitted under the current regulations. This application was acknowledged and accepted in September 2012.

A draft of the Scoping Report was circulated to all relevant Authorities in January 2013 for comment prior to the finalisation of the report and submission to DEA for consideration.

Authorities were contacted directly regarding the availability of the report, which was distributed in digital and / or printed format.

Feedback on the DSR was received from the Mpumalanga Department of Economic Development, Environment and Tourism, from the Mpumalanga Parks and Tourism Agency and from the South African Heritage Resources Agency. This feedback has been transcribed in the Comments and Responses Report. *(Refer to Appendix A7*) No other comments were received.

Requisite specialist studies and surveys were undertaken[7], and the DSR was finalised and submitted to DEA as a Final Scoping Report in March 2013. This was approved by DEA in May 2013.

Feedback on the FSR was received from Mpumalanga Parks and Tourism Agency. This feedback has been transcribed in the Comments and Responses Report (*Refer to Appendix A7*). No other comments were received.

Copies of Authority comments and correspondence stemming from both the lapsed and the current applications are included in *Appendix A*.

2.5 PUBLIC PARTICIPATION

A prior Application for Environmental Authorisation for this project was submitted under the previous EIA Regulations in 2010. The identification of I&AP's and stakeholders, the advertising of the project and a public meeting was undertaken as part of this process. In the interim, however, this application lapsed, and the file was subsequently closed by DEA in August 2011.

This report represents a new process, but because the nature of the project as well as the identified Authorities and Stakeholders are the same as for the lapsed application, it was argued that some of the 2010 process would be valid for this process.

In this regard, an application for exemption from certain aspects of public participation was submitted to Department of Environmental Affairs (DEA) on 17 October 2012. This application was approved on 23 March 2013.

[7] Comments received from SAHRA on the Draft Scoping Report (dated 6 March 2013) indicated that no graves, archaeological, historic or paleontological resources are likely to be affected, and no requirement was stated for any survey or scan in this regard.

All correspondence with Authorities and relevant documentation is attached as *Appendix A1* and are set out as follows:

- Invitations sent to Authorities during the 2010 EIA and 2012 EIA Processes respectively;
- Correspondence following the Public and Departmental Meeting held on site on the 12th of April 2010;
- Commentary received during the 2010 EIA;
- Correspondence relating to the lapsing of the 2010 EIA Application;
- Correspondence relating to the lapsing of the 2010 Waste Management License Application;
- SAHRA Comments for the 2010 EIA Application;
- DWA Comments for the 2010 EIA Application;
- DEA Acceptance of 2012 EIA Application;
- DEA Approval of Request for Exemption from certain provisions of the Public Participation Process;
- MDEDET Comments on the Draft Scoping Report 2013;
- MTPA Comments on the Draft Scoping Report 2013;
- MTPA Comments on the Final Scoping Report 2013;
- SAHRA Comments on the Draft Scoping Report 2013;
- DEA Approval of the Final Scoping Report 2013.

All correspondence with Stakeholders and relevant documentation is attached as *Appendix A8* and are set out as follows:

- Invitations send to Stakeholders during the 2010 EIA and 2012 EIA Processes respectively; and
- Invitations to comment on the Draft Scoping Report 2012.
- Invitations to comment on the Draft Scoping Report 2013.
-

2.5.1 I&AP IDENTIFICATION AND REGISTRATION

The identification of potential Interested and Affected Parties (I&AP's) was undertaken through a combination of advertising the process in various forms, and through existing contacts and databases. Input from the client was also sought in this regard.

Identified Stakeholders and potentially Interested and Affected Parties (I&AP's) were invited to register and participate in the process. Relevant Stakeholder and I&AP information have been recorded within a Stakeholder Database, which will be updated on an on-going basis throughout the EIA process to allow for additional Stakeholders who would like to register. *(Refer to Appendix A3).*

In order to provide information about the proposed project and the EIA process, a Background Information Document (BID) was compiled and distributed to registered Stakeholders and I&AP's.

Copies of the invitations and the BID distributed are included in *Appendix A5*.

2.5.2 NOTIFICATION OF THE EIA PROCESS

It is a requirement of the Public Participation Process that the EIA Process be advertised. In this respect, the following was undertaken:

- Site Notices informing of the process (in terms of the previous EIA Regulations, and previous lapsed Application) were placed at the main entrance to the facility on 8th March 2010. These site notices also invited potential I&AP's to attend the public meeting scheduled for the 12th April 2010.
- An advertisement informing of the process (in terms of the previous EIA Regulations, and Previous lapsed Application) was placed in the legal section of the Lowvelder Newspaper on the 30th March 2010.

In addition to the above advertisements and notices, identified key Stakeholders and I&AP's were notified in writing of the proposed development, and invited to attend the public meeting. These included, *inter alia*, the following:

- Adjacent land owners;
- Local Reserve Owners / Managers; and
- Local Camp Managers (KNP and others).

Copies of the advertisements placed and the invitations distributed are included in *Appendix A4* as well as photographs of the erected notices at the Orpen / Manyeleti Control Boom and HHWRS Entrance Gate.

2.5.3 PUBLIC INVOLVEMENT AND CONSULTATION

A Public Meeting was held on the 12th April 2010 at the Hans Hoheisen Wildlife Research Station and a Departmental site meeting was held on the 12th April 2010 at the Hans Hoheisen Wildlife Research Station.

Minutes of the Public Meeting is attached under *Appendix A6* followed by attendance registers for both the Public and Departmental Meetings held.

An Issues and Responses document has been drawn up, in which all comments and inputs received from both Authorities and from I&AP's have been recorded. This document, which is included in *Appendix A7*, includes comments stemming from both the lapsed and the current application to date.

A draft of the Scoping Report was circulated on (14 January 2013) to all registered Stakeholders and I&AP's for comment.

Registered I&AP's were contacted directly regarding the availability of the report for public comment. Soft copies were made available for download off the Internet. Notifications and a link to the download were emailed to all registered I&AP's and Stakeholders. In addition, a hard copy was made available at the Orpen Rest Camp. Digital copies of the report on CD were made available upon request.

A 30-day comment period was allowed (40 days for Authorities), where after all comments received were considered, and amendments made to the Scoping Report (where relevant).

The DSR was finalised and submitted to DEA as a Final Scoping Report in March 2013, and was approved by DEA in May 2013.

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 CONTEXT AND LOCALITY

Refer to Map 1. The Hans Hoheisen Wildlife Research Station is situated on Portion 2 of the Farm Kempiana 90 KU, Mpumalanga. The site lies within the quarter degree grid 2431AD.

Regionally the site is located adjacent to the Kruger National Park (KNP), and is situated on the western boundary thereof in the vicinity of Orpen Gate and Orpen Rest Camp.

The Manyeleti Nature Reserve lies to the southeast and the Timbavati Nature Reserve to the southwest. The Timbavati River bypasses the site less than 1km to the west. Refer to Map 1.

3.2 BIO-PHYSICAL ENVIRONMENT

This section draws extensively from *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station* (Orban, B, June 2012). A copy of the full report has been included as *Appendix B.7*.

3.2.1 CLIMATE

The study area falls within a summer rainfall area, experiences dry winters and can be described as semi-arid and warm. Mean Annual Precipitation (MAP) ranges from about 500-650 mm per annum and is usually received in the form of thundershowers received during the months of October to March. The area generally receives little rainfall during the months from April to September.

The highest monthly temperature of 26° C is recorded in January and the lowest monthly temperature of 0.3° C is recorded in July. Winter temperatures have never been recorded to drop below 0° C. This is generally a frost-free region.

3.2.2 GEOLOGY AND SOILS

Undisturbed State

A number of different types of granite and gabbro underlie the Lowveld region. These rocks include amongst others potassic granite and granodiorite with Timbavati gabbro in the HHWRS.

Only one land type (Fb184) has been identified in the study area.

The Mispah (Orthic A-horizon over hard rock) and Glenrosa soil form (Orthic A-horizon over Lithocutanic B-horizon) dominate the higher lying terrain of the study area. The Lithocutanic B-horizon underlies a diagnostic topsoil horizon and merges into underlying weathering rock. These soils are generally shallow, rarely reaching a depth of more than 450 mm or a clay content of more than 35%.

The Hutton (Orthic A-horizon over red-brown Apedal B-horizon) and Clovelly (Orthic A-horizon over a yellow-brown Apedal B-horizon) soil types dominates the lower lying terrain of the study area.

The red-brown Apedal B-horizon and the yellow-brown Apedal B-horizon are associated with siliceous parent materials such as granite and gneiss both of which have a lower content of weatherable minerals and thus a lower clay-forming potential. The colour is generally uniform, and structure in the soil poorly developed. Root penetration is considered high, but water retention

relatively low. These Apedal soils are generally considered good for crop production, often reaching a depth of between 450 and 700 mm[8].

Current Status

The site constitutes sections where Gabbroid based geology gives rise to vertic clay soils that may exhibit signs of low erodability and poor drainage.

Historic use of the site has resulted in disturbance to the soil horizons and structure of some sections of the site. The presence of hardened surfaces, infrastructure and human habitation within the site has resulted in a disturbance of soil structure in certain areas. There are some sections of the site that exhibit characteristics of an undisturbed geology and soils state.

3.2.3 TOPOGRAPHY AND HYDROLOGY

Undisturbed State

The study area lies at an altitude of between 400m and 480m above sea level, and the landscape is gently undulating throughout.

The major hydrological feature is the Timbavati River, which meanders across the study area. This river bypasses the site less than 1km to the northwest. A high concentration of non-perennial drainage lines are also present within the study area, draining in different directions as they make their way towards the Timbavati River.

The site itself is relatively flat with an average gradient of approximately 1:15. This is a moderate gradient that is discernible on a landscape level. To the immediate west of the site, the gradient steepens to 1:6 along the river. It would appear that the site straddles a local watershed between tributaries, which runs roughly from north to south mid-way across the property.

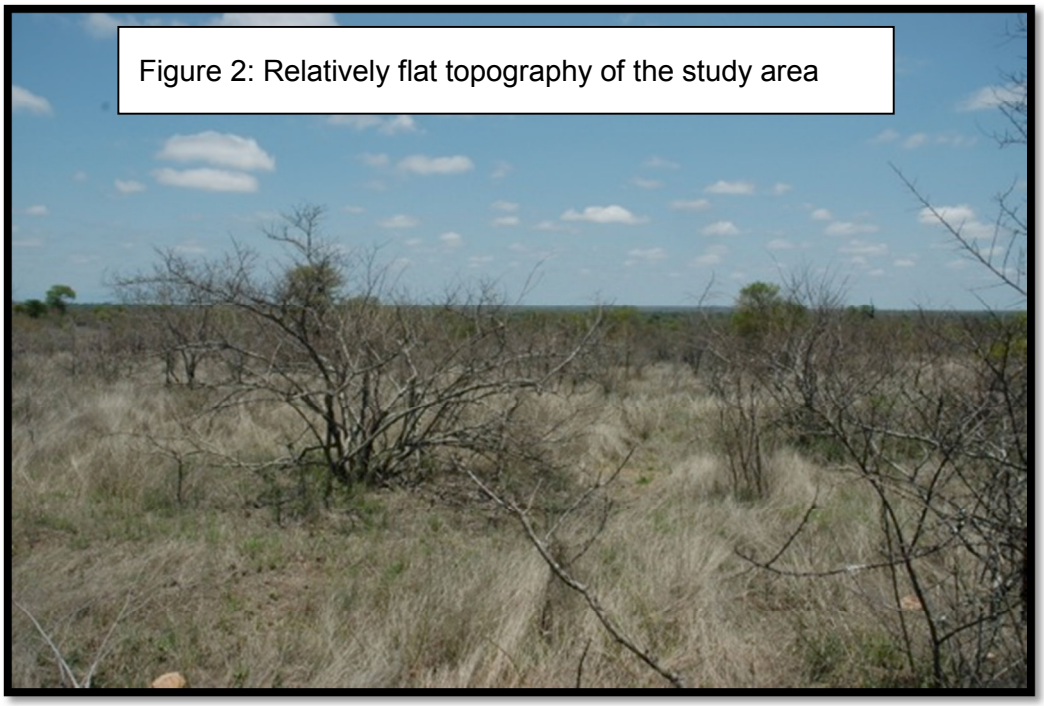

Figure 2: Relatively flat topography of the study area

[8] An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)

Current Status

The proposed upgrade will take place within the existing footprint of the current Hans Hoheisen Research Institute and no significant earthworks are anticipated.

A small tributary of the Timbavati River appears to originate within the site and drain due west. This drainage line lies beyond any existing or proposed development, however. Refer to Map 2.

3.2.4 FLORA

Undisturbed State

The veld type is considered to be Mixed Lowveld Bushveld, or Arid Lowveld, and can be described variously as dense bush on the uplands, open tree savanna in the bottom lands, and dense riverine woodland on the riverbanks and drainages.

The tree layer is characterised by red bushwillow *Combretum apiculatum* subsp*. apiculatum*, silver cluster leaf *Terminalia sericea*, marula *Sclerocarya birrea* subsp. *caffra* and weeping wattle *Peltophorum africanum*. Bottomland situations are dominated by knob thorn *Acacia nigrescens,* scented thorn *Acacia nilotica,* common false-thorn *Albizia harveyi* and magic guarri *Euclea divinorum*.

The shrub layer is moderately developed, except in cases where overgrazing has occurred, which causes the bush to thicken dramatically, and individuals of sickle bush *Dichrostachys cinerea* and flaky thorn *Acacia exuvialis* are commonly found.

The grass layer is poorly to moderately developed, and grasses such as herringbone grass *Pogonarthria squarrosa,* broad curly leaf *Eragrostis rigidior,* Natal red top *Melinis repens,* guinea grass *Panicum maximum,* finger grass *Digitaria eriantha* and spear grass *Heteropogon contortus* are the conspicuous species. Other grasses that are typical of Mixed Lowveld Bushveld are sand quick *Schmidtia pappophoroides,* tassel three-awn *Aristida congesta* subsp. *congesta* and bushveld signal grass *Urochloa mosambicensis*.

Vegetation classification within the HHWRS study area resulted in the identification of the following eight habitat units. A full description of these is included in *Appendix B.7: An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012).*

Current Status of the Site

The vegetation of site mostly ranges from *Natural* to *Modified*. Where buildings and infrastructure have been developed, vegetation is generally disturbed, with denuded patches. In outer lying areas, where no buildings or infrastructure are present, the vegetation is mostly intact.

No Red List threatened plant species were identified in the study area; however, four protected tree species are present, including *Combretum imberbe, Balanites maughamii, Philenoptera violacea* and *Sclerocarya birrea* subsp*. Caffra.* The latter is most dominant and is found in all habitat units.

The highest occurrence of protected tree species is found in Transformed habitat where modification through landscaping and gardening are the two contributing factors to high species diversity. Concomitantly, these transformed areas also have the highest prevalence of undesirable alien species (weeds)[9].

[9] An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)

Figure 3: Disturbed vegetation around buildings and infrastructure

Figure 4: Intact vegetation in undeveloped parts of the site

3.2.5 FAUNA

Undisturbed State:

The Hans Hoheisen Wildlife Research Station is effectively part of the Kruger National Park, and therefore theoretically supports those species occurring naturally within the region.

In addition to the Big 5, at least 51 small mammal species have been listed in the region. Priority game species include White Rhino, Buffalo, Cheetah, Lion, Leopard and Wild Dog. Several other threatened mammal species occur, including African wildcat, Antbear, African civet, Aardwolf and even Serval.

Over 20 mammal predator species have been listed in the area, including some threatened species like Wild Dog, African wild cat, Small-spotted Cat, Aardwolf, Pangolin, a healthy population of Serval as well as lion, cheetah and leopard.

Rare/Endangered game species include White rhino; Sable; Buffalo; Wild Dog; Cheetah; African Wild Cat; Serval, Pangolin.

A total of 367 bird species have been recorded within the area. These include important bird species such as Cape vulture, Martial eagle, African finfoot, Bald ibis, Southern Ground Hornbill and Red-billed oxpecker.

A total of 114 reptile species have been recorded in the Kruger National Park, and of these approximately 42 reptile species have been recorded in the area. The species composition is diverse and includes snakes, lizards, tortoises, terrapins and crocodiles. Pythons are also observed.

Of a total 35 amphibian species (frogs and toads) recorded in South Africa, it is estimated that about 34 species occur in within the area. Of a total of 49 fish species to have been recorded in the Greater Kruger area, a number occur within the region.

Current Status: Mammals

According to *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)*[10]*,* cross boundary animal movement of larger mammals onto the site is not possible, as the boundary fence construction excludes all migration. Small mammal species such as bats that fly over the fence and rodents that can pass through the fence are the only species present within the study area.

The presence of other threatened species such as *Crocidura flavescens*, *Myosorex varius* and *Rhabdomys pumilio* could not be established, but the habitat is considered not suitable for *Dasymys incomtus* or *Thallomys paedulcus*.

No Red Listed or protected small mammal species could be identified and no known historical records are available.

Current Status: Avifauna

Of the 568 potential bird species present in Limpopo, emphasis was placed on Red List and protected bird species that could potentially occur within the HHWRS study area. The bird species of concern are mostly dependant on open water, with a preference for marshlands for their feeding, breeding, nesting and resting requirements.

Bird species of national concern have been discussed in detail in *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)*[11]. These species have been discussed with reference to potentially suitable habitat in the study area, but due to the relatively small size of the study area and the absence of any open water or marshlands most of these birds have only be recorded as incidentals. Although the presence of none of these species can be confirmed, future incidental occurrence cannot be excluded.

[10] Appendix B.7
[11] Appendix B.7

Current Status: Herpetofauna

A number of herpetofaunal species (reptiles) were confirmed by direct observation and reliable occurrence records from other researchers. Although the occurrence of Red List species in the study area could not be confirmed, the protected *Python natalensis* (Southern African python) and plated lizards (*Gerrhosaurus* sp.) are present.

Current Status: Amphibians

According to *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)*[12], suitable habitat does not exist on the property for the two endemic amphibian species believed to be present on the study area. None of the frog species identified are considered threatened or protected.

Current Status: Invertebrates

Invertebrate studies are invariably difficult to accomplish and much of the occurrence data is based on historical records. However, the presence of two baboon spiders (*Augacephalus breyeri* and *Augacephalus junodi*) is confirmed in *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)*[13]. These spiders are predominantly found in Habitat Units 1, 2 and 3.

No other threatened or protected arachnid species were present in the study area; and although seven scorpion species is expected in the study area, only *Parabuthus transvaalicus* (Transvaal thick-tailed scorpion) could be confirmed. Although this scorpion is not threatened or protected, it is of medical concern due to its venomous properties.

Of the 143 potential butterfly species recorded for the study area, the presence of 47 species can be confirmed. None of the species is threatened or protected.

3.2.6 AGRICULTURAL POTENTIAL

In a semi-arid region such as the proposed development area, there is usually a strong correlation between the geological formations, soil types and the associated vegetation. This implies that the soil and the parent material from which it is formed have a strong influence on the plant species composition and structure of the vegetation.

The parent material influences the horizons of the profile, the inherent fertility of the soil, crust formation and compaction thereof. Therefore, the different soil types in the landscape, together with soil depth, determine the potential yield and palatability of the grazing.

A number of different types of granite and gabbro underlie the Lowveld region. These rocks include amongst others potassic granite and granodiorite with Timbavati gabbro in the HHWRS, giving rise to soil profiles that typically indicates relatively poor and shallow soil forms with poor agricultural potential[14].

Of note is that this Agricultural Potential is only theoretical, as the land is not available for agricultural use, being located in such close proximity to the KNP and occupied historically and currently as a research facility.

[12] Appendix B.7
[13] Appendix B.7
[14] An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)

3.2.7 LAND-USE

At present the site forms part of the Kempiana Contractual Park. It is bordered by the Kruger National Park on its eastern side and lies within close proximity to the Manyeleti and Timbavati Nature Reserves.

Hans Hoheisen donated the land and the property has been used as an animal research facility since the 1970's.

Due to a lack of funding, much of the infrastructure fell into a state of disrepair, and has been in a degraded state since the 1990's.

In 2010, the complex was refurbished with the support of various donations and is now managed by the University of Pretoria. The research station provides infrastructure and support for local and international researchers.

3.2.8 INFRASTRUCTURE

Existing buildings and infrastructure include the following:

- Various laboratories, offices, cages and animal pens in the north of the site;
- Three accommodation units in the west of the site;
- Group accommodation in the south of the site;
- Various roads, gates and fences;
- A helicopter landing pad; and
- Limited bulk service infrastructure and reticulation (electrical, water and sewage).

The proposed use of the facility as a wildlife research station is in line with the existing land use. Refer to Map 2.

Figure 5: Access control gate to the HHWRS

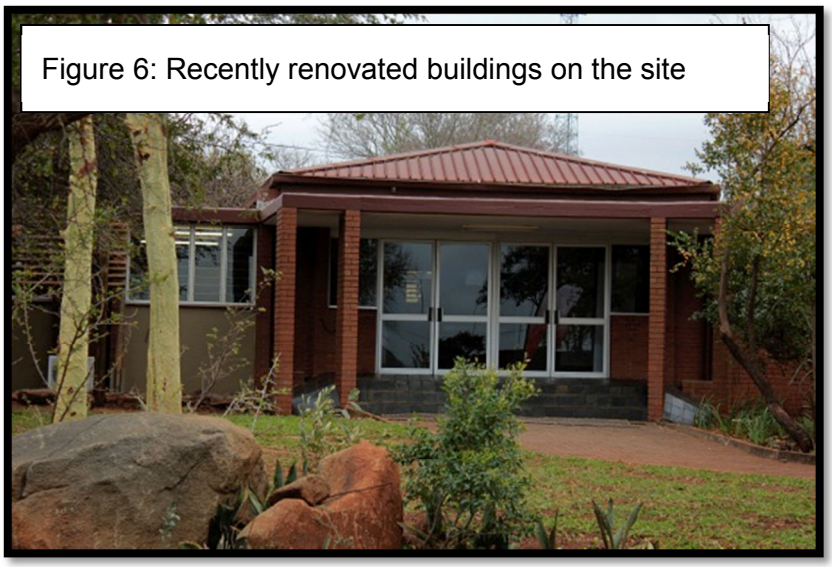

Figure 6: Recently renovated buildings on the site

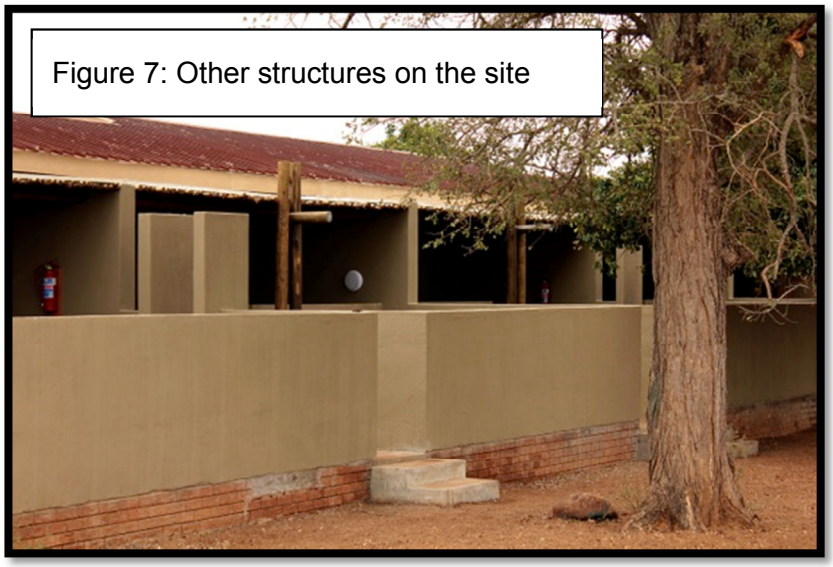

Figure 7: Other structures on the site

3.3 CULTURAL/HISTORIC ENVIRONMENT

The facility was built and commissioned in the 1970's, meaning that none of the buildings or structures present on the site is older than 60 years.

No graves were observed on the site, nor have any been documented during the operational lifespan of the facility. Similarly, no archaeological, paleontological or historical finds have been observed or documented on the site during the past 40 years. Any surface artefacts that may have existed within the development footprint would have long since disappeared.

Sections of the site have been disturbed as a result of buildings, structures and infrastructure, and most of the upgrades will take place within these disturbed areas. There are parts of the site that

have not been disturbed, however. Within these areas, there is a possibility that archaeological, paleontological or historical artefacts may exist buried underground[15].

3.4 SOCIO-ECONOMIC ENVIRONMENT

3.4.1 TOURISM

The Hans Hoheisen Wildlife Research Station is situated close to Orpen Gate along the R531 that runs from Klaserie Town to Orpen Gate. The area surrounding the site is used for conservation purposes as well as tourism based operations integrally liked to conservation.

A number of renowned hospitality and tourism facilities operate in the vicinity, with the Orpen Rest Camp located less than 1km to the northeast, while Ngala Tented Camp and Mr Pirow lie to the south west of the facility.

There are no urban settlements, towns of villages within the study area. The closest permanent residential area in close proximity to the site is the staff accommodation for Orpen Rest Camp.

3.4.2 LOCAL ECONOMY

The site lies within the greater Kruger National Park area, and therefore falls under the local jurisdiction of Mpumalanga Tourism and Parks Authority.

Within this context, there is no local resident population or populated place other than within the above mentioned tourist operations surrounding the facility. The only residents within the study area are landowners, managers and staff within these tourist operations.

3.4.3 AESTHETICS

A Viewshed Analysis was undertaken for the proposed extensions to the HHWRS. The full report has been included as *Appendix B.9.*

The visual quality of the study area is high, generally as a result of the lack of development and the large areas given over to conservation within the region. The nature reserves and the Kruger National Park, which borders the site, are generally well managed, and the Bushveld vegetation is good condition. The height and density of the vegetation also possesses a high Visual Absorption Capacity, and as such, easily conceals visual disturbance beyond.

The buildings and structures on the site a generally single storey red brick structures with no remarkable architectural characteristics or aesthetic merit. A number of large trees have been preserved within the site footprint, and these contribute to the quality of the visual environment somewhat.

The finding of the Visual Analysis is that the proposed infrastructure may result in visual impacts, especially the taller structures such as the incinerator chimney, which may reach a height of up to 15m.

The visual environment immediately surrounding the site will be visually impacted upon during the operational lifespan of the facility. Potential visual impacts will be concentrated within 4km of the proposed facility, although the extent of visual impact will not be limited to this zone. The

[15] Comments received from SAHRA on the Draft Scoping Report (dated 6 March 2013) indicated that no graves, archaeological, historic or paleontological resources are likely to be affected, and no requirement was stated for any survey or scan in this regard.

development site could potentially be visible within an area that includes certain sensitive visual receptors. Such includes users of the R531 as well as visitors to the aforementioned camps and lodges in the area.

It is however important to note that the severity of the visual impact will be largely ameliorated by the very high Visual Absorption Capacity (VAC) of the Bushveld, and can be further mitigated to acceptable levels by applying basic management and mitigation procedures.

The following is a summary of expected impacts remaining, taking the high VAC into consideration, and assuming mitigation as recommended is exercised:

- The anticipated visual impact on sensitive visual receptors (i.e. visitors to the camps and lodges, and travellers along the roads) in close proximity to the proposed facility is likely to be of **high** significance, but may be mitigated to **moderate**. This includes the visual impact of an incinerator chimney.
- The anticipated visual impact on sensitive visual receptors within the region (i.e. beyond the 4km radius) is likely to be of **moderate** significance, but may be mitigated to **low**.
- The anticipated visual impact resulting from the effect of lighting at night on observers in close proximity is likely to be of **moderate** significance, and may be mitigated to **low**.
- The anticipated visual impact of construction on observers in close proximity is likely to be of **low** significance, both before and after mitigation.
- The anticipated visual impact of the facility on the regional visual character, and by implication, on the sense of place, is expected to be of **moderate** significance, and may be mitigated to **low**.

Figure 8: Visual quality at the entrance to the facility

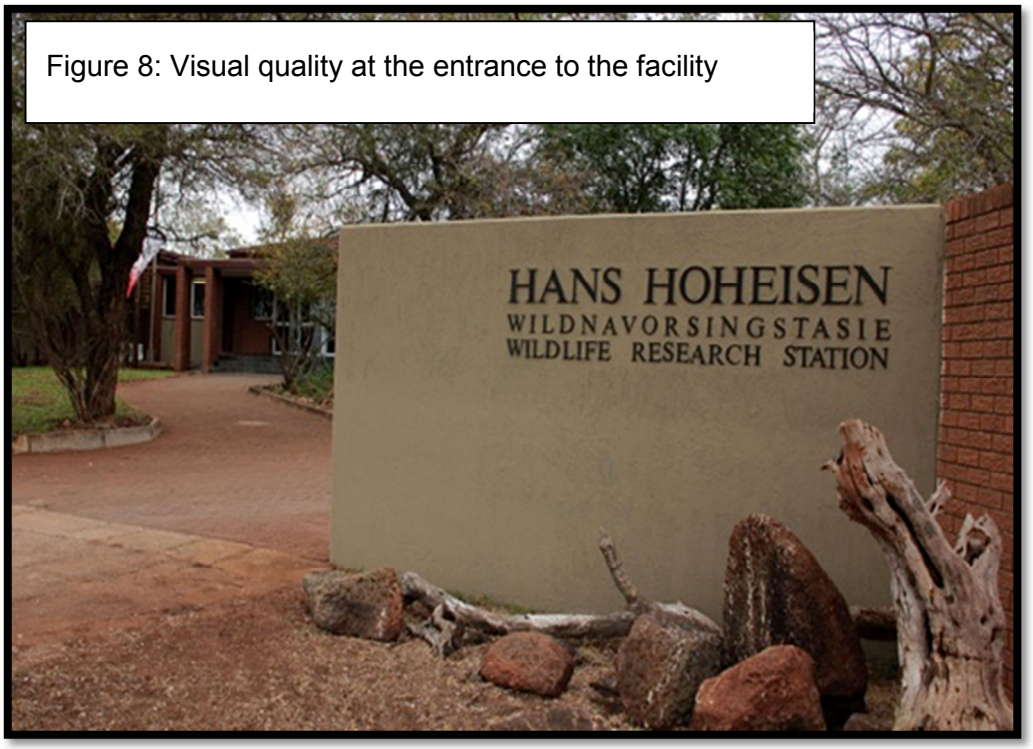

Figure 9: Visual quality along the western edge of the facility

3.5 SENSITIVE ENVIRONMENTS

3.5.1 PHYSICAL ENVIRONMENT

According to *An Environmental Baseline Report for Hans Hoheisen Wildlife Research Station (Orban, B, June 2012)*[16]*, a*n important determinant of the sensitivity of a particular habitat type is the extent to which it is ecologically connected to the surrounding area. Habitat with a high degree of regional landscape connectivity or with extensive drainage systems amongst one another, are perceived to be more sensitive and will be those contributing to important faunal migration.

Floristic sensitivity evaluations are based predominantly on subjective assessment of Phyto-sociological attributes such as plant species diversity, Red List diversity and Endemism. In addition, the presence of especially alien invader species was also considered in the evaluation as these are considered indicative of habitat degradation.

- High sensitivity values indicate areas that are considered pristine, relatively unaffected by human influences or generally managed in an ecological sustainable manner.
- Low sensitivity values indicate areas of poor ecological status or importance in terms of floristic attributes, including areas that have been negatively affected by human impacts or poor management.

Faunal sensitivity is evaluated through species diversity, endemism and the presence of topographical features or undisturbed habitat units with the intrinsic ability to sustain a great diversity of species, among which are those of conservation importance. Sensitivity scale is as follows:

[16] Appendix B.7

- High - Sensitive habitat with either low inherent resistance or low resilience towards disturbance factors. These habitat types represent ecosystems with high connectivity and support high fauna diversities while providing suitable habitat/records of a number of endangered, threatened or near-threatened species, CITES or naturally protected species.
- Moderate – These are partially modified habitat types which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems or habitat types with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species.
- Low – Severely modified habitat where ecological function is arrested or non-functional and low species diversity with a dominant composition consisting of unspecialised and widespread species. The area is characterised by the absence of endangered, threatened or near-threatened species, CITES or naturally protected species.

A combined output of the sensitivity ratings for each habitat type was generated as part of the above specialist study. This was achieved but applying a numerical value to each of the sensitivity classes where:

- Low sensitivity = 1,
- Moderate sensitivity = 2 and
- High sensitivity = 3.

Summation of the sensitivity scores across the floral and faunal categories produced habitat scores between 5 and 15, representing a spread of different possible outcomes. Scores of sensitivity were divided equally between the spread as follows:

- Low sensitivity = 5-7
- Moderate sensitivity = 8-11
- High sensitivity = 12-15

This summative approach assigned equal weight to each of the individual sensitivity evaluations and the equal spread of sensitivity classes removes bias from the interpretation. The results of this combined sensitivity analysis are shown in the table below, and are illustrated on Map 4.

The whole of the HHWRS study area is rated as having a low sensitivity from an ecological perspective.

Table 5: COMBINED SENSITIVITY ANALYSIS BASED ON FAUNA AND FLORA ASSESSMENT

Habitat	Flora	Avifauna	Herpeto-fauna	Inverte-brates	Mammals	Sensitivity
1. Short Open Shrubland	2	1	1	2	1	Low
2. Short Open Shrubland	2	1	1	2	1	Low
3. Tall Open Woodland	2	1	1	2	1	Low
4. Short Open Shrubland	2	1	1	2	1	Low
5. Short Open Woodland	2	1	1	1	1	Low
6. Short Open Woodland	2	1	2	1	1	Low
7. Short Open Woodland	2	1	2	1	1	Low
8. Transformed	3	1	2	1	1	Low

3.5.2 DISEASE RISK

Dr. Markus Hofmeyr, a Wildlife Veterinarian, has compiled an Independent Opinion on the Potential Disease risk of the proposed upgrades (to both humans and animals) at the Hans Hoheisen Wildlife Research Station. This report has been included as *Appendix B.6*.

This report states that the facility acts as a satellite research and project management base for research on wildlife diseases and related livestock interface issues and is completely enclosed by an electric fence and the surrounding environment forms part of a conservation area.

The entire area falls within the Foot and Mouth Disease Infected Zone and movement of samples and animals are controlled within the ambit of the Animal Diseases Act (Act No. 35 of 1984). The facility is therefore ideally placed as a base for research on controlled diseases, including Bovine Malignant Catarrhal Fever (Snotsiekte), Bluetongue, Lumpy Skin Disease, Rift Hayfever, Strangels and Swine Erysipelas.

It was concluded that as the project is being managed by experienced staff from the University of Pretoria (UP), Faculty of Vet Sciences, a basic understanding of disease risk management is inherent. The potential disease risk will be limited for the project expansion if the required mitigation steps are taken, many of which are already in place.

4. ANTICIPATED IMPACTS

This section of the report is aimed at providing a description and brief evaluation of issues and impacts associated with the construction and operational phases of the proposed facility. A preliminary list of impacts anticipated during the construction and operational phases is as follows:

4.1 DESCRIPTION OF IMPACTS RESULTING FROM THE PLANNING PHASE

No potential impacts were identified during the Scoping / EIA Phase concerning the planning of the proposed development.

4.2 DESCRIPTION OF IMPACTS RESULTING FROM THE CONSTRUCTION PHASE

4.2.1 DIRECT IMPACTS:

In terms of the Bio-physical Environment, the following impacts are anticipated during the Construction Phase:

Ground Water:

Of note in this regard is that no municipal water supply services are available in the area. Therefore all residents and users rely on the ground water supply for their lives and livelihood.

- Depletion of ground water due to over use and waste.
- Contamination of ground water due to:
    - Disposal or discharge of sewage and
    - Spills and disposal of hazardous substances and hydrocarbons.

Surface Water:

Of note in this regard is that the Timbavati River bypasses the site just less than 1km to the northwest. A small tributary of the Timbavati River appears to originate within the site and drain due west. This drainage line lies beyond any existing or proposed development, however.

- Disturbance to the hydrological function of the drainage line due to storm water runoff.
- Sediment discharge into the drainage line due to storm water runoff from denuded / construction areas.
- Contamination of the surface water resource due to:
    - Disposal or discharge of sewage;
    - Disposal of construction waste and litter;
    - Spills and disposal of hazardous substances and hydrocarbons;
    - Storm water runoff and
    - Grey water, cement slurry and wash water discharge.

Soils:

Of note in this regard is that the site is relatively flat, with an average gradient of 1:15, which ameliorates the risk of erosion due to runoff somewhat.

- Soil pollution due to:
    - Disposal or discharge of sewage;
    - Spills and disposal of hazardous substances and hydrocarbons and
    - Grey water, cement slurry and wash water discharge.
- Soil erosion due to the removal of stabilising vegetation during construction.
- Soil compaction due to uncontrolled movement and access across the site by construction personnel. This in turn could lead to loss of vegetation and erosion.

Air:

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale.

- Air pollution by emissions from construction vehicles and equipment.
- Dust liberated by general construction activities and movement of construction vehicles to the site and over the site.
- Smoke from fires used for cooking and heating as well as from uncontrolled fires.

Biodiversity (Flora):

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale. In addition, no Red Listed species were identified on site, although 4 protected species were indeed found.

- Removal of exotic and invasive species (positive impact).
- Removal and destruction of vegetation.

- Removal of protected plant species.
- Bush encroachment and invasion of denuded areas.

Biodiversity (Fauna):

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale. The presence of certain threatened and / or protected birds, snakes, lizards and spiders could be expected in this environment, but the sensitivity of the habitat was ultimately determined to be 'low'.

- Loss of habitat and habitat fragmentation due to vegetation clearing.
- Disturbance / displacement of fauna due to construction noise and activities of construction personnel on site.
- Disturbance / displacement of protected species due to construction noise and activities of construction personnel on site.
- Persecution and hunting of fauna (including protected species such as the baboon spider) by construction personnel.

Agricultural Potential:

Of note in this regard is that the soil profiles identified within the study area typically indicate relatively poor and shallow soil forms with poor agricultural potential. In addition, this Agricultural Potential is only theoretical, as the land is not available for agricultural use, being located in such close proximity to the KNP and occupied historically and currently as a research facility.

- Loss of potentially arable land due to construction activities.

Heritage:

Of note in this regard is the fact that the site is already partially occupied by the facility. Therefore, in addition to their being no identified heritage resources existing on site, it is unlikely that any heritage resources will be uncovered during the construction process.

- Damage to and / or destruction of archaeological, paleontological or historical artefacts unearthed during construction.

Socio-Economics:

Of note in this regard is that the residents of this environment are vulnerable to the influx of people seeking work, due to the rural lifestyle and proximity to the KNP and other conservation areas. In addition, the danger of fire is a significant concern in all natural areas.

- Short term employment opportunities in construction (positive impact).
- Opportunity for skills development and on-site training (positive impact).
- Increase in opportunistic crime as a result of an increase in the number of people in the area (as a result of influx of job seekers, and loitering and wandering construction workers).

- Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (as a result of loitering and wandering construction workers).
- Increased incidence of fires and the potential resulting loss of property, life and biodiversity (due to activities such as welding and cooking fires).
- Noise, dust and safety impacts for other road users in the area.

Aesthetics:

If note in this regard is the high Visual Absorption Capacity (VAC) of the bushveld environment, which goes far in the concealment of the facility from adjacent visual receptors (provided this vegetation is intact, in a natural state and not disturbed).

- Potential visual impact of construction activities sensitive visual receptors in close proximity to the site (specifically on nearby tourism operations and access roads).

4.2.2 INDIRECT IMPACTS

Socio-Economics:

Of note in this regard is that tourists expect and rely on a pleasing experience, which is easily threatened by physical, visual, olfactory and auditory intrusions that are not inherent to this natural environment.

- Impact on tourism income due to construction related disturbances (Orpen, Ngala Tented Camp and Mr Pirow).

Aesthetics:

Of note in this regard is that tourists expect and rely on a pleasing experience, which is easily threatened by visual, olfactory and auditory intrusions that are not inherent to this natural environment.

- Impact on tourism income due to visual impact of construction activities (Orpen, Ngala Tented Camp and Mr Pirow).

4.2.3 CUMULATIVE IMPACTS

Ground Water:

Of note in this regard is that no municipal water services are available in the area. Therefore all residents and users rely on the ground water supply for their lives and livelihood.

- Depletion of ground water resources due to accumulated use by increasing numbers of users.

Biodiversity (Flora and Fauna):

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale. In addition, no Red Listed flora species were identified on site, although 4 protected species were indeed found.

The presence of certain threatened and / or protected birds, snakes, lizards and spiders could be expected in this environment, but the sensitivity of the habitat was ultimately determined to be 'low'.

- Cumulative loss of habitat and habitat fragmentation due to vegetation clearing and alteration of habitat.

Socio-Economics:

- Unrepaired damage to roads could result in a long-term issue for road users in the area.

4.3 POTENTIAL IMPACTS RESULTING FROM THE OPERATIONAL PHASE

4.3.1 DIRECT IMPACTS

Ground Water:

Of note in this regard is that no municipal water supply services are available in the area. Therefore all residents and users rely on the ground water supply for their lives and livelihood.

- Depletion of ground water due to over use and waste.
- Contamination of ground water due to:
    - Animal faeces and urine (from boma's and open air facilities);
    - Sewage spills and leaks (from septic tanks and pipelines);
    - Leaks and spills from treated effluent in evaporation dams and grey water systems;
    - Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
    - Run-off from roads and hard surfaces;
    - Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents and fuels).

Surface Water:

Of note in this regard is that the Timbavati River bypasses the site just less than 1km to the northwest. A small tributary of the Timbavati River appears to originate within the site and drain due west. This drainage line lies beyond any existing or proposed development, however.

- Disturbance to the hydrological function of the drainage line due to storm water run-off.
- Sediment discharge into the drainage line due to storm water runoff from un-rehabilitated areas.
- Contamination of the surface water resource due to:
    - Animal faeces and urine (storm water runoff and wash water from boma's and open air facilities);

- Sewage spills and leaks (from septic tanks and pipelines);
- Leaks and spills from treated effluent in evaporation dams and grey water systems;
- Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
- Run-off from roads and hard surfaces;
- Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents, fuels);
- Litter and disposal of general waste.

Soils:

Of note in this regard is that the site is relatively flat, with an average gradient of 1:15, which ameliorates the risk of erosion due to runoff somewhat.

- Soil pollution due to:
  - Animal faeces and urine (from boma's and open air facilities);
  - Sewage spills and leaks (from septic tanks and pipelines);
  - Leaks and spills from treated effluent in evaporation dams and grey water systems;
  - Leaks and spills from hazardous waste streams (treatment tanks and pipelines as well as overflows from laboratories and clinics);
  - Spills and disposal of hazardous substances and hydrocarbons (from pesticides, herbicides solvents and fuels);
- Soil erosion due to uncontrolled storm water and run-off;
- Soil compaction due to trampling by animals within the enclosures. This in turn could lead to loss of vegetation and erosion.

Air:

Of note in this regard is that no inorganic substances, such as plastic containers, sharps etc. will be incinerated – only organic animal carcasses, bedding and faeces.

- Air pollution by emissions from the incinerator.
- Air pollution by emissions from operational vehicles, including waste removal contractors.

Biodiversity (Flora):

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale. In addition, no Red Listed species were identified on site, although 4 protected species were indeed found.

- Bush encroachment and invasion of poorly rehabilitated areas.
- Structural changes in the vegetation due to bulk feeders being held in the enclosures.
- Introduction of foreign vegetation species into the protected area through the importing of feedstocks (such as Lucerne).

Biodiversity (Fauna):

Of note in this regard is that much of the facility infrastructure already exists, and that the scale of the construction works will be relatively limited in scale. The presence of certain threatened and / or protected birds, snakes, lizards and spiders could be expected in this environment, but the sensitivity of the habitat was ultimately determined to be 'low'.

In addition, an Independent Opinion on the Potential Disease risk of the proposed upgrades concluded that the project operator has an understanding of disease risk management. Therefore, the potential disease risk will be limited for the project expansion if the required mitigation steps are taken, many of which are already in place.

- Disturbance / displacement of fauna due to operational activities and personnel present on site.
- Disturbance / displacement of protected species due to operational activities and personnel present on site.
- Animal mortality / fatality (including protected species such as the baboon spider) due to daily operations and facility vehicles (including delivery and waste collection vehicles).
- Potential spread of pathogens under investigation within and beyond the facility.
- Disease risk to fauna in adjacent areas.

Land-Use and Infrastructure:

Of note in this regard is that the facility fell into disrepair, and is now in process of being upgraded and improved.

- Upgrade of the facility and infrastructure of the HHWRS (positive impact).

Socio-Economics:

Again, the Independent Opinion on the Potential Disease risk of the proposed upgrades concluded that the project operator has an understanding of disease risk management. Therefore, the potential disease risk will be limited for the project expansion if the required mitigation steps are taken, many of which are already in place.

Regarding the incinerator, no inorganic substances, such as plastic containers, sharps etc. will be incinerated – only organic animal carcasses, bedding and faeces. Also, the evaporation ponds will not be used as a primary treatment system, but will follow the biological treatment of Hazardous liquid waste emanating from laboratories, clinics etc.

- Long term employment opportunities at the facility (positive impact).
- The establishment of a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities (positive impact).
- Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (as a result of staff and visitors to the facility).
- Increased incidence of fires and the potential resulting loss of property, life and biodiversity (due to the increase in operations and activities on site).

- Olfactory impact, especially on nearby tourism operations, as a result of:
    - Incineration of animal waste in the incinerator.
    - Animal faeces and
    - The water treatment/evaporation ponds.
- Noise impact, especially on nearby tourism operations, as a result of:
    - concentrations of animals in boma's;
    - staff operating the facility and on site vehicles;
    - loud music and voices from off duty staff at the staff accommodation and
    - barking dogs.
- Disease risk to humans.

Aesthetics:

If note in this regard is the high Visual Absorption Capacity (VAC) of the bushveld environment, which goes far in the concealment of the facility from adjacent visual receptors (provided this vegetation is intact, in a natural state and not disturbed).

- The visibility of the facility to, and potential visual impact on, observers travelling along the R531, a main tourist access road to the Kruger National Park and Manyeleti Nature Reserve.
- The visibility of the facility to, and potential visual impact on tourist camps and lodges within the study area.
- The potential visual impact of ancillary infrastructure (i.e. smoke stack) and smoke emissions on observers in close proximity to the proposed facility.
- The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.

4.3.2 INDIRECT IMPACTS

Socio-Economics:

Of note in this regard is that tourists expect and rely on a pleasing experience, which is easily threatened by physical, visual, olfactory and auditory intrusions that are not inherent to this natural environment.

- The support of the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas (positive impact).
- Assistance with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases (positive impact).
- The provision of information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM (positive impact).
- Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to visual impacts (including lighting) of the facility.
- Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to odours emanating from the facility due to:
    - Incineration of animal waste in the incinerator;

    - The accumulation of animal faeces and
    - The water treatment/evaporation ponds.
- An increase in blowflies as a result of the concentration of animals and the accumulation of faeces. Linked to this is the spread of pathogens and bacteria by these flies.

Aesthetics:

If note in this regard is the high Visual Absorption Capacity (VAC) of the bushveld environment, which goes far in the concealment of the facility from adjacent visual receptors (provided this vegetation is intact, in a natural state and not disturbed).

- The potential visual impact of the facility on the visual character of the landscape and sense of place of the region.

4.3.3 CUMULATIVE IMPACTS

Ground Water:

Of note in this regard is that no municipal water services are available in the area. Therefore all residents and users rely on the ground water supply for their lives and livelihood.

- Depletion of ground water resources due to accumulated use by increasing numbers of users.

Aesthetics:

Of note in this regard is that tourists expect and rely on a pleasing experience, which is easily threatened by visual, olfactory and auditory intrusions that are not inherent to this natural environment.

- Cumulative visual impact of lighting as a result of additional development within a greater conservation area (i.e. specifically on nearby tourism operations and access roads).

4.4 POTENTIAL IMPACTS RESULTING FROM THE DECOMMISSIONING PHASE

It is not expected that the Hans Hoheisen Wildlife Research Station will be decommissioned, therefore no direct, indirect or cumulative impacts are anticipated.

5. ENVIRONMENTAL IMPACT ASSESSMENT

The aim of the EIA will be as follows:

- Provide additional, detailed information about the proposed development and the receiving environment (as recommended);
- Provide an overall assessment of the receiving environment;
- Assess the potentially significant environmental impacts (direct, indirect and cumulative) anticipated as a result of the proposed development. This will include

impacts associated with the Construction and Operational phases of the proposed development;
- Identify and recommend appropriate mitigation for potentially significant environmental impacts; and
- Undertake a fully inclusive public participation process to ensure that stakeholders and I&AP's are afforded the opportunity to participate, and to ensure that their issues and concerns are accurately recorded and addressed.

The assessment of impacts will adhere to the minimum requirements in the EIA Regulations, 2010, and take applicable official guidelines into account. The issues raised by interested and affected parties have also been addressed in the assessment of impacts.

Authority consultation will continue throughout the EIA process, and the identified feasible project alternatives (including the 'no-project' alternative) will be assessed.

5.1 METHODOLOGY FOR ASSESSING IMPACTS

The methodology for the assessment of potential environmental impacts states the nature of the potential impact (i.e. a description of the cause of the impact, the affect and how it will be affected) and includes a table quantifying the impact according to the following criteria:

Extent (how far the impact extends):

- **(1) Very low:** within the site only
- **(2) Low:** within the local neighbourhoods
- **(3) Medium:** within the region
- **(4) High:** Nationally
- **(5) Very high:** Internationally

Duration (the timeframe over which the effects of the impact will be felt):

- (1) Very short: 0-1 years
- (2) Short: 2-5 years
- **(3) Medium:** 5-15 years
- **(4) Long:** >15 years
- (5) Permanent

Magnitude (the severity or size of the impact):

- (0) None
- (2) Minor
- (4) Low
- (6) Moderate

- (8) High
- (10) Very High

Probability (the likelihood of the impact actually occurring):

- **(1) Very improbable:** Less than 20% sure of the likelihood of an impact occurring
- **(2) Improbable:** 20-40% sure of the likelihood of an impact occurring
- **(3) Probable:** 40-60% sure of the likelihood of an impact occurring
- **(4) Highly probable:** 60-80% sure of the likelihood of that impact occurring
- **(5) Definite:** More than 80% sure of the likelihood of that impact occurring

The **significance** of the potential visual impact is determined by the sum of the individual scores for extent, duration and magnitude multiplied by the **probability** of the impact occurring i.e. **significance = (extent + duration + magnitude) x probability**

The significance rating scale is interpreted as follows:

- **(2-12) Negligible**: Impact would be of a very low order. In the case of negative impacts, almost no mitigation and or remedial activity would be needed, and any minor steps, which might be needed, would be easy, cheap, and simple. In the case of positive impacts, alternative means would almost all likely be better, in one or a number of ways, than this means of achieving the benefit
- **(13-30) Low:** Impact would be of a low order and with little real effect. In the case of negative impacts, mitigation and / or remedial activity would be either easily achieved or little would be required, or both. In case of positive impacts alternative means for achieving this benefit would likely be easier, cheaper, more effective, less time-consuming, or some combination of these
- **(31-56) Moderate**: Impact would be real but not substantial. In the case of negative impacts, mitigation and / or remedial activity would be both feasible and fairly easily possible. In the case of positive impacts, other means of achieving these benefits would be about equal in time, cost, and effort
- **(57-90) High**: Impacts of a substantial order. In the case of negative impacts, mitigation and / or remedial activity would be feasible but difficult, expensive, time-consuming or some combination of these. In the case of positive impacts, other means of achieving this benefit would be feasible, but these would be more difficult, expensive, time-consuming or some combination of these
- **(91-100) Very High:** Of the highest order possible. In the case of negative impacts, there would be no possible mitigation and / or remedial activity and in the case of positive impacts, there is no real alternative to achieving the benefit.

5.2 ENVIRONMENTAL IMPACT ASSESSMENT: PLANNING PHASE

The significance of direct, indirect and cumulative impacts of the identified issues (refer to section 3) will be assessed.

Table 6: PLANNING PHASE IMPACTS											
POTENTIAL IMPACTS:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance	PROPOSED MITIGATION:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance
ALTERNATIVE 1: PREFERRED ALTERNATIVE											
DIRECT IMPACTS											
None.	5										
INDIRECT IMPACTS											
None.	5										
CUMULATIVE IMPACTS											
None.	5										

NO-GO ALTERNATIVE											
DIRECT IMPACTS											
None.	5										
INDIRECT IMPACTS											
None.	5										
CUMULATIVE IMPACTS											
None.	5										

5.3 ENVIRONMENTAL IMPACT ASSESSMENT: CONSTRUCTION PHASE

Table 7: CONSTRUCTION PHASE IMPACTS											
POTENTIAL IMPACTS:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance	PROPOSED MITIGATION:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance
ALTERNATIVE 1: PREFERRED ALTERNATIVE											
DIRECT IMPACTS											
Ground Water											
Depletion of ground water due to over use and waste.	3	2	6	4	44 M	• Register boreholes to be used for potable water extraction as per DWA requirements. • Monitor the consumption of water on a monthly basis and keep up to date records. • Ensure that all construction personnel are trained in water wise principles, and that they practise prudent use of water during the Construction phase.	3	2	4	2	18 L
Contamination of ground water due to disposal or discharge of sewage	3	2	6	3	33 M	• Ensure that sufficient numbers of mobile toilets are available on site. • Ensure that mobile toilets are maintained in a sanitary and operational state.	3	2	4	2	18 L
Contamination of ground water by spills and disposal of hazardous substances and hydrocarbons.	3	2	4	3	27 L	• Ensure that all hazardous substances (chemicals, oils, etc.) are stored in locked stores on bunded surfaces. • Ensure that all hazardous substances are used and handled by qualified personnel on bunded surfaces.	3	2	2	2	14 L

						• Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste. • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.					
Surface Water												
Disturbance to the hydrological function of the drainage line due to storm water run-off.	3	2	4	2	18 L	• Establish a buffer of 100m along all watercourses on site. • No construction activities may take place within buffer areas. Clearly demarcate the construction work areas and prevent pedestrian and vehicular access into buffer areas.	3	2	2	1	7 N
Sediment discharge into the drainage line due to storm water runoff from denuded /	3	2	4	2	18	• Ecologically-sound storm water management principles, as set out in the Environmental	3	2	2	1	7

construction areas.					L	Management Programme (EMPr), must be adhered to during the construction phase. • The protective buffer around the non-perennial rivers must be respected as it acts as a trap for sediment and contaminants from the construction area. • Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. • Ensure that the least amount of vegetation is removed ahead of construction. • Ensure that measures are in place to control the flow of excess water so that it does not impact on the surface vegetation. • Do not excavate until all required materials / services are on-site, to facilitate immediate laying of services / construction of subsurface infrastructure; • Preferably undertake clearing activities during the dry season in order to prevent erosion and siltation; • Compact backfilled trenches to prevent erosion; • Monitor backfilled areas for erosion and remediate as required; • Runoff from roads must be managed to avoid erosion and pollution problems. • Repair all erosion damage as soon as possible. Do not allow erosion to develop on a large scale before effecting repairs. • Prevent storm water or contaminated water directly entering any watercourse. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation.					N

						• Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required. • Rehabilitation plans must be drawn up for all disturbed areas, and must be approved by the ECO. • Rehabilitation must be implemented immediately upon completion of construction.					
Contamination of the surface water resource due to disposal or discharge of sewage.	3	2	4	3	27 L	• Ensure that sufficient numbers of mobile toilets are available on site. • Ensure that mobile toilets are maintained in a sanitary and operational state.	3	2	2	2	14 L
Contamination of the surface water resource through disposal of construction waste and litter.	3	2	4	3	27 L	• Ensure that all personnel are familiar with waste management requirements on site; • Collect and sort-at-source the different types of waste (recyclables, inert rubble, hazardous and non-recyclable general waste) by placing receptacles at specific points throughout the construction site; • Ensure that personnel make use of the receptacles provided; • Empty receptacles for disposal at least once per week, but more often if required; • Dispose of solid waste at the nearest, applicably licensed recycling centre, salvage yard or landfill site; • Undertake weekly site clean-up operations to maintain the site in a neat and litter-free state.	3	2	2	2	14 L
Contamination of the surface water resource	3	2	4	3	2	• Ensure that all hazardous substances (chemicals, oils,	3	2	2	2	1

by spills and disposal of hazardous substances and hydrocarbons.					7 L	etc.) are stored in locked stores on bunded surfaces. • Ensure that all hazardous substances are used and handled by qualified personnel on bunded surfaces. • Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.					4 L
Contamination of the surface water resource by storm water runoff.	3	2	4	3	27 L	• Ecologically-sound storm water management principles, as set out in the Environmental Management Programme (EMPr), must be adhered to during the construction phase. • The protective buffer around the non-perennial rivers must be respected as it acts as a trap for sediment and contaminants from the construction area.	3	2	2	2	14 L

						• Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover. • Ensure that the least amount of vegetation is removed ahead of construction. • Ensure that measures are in place to control the flow of excess water so that it does not impact on the surface vegetation. • Runoff from roads must be managed to avoid erosion and pollution problems. • Repair all erosion damage as soon as possible. Do not allow erosion to develop on a large scale before effecting repairs. • Prevent storm water or contaminated water directly entering any watercourse. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas.					
Contamination of the surface water resource by grey water, cement slurry and wash water discharge.	3	2	4	3	27 L	• Ensure that concrete and cement works are undertaken in specified areas only. • Install a drainage diversion system to divert clean runoff around areas of potential pollution, e.g. batching area, workshops, etc. • Direct polluted runoff and waste water emanating from the construction site into a collection system (e.g. sump, attenuation dam, PVC porta-ponds, etc.) for treatment or collection and disposal. • Prevent storm water or contaminated water directly entering any watercourse.	3	2	2	2	14 L
Soils											

Soil pollution due to disposal and discharge of sewage.	2	2	6	3	30 L	• Ensure that sufficient numbers of mobile toilets are available on site. • Ensure that mobile toilets are maintained in a sanitary and operational state.	2	2	4	2	16 L
Soil pollution by spills and disposal of hazardous substances and hydrocarbons.	2	2	4	3	30 L	• Ensure that all hazardous substances (chemicals, oils, etc.) are stored in locked stores on bunded surfaces. • Ensure that all hazardous substances are used and handled by qualified personnel on bunded surfaces. • Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.	2	2	2	2	12 N
Soil pollution due to grey water, cement slurry and wash water discharge	2	2	4	3	24	• Ensure that concrete and cement works are	2	2	2	2	12

					L	undertaken in specified areas only. • Install a drainage diversion system to divert clean runoff around areas of potential pollution, e.g. batching area, workshops, etc. • Direct polluted runoff and waste water emanating from the construction site into a collection system (e.g. sump, attenuation dam, PVC porta-ponds, etc.) for treatment or collection and disposal. • Prevent storm water or contaminated water directly entering any watercourse.					N
Soil erosion due to the removal of stabilising vegetation during construction	2	3	6	3	3 3 M	• Ecologically-sound storm water management principles, as set out in the Environmental Management Programme (EMPr), must be adhered to during the construction phase. • Plan construction so as to leave as much of the natural vegetation intact as possible. • A perimeter fence or suitable perimeter demarcation must be erected around the construction works area to prevent access to sensitive environs. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • Maintain site demarcations in position until the cessation of construction work. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Where possible, required equipment and infrastructure	2	3	4	2	1 8 L

						should be placed within existing disturbed areas. • Ensure that the least amount of vegetation is removed ahead of construction. • No vegetation outside of the demarcated construction areas may be removed. • Do not excavate until all required materials / services are on-site, to facilitate immediate laying of services / construction of subsurface infrastructure; • Preferably undertake clearing activities during the dry season in order to prevent erosion and siltation; • Compact backfilled trenches to prevent erosion; • Monitor backfilled areas for erosion and remediate as required; • Runoff from roads must be managed to avoid erosion and pollution problems. • Repair all erosion damage as soon as possible. Do not allow erosion to develop on a large scale before effecting repairs. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation. • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required. • Rehabilitation plans must be drawn up for all disturbed areas, and must be approved by the ECO. • Rehabilitation must be implemented immediately upon					

						completion of construction.					
Soil compaction due to the movement of heavy machinery and vehicles across the site. This in turn could lead to habitat modification and erosion	2	3	6	3	3 3 M	• A perimeter fence or suitable perimeter demarcation must be erected around the construction works area to prevent access to sensitive environs. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • Maintain site demarcations in position until the cessation of construction work. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Where possible, required equipment and infrastructure should be placed within existing disturbed areas. • Conserve topsoil though pre-emptive stripping and stockpiling prior to the commencement of works in any area, pending reapplication during rehabilitation; • Do not disturb, compact or disrupt topsoil stockpiles, and ensure that nothing is stored on them;	2	3	4	2	1 8 L
Air											
Air pollution by emissions from construction vehicles and equipment.	2	2	4	4	3 2 M	• Maintain site vehicles and equipment in an acceptable state of repair (these may not smoke and must comply with SABS standards). • All vehicles must be road-worthy and regularly serviced, and drivers must be qualified and made aware of the need for strict speed limits.	2	2	2	4	2 4 L

Dust liberated by general construction activities and movement of construction vehicles to the site and over the site.	2	2	6	4	40 M	• Construction vehicles transporting materials to and from the construction site must be covered to reduce the formation of dust. • Maintain all site roads and repair these as required. • Regularly spray construction and haul roads with water to reduce dust. • Vegetate or cover long-term stockpiles of soil and fine spoil material to minimise the sources of dust pollution. • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful.	2	2	4	3	24 L
Smoke from fires used for cooking and heating as well as from uncontrolled fires.	3	2	6	3	33 M	• No open fires will be allowed anywhere on the site; • No incineration or burning of waste is permitted on the site; • Provide personnel with gas for cooking in designated and safe areas. • A firebreak should be established around the perimeter of the site prior to the commencement of the construction phase. • The contractor should contact all of the adjacent farm owners prior to the commencement of the construction phase and ensure that he/she has the contact numbers so that they can be contacted in the event of a fire. • Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. • Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind	3	2	4	3	27 L

						conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, winter months; • Contractor to provide adequate fire fighting equipment on-site; • Contractor to provide fire-fighting training to selected construction staff.					
Biodiversity (Flora)												
Removal of exotic and invasive species (positive impact)	1	3	2	4	24 L	• No mitigation.	1	3	2	4	24 L	
Removal and destruction of vegetation	1	3	4	4	32 M	• Plan construction so as to leave as much of the natural vegetation intact as possible. • A perimeter fence or suitable perimeter demarcation must be erected around the construction works area to prevent access to sensitive environs. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • Maintain site demarcations in position until the cessation of construction work. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Where possible, required equipment and infrastructure should be placed within existing disturbed areas. • Ensure that the least amount of vegetation is removed	1	3	2	3	18 L	

						ahead of construction. • No vegetation outside of the demarcated construction areas may be removed. • Only wood from trees felled as part of the construction contract may be sold / made available for firewood. • No large tree may be felled without the permission of the ECO. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation. • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required. • Rehabilitation plans must be drawn up for all disturbed areas, and must be approved by the ECO. • Rehabilitation must be implemented immediately upon completion of construction.					
Removal of protected plant species	3	4	6	4	52 M	• Protected species occurring within the disturbed footprint of the facility (specifically *Combretum imberbe, Balanites maughamii, Philenoptera violacea* and *Sclerocarya birrea* subsp. *Caffra)* must be preserved / transplanted wherever possible. • A vegetation / tree specialist should walk the final site layout to identify and mark all protected trees/plants that could be impacted upon prior to the start of any construction activities. • Draw up a plan (during project planning) indicating the mapped positions of vegetation specimens to be	3	4	4	3	33 M

						conserved and which should be removed and replaced. Avoid the requirement to remove protected trees wherever possible. • Demarcate specimens to be retained with danger tape and / or fencing as required. This barrier to be at least 2m from the stem of the specimen. • Ensure that all conserved species and specimens are suitably protected for the duration of the construction phase. • No protected trees or plants may be removed without the relevant permits from the local authority. • Implement fines for the damage or destruction of marked and protected specimens. It is the contractor's responsibility to ensure that these are retained. • Workers may not tamper or remove flora and neither may anyone collect seed from the plants without permission from the local authority. • Implement a Plant Rescue Plan for protected species within the construction areas. Where feasible, these should be removed by a suitably qualified specialist and replanted as part of vegetation rehabilitation plan.					
Bush encroachment and invasion of denuded areas	1	3	6	4	40 M	• A rehabilitation plan must be implemented that will restore natural vegetation in disturbed areas beyond the footprint of the infrastructure to what it was prior to construction. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation. • Once construction is complete, obsolete roads should be rehabilitated by breaking the surface crust and erecting earth embankments to prevent erosion, while vegetation should be re-established.	1	3	2	2	12 N

						• Rehabilitation must be implemented immediately upon completion of construction. • Monitor backfilled areas for erosion and remediate as required; • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required; • Alien invasive species should be removed prior to construction to contain the spread of seeds in disturbed soils. • Draw up a management and monitoring programme for invasive species detailing actions to prevent the establishment of invasive plants of site during construction. • Implement management actions according to the management plan. • All alien seedlings and saplings must be removed as they emerge or become evident. • Manual / mechanical removal is preferred to chemical control. • All construction vehicles and equipment, as well as construction material should be free of plant material. Therefore, all equipment and vehicles should be thoroughly cleaned prior to access on to the construction site or general study area.					
Biodiversity (Fauna)											

Loss of habitat and habitat fragmentation due to vegetation clearing.	1	3	4	2	16 L	• Plan construction so as to leave as much of the natural vegetation intact as possible. • A perimeter fence or suitable perimeter demarcation must be erected around the construction works area to prevent access to sensitive environs. • Where possible, required equipment and infrastructure should be placed within existing disturbed areas. • Ensure that the least amount of vegetation is removed ahead of construction. • No vegetation outside of the demarcated construction areas may be removed. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation. • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required. • Rehabilitation plans must be drawn up for all disturbed areas, and must be approved by the ECO. • Rehabilitation must be implemented immediately upon completion of construction.	1	3	2	2	12 N
Disturbance / displacement of fauna due to construction noise and activities of construction personnel on site.	2	2	4	4	32 M	• Protected species occurring within the disturbed footprint of the facility (specifically the baboon spider, which is known to occur on the site) must be protected and relocated if necessary, whenever encountered on the site. • A faunal specialist should walk the final site layout to identify all possible burrows that could be impacted	2	2	4	3	24 L
Disturbance / displacement of protected species due to construction noise and activities of construction personnel on site.	2	2	4	4	32 M		2	2	4	3	24 L

						upon. Where possible, relocate specimens to outside of the development areas. • Ensure that construction personnel are briefed on the potential occurrence of protected faunal species, what they look like, and where they are likely to be found. Personnel are to be instructed that these species are not to be hurt or destroyed if encountered. This applies specifically to the snakes, lizards and spiders (baboon spider), as these are often perceived to be vermin and pests. • Personnel must be instructed to report the presence of protected species to the Contractor so that arrangements may be made to relocate these to adjacent bush areas. • Develop a procedure for dealing with animals (including protected species) encountered on the site. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • Maintain site demarcations in position until the cessation of construction work. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Speed control measures must be implemented on site and in the surrounding area to reduce air pollution and animal mortality. • Construction activities should be limited to daylight hours and vehicles should remain on the designated					

						roads at all times.					
Persecution and hunting of fauna (including protected species such as the baboon spider) by construction personnel.	2	2	6	4	40 M	• Protected species occurring within the disturbed footprint of the facility (specifically the baboon spider, which is known to occur on the site) must be protected and relocated if necessary, whenever encountered on the site. • A faunal specialist should walk the final site layout to identify all possible burrows that could be impacted upon. Where possible, relocate specimens to outside of the development areas. • Ensure that construction personnel are briefed on the potential occurrence of protected faunal species, what they look like, and where they are likely to be found. Personnel are to be instructed that these species are not to be hurt or destroyed if encountered. This applies specifically to the snakes, lizards and spiders (baboon spider), as these are often perceived to be vermin and pests. • Personnel must be instructed to report the presence of protected species to the Contractor so that arrangements may be made to relocate these to adjacent bush areas. • Develop a procedure for dealing with animals (including protected species) encountered on the site. • Develop a procedure for dealing with dangerous animals and vermin. Where necessary, call in professionals to remove the animals. • Ensure that all personnel are aware of what the procedures for dealing with animals are. It is the contractor's responsibility to ensure that proper procedures are followed.	2	2	2	2	12 N

						• Construction personnel should be encouraged not to harm any wildlife. • Pets and livestock are not allowed on site. If pets are to be allowed on site, they should be isolated from the general wildlife and properly controlled.					
Agricultural Potential											
Loss of potentially arable land due to construction activities.	1	3	4	4	32 M	• Ecologically-sound storm water management principles, as set out in the Environmental Management Programme (EMPr), must be adhered to during the construction phase. • Plan construction so as to leave as much of the natural vegetation intact as possible. • A perimeter fence or suitable perimeter demarcation must be erected around the construction works area to prevent access to sensitive environs. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundary of the construction area. • Maintain site demarcations in position until the cessation of construction work. • Formalise access roads and make use of existing roads and tracks where feasible, rather than creating new routes through naturally vegetated areas. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Where possible, required equipment and infrastructure should be placed within existing disturbed areas. • Ensure that the least amount of vegetation is removed ahead of construction.	1	3	2	3	18 L

						• Conserve topsoil though pre-emptive stripping and stockpiling prior to the commencement of works in any area, pending reapplication during rehabilitation; • Do not disturb, compact or disrupt topsoil stockpiles, and ensure that nothing is stored on them; • No vegetation outside of the demarcated construction areas may be removed. • Do not excavate until all required materials / services are on-site, to facilitate immediate laying of services / construction of subsurface infrastructure; • Preferably undertake clearing activities during the dry season in order to prevent erosion and siltation; • Compact backfilled trenches to prevent erosion; • Monitor backfilled areas for erosion and remediate as required; • Runoff from roads must be managed to avoid erosion and pollution problems. • Repair all erosion damage as soon as possible. Do not allow erosion to develop on a large scale before effecting repairs. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas. • Ensure that the construction site is rehabilitated using appropriate indigenous vegetation. • Progressively rehabilitate (rip, scarify and plant) areas as soon as works have been completed. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required. • Rehabilitation plans must be drawn up for all disturbed					

						areas, and must be approved by the ECO. • Rehabilitation must be implemented immediately upon completion of construction.						
Heritage												
Damage to and/or destruction of archaeological, paleontological or historical artefacts unearthed during construction.	1	5	2	2	16 L	• If archaeological or historical 'chance finds' are encountered, then work in the area must be halted, and the heritage specialist will assess the situation and make recommendations.	1	5	2	1	8 N
Socio Economics												
Short term employment opportunities in construction (positive impact)	3	4	4	4	44 M	• No mitigation	3	4	4	4	44 M
Opportunity for skills development and on-site training (positive impact)	3	4	4	4	44 M	• No mitigation	3	4	4	4	44 M
Increase in opportunistic crime as a result of an increase in the number of people in the area (i.e. construction personnel)	2	2	6	3	30 L	• The contractor must develop a Code of Conduct for the construction phase. The code should identify what types of behaviour and activities by construction workers are not permitted. • The contractor must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft, poaching and trespassing on adjacent farms; • Construction workers that breach the code of good conduct should be dismissed. All dismissals must comply with the South African labour legislation. • The contractor must implement a policy that no	2	2	4	3	24 L

						employment will be available at the gate. • Where reasonable and practical, local contractors must be appointed and implement a 'locals first' policy, especially for semi and low-skilled job categories. • The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.					
Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (no fences exist between conservation areas and the National Park)	2	2	2	3	18 L	• The movement of construction workers on and off the site must be closely managed and monitored by the contractor. • The contractor is responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • The contractor must make the necessary arrangements for allowing workers from outside the area to return home over weekends. • The housing of construction workers on the site must be limited to security personnel. • Lines of communication must be established and maintained with local landowners so that issues and problems arising on the site and as a result of construction workers may be reported, discussed and resolved.	2	2	2	2	12 N

Increased incidence of fires and the potential resulting loss of property, life and biodiversity	3	2	8	4	52 M	• No open fires will be allowed anywhere on the site; • No incineration or burning of waste is permitted on the site; • Provide personnel with gas for cooking in designated and safe areas. • A firebreak should be established around the perimeter of the site prior to the commencement of the construction phase. • The contractor should contact all of the adjacent farm owners prior to the commencement of the construction phase and ensure that he/she has the contact numbers so that they can be contacted in the event of a fire. • Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are properly managed and are confined to areas where the risk of fires has been reduced. • Measures to reduce the risk of fires include clearing working areas and avoiding working in high wind conditions when the risk of fires is greater. In this regard special care should be taken during the high risk dry, winter months; • Contractor to provide adequate fire fighting equipment on-site.	3	2	6	3	33 M
Noise, dust and safety impacts for other road users in the area	3	2	4	4	36 M	• Maintain site vehicles and equipment in an acceptable state of repair (these may not smoke and must comply with SABS standards). • Construction vehicles transporting materials to and from the construction site must be covered to reduce the formation of dust. • Maintain all site roads and repair these as required. • Regularly spray construction and haul roads with water	3	2	2	3	21 L

						to reduce dust. • All vehicles must be road-worthy and regularly serviced, and drivers must be qualified and made aware of need for strict speed limits. • The movement of construction vehicles should be confined to the period of 08h00 and 17h00. This is aimed at reducing the potential noise impacts on local tourism operations; • The contractor must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired before the completion of the construction phase. The costs associated with the repair must be borne by the contractor.					
Aesthetic											
Potential visual impact of construction activities sensitive visual receptors in close proximity to the site (i.e. specifically on nearby tourism operations and access roads)	2	2	6	4	40 M	• Ensure that vegetation is not unnecessarily cleared or removed during the construction period. • Reduce the construction period through careful logistical planning and productive implementation of resources. • Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible. • Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads. • Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities. • Reduce and control construction dust through the use of approved dust suppression techniques as and when	2	2	4	3	24 L

						required (i.e. whenever dust becomes apparent). • Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting. • Rehabilitate all disturbed areas, construction areas, roads, slopes etc. immediately after the completion of construction works.					
INDIRECT IMPACTS												
Socio-Economics												
Impact on tourism income due to construction related disturbances (Orpen, Ngala Tented Camp and Mr Pirow).	2	3	4	3	27 L	• As per the direct impact mitigation measures.	2	3	2	2	14 L
Aesthetic												
Impact on tourism income due to visual impact of construction activities (Orpen, Ngala Tented Camp and Mr Pirow).	2	3	4	3	27 L	• As per the direct impact mitigation measures.	2	3	2	2	14 L
CUMULATIVE IMPACTS												
Ground Water												
Depletion of ground water resources due to accumulated use by increasing numbers of users.	3	2	6	4	44 M	• As per the direct impact mitigation measures.	3	2	4	2	18 L
Biodiversity (Flora and Fauna)												
Cumulative loss of habitat and habitat fragmentation due to vegetation clearing and alteration of habitat.	1	3	4	2	16 L	• As per the direct impact mitigation measures.	1	3	2	2	12 N

Socio-Economics												
Unrepaired damage to roads could result in a long-term issue for road users in the area.	3	3	6	3	36 M	• As per the direct impact mitigation measures.	3	3	4	2	20 L	

NO-GO ALTERNATIVE												
DIRECT IMPACTS												
None.												
INDIRECT IMPACTS												
None.												
CUMULATIVE IMPACTS												
None.												

5.4 ENVIRONMENTAL IMPACT ASSESSMENT: OPERATIONAL PHASE

Table 8: OPERATIONALPHASE IMPACTS											
POTENTIAL IMPACTS:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance	PROPOSED MITIGATION:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance
ALTERNATIVE 1: PREFERRED ALTERNATIVE											
DIRECT IMPACTS											

Ground Water											
Depletion of ground water due to over use and waste.	3	4	6	4	52 M	• Register boreholes to be used for potable water extraction as per DWA requirements. • Apply for a Water Use Licence for the abstraction of the operational requirement of water as per DWA requirements. • Ensure that water storage facilities are designed according to the demand requirements. • Monitor the consumption of water on a monthly basis and keep up to date records. • Ensure that consumption does not exceed permitted quantities. Take action to reduce consumption if necessary. • Install a leak detection system, and promptly attend to leaks as required. • Make use of water saving devices and technologies wherever possible. Measures include the specification of low flow shower heads and taps, and the use of grey water from ablutions and tea kitchens for road wetting and irrigation in selected areas. • Ensure that all facility staff is trained in water wise principles, and that they practise prudent use of water at all times.	3	4	4	2	22 L
Contamination of ground water due to animal faeces and urine (boma's and open air facilities).	3	4	6	3	39 M	• Install cut off drains along boma's, animal enclosures and pens to ensure that storm water is diverted around these areas, and that runoff originating from within, remains inside. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal	3	4	4	2	22 L

						enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in the proper manner (i.e. incineration) as soon as possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures. • Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. • Establish test boreholes within a 2km radius at the onset of operations and test these to establish baseline data. • Undertake quality testing yearly, at the same time of year and keep up to date records. • Implement remedial action should this be required.					
Contamination of ground water due to sewage spills and leaks.	3	4	6	2	26 L	• Ensure that facility sewage system is designed according to the demand requirements. • Ensure that the facility sewage system is not overloaded, and that it functions within its design capacity. • Take action to reduce output or increase capacity if necessary. • Ensure that the facility sewage system is maintained in a sanitary and operational state.	3	4	4	1	11 N

						• Regularly check the facility sewage system (preferably monthly) to ensure it is functionally sound. If necessary, employ the services of a professional, suitably qualified independent body. • Implement repairs immediately upon detection of a failure or fault. • Replace old, inadequate and failing equipment as required. • Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. • Establish test boreholes within a 2km radius at the onset of operations and test these to establish baseline data. • Undertake quality testing yearly, at the same time of year and keep up to date records. • Implement remedial action should this be required.					
Contamination of ground water due to leaks and spills from treated effluent in evaporative dams and grey water.	3	4	6	2	26 L	• Ensure that the effluent treatment system is designed according to the demand requirements. • Ensure that the effluent treatment system, including evaporation dams, are not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the effluent treatment system is maintained in a sanitary and operational state. • Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound.	3	4	4	1	11 N

						• Undertake monthly wastewater monitoring to ensure that the output quality of the water complies with the minimum standards as prescribed by DWA. • Wastewater to be used for irrigation must comply with the following standards: • electrical conductivity does not exceed 200 milliSiemens per metre (mS/m) • pH is not less than 6 or more than 9 pH units • Chemical Oxygen Demand (COD) does not exceed 400mg/l after removal of algae • Faecal coliforms do not exceed 1000 000 per 100 ml • Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. • Establish test boreholes within a 2km radius at the onset of operations and test these to establish baseline data. • Undertake quality testing yearly, at the same time of year and keep up to date records. • Implement remedial action should this be required.					
Contamination of ground water due to leaks and spills from hazardous waste streams.	3	4	8	2	30 L	• Ensure that the treatment system for hazardous liquid waste is designed according to the demand requirements. • The hazardous liquid waste treatment system should comprise of two holding tanks linked in series. The second tank is a backup to the first, and both back up to a drain system that flows back up to the lab when the tanks are full. • Ensure that the treatment system for hazardous liquid	3	4	4	1	11 N

						waste is not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the treatment system for hazardous liquid waste is maintained in a sanitary and operational state. • Regularly check the treatment system for hazardous liquid waste (preferably monthly) to ensure that the system is functionally sound. • Develop an Operational and Maintenance Program for liquid laboratory waste, addressing day to day maintenance and management actions, as well as emergency procedures. • Develop an Operational Waste Management & Overflow Response Plan and reporting procedure to addresses mandatory provisions that must be set in place and implemented during day to day operation of, or should any accidental or other malfunction of the system result in spillage and or pollution of the environment. • Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. • Establish test boreholes within a 2km radius at the onset of operations and test these to establish baseline data. • Undertake quality testing yearly, at the same time of year and keep up to date records. • Implement remedial action should this be required.					
Contamination of ground water due to run-off from roads and hard surface.	3	4	4	3	33	• Maintain the storm water management system for the	3	4	2	2	18

					M	facility on an on-going basis and ensure that this is always in good working order. • Runoff from roads must be managed to avoid erosion and pollution problems. • Maintain all buffer zones to trap sediments.					L
Contamination of ground water due to pesticides and herbicides (ground maintenance), toxins and hydrocarbons (equipment and facilities maintenance).	3	4	4	3	3 3 M	• Develop operational guidelines for implementing Clean Technologies (solvents, detergents fertilisers and pesticides). • Ensure that all solvents, detergents, chemicals, fuels etc. are stored in locked stores on bunded surfaces. • Ensure that all potentially hazardous substances are used and handled by qualified personnel only. • Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous	3	4	2	2	1 8 L

						substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.						
Surface Water												
Disturbance to the hydrological function of the drainage line due to storm water run-off.	3	4	4	2	22 L	• Maintain all protective buffers as they act as a trap for sediment and contaminants. • Maintain the storm water management system for the facility on an on-going basis and ensure that this is always in good working order, and not blocked or in need of repair. • Runoff from roads must be managed to avoid erosion and pollution problems. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas. • Monitor all rehabilitated areas for at least a year following the completion of rehabilitation works for failure of vegetation to establish and / or erosion. Immediately implement remedial measures as required. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Regularly inspect all rehabilitated areas and implement remedial measures as required.	3	4	2	1	9 N
Sediment discharge into the drainage line due to storm water runoff from un-rehabilitated areas.	3	4	4	2	22 L		3	4	2	1	9 N
Contamination of the surface water resource due to animal faeces and urine (storm water runoff and wash water from boma's and open air facilities).	3	4	4	2	22 L	• Maintain all protective buffers as they act as a trap for sediment and contaminants. • Maintain the storm water management system for the facility on an on-going basis and ensure that this is always in good working order, and not blocked or in need of repair. • Install cut off drains along boma's, animal enclosures and pens to ensure that storm water is diverted around	3	4	2	1	9 N

						these areas, and that runoff originating from within, remains inside. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in the proper manner (i.e. incineration) as soon as possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures.					
Contamination of the surface water resource due to sewage spills and leaks.	3	4	4	2	22 L	• Maintain all protective buffers as they act as a trap for sediment and contaminants. • Ensure that facility sewage system is designed according to the demand requirements. • Ensure that the facility sewage system is not overloaded, and that it functions within its design capacity. • Take action to reduce output or increase capacity if necessary. • Ensure that the facility sewage system is maintained in a sanitary and operational state. • Regularly check the facility sewage system (preferably monthly) to ensure it is functionally sound. If necessary, employ the services of a professional, suitably qualified independent body.	3	4	2	1	9 N

						• Implement repairs immediately upon detection of a failure or fault. • Replace old, inadequate and failing equipment as required.						
Contamination of the surface water resource due to leaks and spills from treated effluent in evaporation dams and grey water.	3	4	4	2	22 L	• Maintain all protective buffers as they act as a trap for sediment and contaminants. • Ensure that the effluent treatment system is designed according to the demand requirements. • Ensure that the effluent treatment system, including evaporation dams, are not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the effluent treatment system is maintained in a sanitary and operational state. • Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound. • Undertake monthly wastewater monitoring to ensure that the output quality of the water complies with the minimum standards as prescribed by DWA.	3	4	2	1	9 L
Contamination of the surface water resource due to leaks and spills from hazardous waste streams.	3	4	6	2	26 L	• Maintain all protective buffers as they act as a trap for sediment and contaminants. • Ensure that the treatment system for hazardous liquid waste is designed according to the demand requirements. • The hazardous liquid waste treatment system should comprise of two holding tanks linked in series. The second tank is a backup to the first, and both back up to a drain system that flows back up to the lab when the	3	4	2	1	9 N

						tanks are full. • Ensure that the treatment system for hazardous liquid waste is not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the treatment system for hazardous liquid waste is maintained in a sanitary and operational state. • Regularly check the treatment system for hazardous liquid waste (preferably monthly) to ensure that the system is functionally sound. • Develop an Operational and Maintenance Program for liquid laboratory waste, addressing day to day maintenance and management actions, as well as emergency procedures. • Develop an Operational Waste Management & Overflow Response Plan and reporting procedure to addresses mandatory provisions that must be set in place and implemented during day to day operation of, or should any accidental or other malfunction of the system result in spillage and or pollution of the environment.					
Contamination of the surface water resource due to run-off from roads and hard surfaces	3	4	4	3	33 M	• Maintain the storm water management system for the facility on an on-going basis and ensure that this is always in good working order. • Runoff from roads must be managed to avoid erosion and pollution problems. • Maintain all buffer zones to trap sediments.	3	4	2	2	18 L
Contamination of the surface water resource due to pesticides and herbicides (ground maintenance), toxins and hydrocarbons (equipment and facilities maintenance).	3	4	4	3	33 M	• Develop operational guidelines for implementing Clean Technologies (solvents, detergents fertilisers and pesticides). • Ensure that all solvents, detergents, chemicals, fuels	3	4	2	2	18 L

						etc. are stored in locked stores on bunded surfaces. • Ensure that all potentially hazardous substances are used and handled by qualified personnel only. • Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.					
Contamination of the surface water resource due to litter and disposal of general waste	3	4	4	3	33 M	• Ensure that all personnel are familiar with waste management requirements on site; • Collect and sort-at-source the different types of waste (recyclables, inert rubble, hazardous and non-recyclable general waste) by placing receptacles at specific points throughout the facility; • Ensure that personnel make use of the receptacles	3	4	2	2	18 L

						provided; • Empty receptacles for disposal at least once per week, but more often if required; • Recyclables and general waste must be collected from the development by reputable companies on a regular basis. • Undertake weekly site clean-up operations to maintain the site in a neat and litter-free state.					
Soils												
Soil pollution due to animal faeces and urine (boma's and open air facilities)	2	4	6	4	48 M	• Install cut off drains along boma's, animal enclosures and pens to ensure that storm water is diverted around these areas, and that runoff originating from within, remains inside. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in the proper manner (i.e. incineration) as soon as possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures.	2	4	4	3	30 L
Soil pollution due to sewage spills and leaks.	2	4	6	3	36	• Ensure that facility sewage system is designed according to the demand requirements. • Ensure that the facility sewage system is not	2	4	4	2	20

					M	overloaded, and that it functions within its design capacity. • Take action to reduce output or increase capacity if necessary. • Ensure that the facility sewage system is maintained in a sanitary and operational state. • Regularly check the facility sewage system (preferably monthly) to ensure it is functionally sound. If necessary, employ the services of a professional, suitably qualified independent body. • Implement repairs immediately upon detection of a failure or fault. • Replace old, inadequate and failing equipment as required.					L
Soil pollution due to leaks and spills from treated effluent in evaporation dams and grey water	2	4	6	3	36 M	• Ensure that the effluent treatment system is designed according to the demand requirements. • Ensure that the effluent treatment system, including evaporation dams, are not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the effluent treatment system is maintained in a sanitary and operational state. • Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound. • Undertake monthly wastewater monitoring to ensure that the output quality of the water complies with the minimum standards as prescribed by DWA. • Wastewater to be used for irrigation must comply with the following standards:	2	4	4	2	20 L

						• electrical conductivity does not exceed 200 milliSiemens per metre (mS/m) • pH is not less than 6 or more than 9 pH units • Chemical Oxygen Demand (COD) does not exceed 400mg/l after removal of algae • Faecal coliforms do not exceed 1000 000 per 100 ml					
Soil pollution due to leaks and spills from hazardous waste streams.	2	4	8	3	42 M	• Ensure that the treatment system for hazardous liquid waste is designed according to the demand requirements. • The hazardous liquid waste treatment system should comprise of two holding tanks linked in series. The second tank is a backup to the first, and both back up to a drain system that flows back up to the lab when the tanks are full. • Ensure that the treatment system for hazardous liquid waste is not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the treatment system for hazardous liquid waste is maintained in a sanitary and operational state. • Regularly check the treatment system for hazardous liquid waste (preferably monthly) to ensure that the system is functionally sound. • Develop an Operational and Maintenance Program for liquid laboratory waste, addressing day to day maintenance and management actions, as well as emergency procedures. • Develop an Operational Waste Management & Overflow Response Plan and reporting procedure to addresses mandatory provisions that must be set in place and implemented during day to day operation of,	2	4	4	2	20 L

						or should any accidental or other malfunction of the system result in spillage and or pollution of the environment.						
Soil pollution due to pesticides and herbicides (ground maintenance), toxins and hydrocarbons (equipment and facilities maintenance).	2	4	6	3	36 M	• Develop operational guidelines for implementing Clean Technologies (solvents, detergents fertilisers and pesticides). • Ensure that all solvents, detergents, chemicals, fuels etc. are stored in locked stores on bunded surfaces. • Ensure that all potentially hazardous substances are used and handled by qualified personnel only. • Follow manufacturer's instruction when using potentially hazardous substances, especially in terms of quantities, time of application etc. • Ensure that all products are used according to manufacturer's instructions and that staff are trained in the use and handling thereof. • Maintain site vehicles and equipment in an acceptable state of repair (these may not leak or smoke and must comply with SABS standards). • Ensure that all maintenance and servicing of vehicles and equipment is undertaken on bunded surfaces with appropriate runoff containment measures installed. • Ensure that all hazardous wastes (such as used oil, oil containers, chemical containers etc.) are disposed of as hazardous waste • Ensure that a spills containment kit is available on site and that personnel are trained in spills clean up procedures. • Immediately clean leaks and spills of hazardous substances and dispose of as hazardous waste. • Report major spills to the regional DWA office.	2	4	4	2	20 L

Soil erosion due to uncontrolled storm water and run-off.	1	4	8	4	52 M	• Minimise the extent of hard surface wherever possible, favouring the retention vegetation, landscape and permeable surfaces. • Favour the installation of permeable paving wherever possible, allowing runoff to infiltrate as a first point of departure. • Maintain the storm water management system for the facility on an on-going basis and ensure that this is always in good working order. • Runoff from roads must be managed to avoid erosion and pollution problems. • Maintain all buffer zones to trap sediments. • Runoff from roads must be managed to avoid erosion and pollution problems. • Repair all erosion damage as soon as possible. Do not allow erosion to develop on a large scale before effecting repairs. • Dissipate concentrated storm water flows through energy dissipaters or vegetated areas. • During washing and cleaning, ensure that the use of excessive amounts of water is avoided.	1	4	4	2	18 L
Soil compaction due to uncontrolled movement and access across the site and trampling by animals within the enclosures. This in turn could lead to loss of vegetation and erosion.	1	4	8	4	52 M	• Erect and maintain the perimeter fence for the facility. • Prohibit vehicular or pedestrian access into natural areas beyond the demarcated boundaries of the facility and of demarcated activity areas. • Erect and maintain adequate fences around all animal boma's and enclosures to prevent animal access to sensitive environs. • Formalise access roads and disallow off-road driving as far as possible. • Regulate and control movement over the site.	1	4	6	3	33 M

						Personnel, vehicles and equipment to move along designated routes. • Where possible, required equipment and infrastructure should be placed within existing disturbed areas. • Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Monitor all rehabilitated areas for at least a year following the completion of rehabilitation works for failure of vegetation to establish and / or erosion. Immediately implement remedial measures as required. • Subdivide and rotate use of encampments and grazing areas, allowing depleted encampments to lie unused and recover for a season. Set a rotation programme to ensure that all camps are allowed to 'rest'.					
Air											
Air pollution by emissions from the incinerator.	3	4	6	5	65 H	• Ensure that the incinerator is designed according to the demand requirements. • Apply for an Air Emissions License for the Incinerator as per the requirements of DEA (Air Quality). • Limit the use of the incinerator to organic waste (i.e. animal carcasses, body fluids, bedding and faeces). Do not incinerate non-organics, plastic containers etc. • The installation of a Multiple Chamber Incinerator. Manufactured in the Republic of South Africa is recommended (this may be modified / customised to suit the operational requirements of the facility). • The multiple chamber of the recommended incinerator includes auto-mated combustion control, dry process neutralisation of acid gases, improved scrubbers, dry, high temperature ceramic filters and a host of other	3	4	4	5	55 M

						refinements that will burn without emitting dangerous levels of dioxins, furans, heavy metals, carbon monoxide, methane or any other harmful substances. With built-in emission control, air pollution is apparently minimized whilst greenhouse gases methane and carbon monoxide are eliminated and chloroform is destroyed.					
Air pollution by emissions from operational vehicles, including waste removal contractors.	3	4	4	4	4 4 M	• Encourage group travel and lift clubs wherever possible. • Set up a schedule of general waste collection by local contractor, dumping the waste at the closest registered waste disposal facility. • Set up a schedule of medical and hazardous waste collection by specialist contractor, for incineration at the Onderstepoort facility in Pretoria and at the nearest registered waste disposal facility respectively.	3	4	4	3	3 3 L
Biodiversity (Flora)												
Bush encroachment and invasion of poorly rehabilitated areas.	2	3	8	4	5 2 M	• Cordon off rehabilitated areas and do not allow grazing or access into these areas until such time that re-vegetation was found to be successful. • Monitor all rehabilitated areas for at least a year following the completion of rehabilitation works for failure of vegetation to establish and / or erosion. Immediately implement remedial measures as required. • Draw up a management and monitoring programme for invasive species detailing actions to prevent the establishment of invasive plants on site. • Implement management actions according to the management plan. • All alien seedlings and saplings must be removed as	2	3	4	2	1 8 L

						they emerge or become evident. • Manual / mechanical removal is preferred to chemical control. • Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc. • Ensure that only properly trained people handle and make use of chemicals. • All operational vehicles and equipment (including delivery and waste removal vehicles) should be free of plant material. All equipment and vehicles should be thoroughly cleaned prior to access on to the site. • The Kruger National Park's policy on importing feedstuffs, such as lucerne, into protected areas must be adhered to.					
Structural changes in the vegetation due to bulk feeders being held in the enclosures.	1	5	4	4	40 M	• Identify protection-worthy tree specimens and tree clumps within the enclosures and cordon these off using suitable fencing before bulk feeders are introduced into the enclosures. • No wood may be collected for firewood or any other purpose, and no large tree may be felled without a specific and justified reason (i.e. such as death, disease or a safety risk).	1	5	2	2	16 L
Introduction of foreign vegetation species into the protected area through the importing of feedstocks (such as Lucerne).	2	4	8	3	42 M	• Draw up a management and monitoring programme for invasive species detailing actions to prevent the establishment of invasive plants on site. • Implement management actions according to the management plan. • All alien seedlings and saplings must be removed as they emerge or become evident. • Manual / mechanical removal is preferred to chemical	2	4	4	2	20 L

						control. • Follow manufacturer's instruction when using chemical methods, especially in terms of quantities, time of application etc. • Ensure that only properly trained people handle and make use of chemicals. • All operational vehicles and equipment (including delivery and waste removal vehicles) should be free of plant material. All equipment and vehicles should be thoroughly cleaned prior to access on to the site. • The Kruger National Park's policy on importing feedstuffs, such as lucerne, into protected areas must be adhered to.					
Biodiversity (Fauna)											
Disturbance / displacement of fauna due to operational activities and personnel present on site.	2	4	4	4	40 M	• Maintain a fence around the perimeter of the facility which is designed to allow access by small mammals, tortoises etc. • Keep noise to a minimum at all times, and minimise lighting of the facility at night. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Speed control measures must be implemented on site and in the surrounding area to reduce air pollution and animal mortality. • Maintenance activities should be limited to daylight hours and vehicles should remain on the designated roads at all times. • No unauthorised access is permitted to buffer areas or any natural areas outside of the facility footprint.	2	4	4	3	30 L
Disturbance / displacement of protected species due to operational activities and personnel present on site.	2	4	4	3	30 L		2	4	4	2	20 L

Animal mortality / fatality (including protected species such as the baboon spider) due to daily operations and facility vehicles (including delivery and waste collection vehicles).	2	4	4	3	30 L	• Protected species occurring within the disturbed footprint of the facility (specifically the baboon spider, which is known to occur on the site) must be protected and relocated if necessary, whenever encountered on the site. • Ensure that personnel are briefed on the potential occurrence of protected faunal species, what they look like, and where they are likely to be found. Personnel are to be instructed that these species are not to be hurt or destroyed if encountered. This applies specifically to the snakes, lizards and spiders (baboon spider), as these are often perceived to be vermin and pests. • Personnel must be instructed to report the presence of protected species so that arrangements may be made to relocate these to adjacent bush areas. • Develop a procedure for dealing with animals (including protected species) encountered on the site. • Develop a procedure for dealing with dangerous animals and vermin. Where necessary, call in professionals to remove the animals. • Ensure that all personnel are aware of what the procedures for dealing with animals are. It is the contractor's responsibility to ensure that proper procedures are followed. • Regulate and control movement over the site. Personnel, vehicles and equipment to move along designated routes. • Speed control measures must be implemented on site and in the surrounding area to reduce air pollution and animal mortality. • Maintenance activities should be limited to daylight	2	4	2	2	16 L

						hours and vehicles should remain on the designated roads at all times. • Staff and visitors should be encouraged not to harm any wildlife. • Pets and livestock should not be allowed on site. If pets are to be allowed on site, they should be isolated from the general wildlife and properly controlled.					
Potential spread of pathogens under investigation within and beyond the facility.	3	4	10	4	68 H	• Control of samples; • Proper facility Bio- Security; • Project separation; • Bio-Sanity and proper management of waste; • Proper standard operating procedure for feeding and handling of animals in the facilities; • Projects that deal with highly infectious diseases must be in isolated facilities with separate staff with proper Bio-Security (including clothes and washing facilities); • Proper incinerator to destroy infected animal parts and materials; • Projects dealing with potential zoonotic diseases need to be managed with caution, proper education of staff, especially staff feeding animals in the project; • Samples need to be managed with best practice applied; • Necessary permits and laboratory Bio-Security is crucial to ensure samples do not become a source of disease transmission; • Disease regulations applicable to sample movement and security must be adhered to; • Staff working in facility will require health checks, especially staff feeding and handling animals; • Visitor contact with animals need to be restricted and	3	4	6	2	26 L
Disease risk to fauna in adjacent areas.	3	4	10	4	68 H		3	4	6	2	26 L

						screened; • Electric fencing surrounding the facility needs to be maintained and checked daily; • Any stray animal into the facility needs to be removed - Bio-Security of facilities and project boma's is critical to avoid introduction of disease via stray animals; • Ensure that animals that have been infected for disease study do not escape from the facility; • Proper Bio-Security of facilities, proper protocols for feeding and managing animals in boma's/cages; • Proper project registration - research objectives and priorities will be needed to help guide project registration and importance; • Animal use and care; • Clean and well maintained facilities with clear handling and feeding operating procedures for animals in facilities; • Well managed visitor access to projects; • Publication produced as soon as possible during and after projects completed; • Develop and implement projects that are relevant and have been discussed within the Science- Management context; • All disease research needs to take place within the context of Animal Disease Laws and Occupation Health and Safety Requirements; • The project registration process, operating procedures and partners with relevant research projects will help mitigate legal issues that may arise when doing research on diseases, especially controlled and zoonotic diseases; • State Veterinary involvement with controlled diseases;					

						• Labs need to be managed according to relevant lab activities – infectious disease samples with potential high risk of transmission require labs equipped with correct laminar and Bio-Safety restrictions flow in unit for proper emergency and access procedures; • Chemicals need to be transported, stored and handled as per proper requirements and level of toxicity; • Washing facilities for rinsing off spilt chemicals must be in place; • Proper disposal of chemical and lab by-products must be in line with ecological and Bio-Sanity Standards.					
Land-Use and Infrastructure												
Upgrade of the facility and infrastructure of the HHWRS (positive impact).	2	4	4	5	50 M	• None.	2	4	4	5	50 M
Socio-Economic												
Long-term employment opportunities at the facility (limited positive impact).	3	4	4	3	33 L	• None.	3	4	4	3	33 L
The establishment of a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities (positive impact).	5	4	8	4	68 H	• None.	5	4	8	4	68 H
Threat to security of neighbouring residents / land owners as a result of an increase in the number of people in the area (no fences exist between conservation areas and the National Park).	2	3	4	2	18 L	• The operator must develop a Code of Conduct for the operational phase and ensure that all personnel subscribe to this. • The movement of visitors and personnel on and off the site must be closely managed and monitored by the	2	3	2	1	7 N

						operator. • The operator is responsible for making the necessary arrangements for transporting workers to and from site on a daily basis. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved					
Increased incidence of fires and the potential resulting loss of property, life and biodiversity	3	4	8	3	45 M	• Ensure that the necessary fire fighting equipment is on site in terms of SABS 1200 and act in accordance with relevant legislative requirements. • Ensure that personnel are familiar with protocol and procedures in the event of a fire. • No open fires will be allowed anywhere on the site; • No incineration or burning of general waste is permitted on the site; • A firebreak should be maintained around the perimeter of the facility. • The operator should ensure that he / she has the contact details all of the adjacent farm owners so that they can be contacted in the event of a fire.	3	4	6	2	26 L
Olfactory impact, especially on nearby tourism operations, as a result of incineration of animal waste in the incinerator.	3	4	6	4	52 M	• Schedule regular incineration times in consultation with local tourism operators, and agree on times that would least inconvenience neighbours. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved • Ensure that the incinerator is designed according to the demand requirements.	3	4	4	4	44 M

						• Apply for an Air Emissions License for the Incinerator as per the requirements of DEA (Air Quality). • Limit the use of the incinerator to organic waste (i.e. animal carcasses, body fluids, bedding and faeces). Do not incinerate non-organics, plastic containers etc. • The installation of a Multiple Chamber Incinerator. Manufactured in the Republic of South Africa is recommended (this may be modified / customised to suit the operational requirements of the facility). • The multiple chamber of the recommended incinerator includes auto-mated combustion control, dry process neutralisation of acid gases, improved scrubbers, dry, high temperature ceramic filters and a host of other refinements that will burn without emitting dangerous levels of dioxins, furans, heavy metals, carbon monoxide, methane or any other harmful substances. With built-in emission control, air pollution is apparently minimized whilst greenhouse gases methane and carbon monoxide are eliminated and chloroform is destroyed.					
Olfactory impact, especially on nearby tourism operations, as a result of animal faeces.	2	4	6	4	48 M	• Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in	2	4	4	3	30 L

						the proper manner (i.e. incineration) as soon as possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures.					
Olfactory impact, especially on nearby tourism operations, as a result of the water treatment / evaporation ponds.	2	4	6	4	48 M	• Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • The evaporation dams will not be designed as a stand-alone treatment system. Waste will first pass through a primary treatment system, in which the effluent will be treated / sterilised, whereafter it will be deposited into the evaporation dams. • Ensure that the effluent treatment system is designed according to the demand requirements. • Ensure that the effluent treatment system, including evaporation dams, are not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the effluent treatment system is maintained in a sanitary and operational state. • Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound.	2	4	4	3	30 L
Noise impact, especially on nearby tourism operations, as a result of concentrations of animals in boma's.	2	4	8	4	56	• Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and	2	4	6	3	36

					M	resolved. • Ensure that boma's, enclosures and pens are not overpopulated. • Ensure that animals kept in enclosures are properly fed, treated and medicated (as required) to eliminate unnecessary pain, discomfort and suffering.					M
Noise impact, especially on nearby tourism operations, as a result of staff operating the facility and on site vehicles.	2	4	6	4	48 M	• Regulate and control movement over the site. • Speed control measures must be implemented on site and in the surrounding area. • Operational and maintenance activities should be limited to daylight hours. • The operator must develop a Code of Conduct for the operational phase and ensure that all personnel subscribe to this. • The movement of visitors and personnel on and off the site must be closely managed and monitored by the operator. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Pets and livestock should not be allowed on site. If pets are to be allowed on site, they should be properly controlled.	2	4	4	3	30 L
Noise impact, especially on nearby tourism operations, as a result of loud music and voices from off duty staff at the staff accommodation.	2	4	6	4	48 M		2	4	4	3	30 L
Noise impact, especially on nearby tourism operations, as a result of barking dogs.	2	4	6	4	48 M		2	4	4	3	30 L
Disease risk to humans.	3	4	10	3	51 M	• Control of samples; • Proper facility Bio- Security; • Project separation; • Bio-Sanity and proper management of waste; • Proper standard operating procedure for feeding and handling of animals in the facilities;	3	4	6	1	13 L

						• Projects that deal with highly infectious diseases must be in isolated facilities with separate staff with proper Bio-Security (including clothes and washing facilities); • Proper incinerator to destroy infected animal parts and materials; • Projects dealing with potential zoonotic diseases need to be managed with caution, proper education of staff, especially staff feeding animals in the project; • Samples need to be managed with best practice applied; • Necessary permits and laboratory Bio-Security is crucial to ensure samples do not become a source of disease transmission; • Disease regulations applicable to sample movement and security must be adhered to; • Staff working in facility will require health checks, especially staff feeding and handling animals; • Visitor contact with animals need to be restricted and screened; • Electric fencing surrounding the facility needs to be maintained and checked daily; • Any stray animal into the facility needs to be removed - Bio-Security of facilities and project boma's is critical to avoid introduction of disease via stray animals; • Ensure that animals that have been infected for disease study do not escape from the facility; • Proper Bio-Security of facilities, proper protocols for feeding and managing animals in boma's/cages; • Proper project registration - research objectives and priorities will be needed to help guide project registration and importance; • Animal use and care approval of projects;					

						• Clean and well maintained facilities with clear handling and feeding operating procedures for animals in facilities; • Well managed visitor access to projects; • Publication produced as soon as possible during and after projects completed; • Develop and implement projects that are relevant and have been discussed within the Science- Management context; • All disease research needs to take place within the context of Animal Disease Laws and Occupation Health and Safety Requirements; • The project registration process, operating procedures and partners with relevant research projects will help mitigate legal issues that may arise when doing research on diseases, especially controlled and zoonotic diseases; • State Veterinary involvement with controlled diseases; • Labs need to be managed according to relevant lab activities – infectious disease samples with potential high risk of transmission require labs equipped with correct laminar and Bio-Safety restrictions flow in unit for proper emergency and access procedures; • Chemicals need to be transported, stored and handled as per proper requirements and level of toxicity; • Washing facilities for rinsing off spilt chemicals must be in place; • Proper disposal of chemical and lab by-products must be in line with ecological and Bio-Sanity Standards.					
Aesthetics												
The visibility of the facility to, and potential	3	5	8	3	4	• Retain a buffer (approximately 30-50m wide) of intact	3	5	8	2	3	

visual impact on, observers travelling along the R531, a main tourist access road to the Kruger National Park and Manyeleti Nature Reserve.					8 M	natural vegetation along the perimeter of the development site footprint. This buffer may be within or behind the security fence. • Limit the height of the incinerator chimney to a maximum of 15m. • Retain and maintain natural vegetation in all areas outside of the development footprint. • Construct vegetated earth berms to screen the facility from the immediate neighbours, especially along the common boundary with Orpen Rest Camp in the north-east. • Plan the ancillary buildings in such a way and in such a location that clearing of vegetation is minimised. • Consolidate infrastructure and make use of already disturbed sites rather than pristine areas. • Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the development. The following is recommended: • Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); • Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; • Making use of minimum lumen or wattage in fixtures; • Making use of down-lighters, or shielded fixtures; • Making use of Low Pressure Sodium lighting or other types of low impact lighting. • Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. • Maintain the general appearance of the facility as a					2 M
The visibility of the facility to, and potential visual impact on tourist camps and lodges within the study area.	3	5	10	3	54 M		3	5	10	2	36 M
The potential visual impact of ancillary infrastructure (i.e. incinerator smoke stack) and smoke emissions on observers in close proximity to the proposed facility.	3	5	6	3	42 M		3	5	6	2	28 L
The potential visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility.	3	5	8	3	48 M		3	5	8	2	32 M

						whole, including the internal roads, servitudes and the ancillary buildings. • Respect the high quality of the visual environment, and endeavour to maintain these through responsive operations, such as programming of deliveries, incineration and other potentially visually disruptive activities to times that are not important for tourism. • Minimise lighting of the facility at night. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Maintain roads to forego erosion and to suppress dust. • Monitor rehabilitated areas, and implement remedial action as and when required.					
INDIRECT IMPACTS												
Socio-Economic												
The support of the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas, given the impact of these diseases and their control on land-use options for development and poverty reduction, particularly of the rural poor (positive impact).	5	4	8	4	68 H	• None.	5	4	8	4	68 H
Assistance with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases (positive impact).	5	4	8	4	68 H	• None.	5	4	8	4	68 H

The provision of information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM (positive impact).	5	4	8	4	68 H	• None.	5	4	8	4	68 H
Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to visual impacts (including lighting) of the facility.	2	4	8	4	56 M	• Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of the development site footprint. This buffer may be within or behind the security fence. • Limit the height of the incinerator chimney to a maximum of 15m. • Retain and maintain natural vegetation in all areas outside of the development footprint. • Construct vegetated earth berms to screen the facility from the immediate neighbours, especially along the common boundary with Orpen Rest Camp in the north-east. • Plan the ancillary buildings in such a way and in such a location that clearing of vegetation is minimised. • Consolidate infrastructure and make use of already disturbed sites rather than pristine areas. • Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the development. The following is recommended: • Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); • Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; • Making use of minimum lumen or wattage in fixtures; • Making use of down-lighters, or shielded fixtures; • Making use of Low Pressure Sodium lighting or other types of low impact lighting.	2	4	8	3	42 M

						• Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. • Maintain the general appearance of the facility as a whole, including the internal roads, servitudes and the ancillary buildings. • Respect the high quality of the visual environment, and endeavour to maintain these through responsive operations, such as programming of deliveries, incineration and other potentially visually disruptive activities to times that are not important for tourism. • Keep noise to a minimum at all times, and minimise lighting of the facility at night. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Maintain roads to forego erosion and to suppress dust. • Monitor rehabilitated areas, and implement remedial action as and when required.					
Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to odours emanating from the facility due to incineration of animal waste in the incinerator.	3	4	8	4	60 H	• Schedule regular incineration times in consultation with local tourism operators, and agree on times that would least inconvenience neighbours. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved • Ensure that the incinerator is designed according to the demand requirements. • Apply for an Air Emissions License for the Incinerator	3	4	8	3	45 M

						as per the requirements of DEA (Air Quality). • Limit the use of the incinerator to organic waste (i.e. animal carcasses, body fluids, bedding and faeces). Do not incinerate non-organics, plastic containers etc. • The installation of a Multiple Chamber Incinerator. Manufactured in the Republic of South Africa is recommended (this may be modified / customised to suit the operational requirements of the facility). • The multiple chamber of the recommended incinerator includes auto-mated combustion control, dry process neutralisation of acid gases, improved scrubbers, dry, high temperature ceramic filters and a host of other refinements that will burn without emitting dangerous levels of dioxins, furans, heavy metals, carbon monoxide, methane or any other harmful substances. With built-in emission control, air pollution is apparently minimized whilst greenhouse gases methane and carbon monoxide are eliminated and chloroform is destroyed.					
Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to odours emanating from the facility due to the accumulation of animal faeces.	2	4	8	4	56 M	• Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in the proper manner (i.e. incineration) as soon as	2	4	8	3	42 M

						possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures.					
Impact on tourism income (Orpen, Ngala Tented Camp and Mr Pirow) due to odours emanating from the facility due to the water treatment / evaporation ponds.	2	4	8	4	56 M	• Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Ensure that the effluent treatment system is designed according to the demand requirements. • The evaporation dams will not be designed as a stand-alone treatment system. Waste will first pass through a primary treatment system, in which the effluent will be treated / sterilised, whereafter it will be deposited into the evaporation dams. • Ensure that the effluent treatment system, including evaporation dams, are not overloaded and that no overflows occur. • Take action to reduce output or increase capacity if necessary. • Ensure that the effluent treatment system is maintained in a sanitary and operational state. • Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound.	2	4	8	3	42 M
An increase in blowflies as a result of the concentration of animals and the accumulation of faeces. Linked to this is the spread of pathogens and bacteria by these	3	4	8	4	60 H	• Implement fly management measures on an on-going basis at the facility, using approved methods for a wilderness area. • Lines of communication must be established and	3	4	8	3	45 M

flies.						maintained with local landowners so that issues and problems arising may be reported, discussed and resolved. • Ensure that boma's, enclosures and pens are not overpopulated. • Establish a daily routine of clean-up in all animal enclosure areas, removing faeces and other waste from boma's and pens and replacing animal bedding as required. • Ensure that faeces and soiled bedding is disposed of in the proper manner (i.e. incineration) as soon as possible after removal, or shortly thereafter. • Ensure that temporary storage of faeces and soiled bedding is limited. Where temporary storage of waste is unavoidable, ensure that the waste is stored on an impermeable, bunded surface equipped with runoff containment measures.					
Aesthetics												
The potential visual impact of the facility on the visual character of the landscape and sense of place of the region.	3	5	6	3	42 M	• Retain a buffer (approximately 30-50m wide) of intact natural vegetation along the perimeter of the development site footprint. This buffer may be within or behind the security fence. • Limit the height of the incinerator chimney to a maximum of 15m. • Retain and maintain natural vegetation in all areas outside of the development footprint. • Construct vegetated earth berms to screen the facility from the immediate neighbours, especially along the common boundary with Orpen Rest Camp in the north-east. • Plan the ancillary buildings in such a way and in such a	3	5	6	2	28 L

						location that clearing of vegetation is minimised. • Consolidate infrastructure and make use of already disturbed sites rather than pristine areas. • Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the development. The following is recommended: • Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); • Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; • Making use of minimum lumen or wattage in fixtures; • Making use of down-lighters, or shielded fixtures; • Making use of Low Pressure Sodium lighting or other types of low impact lighting. • Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. • Maintain the general appearance of the facility as a whole, including the internal roads, servitudes and the ancillary buildings. • Respect the high quality of the visual environment, and endeavour to maintain these through responsive operations, such as programming of deliveries, incineration and other potentially visually disruptive activities to times that are not important for tourism. • Keep noise to a minimum at all times, and minimise lighting of the facility at night. • Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and					

						resolved. • Maintain roads to forego erosion and to suppress dust. • Monitor rehabilitated areas, and implement remedial action as and when required.						
CUMULATIVE IMPACTS												
Ground Water												
Depletion of ground water resources due to accumulated use by increasing numbers of users.	3	4	6	4	52 M	• Register boreholes to be used for potable water extraction as per DWA requirements. • Apply for a Water Use Licence for the abstraction of the operational requirement of water as per DWA requirements. • Ensure that water storage facilities are designed according to the demand requirements. • Monitor the consumption of water on a monthly basis and keep up to date records. • Ensure that consumption does not exceed permitted quantities. Take action to reduce consumption if necessary. • Install a leak detection system, and promptly attend to leaks as required. • Make use of water saving devices and technologies wherever possible. Measures include the specification of low flow shower heads and taps, and the use of grey water from ablutions and tea kitchens for road wetting and irrigation in selected areas. • Ensure that all facility staff is trained in water wise principles, and that they practise prudent use of water at all times.	3	4	4	2	22 L

Aesthetics											
Cumulative visual impact of lighting as a result of additional development within a greater conservation area (i.e. specifically on nearby tourism operations and access roads).	3	5	8	3	48 M	• Consult a lighting engineer in the design and planning of lighting to ensure the correct specification and placement of lighting and light fixtures for the development. The following is recommended: • Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); • Limiting mounting heights of lighting fixtures, or alternatively using foot-lights or bollard level lights; • Making use of minimum lumen or wattage in fixtures; • Making use of down-lighters, or shielded fixtures; • Making use of Low Pressure Sodium lighting or other types of low impact lighting. • Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes. • Minimise lighting of the facility at night.	3	5	8	2	32 M

NO-GO ALTERNATIVE											
DIRECT IMPACTS											
The loss of an opportunity to establish a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities.	5	4	8	4	68 H	• None.	5	4	8	4	68 H
INDIRECT IMPACTS											

The loss of an opportunity to support the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas, given the impact of these diseases and their control on land-use options for development and poverty reduction, particularly of the rural poor.	5	4	8	4	68 H	• None.	5	4	8	4	68 H
The loss of an opportunity to assist with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases.	5	4	8	4	68 H	• None.	5	4	8	4	68 H
The loss of an opportunity to provide information that will facilitate harmonisation of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM.	5	4	8	4	68 H	• None.	5	4	8	4	68 H
CUMULATIVE IMPACTS												
None.												

5.5 ENVIRONMENTAL IMPACT ASSESSMENT: DECOMMISSIONING PHASE

Table 9: DECOMMISIONING PHASE IMPACTS											
POTENTIAL IMPACTS:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance	PROPOSED MITIGATION:	Extent (1-5)	Duration (1-5)	Magnitude (0-10)	Probability (1-5)	Significance
ALTERNATIVE 1: PREFERRED ALTERNATIVE											
DIRECT IMPACTS											
None.											
INDIRECT IMPACTS											
None.											
CUMULATIVE IMPACTS											
None.											
NO-GO ALTERNATIVE											
DIRECT IMPACTS											
None.											
INDIRECT IMPACTS											
None.											
CUMULATIVE IMPACTS											
None.											

6. ENVIRONMENTAL IMPACT STATEMENT

6.1 ALTERNATIVE 1: PREFERRED ALTERNATIVE

The proposed upgrades to the Hans Hoheisen Wildlife Research Station will result in a number of positive impacts that are of national, and even international significance in the field of veterinary research.

These **positive impacts**, which are of a **long term** nature, are of **high significance**. The anticipated positive impacts may be summarized as follows:

- The establishment of a research platform to support research involving the diseases of wildlife, humans, and livestock at an interface between a Transfrontier Conservation Area (TFCA), the Greater Limpopo Trans Frontier Park and local communities;
- An opportunity to support the management of diseases at the interface (wildlife / livestock / humans) that have a negative effect on the development of trans frontier parks and conservation areas, given the impact of these diseases and their control on land-use options for development and poverty reduction, particularly of the rural poor;
- An opportunity to assist with the development of human resources, infrastructure and technology with emphasis on Detection, Identification and Monitoring (DIM) of diseases;
- An opportunity to provide information that will facilitate harmonization of policies, and the improvement of varying standards and competencies of participating countries within the context of DIM.

In terms of potential **negative impacts**, the construction phase is expected to represent the most risk and to be the most environmentally disruptive. This phase is, however of a short term nature, and provided all impacts are mitigated as recommended, and the provisions of construction management as detailed in the EMPr (*Appendix F)* are followed, almost all negative impacts may be mitigated to a **low or negligible significance**.

There are two exceptions in this regard, for which the post mitigation significance is **moderate**:

- The first is the removal of protected plant species within the development footprint. These are all trees, and it is not likely that that the removal of a few specimens may be completely avoided. It is also not likely that large and established trees will be easily transplanted.
- The second is the increased incidence of fires and the resulting loss of property, life and diversity. The context of this site within a natural area, and in close proximity to the KNP and other conservation areas renders it particularly vulnerable to this risk.

Positive impacts resulting from the construction phase include short term employment opportunities in construction and opportunity for skills development and on-site training. Regardless of the fact that these will be short lived, their significance is considered **high**.

Anticipated **negative impacts** associated with the operation of the facility are almost exclusively of **low or negligible significance** (post mitigation). Negative impacts of **moderate significance** (post mitigation) include the following:

- Soil compaction due to trampling by animals within the enclosures, which could lead to loss of vegetation and erosion. Even with the recommended mitigation, it is anticipated that this compaction of soil will be unavoidable.
- Air pollution, by emissions from the incinerator. Even with modern, environmentally responsive design with built-in emission control, the fact of the matter remains that incineration results in emissions.
- Related to the above, is olfactory impact, especially on nearby tourism operations, as a result of incineration of animal waste in the incinerator. Again, regardless of the technology to reduce and scrub emissions, these will still be present, and some olfactory impact will result.
- Noise impact, especially on nearby tourism operations, as a result of concentrations of animals in boma's. Associated with this impact is the potential loss of income for tourist operations.
- The visibility of the facility to observers travelling along the R531, a main tourist access road to the Kruger National Park and Manyeleti Nature Reserve and on tourist camps and lodges within the study area. Even though the high VAC of the vegetation will screen this impact to a large extent. Some visibility of facility infrastructure is likely to remain, especially in the dry season. Associated with this impact is the potential loss of income for tourist operations.
- The direct and indirect visual impact of operational, safety and security lighting of the facility at night on observers residing in close proximity of the facility. Even though the high VAC of the vegetation will screen this impact to a large extent. Some visibility of facility infrastructure is likely to remain, especially in the dry season. Associated with this impact is the potential loss of income for tourist operations.
- The indirect impact of visual, olfactory and noise on tourism income for nearby tourism operations (including Orpen, Ngala Tented Camp and Mr Pirow).
- Last, is the indirect impact of blowflies as a result of the concentration of animals and the accumulation of faeces. Even with strict management and mitigation, flies will always be an issue where animals are kept in concentrations.

The above post mitigation impacts are largely socio-economic in nature and relate to the impact on local tourism operations and lodges. Of importance is that tourists expect and rely on a pleasing experience, which is easily threatened by physical, visual, olfactory and auditory intrusions that are not inherent to this natural environment.

Notwithstanding the above, the post-mitigation impacts of moderate significance are not considered to be fatal flaws to the proposed development. The reason being that the types of impacts cannot be scientifically quantified, and as such, the anticipated significance reflects a worst case scenario. In addition, the recommended mitigation requires that open lines of communication be established and maintained between the HHWRS and local land owners and tourism operators. In this way, issues that threaten, inconvenience or irritate either party may be tables, discussed and resolved.

Overall, therefore, it is the opinion of the author that the anticipated positive impacts associated with the planning, construction, operation and decommissioning of the proposed facility outweigh the anticipated negative impacts. Neither the integrity of the environment, or the lives and livelihood of neighbouring land owners and other local residents will be compromised in an unacceptable manner.

Bearing in mind that all significant negative impacts can be mitigated and managed, it is recommended that the development as detailed in Alternative 1 be accepted.

6.2 NO GO ALTERNATIVE

The No Development Alternative would result in none of the direct negative impacts associated with the construction and operation and decommissioning of the proposed HHWRS, as the status quo of the receiving environment would remain unaltered.

Although this may be seen as a positive outcome, it should be borne in mind that at the same time, none of the long term positive impacts, which are all of **high significance,** would be realized either.

Overall, therefore, it is the opinion of the author that the anticipated negative impacts associated with this alternative outweigh the anticipated positive impacts.

In this respect, it is not recommended that the development as detailed in the No Development Alternative not be accepted.

7. RECOMMENDATION OF THE PRACTITIONER

The Planning Phase:

In terms of general project planning, the provisions contained in the EMPr (*Appendix 3)* must be followed. Specific reference is made to the following, however:

- Register boreholes to be used for potable water extraction as per DWA requirements.
- Apply for a Water Use Licence for the abstraction of the operational requirement of water as per DWA requirements.
- Ensure that water storage facilities are designed according to the demand requirements.
- Apply for an Air Emissions License for the Incinerator as per the requirements of DEA (Air Quality).
- Ensure that the incinerator is designed according to the demand requirements.
- Ensure that facility sewage system is designed according to the demand requirements.
- Ensure that the effluent treatment system is designed according to the demand requirements.
- Ensure that the treatment system for hazardous liquid waste is designed according to the demand requirements.
- Develop an Operational and Maintenance Program for liquid laboratory waste, addressing day to day maintenance and management actions, as well as emergency procedures.
- Develop an Operational Waste Management & Overflow Response Plan and reporting procedure to addresses mandatory provisions that must be set in place and implemented during day to day operation of, or should any accidental or other malfunction of the system result in spillage and or pollution of the environment.
- Develop operational guidelines for implementing Clean Technologies (solvents, detergents fertilisers and pesticides).
- Develop a Code of Conduct for the operational phase and ensure that all personnel subscribe to this.
- Institute a regional ground water testing regime, whereby boreholes at the facility and those within a 2km radius are quality tested. This quality testing will help to establish whether the facility and its functions are impacting on regional ground water quality. Establish test boreholes within a 2km radius at the onset of operations and test these to establish baseline data.

The Construction Phase:

In terms of construction, the provisions contained in the EMPr (*Appendix F)* must be followed. Specific reference is made to the following, however:

- Draw up a Construction Operations Plan indicating how the construction site will operate in terms of access, activities, phasing, etc. (during project planning).
- A vegetation / tree specialist should walk the final site layout to identify and mark all protected trees/plants that could be impacted upon prior to the start of any construction activities.

- Draw up a plan (during project planning) indicating the mapped positions of vegetation specimens to be conserved and which should be removed and replaced. Avoid the requirement to remove protected trees wherever possible. Demarcate specimens to be retained with danger tape and / or fencing as required. This barrier to be at least 2m from the stem of the specimen.
- A faunal specialist should walk the final site layout to identify all possible burrows that could be impacted upon. Where possible, relocate specimens to outside of the development areas.
- The contractor should contact all of the adjacent farm owners prior to the commencement of the construction phase and ensure that he/she has the contact numbers so that they can be contacted in the event of a fire.
- All appointed contractors must ensure that the EMPr (*Appendix 3*) and any accompanying documentation are adhered to, and that all instructions are carried out.
- The function of ensuring compliance with the EMPr must be delegated to a person with knowledge of environmental and construction matters (i.e. an Environmental Control Officer (ECO)). This ECO should be appointed for the full duration of construction period, as well as post rehabilitation, for at least a year, to ensure environmental compliance and optimal environmental outcomes.

The Operational Phase:

An Operational Management Plan must be drawn up, which will address all environmental operational aspects of the development. The Operational Management must include, but will not be limited to the operational aspects discussed in the EMPr (*Appendix 3*). Specific reference is made to the following, however:

- Monitor the consumption of water on a monthly basis and keep up to date records.
- Undertake ground water quality testing yearly, at the same time of year and keep up to date records.
- Set up a schedule of medical and hazardous waste collection by specialist contractor, for incineration at the Onderstepoort facility in Pretoria and at the nearest registered waste disposal facility respectively.
- Regularly check the facility sewage system (preferably monthly) to ensure it is functionally sound. If necessary, employ the services of a professional, suitably qualified independent body
- Regularly check the effluent treatment system (preferably monthly) to ensure that the system is functionally sound.
- Regularly check the treatment system for hazardous liquid waste (preferably monthly) to ensure that the system is functionally sound.
- Undertake monthly wastewater monitoring to ensure that the output quality of the water complies with the minimum standards as prescribed by DWA.
- The operator should ensure that he / she has the contact details all of the adjacent farm owners so that they can be contacted in the event of a fire.
- Respect the high quality of the visual environment, and endeavour to maintain these through responsive operations, such as programming of deliveries, incineration and other potentially visually disruptive activities to times that are not important for tourism.

- Lines of communication must be established and maintained with local landowners so that issues and problems arising may be reported, discussed and resolved.

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MAPS

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Map 3: Proposed Facility Layout, Zoning and Circulation
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APPENDICES

Appendix A: Public Participation Process

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Appendix B – Other Information

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B.2 Description of Bio-Safety Levels
B.3 Laboratory Safety Manual of the Department of Veterinary Tropical Diseases (Faculty of Veterinary Science, University of Pretoria (UP))
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B.6 Independent Opinion on the Potential Disease Risk of the Proposed Upgrade of the Hans Hoheisen Wildlife Research Station
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Appendix C – Environmental Management Programme (EMP)