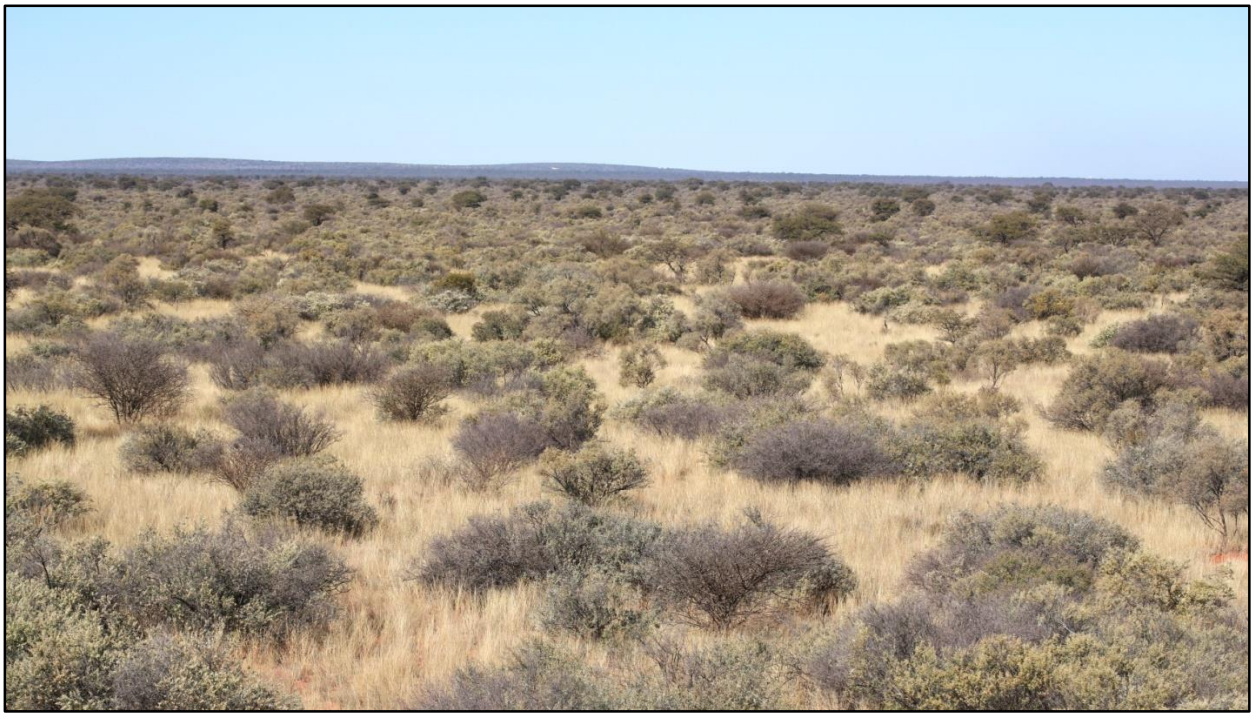
SCOPING AND ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED HYPERION SOLAR DEVELOPMENT 2 AND ASSOCIATED INFRASTRUCTURE NEAR KATHU, NORTHERN CAPE:

FAUNA & FLORA SPECIALIST EIA PHASE REPORT



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PRODUCED FOR SAVANNAH ENVIRONMENTAL

BY

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EXECUTIVE SUMMARY

Hyperion Solar Development 2 (Pty) Ltd is proposing the establishment of a 75MW commercial Photovoltaic (PV) solar energy facility (SEF) and associated infrastructure, called Hyperion Solar Development 2 (proposed development), on the Remainder of the Farm Lyndoch 432, situated in the Gamagara Local Municipality in the Northern Cape Province. Three additional 75MW SEFs and associated infrastructure are proposed within the same property (project site) and will be submitted as separate projects. This report has been compiled specifically for the Hyperion Solar Development 2 including associated infrastructure. The proposed development is currently in the EIA Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist terrestrial biodiversity EIA study of the project site as part of the Scoping and Environmental Impact Assessment (EIA) process.

A field assessment over different seasons as well as a desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the project site. The vegetation of the Hyperion project site consists of Kathu Bushveld which is a relatively restricted vegetation type, but which is currently not threatened as it is still largely intact despite an increasing development footprint due to mining and solar PV development in the area. Within the context of the site, the area east of the Vlermuisleegte River is considered more sensitive than the area to the west of the river. As a result, the developer has restricted the development to the western portion of the property which is considered relatively low sensitivity and suitable for development.

The site has a relatively high abundance of *Vachellia erioloba* and *Vachellia haematoxylon* and the loss of relatively high numbers of individuals of these species cannot be avoided. These species are however very abundant in the area and the local populations would not be compromised to any degree by their loss from the development footprint. Given that the site is not exceptional in terms of the size or density of trees present, the loss of the affected individuals should be seen as being secondary to the loss of habitat. Although the number of individuals lost would exceed the suggested DAFF thresholds for offsets, for ecological purposes, a threshold for habitat loss of 500ha is given as being a reasonable threshold above which an offset could potentially be considered. An offset is not recommended for the current development, but for that facility or facilities that result in the overall footprint within the site exceeding 500ha, the consideration of an offset should come into effect. An offset is not considered to be definitively required above 500ha, but that above this threshold, the need and manner in which an offset could be implemented should be investigated in detail, with input from DAFF and based on both ecological considerations and the mandate of DAFF to ensure sustainable development.

In terms of fauna, there are few species of conservation concern that are likely to be present or abundant at the site and the primary impact of the development on fauna would

be some habitat loss for the more common resident species. As such, no high long-term post-mitigation impacts on fauna are expected to occur as a result of the Hyperion 2 development. Overall, and despite the abundance of *Vachellia erioloba* and *V.haematoxylon* on the site, there are no potential impacts associated with the proposed development that are considered to be of high significance and which cannot be mitigated to an acceptable level. As such, there are no fatal flaws or other major impediments from an ecological perspective that should prevent the development from going ahead.

Impact Statement

The development footprint of the Hyperion Solar 2 facility is restricted to low and moderate sensitivity habitat common in the Kathu-Hotazel-Kuruman area. The affected area is considered suitable for development and there are no impacts associated with the Hyperion Solar 2 facility that cannot be mitigated to a low level. Although cumulative impacts in the wider Kathu area are currently on the increase due to the expansion of the mines and the proliferation of solar facilities in the area, these still occupy a small proportion of the Kathu Bushveld vegetation type and the contribution of the current development to cumulative impact would be low and considered acceptable. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Hyperion Solar 2 facility can be supported from a terrestrial ecology point of view.

CONTENTS

COMPLIANCE WITH APPENDIX 6 OF THE 2014 EIA REGULATIONS, AS AMENDED

Requirements of Appendix 6 – GN R326 2014 EIA Regulations, 7 April 2017	**Addressed in the Specialist Report**
1. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	6
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	7
c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2.3
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 3
g) an identification of any areas to be avoided, including buffers;	Section 3
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 3
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.3
j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 3
k) any mitigation measures for inclusion in the EMPr;	Section 5
l) any conditions for inclusion in the environmental authorisation;	Section 5
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 5
n) a reasoned opinion- i. whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Section 6
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	See Main Report
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	See Main Report
q) any other information requested by the competent authority.	
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

SHORT CV/SUMMARY OF EXPERTISE – SIMON TODD

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Ecological Solutions for People & the Environment

Simon Todd is Director and principal scientist at 3Foxes Biodiversity Solutions and has over 20 years of experience in biodiversity measurement, management and assessment. He has provided specialist ecological input on more than 200 different developments distributed widely across the country. This includes input on the Wind and Solar SEA (REDZ) as well as the Eskom Grid Infrastructure (EGI) SEA and Karoo Shale Gas SEA. He is on the National Vegetation Map Committee as representative of the Nama and Succulent Karoo Biomes. Simon Todd is a recognised ecological expert and is a past chairman and current deputy chair of the Arid-Zone Ecology Forum. He is registered with the South African Council for Natural Scientific Professions (No. 400425/11).

A selection of recent work is as follows:

Strategic Environmental Assessments

Co-Author. Chapter 7 - Biodiversity & Ecosystems - Shale Gas SEA. CSIR 2016.
Co-Author. Chapter 1 Scenarios and Activities – Shale Gas SEA. CSIR 2016.
Co-Author – Ecological Chapter – Wind and Solar SEA. CSIR 2014.
Co-Author – Ecological Chapter – Eskom Grid Infrastructure SEA. CSIR 2015.
Contributor – Ecological & Conservation components to SKA SEA. CSIR 2017.

Recent Specialist Ecological Studies in the Vicinity of the Current Site

- Kathu Solar PV Facility. Fauna and Flora EIA Process. Cape EAPrac 2015.
- Mogobe Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Logoko Solar PV Facility. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- RE Capital 10 Solar Power Plant, Postmasburg. Fauna and Flora EIA Proces. Cape EAPrac 2015.
- Walk-through study of Kumba Iron Ore expansion area at Dingleton, Northern Cape. MSA Group. 2017.
- Adams PV Project – EIA process and follow-up vegetation survey. Aurora Power Solutions. 2016.
- Mamatwane Compilation Yard. Fauna and Flora EIA process. ERM. 2013.
- Olifantshoek-Emil 132kV power line. Fauna and Flora BA process. Savannah Environmental 2017.

SPECIALIST DECLARATION

I, ..Simon Todd....., as the appointed independent specialist, in terms of the 2014 EIA Regulations, hereby declare that I:

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

Signature of the specialist: 

Name of Specialist: ____Simon Todd_____

Date: ____20 March 2019_____

1 INTRODUCTION

Hyperion Solar Development 2 (Pty) Ltd is proposing the establishment of a 75MW commercial Photovoltaic (PV) solar energy facility (SEF) and associated infrastructure, called Hyperion Solar Development 2 (proposed development), on the Remainder of the Farm Lyndoch 432, situated in the Gamagara Local Municipality in the Northern Cape Province. Three additional 75MW SEFs and associated infrastructure are proposed within the same property (project site) and will be submitted as separate projects. This report has been compiled specifically for the Hyperion Solar Development 2 including associated infrastructure. The proposed development is currently in the EIA Phase and 3Foxes Biodiversity Solutions has been appointed to provide a specialist terrestrial biodiversity EIA phase study of the project site as part of the Scoping and Environmental Impact Assessment (EIA) process.

The purpose of the Hyperion Solar Development 2 Terrestrial Biodiversity Scoping Report is to describe and detail the ecological features of the project site, provide an assessment of the ecological sensitivity of the project site, and identify the likely impacts that would be associated with the proposed development area as a SEF. Two site visits as well as a desktop review of the available ecological information for the area was conducted in order to identify and characterise the ecological features of the project site. This information is used to derive an ecological sensitivity map which has been used to inform the layout of the development. Impacts are assessed for the pre-construction, construction, operation, and decommissioning phases of the development. A variety of avoidance and mitigation measures associated with each identified impact are recommended to reduce the likely impact of the development, which should be included in the EMPr for the development. The full scope of study is detailed below.

SCOPE OF STUDY

The scope of the study includes the following activities:

- a description of the environment that may be affected by the activity and the manner in which the environment may be affected by the proposed development
- a description and evaluation of environmental issues and potential impacts (incl. using direct, indirect and cumulative impacts) that have been identified
- a statement regarding the potential significance of the identified issues based on the evaluation of the issues/impacts
- an indication of the methodology used in determining the significance of potential environmental impacts
- an assessment of the significance of direct, indirect and cumulative impacts in terms of the following criteria:

- the nature of the impact, which shall include a description of what causes the effect, what will be affected, and how it will be affected
- the extent of the impact, indicating whether the impact will be local (limited to the immediate area or site of the proposed development), regional, national or international
- the duration of the impact, indicating whether the lifetime of the impact will be of a short-term duration (0-5 years), medium-term (5- 15 years), long-term (> 15 years, where the impact will cease after the operational life of the activity), or permanent
- the probability of the impact, describing the likelihood of the impact actually occurring, indicated as improbable (low likelihood) probable (distinct possibility), highly probable (most likely), or definite (impact will occur regardless of any preventable measures)
- the severity/beneficial scale indicating whether the impact will be very severe/beneficial (a permanent change which cannot be mitigated/permanent and significant benefit with no real alternative to achieving this benefit), severe/beneficial (long-term impact that could be mitigated/long-term benefit), moderately severe/beneficial (medium- to long-term impact that could be mitigated/ medium- to long-term benefit), slight, or have no effect
- the significance which shall be determined through a synthesis of the characteristics described above and can be assessed as low medium or high
- the status which will be described as either positive, negative or neutral
- the degree to which the impact can be reversed
- the degree to which the impact may cause irreplaceable loss of resources
- the degree to which the impact can be mitigated

- a description and comparative assessment of all alternatives
- recommendations regarding practical mitigation measures for potentially significant impacts, for inclusion in the Environmental Management Programme (EMPr)
- an indication of the extent to which the issue could be addressed by the adoption of mitigation measures
- a description of any assumptions uncertainties and gaps in knowledge
- an environmental impact statement (EIS) which contains:
  - a summary of the key findings of the EIA;
  - an assessment of the positive and negative implications of the proposed development;
  - a comparative assessment of the positive and negative implications of identified alternatives.

General Considerations:

- Disclose any gaps in information or assumptions made.
- Identify recommendations for mitigatory measures to minimise impacts.
- Outline additional management guidelines.
- Provide monitoring requirements, mitigation measures and recommendations in a table format as input into the EMPr for faunal related issues.

A description of the potential impacts of the development and recommended mitigation measures are to be provided, which will be separated into the following project phases:

- Preconstruction
- Construction
- Operational Phase

1.1 ASSESSMENT APPROACH & PHILOSOPHY

This assessment is conducted according to the 2014 EIA Regulations, as amended (Government Notice Regulation 326) in terms of the National Environmental Management Act (Act 107 of 1998) as amended (NEMA), as well as best-practice guidelines and principles for biodiversity assessment as outlined by Brownlie (2005) and De Villiers et al. (2005).This includes adherence to the following broad principles:

- That a precautionary and risk-averse approach be adopted towards projects which may result in substantial detrimental impacts on biodiversity and ecosystems, especially the irreversible loss of habitat and ecological functioning in threatened ecosystems or designated sensitive areas: i.e. Critical Biodiversity Areas (as identified by systematic conservation plans, Biodiversity Sector Plans or Bioregional Plans) and Freshwater Ecosystem Priority Areas.

- Demonstrate how the proponent intends complying with the principles contained in section 2 of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended (NEMA), which, amongst other things, indicates that environmental management should:

    - In order of priority aim to: avoid, minimise or remedy disturbance of ecosystems and loss of biodiversity;
    - Avoid degradation of the environment;
    - Avoid jeopardising ecosystem integrity;
    - Pursue the best practicable environmental option by means of integrated environmental management;

- Protect the environment as the people's common heritage;
- Control and minimise environmental damage; and
- Pay specific attention to management and planning procedures pertaining to sensitive, vulnerable, highly dynamic or stressed ecosystems.

These principles serve as guidelines for all decision-making concerning matters that may affect the environment. As such, it is incumbent upon the proponent to show how the proposed development would comply with these principles and thereby contribute towards the achievement of sustainable development as defined by the NEMA.

In order to adhere to the above principles and best-practice guidelines, the following approach forms the basis for the study approach and assessment philosophy:
The study will include data searches, desktop studies, site walkovers / field survey of the property and baseline data collection, describing:

- A description of the broad ecological characteristics of the site and its surrounds in terms of any mapped spatial components of ecological processes and/or patchiness, patch size, relative isolation of patches, connectivity, corridors, disturbance regimes, ecotones, buffering, viability, etc.

In terms of **pattern**, the following will be identified or described:

Community and ecosystem level

- The main vegetation type, its aerial extent and interaction with neighbouring types, soils or topography
- Threatened or vulnerable ecosystems (*cf. SA vegetation map/National Spatial Biodiversity Assessment, fine-scale systematic conservation plans, etc*)

Species level

- Red Data Book (RDB) species (giving location if possible using GPS)
- The viability of an estimated population size of the RDB species that are present (include the degree of confidence in prediction based on availability of information and specialist knowledge, i.e. High=70-100% confident, Medium 40-70% confident, Low 0-40% confident)
- The likelihood of other RDB species, or species of conservation concern, occurring in the vicinity (include degree of confidence)

Fauna

- Describe and assess the terrestrial fauna present in the area that will be affected by the proposed development.
- Conduct a faunal assessment that can be integrated into the ecological study.
- Describe the existing impacts of current land use as they affect the fauna.

- Clarify species of special concern (SSC) and that are known to be:
    - endemic to the region;
    - that are considered to be of conservational concern;
    - that are in commercial trade (CITES listed species);
- or, are of cultural significance.
- Provide monitoring requirements as input into the EMPr for faunal related issues.

Other pattern issues

- Any significant landscape features or rare or important vegetation associations such as seasonal wetlands, alluvium, seeps, quartz patches or salt marshes in the vicinity.
- The extent of alien plant cover of the project site, and whether the infestation is the result of prior soil disturbance such as ploughing or quarrying (alien cover resulting from disturbance is generally more difficult to restore than infestation of undisturbed sites).
- The condition of the project site in terms of current or previous land uses.

In terms of **process**, the following will be identified or described:

- The key ecological "drivers" of ecosystems on the project site and in the vicinity, such as fire.
- Any mapped spatial component of an ecological process that may occur at the project site or in its vicinity (i.e. *corridors* such as watercourses, upland-lowland gradients, migration routes, coastal linkages or inland-trending dunes, and *vegetation boundaries* such as edaphic interfaces, upland-lowland interfaces or biome boundaries).
- Any possible changes in key processes, e.g. increased fire frequency or drainage/artificial recharge of aquatic systems.
- Furthermore, any further studies that may be required during or after the EIA process will be outlined.
- All relevant legislation, permits and standards that would apply to the proposed development will be identified.
- The opportunities and constraints for proposed development will be described and shown graphically on an aerial photograph, satellite image or map delineated at an appropriate level of spatial accuracy.

1.2 RELEVANT ASPECTS OF THE DEVELOPMENT

Hyperion Solar Development 2 is proposed on the Remaining Extent of the Farm Lyndoch 432 (the project site), which is located approximately 16km north of Kathu in the Gamagara Local Municipality (LM) and within the greater John Taolo Gaetsewe District Municipality (DM), in the Northern Cape Province. Each project will be designed to have a contracted capacity of up to 75MW, and will make use of either fixed-tilt, single-axis tracking, or dual-axis (double-axis) tracking photovoltaic (PV) solar technology for the generation of electricity.

The proposed project will comprise the following key infrastructure and components:

- Arrays of PV panels (static or tracking PV system) with a contracted capacity of up to 75MW.
- Mounting structures to support the PV panels.
- On-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and distribution power transformers.
- An on-site substation to facilitate the connection between the project and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the existing Ferrum Substation/or other. This is however not assessed as part of the current development.
- Cabling between the project's components (to be laid underground where practical).
- Battery storage mechanism with a storage capacity of up to 300MWh.
- Water purification plant.
- Site Offices and Maintenance Buildings, including workshop areas for maintenance and storage.
- Batching plant.
- Temporary laydown area.
- Main access road to the site, internal access roads and fencing around the development area.

Based on the outcome of the meeting and consultations with affected landowners during the Scoping Phase, the following four access road alternatives were identified for consideration for Hyperion Solar Development 2 within the EIA studies (refer to Figure 3.2):

<u>Alternative 1:</u>

This alternative formed part of the Scoping Phase and entails the upgrade of approximately 3.6km of the existing T26 gravel road situated between the project site and the N14 national road. The existing road will be upgraded from approximately 5m to 9m in width

and will traverse four properties; the Remaining Extent of the Farm Lyndoch 432; Portion 1, 2 and the Remaining Extent of the Farm Cowley 457.

Alternative 2:
This is a new alternative identified for consideration in the EIA process. Alternative 2 entails the establishment of a new access road approximately 3.6km in length and 9m in width. The new access road is proposed to be located adjacent to the existing T26 gravel road and will traverse four properties; the Remaining Extent of the Farm Lyndoch 432, Portion 1, 2 and the Remaining Extent of the Farm Cowley 457.

Alternative 3:
Alternative 3 entails the establishment of a new access road approximately 5.1km in length and 9m in width and the upgrade of approximately 10.3km of the existing T25 gravel road from approximately 5m in width to 9m in width. This alternative was previously known as Alternative 2 in the Scoping Phase and was realigned in order to avoid the protected Kathu Forest. Alternative 3 will traverse five properties; the Remaining Extent of the Farm Lyndoch 432, Portion 1 of the Farm Selsden 464, the Remaining Extent of the Farm Kathu 465, Portion 1 of the Farm Halliford 466 and the Remaining Extent of the Farm Marsh 467.

Alternative 4:
Access Road Alternative 4 entails the establishment of a new access road approximately 6.2km in length and 9m in width situated between the western boundary of the project site and the R380 regional road. This alternative was proposed by the DAFF as an additional alternative which will traverse four properties; the Remaining Extent of the Farm Lyndoch 432, Portion 1 and the Remaining Extent of the Farm Selsden 464 and the Remaining Extent of the Farm Halliford 466.

A 20m wide corridor for each of the four alternatives has been considered and assessed during the EIA Phase in order to determine the most preferred route from an environmental perspective.

2 METHODOLOGY

2.1 DATA SOURCING AND REVIEW

Data sources from the literature consulted and used where necessary in the study includes the following:

Vegetation:

- Vegetation types and their conservation status were extracted from the South African National Vegetation Map (Mucina & Rutherford 2006 and 2012 Powrie

update) as well as the National List of Threatened Ecosystems (2011), where relevant.

- Information on plant species recorded for the broad area around the site was extracted from the SANBI POSA database hosted by SANBI. The species list was derived from a considerably larger area than the project site, but this is necessary to ensure a conservative approach as well as counter the fact that the project site itself or the immediate area has not been well sampled in the past.
- The IUCN conservation status of the species in the list was also extracted from the database and is based on the Threatened Species Programme, Red List of South African Plants (2018).

Ecosystem

- Critical Biodiversity Areas (CBAs) were extracted from the Northern Cape Critical Biodiversity Areas Map (Oosthuysen & Holness 2016).
- Freshwater and wetland information was extracted from the National Freshwater Ecosystem Priority Areas assessment (NFEPA) (Nel et al. 2011).
- Important catchments and protected areas expansion areas were extracted from the National Protected Areas Expansion Strategy 2008 (NPAES).

Fauna

- Lists of mammals, reptiles and amphibians which are likely to occur at the project site were derived based on distribution records from the literature and Animal Demography Unit (ADU) Virtual Museum spatial database (http://vmus.adu.org.za/).
- Literature consulted includes Branch (1988) and Alexander and Marais (2007) for reptiles, Du Preez and Carruthers (2009) for amphibians, Friedmann and Daly (2004) and Skinner and Chimimba (2005) for mammals.
- Apart from the literature sources, additional information on fauna was extracted from the Animal Demography Unit (ADU) web portal http://vmus.adu.org.za
- The faunal species lists provided are based on species which are known to occur in the broad geographical area, as well as a preliminary assessment of the availability and quality of suitable habitat at the project site.
- The conservation status of mammals is based on the IUCN Red List Categories (EWT/SANBI 2016), while reptiles are based on the South African Reptile Conservation Assessment (Bates et al. 2013) and amphibians on Minter et al. (2004) as well as the IUCN (2018).

2.2 SITE VISITS & FIELD ASSESSMENT

The site was visited on the 21st of July 2018 as well as on the 29th, 30th and 31st of January 2019 and then the 26th of February. During the site visits, the different biodiversity

features, habitat, and landscape units present at the site were identified and mapped in the field. Specific features visible on the satellite imagery of the site were also marked for field inspection and were verified and assessed during the site visit. Walk-through-surveys were conducted within representative areas across the different habitat units identified and all plant and animal species observed were recorded. Active searches for reptiles and amphibians were also conducted within habitats likely to harbour or be important for such. The presence of sensitive habitats such as stands of large trees, pans or rocky outcrops were noted in the field where present and recorded on a GPS.

As the density of tree species of conservation concern is an issue at the site, specific measures to sample and estimate the density of protected trees was taken. A total of 11 sample plots, each approximately 1ha in extent were distributed across the site and all protected tree species within these plots were recorded. In the case of *Vachellia erioloba*, the height and canopy width was also estimated and recorded for each tree. This was not done for *Vachellia haematoxylon* as all the individuals present on the site are of the shorter shrubby type and no large trees of this species are present.

2.3 SENSITIVITY MAPPING & ASSESSMENT

An ecological sensitivity map of the site was produced by integrating the available ecological and biodiversity information available in the literature and various spatial databases with mapping based on the satellite imagery as well as personal knowledge of the project site. This includes delineating different habitat units identified on the satellite imagery and assigning likely sensitivity values to the units based on their ecological properties, conservation value and the potential presence of species of conservation concern. The ecological sensitivity of the different units identified in the mapping procedure was rated according to the following scale:

- **Low** – Areas of natural or transformed habitat with a low sensitivity where there is likely to be a negligible impact on ecological processes and terrestrial biodiversity. Most types of development can proceed within these areas with little ecological impact.
- **Medium** - Areas of natural or previously transformed land where the impacts are likely to be largely local and the risk of secondary impact such as erosion low. These areas usually comprise the bulk of habitats within an area. Development within these areas can proceed with relatively little ecological impact provided that appropriate mitigation measures are taken.
- **High** – Areas of natural or transformed land where a high impact is anticipated due to the high biodiversity value, sensitivity or important ecological role of the area. These areas may contain or be important habitat for faunal species or provide

important ecological services such as water flow regulation or forage provision. Development within these areas is undesirable and should only proceed with caution as it may not be possible to mitigate all impacts appropriately.

- **Very High/No-Go** – Critical and unique habitats that serve as habitat for rare/endangered species or perform critical ecological roles. These areas are essentially no-go areas from a developmental perspective and should be avoided as much as possible.

2.4 SAMPLING LIMITATIONS AND ASSUMPTIONS

The current study included a field assessment which took place across different seasons as well as a desktop study. This serves to significantly reduce the limitations and assumptions required for the study. For the current assessment, the vegetation was in a reasonably good condition for sampling at the time of the field assessment as there had been some late season rainfall prior to the initial field assessment as well as some early summer rain prior to the summer season site visits. Although it is likely that some forbs and annuals were missed during the field assessment, there are few species of concern within the area and this is not seen as a significant limitation of the current study. Overall, the information collected on-site is considered reliable and there are few limitations with regards to the vegetation sampling and the timing of the site visits.

In terms of fauna, detailed studies were not conducted for the Scoping study, but several factors reduce the uncertainty associated with the assessment. Apart from the active searches that were conducted for reptiles and amphibians during the current study, additional species presence is inferred based on results obtained from the previous studies the consultant has conducted on the numerous study areas, in the Kathu area. Many remote areas have not been well-sampled in the past with the result that the species lists derived from the available spatial databases for the area do not always adequately reflect the actual fauna present at the project site. This is acknowledged as a limitation of the study, however, it is substantially reduced given the previous experience in the area. In order to further reduce this limitation, and ensure a conservative approach, the species lists derived for the project site from the literature were obtained from an area significantly larger than the project site and are likely to include a much wider array of species than actually occur at the project site. This is a cautious and conservative approach which takes the study limitations into account.

3 DESCRIPTION OF THE AFFECTED ENVIRONMENT- BASELINE

3.1 BROAD-SCALE VEGETATION PATTERNS

According to the national vegetation map (Mucina & Rutherford 2006), the project site is restricted to the Kathu Bushveld vegetation type. This vegetation unit occupies an area of 7 443 km^2 and extends from around Kathu and Dibeng in the south through Hotazel and to the Botswana border between Van Zylsrus and McCarthysrus. In terms of soils the vegetation type is associated with aeolian red sand and surface calcrete and deep sandy soils of the Hutton and Clovelly soil forms. The main land types are Ah and Ae with some Ag. The Kathu Bushveld vegetation type is still considered largely intact and less than 2% has been transformed by mining activity and other development, and it is classified as Least Threatened. However, there has been a recent increase in mining as well as solar development within this vegetation type with the result that it has experienced significant recent habitat loss as well as become increasingly fragmented. It is also poorly conserved and does not currently fall within any formal conservation areas apart from the recently declared Kumba Iron Ore offset areas west of Kathu. Although no endemic species are restricted to this vegetation type, a number of Kalahari endemics are known to occur in this vegetation type such as *Vachellia luederitzii* var *luederitzii, Anthephora argentea*, *Megaloprotachne albescens*, *Panicum kalaharense* and *Neuradopsis bechuanensis*. It is more fully described as it occurs at the project site in the next section. Other vegetation types that occur in the wider area include Kuruman Thornveld to the east and Kuruman Mountain Bushveld to the south and east, neither of which is of conservation concern or occur within the project site.

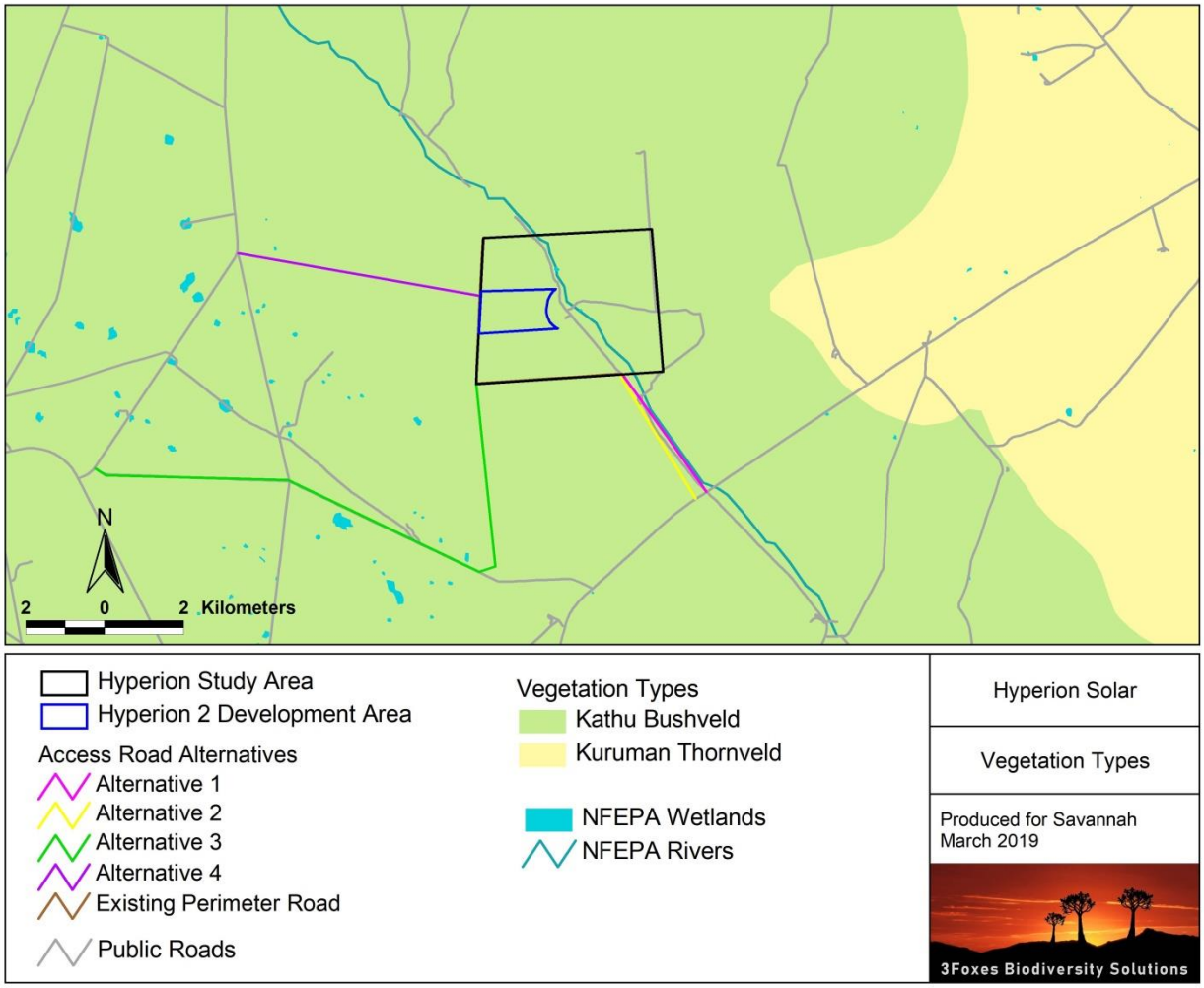

Figure 1. Broad-scale overview of the vegetation in and around the Hyperion site. The vegetation map is an extract of the national vegetation map as produced by Mucina and Rutherford (2006/2012), and also includes drainage lines and wetlands delineated under the NFEPA assessment (Nel et al. 2011).

3.2 HABITATS & PLANT COMMUNITIES

The vegetation of the project site consists of Bushveld with a well-developed tree layer and a variable-density grass layer. Three broad vegetation communities can be identified, the area west of the Vlermuisleegte River, the river itself and the area east of the Vlermuisleegte River. The area west of the river is largely dominated by *Tarchonanthus camphoratus* and *Vachellia haematoxylon* with a few areas where *Vachellia erioloba* and/or *Vachellia mellifera* become dominant. In the area east of the river, the vegetation is generally more open and largely dominated by *Vachellia erioloba* with some localised areas dominated by *Vachellia mellifera* or *Terminalia sericea*. The Vlermuisleegte River does not flow on a regular basis and has largely been in-filled with sand. It is characterised by a high

density of large *Vachellia erioloba* trees. The area east of the Vlermuisleegte River was identified during the scoping phase as unsuitable for development and excluded from the PV development. As a result, the development has been restricted to the western portion of the farm which is considered broadly less sensitive than the east.

Within the eastern section of the property, which would be affected by the development, there is some variation in the woody component of the vegetation due firstly to a fire which affected the area in 2012 and secondly due to natural variation in species dominance associated with subtle changes in soil depth and texture. The density of *Vachellia haematoxylon* across the site is relatively homogenous, but there is significant variation in the density of *Vachellia erioloba* and large shrubs such as *Tarchonanthus camphoratus*, *Grewia flava* and *Vachellia mellifera*.

Apart from the above dominant trees other common woody species present at the site include *Zizyphus mucronata*, *Gymnosporia buxifolia*, *Vachellia mellifera* subsp. *detinens*, *Searsia ciliata*, *Ehretia rigida* subsp. *rigida*, *Diospyros lycioides* subsp. *lycioides* and *Grewia flava*. The grass layer is dominated by *Schmidtia pappophoroides*, *Aristida meridionalis, Aristida stipitata* subsp. *stipitata*, *Stipagrostis uniplumis* var. *uniplumis*, *Stipagrostis obtusa*, *Cynodon dactylon, Enneapogon desvauxii, Eragrostis lehmanniana* and Aristida *congesta* subsp. *congesta*. The density and diversity of shrubs is fairly low but includes *Asparagus laricinus*, *Asparagus retrofractus*, *Felicia muricata* subsp. c*inerascens*, *Pentzia calcarea*, *Vachellia hebeclada*, *Hermannia tomentosa*, *Gnidia polycephala* and *Lantana rugosa*. Forbs included *Dicoma schinzii*, *Geigeria ornativa*, *Elephantorrhiza elephantina*, *Indigofera daleoides* var. *daleoides* and *Gisekia pharnacioides* var. *pharnacioides*.

Figure 2. The typical vegetation within the proposed development footprint is dominated by *Tarchonanthus camphoratus*, *Grewia flava*, *Vachellia haematoxylon* with occasional *Vachellia erioloba*.

Figure 3. Looking north from the low gravelly area along the southern boundary of the PV 2 area. This is considered to be a medium sensitivity area within the development footprint that was not previously affected by fire, with a relatively high density of mature *Vachelia erioloba* trees.

Figure 4. Vegetation of the Vlermuisleegte River, showing the large *Vachelia erioloba* trees that characterise the river bed. This area would not be affected by the development, but is illustrated to show the variety of habitats present on the site.

3.3 LISTED AND PROTECTED PLANT SPECIES

Three NFA-protected tree species occur at the site, *Boscia albitrunca*, *Vachelia erioloba* and *Vachelia haematoxylon*. No *Boscia albitrunca* were observed within the development footprint and this species appears to be restricted to the area east of the Vlermuisleegte River. The density of both *Vachelia* species is fairly high across the site and it would not be possible to avoid impact on these species. Apart from the above species it is possible that Devils' Claw *Harpagophytum procumbens* is present at the site, although it was not observed during the site visit. This is a provincially protected species that is common within certain Kalahari veld types and is widespread and common in the area with the result that the presence of this species at the site would not be of high significance.

The density of *Vachellia erioloba* at the site varies between 2.5 and 70 trees/ha, with an average density of 22 trees/ha. Based on a footprint area of 180ha, the Hyperion 2 project would result in the loss of approximately 3928 *Vachellia erioloba* trees. The height, size, and class distribution of the trees is illustrated below in Figure 5. There is a high proportion of young trees, with almost 75% of the trees present being less than 2m in height. This is related to the fire that affected the site and the subsequent recruitment of a new cohort of young trees and resprouting of existing trees that that were not killed by the fire. As

Vachellia haematoxylon is a dominant shrub within the study area, relatively large numbers of this species would be affected. This species occurs at an average density of 107 trees/ha, resulting in an estimated total of 19 298 shrubs within the Hyperion PV2 footprint area. Although this seems like a very large number, these are low shrubs, the vast majority of which are less than 2m in height and, unlike in areas where there are fewer trees and where *V. haematoxylon* can grow into a substantial tree, these are not of high ecological value within the context of the site and likely play a similar role to other dominant large shrubs present such as *Grewia flava* and *Tarchonanthus camporatus*. As such, there is not a particular concern with the loss of these individuals from the development footprint as compared to the loss of the other dominant shrub species present. Consequently, the major issue associated with the development, regarding its impact on *V. haematoxylon* should be seen as habitat loss within a favourable environment for this species, with the determination of precisely how many plants would be lost being of lesser significance.

For both *Vachellia erioloba* and *V.haematoxylon*, the development would contribute to cumulative impact on habitat availability for these species in the area. Should all four Hyperion plants be built, this would result in approximately 900ha of habitat loss for these species. Although the Kathu Bushveld vegetation type is still largely intact, it is experiencing increased levels of habitat loss in the Kathu area due to both mining and solar energy development. Furthermore, not all areas of Kathu Bushveld should be considered to have equal value and those areas dominated by either *Vachellia mellifera* or *Tarchonanthus camphoratus* are most likely the result of degradation and have lower ecological value. As such, characteristic examples of Kathu Bushveld with *Vachellia erioloba* and *V.haematoxylon* dominant should be seen as having relatively high ecological and conservation value. Although the total potential loss of 900ha of habitat from the area due to the development of all four Hyperion projects sounds potentially significant, this represents 0.12% of the total extent of Kathu Bushveld. Assuming that only 50% of this vegetation type is in a good condition, then this still represents only 0.24% additional habitat loss resulting from the whole development, with the contribution of the Hyperion PV2 development at less than 0.026% of this. From a purely ecological point of view, for both *Vachellia erioloba* and *V.haematoxylon*, it is clear that this extent of habitat loss does not justify the imposition of an offset for the development of a single PV plant at the site. Thresholds that should potentially be of concern are discussed in more detail in Section 3.6 where the overall cumulative impacts associated with the Hyperion development are covered.

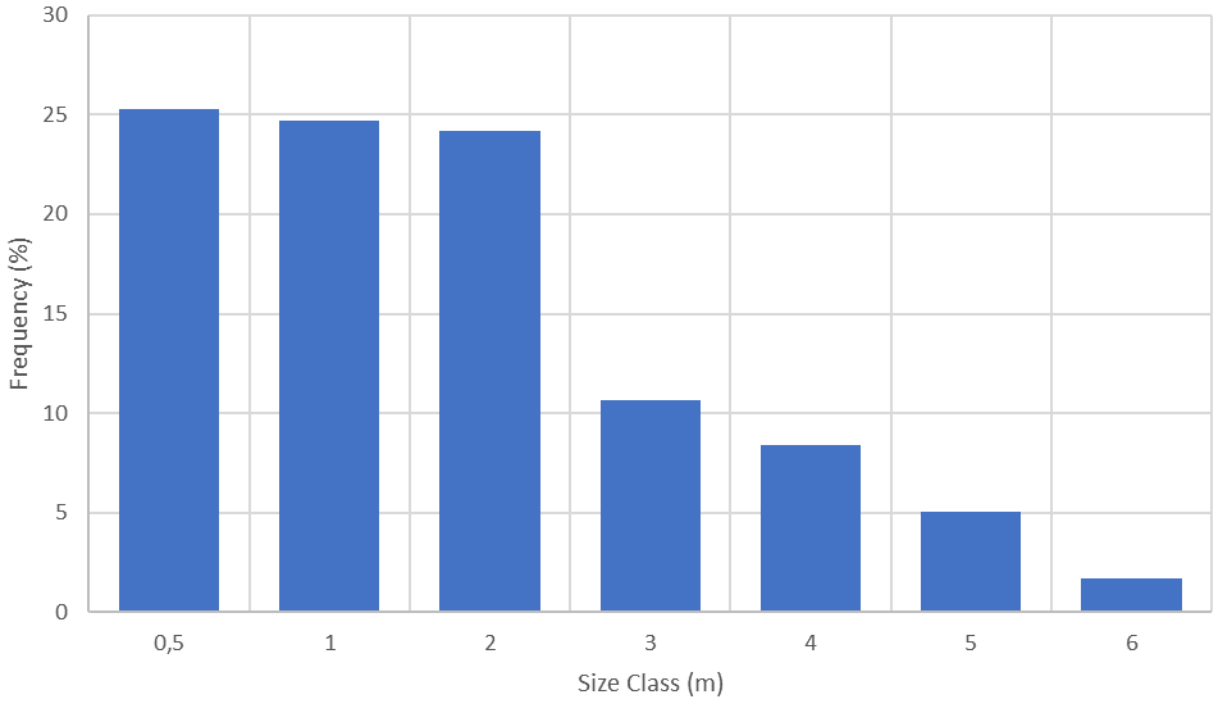

Figure 5. Size class distribution of *Vachellia erioloba* within the development area of the Hyperion site, showing that this is skewed towards young trees less than2m tall.

3.4 Faunal Communities

3.4.1 Mammals

The mammalian community at the project site is likely to be of moderate diversity; although more than 50 species of terrestrial mammals are known from the wider area, the extent and habitat diversity of the project site is too low to support a very wide range of mammals. Species observed or otherwise confirmed present in the area include Aardvark, Cape Porcupine, Springhare, South African Ground Squirrel, Scrub hare, Vervet Monkey, Small-spotted Genet, Yellow Mongoose, Slender Mongoose, Black-Backed Jackal, Steenbok, Duiker and Kudu. Small mammals trapped in the area include Desert Pygmy Mouse *Mus indutus*, Multimammate Mouse *Mastomys coucha*, Bushveld Gerbil *Tatera leucogaster*, Hairy footed Gerbil *Gerbillurus paeba*, Pouched Mouse *Saccostomus campestris* and Grey Climbing Mouse *Dendromus melanotis*.

Five listed terrestrial mammal species potentially occur in the area; these are the Brown Hyaena *Hyaena brunnea* (Near Threatened), Black-footed Cat *Felis nigripes* (Vulnerable), Leopard *Panthera pardus* (VU), Ground Pangolin *Smutsia temminckii* (Vulnerable) and South African Hedgehog *Atelerix frontalis* (Vulnerable). The Leopard and Brown Hyaena are not

likely to occur in the area on account of the agricultural land-use in the area which is not usually conducive to the persistence of large carnivores. The Black-footed Cat is a secretive species which would be likely to occur in the wider area and possibly at the project site given that it occurs within arid, open country. The Hedgehog and Ground Pangolin may also occur in the area at typically low density. Given the extensive national ranges of these species, the impact of the proposed development on habitat loss for these species would be minimal and a long-term impact on these species would be unlikely.

3.4.2 Reptiles

The project site lies in or near the distribution range of more than 50 reptile species, although many of these are unlikely to occur at the project site as it is restricted largely to sandy substrate and does not include rocky habitat or other habitats that are important for reptiles (Appendix 3). No species of conservation concern are known to occur in the area. The habitat diversity within the study area is relatively low with the result that the number of reptile species present within the project site is likely to be relatively low and only a proportion of the species known from the area are likely to be present on the project site itself.

Species observed on the site of in the immediate area in the past include Serrated Tent Tortoise *Psammobates oculifer*, Cape Cobra *Naja nivea*, Ground Agama *Agama aculeata*, Spotted Sand Lizard *Pedioplanis lineoocellata*, Variable Skink *Trachylepis varia*, Bibron's Blind Snake *Afrotyphlops bibronii*, Western Rock Skink *Mabuya sulcata sulcata*, Kalahari Tree Skink Trachylepis spilogaster, Cape Gecko *Lygodactylus capensis capensis*, Speckled Rock Skink *Trachylepis punctatissima*, Striped Skaapsteker *Psammophylax tritaeniatus* and Boomslang *Dispholidus typus typus*. Impacts on reptiles are likely to be restricted largely to habitat loss within the development footprint. This is likely to be of local significance only as there are no very rare species or specialised habitats present within the footprint area.

3.4.3 Amphibians

The project site lies within or near the range of 10 amphibian species, indicating that the project site potentially has a moderately diverse frog community for an arid area. There is no natural permanent water or artificial earth dams within the project site that would represent suitable breeding habitat for most of these species. The pans which are present at the site would occasionally contain sufficient water for breeding purposes for those species which do not require permanent water. Given the paucity of permanent water at the site, only those species which are relatively independent of water are likely to occur in the area. Species observed in the area include Eastern Olive Toad *Amietophrynus garmani* and Bushveld Rain Frog *Breviceps adspersus*, both of which are likely to occur at the project

site. There is no standing water on the project site that could be used by amphibians for breeding purposes.

The only species of conservation concern which occurs in the wider area is the Giant Bullfrog *Pyxicephalus adspersus*. The project site lies at the margin of the known distribution of this species and it has not been recorded from any of the quarter degree squares around the project site, suggesting that it is unlikely to occur there. Impacts on amphibians are however likely to be low and restricted largely to habitat loss during construction.

3.5 CRITICAL BIODIVERSITY AREAS & BROAD-SCALE PROCESSES

An extract of the Northern Cape Critical Biodiversity Areas map for the study area is depicted below in Figure 6. The majority of the project site lies within an area classified as "Other natural areas" and is not classified as a CBA or Ecological Support Area (ESA). The Vlermuisleegte River corridor is however classified as an ESA and would be marginally impacted by the proposed development. There are no CBAs in close proximity to the project site, indicating that the proposed development does not pose a threat to any CBAs or other areas considered to be of significance from a broad-scale conservation planning perspective.

In terms of the access road options, Alternative 1, the existing access route runs adjacent to the Vlermuisleegte river, which is a potential concern as this area is an ESA, but the existing road is already used by heavy vehicles and any required upgrades would be minor in nature and not likely to generate significant additional impact to the affected ESA. Alternative 2, a new road through this area is not highly desirable as it would also run through the ESA and result in some habitat loss. Alternative 3 is both the longest route and also impinges a little on a CBA 2 associated with the Camelthorn Forest north of Kathu. As a result, this the least desirable route in terms of impacts on CBAs. Alternative 4, the route from the west, is mostly within other natural areas, except towards the Kathu-Hotazel road, where there are some areas of ESA that would be affected. The use of the existing road, Alternative 1 is preferred in terms of potential impacts on CBAs and broad scale ecological processes, followed by Alternative 4 and then Alternative 2.

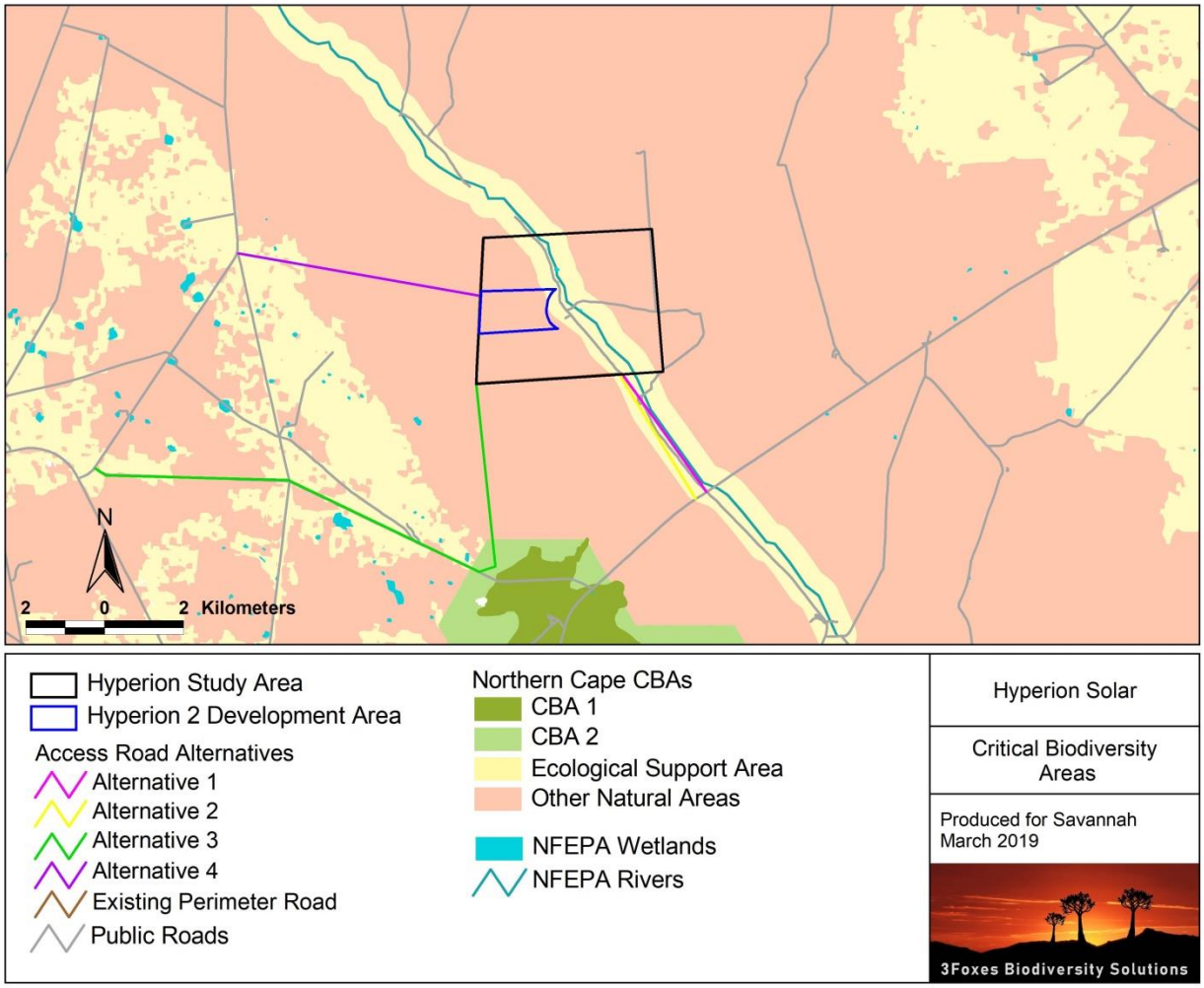

Figure 6. Extract of the Northern Cape Critical Biodiversity Areas map for the study area, showing that there are no CBAs in close proximity to the site, but access road Alternative 2 does go through a short area of CBA 1 and CBA 2. .

3.6 CURRENT BASELINE & CUMULATIVE IMPACT

There are numerous other proposed PV facilities in the wider area surrounding the project site (Figure 7). There are several existing solar projects in the Kathu area including the already built Kalahari Solar (CSP), Kathu Solar (PV), Sishen Solar (PV) and Adams Solar (PV). The existing plants occupy an area of about 950ha and are considered to form part of the existing baseline for the area. The footprint of these are however relatively low in comparison with the footprint of the iron and manganese mines in the area, which is estimated at 12 000ha and are currently the major driver of habitat loss and transformation in the Hotazel-Kuruman-Kathu area. There are several authorised developments in the general vicinity to the project site, which would potentially add an area of about 1000ha to the baseline. All these developments raise the potential for cumulative impact in the area,

especially within the Kathu Bushveld vegetation type. However, the overall development pressure in the wider area is still relatively low and while the Vlermuisleegte River is considered to represent an important movement corridor for fauna, the development area is relatively homogenous, suggesting that the affected area is not likely to be of high significance for landscape connectivity. As discussed in Section 3.3, the cumulative impact on protected tree species is a potential concern given the relatively high numbers of trees that would be affected. However, both *Vachellia erioloba* and *V.haematoxylon* are widespread species across the Kalahari and the loss of the affected individuals would not pose a threat of any kind to the local or regional populations of these species. As pointed out in Section 3.3, the real issue is around the loss of habitat and the implications of this for ecological functioning and landscape connectivity in the area. In terms of ecological considerations, there is no clear threshold of habitat loss above which an offset can be objectively defined as being necessary, especially given that the affected area is not within a CBA. However, the loss of the affected individuals of protected tree species exceeds the thresholds that DAFF has defined as being necessary to trigger an offset. Given that the site is not exceptional in terms of the size or density of trees present, the loss of the affected individuals should be seen as being secondary to the loss of habitat and for these purposes, a threshold of 500ha is given as being a reasonable threshold above which an offset could potentially be considered. In other words, until such time as the footprint of the Hyperion development exceeds 500ha, an offset is not recommended, but for that facility or facilities that result in the overall footprint within the site exceeding 500ha, that should trigger a consideration of an offset. That is not to say that an offset is definitively required above 500ha, but that above this threshold, the need and manner in which an offset could be implemented should be investigated in detail, with input from DAFF and based on both ecological considerations and the mandate of DAFF to ensure sustainable development.

In terms of the comments received from DAFF following the site inspection, DAFF has indicated that Hyperion 2 can possibly proceed without the need for an offset. Based on the analysis presented here, this recommendation is supported by the current study and no offset is considered necessary for the Hyperion 2 development, but any further development of the site may require a more detailed offset study and analysis.

In terms of mitigation requirements to reduce the impact of the development on protected tree species, DAFF has indicated that off-site mitigation would be required, potentially in the form of urban greening or similar contribution to environmental enhancement where this otherwise would be unlikely to occur. In terms of the DAFF guidelines a ratio of 3:1 should be used, indicating that for every tree destroyed, 3 seedlings should be planted. The number of affected trees within Hyperion 2 is estimated at almost 4000 *Vachellia erioloba* trees and almost 20 000 *Vachellia haematoxylon* trees. As such, this would require 72 000 seedlings to be supplied. However, there are some additional considerations that should be

taken into account such as small stature of most of the *Vachellia haematoxylon* trees present on the site as well as the lower desirability of this species for use in greening projects. As this species is less suitable for greening type projects and is likely to be shorter-lived in this situation as well, it is recommended that substitution of *Vachellia haematoxylon* with *Vachellia erioloba* be allowed to occur and that since *Vachellia erioloba* is significantly larger than *Vachellia haematoxylon*, that a ratio of 4:1 be used for such substitution. The following guidelines are provided here and which can be used as stipulations for the EA:

- The total number of trees to be provided for greening projects should comply with the DAFF guidelines but with the stipulation that, if desired, *Vachelia haematoxylon* can be substituted with *Vachelia erioloba* at a ratio of 4:1. As such for every 4 *Vachelia haematoxylon* destroyed, at least 1 *Vachelia erioloba* seedling should be planted.
- The numbers of seedlings required to meet the said mitigation would thus be a total of 12 000 *Vachelia erioloba* seedlings and up to 60 000 *Vachelia haematoxylon* seedlings which can be substituted wholly or partly by *Vachellia erioloba* at a ratio of 4:1, giving rise to a maximum number of *Vachelia erioloba* seedlings of 15 000 for a full substitution.
- The seedlings should be supplied at a size suitable for transplant with a high likelihood of survival. Although some input or negotiation with DAFF in this regard should take place, a minimum height of seedlings of 50cm is provided here as a guideline.
- The seedlings should be supplied for greening projects in Kathu as well as other surrounding towns including but not limited to Olifantshoek, Kuruman, Postmasburg and Deben.
- Contracts for the supply of the seedlings should be signed before construction commences and the full quota of seedlings should be supplied within 5 years of the commencement of construction.

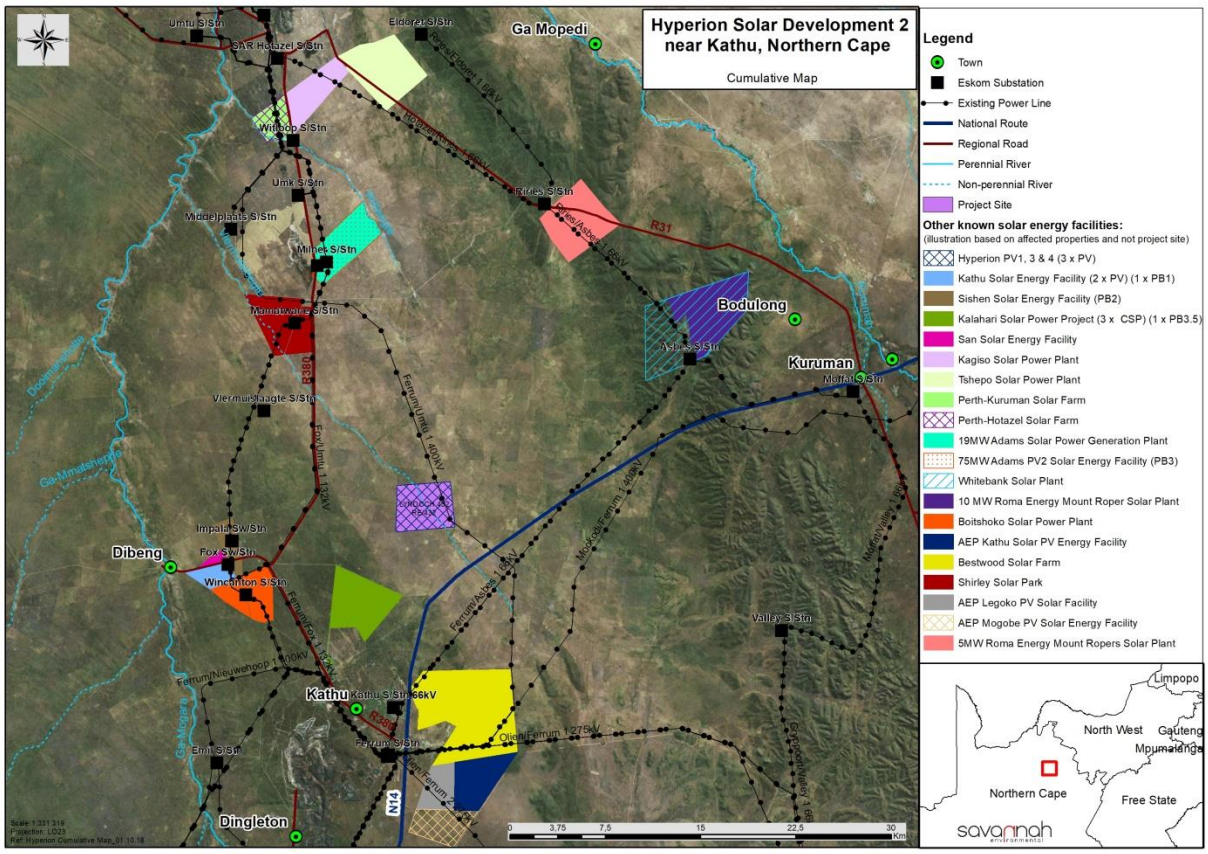

Figure 7. Map of renewable energy development facilities as well as current applications for the wider study area. It is important to note that the map indicates the affected properties and not the extent of the facilities themselves.

3.7 SITE SENSITIVITY ASSESSMENT

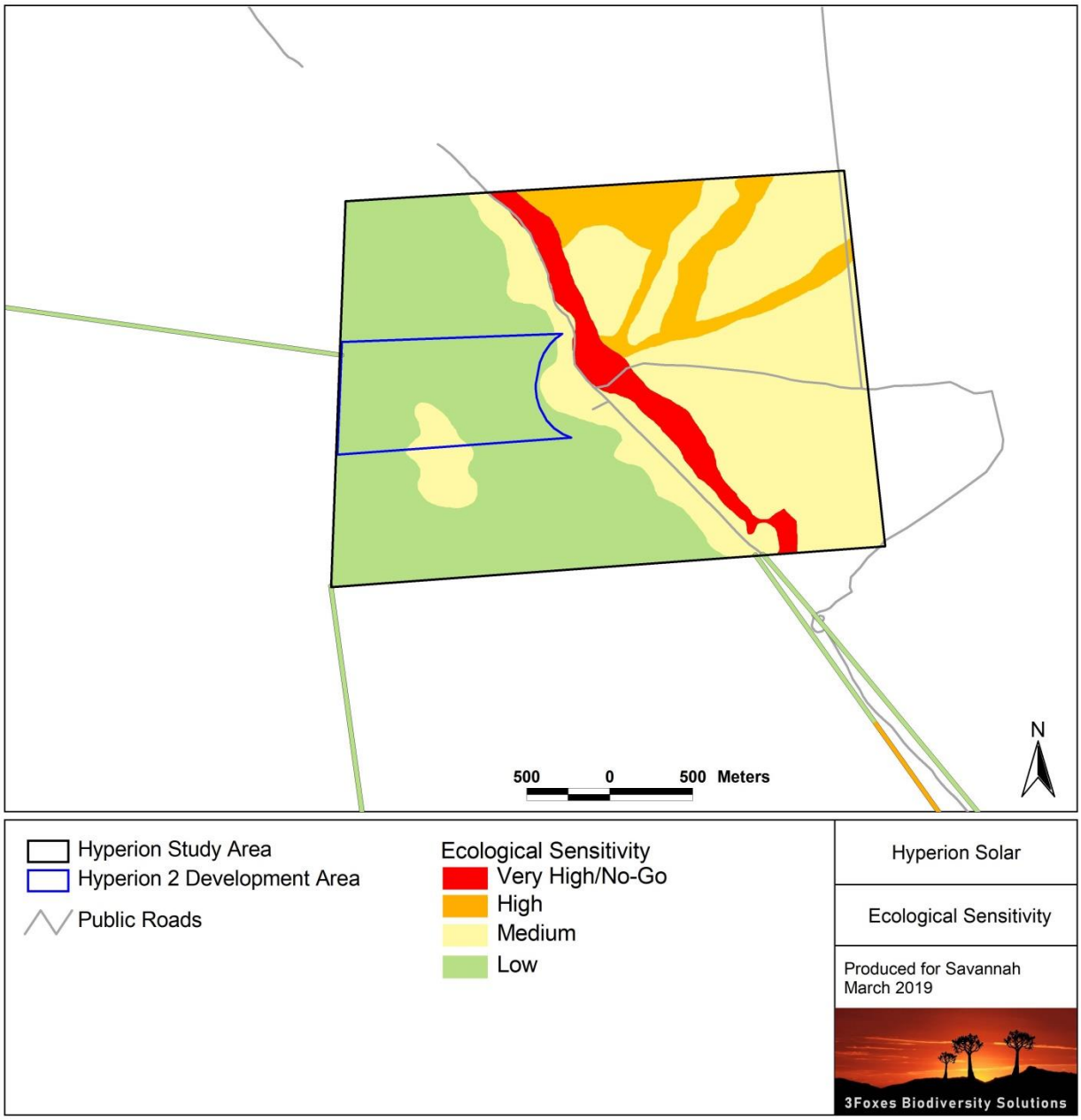

Figure 8. Sensitivity map for the Hyperion Solar Development 2 development area and the wider Hyperion site.

The sensitivity map for the project site and development area associated with Hyperion Solar Development 2 is illustrated above in Figure 8. The main sensitive feature of the project site is the Vlermuisleegte River which is considered to be unsuitable for development and is therefore considered to be a no-go area for all project components apart from the

existing access road which impinges marginally into this area. The majority of the area east of the Vlermuisleegte River has a moderate to high *Vachellia erioloba* density and is considered Medium or High sensitivity. This part of the site is considered to have significantly higher sensitivity than the area west of the Vlermuisleegte River due firstly to the high abundance of protected tree species, but also due to the higher habitat diversity and associated value of this part of the site for fauna. Due to these results which informed the Scoping Phase of the development, the developer has chosen to restrict the development to the western portion of the property.

The majority of the western half of the project site is considered low sensitivity due to the lower abundance of protected tree species and dominance of *Tarchonanthus camphoratus* across large parts of this area, which is generally an indicator of poor veld condition. Although the density of protected trees west of the river is much lower than the areas to the east, the overall number trees that are likely to be affected by the development is still relatively high. There is a low ridge in the central part of this half of the project site which is considered to be medium sensitivity as it has higher plant diversity and is a relatively uncommon habitat in context of the site. However, no species of high conservation concern were observed in this area and it is considered potentially suitable for development. However, even within the generally lower sensitivity western part of the site, the abundance of the protected tree species *Vachellia erioloba* and *V.haematoxylon* is still relatively high and the impact of the development on these species is considered to represent the most significant impact associated with the development.

In terms of the access road options, Alternative 1, upgrading the existing access route is considered to represent the most favourable alternative for the development as it would result in the least overall habitat loss and additional disturbance. Alternative 2, the creation of a new access route adjacent to the existing access is considered acceptable and would generate relatively low overall impact, although the density of protected trees is relatively high along some parts of the route. Alternative 3 is the longest access road alternative and is considered the least desirable as it would generate the greatest extent of habitat loss and also goes through several areas with relatively high densities of *Vachellia erioloba*. Alternative 4 provides access the site from the west and is also considered to represent an acceptable alternative as there are no features of significance in this area and it traverses typical low and medium sensitivity thornveld and some lower sensitivity areas dominated by *Vachellia mellifera*.

4 IDENTIFICATION & NATURE OF IMPACTS

In this section, the potential impacts and associated risk factors that may be generated by the proposed development are identified. In order to ensure that the impacts identified are broadly applicable and inclusive, all the likely or potential impacts that may be associated

with the proposed development are listed. The relevance and applicability of each potential impact to the current situation are then examined in more detail in the next section.

4.1 IDENTIFICATION OF POTENTIAL IMPACTS AND DAMAGING ACTIVITIES

Potential ecological impacts resulting from the proposed development of the Hyperion Solar Development 2 and associated infrastructure and access roads would stem from a variety of different activities and risk factors associated with the preconstruction, construction and operational phases of the project including the following:

Impacts on vegetation and protected plant species

Several protected species occur at the project site which may be impacted by the proposed development and the upgrading of access roads, most notably *Vachellia erioloba* and *A.haematoxylon*. Vegetation clearing during construction will lead to the loss of currently intact habitat within the proposed development footprint and is an inevitable consequence of the proposed development. As this impact is certain to occur it will be assessed for the construction phase as this is when the impact will occur, although the consequences will persist for a long time after construction.

Direct faunal impacts

Increased levels of noise, pollution, disturbance and human presence during construction will be detrimental to fauna. Sensitive and shy fauna would move away from the area during the construction phase as a result of the noise and human activities present, while some slow-moving species would not be able to avoid the construction activities and might be killed. Some impact on fauna is highly likely to occur during construction as well as operation and this impact will therefore be assessed for the construction phase and operational phase.

Impact on CBAs and broad-scale ecological processes

Transformation of intact habitat on a cumulative basis would contribute to the fragmentation of the landscape and would potentially disrupt the connectivity of the landscape for fauna and flora and impair their ability to respond to environmental fluctuations. Due to the presence of a number of other renewable energy and mining developments in the area, this is a potential cumulative impact of the development that is assessed.

5 ASSESSMENT OF IMPACTS

The various identified potential impacts are assessed below for the different phases of the proposed development.

5.1 HYPERION SOLAR DEVELOPMENT 2

The following is an assessment of the Hyperion Solar Development 2 and associated infrastructure including access roads, for the planning and construction and operational phase of the proposed development.

5.1.1 Planning & Construction Phase

Impact 1. Impacts on vegetation and listed or protected plant species resulting from construction activities

Impact Nature: Impacts on vegetation will occur due to disturbance and vegetation clearing associated with the construction of the facility. In addition, there will be significant loss of individuals of protected tree species.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	Medium (55)	Medium (50)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	This impact cannot be well mitigated because the loss of vegetation and individuals of protected tree species is unavoidable and is a certain outcome of the development.	
Mitigation	• Pre-construction walk-through of the facility's final layout in order to locate species of conservation concern that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions. • Search and rescue for identified species of concern before construction. • Vegetation clearing to commence only after walk-through and search and rescue has been conducted and necessary permits obtained. • Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to. This includes awareness of no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimising	

	wildlife interactions, remaining within demarcated construction areas etc. • Contractor's Environmental Officer (EO) to provide supervision and oversight of vegetation clearing activities within sensitive areas such as near the pans. • Vegetation clearing to be kept to a minimum. No unnecessary vegetation to be cleared. • All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area. • Temporary laydown areas should be located within previously transformed areas or areas that have been identified as being of low sensitivity. These areas should be rehabilitated after use.
Cumulative Impacts	The development will contribute to cumulative impacts on habitat loss and transformation in the area. Although large numbers of protected trees would be affected, these are the dominant trees of the area and cumulative impacts on their populations would be low.
Residual Risks	As the loss of currently intact vegetation is an unavoidable consequence of the development, the habitat loss associated with the development remains a moderate residual impact even after mitigation and avoidance of more sensitive areas.

Impact 2. Direct Faunal Impacts Due to Construction Activities

Impact Nature: Disturbance, transformation and loss of habitat will have a negative effect on resident fauna during construction. Due to noise and operation of heavy machinery, faunal disturbance will extend well beyond the footprint and extend into adjacent areas. This will however be transient and restricted to the construction phase.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low to Medium (5)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium (32)	Low (28)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Although the large amounts of noise and disturbance generated at the site during construction is largely unavoidable, impacts such as those	

	resulting from the presence of construction personnel at the site can be easily mitigated.
Mitigation	• All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition. • Any fauna threatened by the construction activities should be removed to safety by an appropriately qualified environmental officer. • All construction vehicles should adhere to a low speed limit (30km/h for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • If trenches need to be dug for electrical cabling or other purpose, these should not be left open for extended periods of time as fauna may fall in and become trapped in them. Trenches which are standing open should have places where there are soil ramps allowing fauna to escape the trench.
Cumulative Impacts	During the construction phase the activity would contribute to cumulative fauna disturbance and disruption in the area, but as there are still tracts of intact habitat in the area, it is likely that displaced fauna will have space to move about the site to avoid areas of high activity.
Residual Risks	It is probable that some individuals of susceptible species will be lost to construction-related activities despite mitigation. However, this is not likely to impact the viability of the local population of any fauna species.

5.1.2 Operational Phase Impacts

Impact 1. Faunal Impacts due to Operation

Impact Nature: The operation and presence of the facility may lead to disturbance or persecution of fauna within or adjacent to the facility.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)

Significance	Low (27)	Low (21)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	To a large extent, but some low-level residual impact due to noise and human disturbance during maintenance is likely.	
Mitigation	• Any potentially dangerous fauna such as snakes or fauna threatened by the maintenance and operational activities should be removed to a safe location. • If the site must be lit at night for security purposes, this should be done with downward-directed low-UV type lights (such as most LEDs), which do not attract insects. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • All vehicles accessing the site should adhere to a low speed limit (30km/h max for heavy vehicles and 40km/h for light vehicles) to avoid collisions with susceptible species such as snakes and tortoises. • If the facility is to be fenced, then no electrified strands should be placed within 30cm of the ground as some species such as tortoises are susceptible to electrocution from electric fences because they do not move away when electrocuted but rather adopt defensive behaviour and are killed by repeated shocks. Alternatively, the electrified strands should be placed on the inside of the fence and not the outside as is the case on the majority of already constructed PV plants.	
Cumulative Impacts	The development would contribute to cumulative disturbance for fauna, but the contribution would be low for most species and is not considered highly significant.	
Residual Risks	Disturbance from maintenance activities will occur at a low level with the result that disturbance would be largely restricted to the site.	

5.1.3 Decommissioning Phase

Decommissioning Phase Impact 1. Habitat Degradation due to Erosion and Alien Plant Invasion

Impact Nature: Disturbance created during decommissioning will leave the site vulnerable to erosion and alien plant invasion for several years.		
	Without Mitigation	**With Mitigation**

Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (3)
Magnitude	Medium (4)	Low (3)
Probability	Likely (4)	Likely (3)
Significance	Medium (32)	Low (21)
Status	Negative	Negative
Reversibility	Low	High
Irreplaceable loss of resources	Moderate	Low
Can impacts be mitigated?	Yes, with proper management and avoidance, this impact can be mitigated to a low level.	
Mitigation	• Erosion management at the site should take place according to the Erosion Management Plan and Rehabilitation Plan. This should make provision for monitoring of the site for at least 5 years after decommissioning. • All erosion problems observed should be rectified as soon as possible, using the appropriate erosion control structures and revegetation techniques. • There should be follow-up rehabilitation and revegetation of any remaining bare areas with indigenous perennial shrubs, grasses and trees from the local area. • Alien management at the site should take place according to the Alien Invasive Management Plan. This should make provision for alien monitoring and management for at least 5 years after decommissioning. • Regular (annual) monitoring for alien plants during operation to ensure that no erosion problems have developed as result of the disturbance, as per the Alien Management Plan for the project. • Woody aliens should be controlled on at least an annual basis using the appropriate alien control techniques as determined by the species present. This might include the use of herbicides where no practical manual means are available.	
Cumulative Impacts	Erosion and alien plant invasion would contribute to degradation in the area, but as this can be well-mitigated, the contribution can be minimised.	
Residual Risks	Some erosion and alien plant invasion is likely to occur even with the implementation of control measures, but would have a low impact if effectively managed.	

Decommissioning Phase Impact 2. Direct Faunal Impacts Due to Decommissioning Activities

Impact Nature: Due to disturbance, noise and the operation of heavy machinery, faunal disturbance due to decommissioning will extend beyond the footprint and impact adjacent areas to some degree. This will however be transient and restricted to the period while machinery is operational. In the long term, decommissioning should restore the ecological functioning and at least some habitat value to the affected areas.		
	Without Mitigation	**With Mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	Low (28)	Low (18)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	No	No
Can impacts be mitigated?	Although the noise and disturbance generated at the site during decommissioning is probably largely unavoidable, this will be transient and ultimately the habitat should be restored to something useable by the local fauna.	
Mitigation	• All personnel should undergo environmental induction with regards to fauna and, in particular, awareness about not harming or collecting species such as snakes, tortoises and owls, which are often persecuted out of superstition. • Any fauna threatened by the decommissioning activities should be removed to safety by an appropriately qualified environmental officer. • All vehicles should adhere to a low speed limit to avoid collisions with susceptible species such as snakes and tortoises. • All hazardous materials should be stored in the appropriate manner to prevent contamination of the site and ultimately removed from the site as part of decommissioning. Any accidental chemical, fuel and oil spills that occur at the site should be cleaned up in the appropriate manner as related to the nature of the spill. • The site should be rehabilitated with locally occurring species to restore ecosystem structure and function.	
Cumulative Impacts	During the decommissioning, the associated disturbance would contribute to cumulative fauna disturbance and disruption in the area, but this would be transient and not of long-term impact.	

Residual Risks	Although some components of disturbance cannot be avoided, the site itself would have low faunal abundance at decommissioning and no significant residual impacts are likely.

5.1.4 Cumulative Impacts

The following are the cumulative impacts that are assessed as being a likely consequence of the development of the Hyperion PV 1 Facility. This is assessed in context of the extent of the current site, other developments in the area as well as general habitat loss and transformation resulting from mining, agriculture and other activities in the area.

Cumulative Impact 1. Reduced ability to meet conservation obligations & targets due to cumulative habitat loss

Nature: The development of the Hyperion PV 1 project will contribute to cumulative habitat loss and other cumulative impacts in the wider Kathu area.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	Low (16)	Medium (30)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated	To some degree, but the majority of the impact results from the presence of the facility which cannot be mitigated.	
Mitigation: • Ensure that impact to the Vlermuisleegte River corridor is minimised and that connectivity of the landscape through this area is maintained. There should also not be any further development within the eastern section of the property. • Ensure that the fencing around each facility is friendly with fauna and avifauna. This includes not having any electrified strands within 30cm of the ground as well as implementing a design that		

prevents fauna and avifauna from becoming trapped between the inner and out layer of the fence as this has been demonstrated to be a common impact associated with existing PV plants. • Ensure that an alien management plan and erosion management plan compiled for each project are effectively implemented at the site.	
Residual Risks	Once present, the facility and its' immediate environment will not be available for meeting conservation targets for at least 20 years and thereafter, even when rehabilitated, it would have low conservation value. As such, the development would result in some permanent loss of conservation value for the affected area.

Cumulative Impact 2. Negative impact on broad-scale ecological processes.

Impact Nature: Development of the Hyperion PV 1 plant may impact on broad-scale ecological processes such as the ability of fauna to disperse.

The development would potentially contribute to habitat degradation and the loss of landscape connectivity and ecosystem function within the area, but this is likely to be relatively low as most species are likely to be able to avoid the facility as there are still relatively large intact corridors present in the area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (3)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	Low (16)	Low (27)
Status	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources	Low	Low
Can impacts be mitigated?	Only partly as a significant proportion of the impact results from the presence and operation of the facility which cannot be well mitigated.	
Mitigation	• Ensure that known faunal movement corridors such as the Vlermuisleegte River are not developed and remain accessible to fauna. • Ensure that the mitigation hierarchy is applied with a particular emphasis on reducing the development footprint, rehabilitating disturbed areas and minimising degradation around the site. • An open space management plan should be developed for the site, which should include management of biodiversity within the affected areas, as well as that in the adjacent bushveld.	

Residual Risks	The presence of the various facilities will represent an obstacle for some fauna which would contribute to fragmentation in the area.

5.1.5 Comparative Assessment of Access Road Alternatives

A comparative assessment of the access road alternatives is detailed below and includes the identification of the preferred alternative.

Alternative	Preference	Reasons (incl. potential issues)
ACCESS ROAD OPTION		
Alternative 1	Preferred	Alternative 1, upgrading the existing access route is considered to represent the most favourable alternative for the development as it would result in the least overall habitat loss and additional disturbance.
Alternative 2	Favourable	Alternative 2, the creation of a new access route adjacent to the existing access is considered acceptable and would generate relatively low overall impact, although the density of protected trees is relatively high along some parts of the route.
Alternative 3	Least Preferred	Alternative 3 is the longest access road alternative and is considered the least desirable as it would generate the greatest extent of habitat loss and also goes through several areas with relatively high densities of *Vachellia erioloba* and also impinges a little on a CBA. This is considered the least preferred alternative.
Alternative 4	Favourable	Alternative 4 provides access the site from the west and is also considered to represent an acceptable alternative as there are no features of significance in this area and it traverses typical low and medium sensitivity thornveld and some lower sensitivity areas dominated by *Vachellia mellifera*.

6 CONCLUSION & RECOMMENDATIONS

The vegetation of the Hyperion Solar Development 2 project site consists of Kathu Bushveld which is a relatively restricted vegetation type, but which is currently not threatened as it is still largely intact despite an increasing development footprint due to mining and solar PV development in the area. Within the context of the site, that area east of the Vlermuisleegte River is considered more sensitive than the area to the west of the river. As a result, the developer has restricted the development to the western portion of the property which is considered relatively low sensitivity and suitable for development.

The whole site has a relatively high abundance of *Vachellia erioloba* and *Vachellia haematoxylon* and the loss of relatively high numbers of individuals of these species cannot be avoided. These species are however very abundant in the area and the local populations would not be compromised to any degree. Given that the site is not exceptional in terms of the size or density of trees present, the loss of the affected individuals should be seen as being secondary to the loss of habitat. Although the number of individuals lost would exceed the suggested DAFF thresholds for offsets, for ecological purposes, a threshold for habitat loss of 500ha is given as being a reasonable threshold above which an offset could potentially be considered. As such, an offset is not recommended for the current Hyperion 2 development, but for that facility or facilities that result in the overall footprint within the site exceeding 500ha, that should trigger at least the consideration of an offset. That is not to say that an offset is definitively required above 500ha, but that above this threshold, the need and manner in which an offset could be implemented should be investigated in detail, with input from DAFF and based on both ecological considerations and the mandate of DAFF to ensure sustainable development.

In terms of fauna, there are few species of conservation concern that are likely to be present or abundant at the site and the primary impact of the development on fauna would be some habitat loss for the more common resident species. As such, no high long-term post-mitigation impacts on fauna are expected to occur as a result of the Hyperion development. Overall, and despite the abundance of *Vachellia erioloba* and *V.haematoxylon* on the site, there are no potential impacts associated with the proposed development that are considered to be of high significance and which cannot be mitigated to an acceptable level. As such, there are no fatal flaws or other major impediments that should prevent the development from going ahead.

Impact Statement

The development footprint of the Hyperion Solar Development 2 facility is restricted to low and moderate sensitivity habitat common in the Kathu-Hotazel-Kuruman area. The affected area is considered suitable for development and there are no impacts associated with the facility that cannot be mitigated to a low level. Although cumulative impacts in the wider Kathu area are currently on the increase due to the expansion of the mines and the proliferation of solar PV facilities in the area, these still occupy a small proportion of the Kathu Bushveld vegetation type and the contribution of the current development to cumulative impact would be low and considered acceptable. As such there are no fatal flaws or high post-mitigation impacts that should prevent the development from proceeding. Based on the layout provided for the assessment, the Hyperion Solar Development facility can be supported from a terrestrial ecology point of view. Access Road Alternative 1 is considered to be the preferred access road alternative.

7 Activities for Inclusion the Draft EMPr

An Environmental Management Programme (EMPr) provides a link between the predicted impacts and mitigation measures recommended within the EIA and the implementation and operational activities of a project. As the construction and operation of the Hyperion PV plant may impact the environment, activities which pose a threat should be managed and mitigated so that unnecessary or preventable environmental impacts do not result. The primary objective of the EMPr is to detail actions required to address the impacts identified in the EIA during the establishment, operation and rehabilitation of the proposed infrastructure. The EMPr provides an elaboration of how to implement the mitigation measures documented in the EIA. As such the purpose of the EMPr can be outlined as follows:

- To outline mitigation measures and environmental specifications which are required to be implemented for the planning, establishment, rehabilitation and operation/maintenance phases of the project in order to minimise and manage the extent of environmental impacts.
- To ensure that the establishment and operation phases of the wind farm do not result in undue or reasonably avoidable adverse environmental impacts, and ensure that any potential environmental benefits are enhanced.
- To identify entities who will be responsible for the implementation of the measures and outline functions and responsibilities.
- To propose mechanisms for monitoring compliance, and preventing long-term or permanent environmental degradation.
- To facilitate appropriate and proactive response to unforeseen events or changes in project implementation that were not considered in the EIA process

Below are the ecologically-orientated measures that should be implemented as part of the EMPr for the development to reduce the significance or extent of the above impacts. The measures below do not exactly match with the impacts that have been identified, as certain mitigation measures, such as limiting the loss of vegetation may be effective at combating several different impacts, such as erosion, faunal impact etc.

Construction Phase Activities

Objective: Limit disturbance of vegetation and loss of protected flora during construction			
Potential Impact	Loss of plant cover leading to erosion as well as loss of faunal habitat and loss of specimens of protected plants.		
Activity/risk source	Vegetation clearing for the following » Clearing for infrastructure establishment. » Access roads. » Laydown areas. » Construction Camps.		
Mitigation: Target/Objective	» Low footprint and low impact on terrestrial environment. » Low impact on protected plant species.		
Mitigation: Action/control		Responsibility	Timeframe
» Preconstruction walk-through of PV Plant and access road footprints to identify protected species and obtain information to inform a preconstruction Search and Rescue operation. » Obtain relevant permits from the Department of Agriculture, Forestry and Fisheries (DAFF) and the Northern Cape Department of Environment and Nature Conservation (DENC) prior to any construction activities at the site. » Affected individuals of selected (ie those that are of high conservation value or which have a high probability of surviving translocation) protected species which cannot be avoided should be translocated to a safe area on the site prior to construction. This does not include woody species which cannot be translocated and where these are protected by DAFF and permit for their destruction would be required. » Erosion control measures should be implemented in areas where slopes have been disturbed. » Revegetation of cleared areas or monitoring to ensure that recovery is taking place. » Alien plant clearing where necessary.		Management/EO	Construction & Operation
Performance Indicator	» Vegetation loss restricted to infrastructure footprint. » Impact on protected plant species reduced to some degree through Search and Rescue. » Permit obtained to destroy or translocate affected individuals of protected species.		
Monitoring	EO to monitor construction to ensure that: » Vegetation is cleared only within essential areas. » Erosion risk is maintained at an acceptable level through flow regulation structures where appropriate and the maintenance of plant cover wherever possible.		

Objective: Limit direct and indirect terrestrial faunal impacts during construction			
Project component/s	Construction activities especially the following: » Vegetation clearing. » Human presence. » Operation of heavy machinery.		
Potential Impact	Disturbance of faunal communities due to construction as well as poaching and hunting risk from construction staff.		
Activity/risk source	» Habitat transformation during construction. » Presence of construction crews. » Operation of heavy vehicles.		
Mitigation: Target/Objective	Low faunal impact during construction.		
Mitigation: Action/control		Responsibility	Timeframe
» Environmental induction for all construction staff. » EO to monitor and enforce ban on hunting, collecting etc. of all plants and animals or their products. » Any fauna encountered during construction should be removed to safety by the EO or other suitably qualified person, or allowed to passively vacate the area. » All vehicles to adhere to low speed limits (40km/h max) on the site, to reduce risk of faunal collisions as well as reduce dust. » All night-lighting should use low-UV type lights (such as most LEDs), which do not attract insects. The lights should also be of types which are directed downward and do not result in large amounts of light pollution.		Management/EO	Construction
Performance Indicator	» Low mortality of fauna due to construction machinery and activities. » No poaching etc of fauna by construction personnel during construction. » Removal to safety of fauna encountered during construction.		
Monitoring	Monitoring for compliance during the construction phase. All incidents to be noted.		

Operational Phase Activities

OBJECTIVE: Limit the ecological footprint of the PV Plant	
Project component/s	Presence and operation of the facility including » Movement of vehicles to and from the site. » Presence of the PV infrastructure and site fencing.
Potential Impact	» Alien plant invasion » Erosion » Pollution

	» Faunal Impacts		
Activity/risk source	» Alien plant invasion in and around the road. » Unregulated runoff from the access road. » Human presence during road maintenance activities » Pollution from maintenance vehicles due to oil or fuel leaks etc. » Maintenance activities which may lead to negative impacts such as pollution, herbicide drift etc.		
Mitigation: Target/Objective	Low ecological footprint of the PV Plant during operation.		
Mitigation: Action/control		Responsibility	Timeframe
Vegetation control should be by manual clearing and herbicides should not be used except to control alien plants in the prescribed manner.		Management/ Contractor	Operation
Annual monitoring for alien plant species - with follow up clearing as needed – or as per the frequency stated in the alien invasive management plan to be developed for the site.		Management/ Contractor	Operation
Annual site inspection for erosion or water flow regulation problems – with follow up remedial action where problems are identified.		Management/ Contractor	Operation
Performance Indicator	» No erosion problems at the site. » Low abundance of alien plants.		
Monitoring	» Annual monitoring with records of alien species presence and clearing actions. » Annual monitoring with records of erosion problems and mitigation actions taken with photographs.		

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9 ANNEX 1. LIST OF PLANT SPECIES

List of plant species confirmed present at the Hyperion site during the course of the field assessment.

Family	Species	IUCN Status
ACANTHACEAE	*Barleria rigida*	LC
ACANTHACEAE	*Justicia puberula*	LC
AIZOACEAE	*Plinthus sericeus*	LC
AMARANTHACEAE	*Gomphrena celosioides*	LC
AMARANTHACEAE	*Hermbstaedtia odorata var. odorata*	LC
AMARANTHACEAE	*Pupalia lappacea var. lappacea*	LC
AMARYLLIDACEAE	*Boophone disticha*	LC
ANACARDIACEAE	*Searsia ciliata*	LC
APOCYNACEAE	*Raphionacme velutina*	LC
ASPARAGACEAE	*Asparagus laricinus*	LC
ASPARAGACEAE	*Asparagus retrofractus*	LC
ASPHODELIACEAE	*Bulbine narcissifolia*	LC
ASTERACEAE	*Chrysocoma ciliata*	LC
ASTERACEAE	*Dicoma schinzii*	LC
ASTERACEAE	*Felicia muricata subsp. cinerascens*	LC
ASTERACEAE	*Gazania krebsiana subsp. krebsiana*	LC
ASTERACEAE	*Geigeria ornativa*	LC
ASTERACEAE	*Helichrysum zeyheri*	LC
ASTERACEAE	*Hertia pallens*	LC
ASTERACEAE	*Nolletia ciliaris*	LC
ASTERACEAE	*Osteospermum muricatum*	LC
ASTERACEAE	*Pegolettia retrofracta*	LC
ASTERACEAE	*Pentzia calcarea*	LC
ASTERACEAE	*Pentzia sphaerocephala*	LC
ASTERACEAE	*Pteronia incana*	LC
ASTERACEAE	*Rosenia humilis*	LC
ASTERACEAE	*Senecio inaequidens*	LC
ASTERACEAE	*Tarchonanthus camphoratus*	LC
ASTERACEAE	*Verbesina encelioides*	LC
BORAGINACEAE	*Ehretia rigida subsp. rigida*	LC
BORAGINACEAE	*Heliotropium ciliatum*	LC
CAPPARACEAE	*Cleome rubella*	LC
CELASTRACEAE	*Gymnosporia buxifolia*	LC
COMMELINACEAE	*Commelina africana var. africana*	LC
CUCURBITACEAE	*Acanthosicyos naudinianus*	LC
CUCURBITACEAE	*Coccinia sessilifolia*	LC
CUCURBITACEAE	*Cucumis africanus*	LC

CYPERACEAE	*Cyperus margaritaceus var. margaritaceus*	LC
CYPERACEAE	*Kyllinga alba*	LC
EBENACEAE	*Diospyros lycioides subsp. lycioides*	LC
ERIOSPERMACEAE	*Eriospermum sp.*	LC
EUPHORBIACEAE	*Tragia dioica*	LC
FABACEAE	*Vachellia hebeclada*	LC
FABACEAE	*Vachellia erioloba*	LC
FABACEAE	*Vachellia haematoxylon*	LC
FABACEAE	*Vachellia karroo*	LC
FABACEAE	*Vachellia mellifera subsp. detinens*	LC
FABACEAE	*Cyamopsis serrata*	LC
FABACEAE	*Elephantorrhiza elephantina*	LC
FABACEAE	*Indigofera daleoides var. daleoides*	LC
FABACEAE	*Lessertia pauciflora var. pauciflora*	LC
FABACEAE	*Melolobium exudans*	LC
FABACEAE	*Melolobium macrocalyx var. macrocalyx*	LC
FABACEAE	*Senna italica subsp. arachoides*	LC
FABACEAE	*Tephrosia burchellii*	LC
FABACEAE	*Tephrosia longipes subsp. longipes var. longipes*	LC
GERANIACEAE	*Monsonia angustifolia*	LC
GISEKIACEAE	*Gisekia pharnacioides var. pharnacioides*	LC
HYACINTHACEAE	*Dipcadi viride*	LC
HYACINTHACEAE	*Ledebouria ovatifolia*	LC
IRIDACEAE	*Babiana bainesii*	LC
LAMIACEAE	*Acrotome inflata*	LC
LAMIACEAE	*Leucas capensis*	LC
MALVACEAE	*Corchorus pinnatipartitus*	LC
MALVACEAE	*Grewia flava*	LC
MALVACEAE	*Hermannia comosa*	LC
MALVACEAE	*Hermannia jacobeifolia*	LC
MALVACEAE	*Hermannia linnaeoides*	LC
MALVACEAE	*Hermannia tomentosa*	LC
MALVACEAE	*Hibiscus marlothianus*	LC
MALVACEAE	*Hibiscus pusillus*	LC
MALVACEAE	*Pavonia burchellii*	LC
MOLLUGINACEAE	*Hypertelis salsoloides*	LC
MOLLUGINACEAE	*Limeum aethiopicum var. intermedium*	LC
MOLLUGINACEAE	*Limeum argute carinatum var argute carinatum*	LC
MOLLUGINACEAE	*Limeum fenestratum var. fenestratum*	LC
MOLLUGINACEAE	*Limeum sulcatum var sulcatum*	LC
MOLLUGINACEAE	*Mollugo cerviana*	LC
OROBANCHACEAE	*Striga bilabiata subsp. bilabiata*	LC
OXALIDACEAE	*Oxalis depressa*	LC
OXALIDACEAE	*Oxalis lawsonii*	LC

PEDALIACEAE	*Sesamum triphyllum*	LC
PHYLLANTHACEAE	*Phyllanthus maderaspatensis*	LC
POACEAE	*Aristida adscensionis*	LC
POACEAE	*Aristida congesta subsp. congesta*	LC
POACEAE	*Aristida meridionalis*	LC
POACEAE	*Aristida stipitata subsp. graciliflora*	LC
POACEAE	*Aristida stipitata subsp. stipitata*	LC
POACEAE	*Brachiaria marlothii*	LC
POACEAE	*Cenchrus ciliaris*	LC
POACEAE	*Cymbopogon popischilli*	LC
POACEAE	*Cynodon dactylon*	LC
POACEAE	*Enneapogon cenchroides*	LC
POACEAE	*Enneapogon desvauxii*	LC
POACEAE	*Eragrostis biflora*	LC
POACEAE	*Eragrostis lehmanniana var. chaunantha*	LC
POACEAE	*Eragrostis nindensis*	LC
POACEAE	*Eragrostis obtusa*	LC
POACEAE	*Fingerhuthia africana*	LC
POACEAE	*Melinis repens subsp. repens*	LC
POACEAE	*Oropetium capense*	LC
POACEAE	*Pogonarthria squarrosa*	LC
POACEAE	*Schmidtia pappophoroides*	LC
POACEAE	*Stipagrostis obtusa*	LC
POACEAE	*Stipagrostis uniplumis var. uniplumis*	LC
POACEAE	*Tragus berteronianus*	LC
POLYGALACEAE	*Polygala seminuda*	LC
PORTULACACEAE	*Portulaca kermesina*	LC
PORTULACACEAE	*Talinum arnotii*	LC
RANUNCULACEAE	*Clematis brachiata*	LC
RHAMNACEAE	*Ziziphus mucronata subsp. mucronata*	LC
RUBIACEAE	*Kohautia caespitosa subsp. brachyloba*	LC
SCROPHULARIACEAE	*Aptosimum albomarginatum*	LC
SCROPHULARIACEAE	*Aptosimum elongatum*	LC
SCROPHULARIACEAE	*Aptosimum lineare var. lineare*	LC
SCROPHULARIACEAE	*Chaenostoma halimifolium*	LC
SCROPHULARIACEAE	*Jamesbrittenia atropurpurea subsp. atropurpurea*	LC
SCROPHULARIACEAE	*Peliostomum leuchorhizum*	LC
SCROPHULARIACEAE	*Selago mixta*	LC
SCROPHULARIACEAE	*Sutera griquensis*	LC
SOLANACEAE	*Datura stramonium*	LC
SOLANACEAE	*Lycium hirsutum*	LC
THYMELAEACEAE	*Gnidia polycephala*	LC
VAHLIACEAE	*Vahlia capensis subsp. vulgaris var. vulgaris*	LC
VERBENACEAE	*Chascanum pinnatifidum var. pinnatifidum*	LC

VERBENACEAE	*Lantana rugosa*	LC
ZYGOPHYLLACEAE	*Tribulus terrestris*	LC

10 ANNEX 2. LIST OF MAMMALS

List of mammals which have been observed or which are likely to occur in the vicinity of the Hyperion site. Conservation status is from 2016 EWT/SANBI Red List.

Family	Scientific name	Common name	Red list category	Number of records
Bathyergidae	*Bathyergus janetta*	Namaqua Dune Mole-rat	Least Concern (2016)	1
Bathyergidae	*Cryptomys hottentotus*	Southern African Mole-rat	Least Concern (2016)	6
Bathyergidae	*Fukomys damarensis*	Damara Mole-rat	Least Concern (2016)	12
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern (2016)	7
Bovidae	*Oreotragus oreotragus*	Klipspringer	Least Concern (2016)	6
Bovidae	*Oryx gazella*	Gemsbok	Least Concern (2016)	16
Bovidae	*Raphicerus campestris*	Steenbok	Least Concern (2016)	9
Bovidae	*Sylvicapra grimmia*	Bush Duiker	Least Concern (2016)	8
Bovidae	*Tragelaphus strepsiceros*	Greater Kudu	Least Concern (2016)	12
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern (2016)	10
Canidae	*Otocyon megalotis*	Bat-eared Fox	Least Concern (2016)	5
Canidae	*Vulpes chama*	Cape Fox	Least Concern (2016)	7
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern (2016)	8
Erinaceidae	*Atelerix frontalis*	Southern African Hedgehog	Near Threatened (2016)	9
Felidae	*Caracal caracal*	Caracal	Least Concern (2016)	1
Felidae	*Felis nigripes*	Black-footed Cat	Vulnerable (2016)	3
Felidae	*Felis silvestris*	Wildcat	Least Concern (2016)	1
Felidae	*Panthera pardus*	Leopard	Vulnerable (2016)	4
Gliridae	*Graphiurus platyops*	Flat-headed African Dormouse	Data deficient	1
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern (2016)	2
Herpestidae	*Herpestes sanguineus*	Slender Mongoose	Least Concern (2016)	2
Herpestidae	*Suricata suricatta*	Meerkat	Least Concern (2016)	3
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened	12
Hyaenidae	*Proteles cristata*	Aardwolf	Least Concern (2016)	6
Hystricidae	*Hystrix africaeaustralis*	Cape Porcupine	Least Concern	16
Leporidae	*Lepus capensis*	Cape Hare	Least Concern	18
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern	16

Leporidae	*Pronolagus rupestris*	Smith's Red Rock Hare	Least Concern (2016)	14
Macroscelididae	*Elephantulus intufi*	Bushveld Elephant Shrew	Least Concern (2016)	1
Macroscelididae	*Elephantulus myurus*	Eastern Rock Elephant Shrew	Least Concern (2016)	29
Macroscelididae	*Elephantulus rupestris*	Western Rock Elephant Shrew	Least Concern (2016)	37
Macroscelididae	*Macroscelides proboscideus*	Short-eared Elephant Shrew	Least Concern (2016)	1
Manidae	*Smutsia temminckii*	Ground Pangolin	Vulnerable (2016)	23
Muridae	*Aethomys chrysophilus*	Red Veld Aethomys	Least Concern (2016)	3
Muridae	*Aethomys namaquensis*	Namaqua Rock Mouse	Least Concern	171
Muridae	*Desmodillus auricularis*	Cape Short-tailed Gerbil	Least Concern (2016)	38
Muridae	*Gerbilliscus brantsii*	Highveld Gerbil	Least Concern (2016)	4
Muridae	*Gerbilliscus leucogaster*	Bushveld Gerbil	Least Concern (2016)	103
Muridae	*Gerbilliscus paeba*	Paeba Hairy-footed Gerbil	Least Concern (2016)	2
Muridae	*Gerbilliscus vallinus*	Brush-tailed Hairy-footed Gerbil	Least Concern (2016)	4
Muridae	*Mastomys coucha*	Southern African Mastomys	Least Concern (2016)	56
Muridae	*Mus (Nannomys) minutoides*	Southern African Pygmy Mouse	Least Concern	27
Muridae	*Otomys auratus*	Southern African Vlei Rat	Near Threatened (2016)	3
Muridae	*Parotomys brantsii*	Brants's Whistling Rat	Least Concern (2016)	1
Muridae	*Rhabdomys pumilio*	Xeric Four-striped Grass Rat	Least Concern (2016)	41
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern (2016)	2
Mustelidae	*Mellivora capensis*	Honey Badger	Least Concern (2016)	4
Nesomyidae	*Saccostomus campestris*	Southern African Pouched Mouse	Least Concern (2016)	45
Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern (2016)	4
Pedetidae	*Pedetes capensis*	South African Spring Hare	Least Concern (2016)	23
Procaviidae	*Procavia capensis*	Cape Rock Hyrax	Least Concern (2016)	15
Sciuridae	*Xerus inauris*	South African Ground Squirrel	Least Concern	16
Soricidae	*Crocidura cyanea*	Reddish-gray Musk Shrew	Least Concern (2016)	3
Soricidae	*Crocidura hirta*	Lesser Red Musk Shrew	Least Concern (2016)	12
Suidae	*Phacochoerus africanus*	Common Warthog	Least Concern (2016)	11

11 ANNEX 2. LIST OF REPTILES

List of reptiles which are likely to occur at the proposed Hyperion site, based on the ReptileMap database. Conservation status is from Bates et al. (2014).

Family	Scientific name	Common name	Red list category	Number of records
Agamidae	*Agama aculeata aculeata*	Common Ground Agama	Least Concern (SARCA 2014)	41
Agamidae	*Agama atra*	Southern Rock Agama	Least Concern (SARCA 2014)	17
Amphisbaenidae	*Monopeltis mauricei*	Maurice's Worm Lizard	Least Concern (SARCA 2014)	1
Amphisbaenidae	*Zygaspis quadrifrons*	Kalahari Dwarf Worm Lizard	Least Concern (SARCA 2014)	4
Chamaeleonidae	*Chamaeleo dilepis dilepis*	Common Flap-neck Chameleon	Least Concern (SARCA 2014)	8
Colubridae	*Dasypeltis scabra*	Rhombic Egg-eater	Least Concern (SARCA 2014)	2
Colubridae	*Dispholidus typus typus*	Boomslang	Least Concern (SARCA 2014)	3
Colubridae	*Philothamnus semivariegatus*	Spotted Bush Snake	Least Concern (SARCA 2014)	1
Colubridae	*Telescopus semiannulatus semiannulatus*	Eastern Tiger Snake	Least Concern (SARCA 2014)	9
Cordylidae	*Karusasaurus polyzonus*	Karoo Girdled Lizard	Least Concern (SARCA 2014)	7
Elapidae	*Aspidelaps scutatus scutatus*	Speckled Shield Cobra	Least Concern (SARCA 2014)	4
Elapidae	*Dendroaspis polylepis*	Black Mamba	Least Concern (SARCA 2014)	1
Elapidae	*Naja nigricincta woodi*	Black Spitting Cobra	Least Concern (SARCA 2014)	2
Elapidae	*Naja nivea*	Cape Cobra	Least Concern (SARCA 2014)	4
Gekkonidae	*Chondrodactylus angulifer*	Giant Ground Gecko	Least Concern (IUCN 2009)	4
Gekkonidae	*Chondrodactylus angulifer angulifer*	Common Giant Ground Gecko	Least Concern (SARCA 2014)	9
Gekkonidae	*Chondrodactylus bibronii*	Bibron's Gecko	Least Concern (SARCA 2014)	3
Gekkonidae	*Lygodactylus bradfieldi*	Bradfield's Dwarf Gecko	Least Concern (SARCA 2014)	1
Gekkonidae	*Lygodactylus capensis capensis*	Common Dwarf Gecko	Least Concern (SARCA 2014)	8
Gekkonidae	*Pachydactylus capensis*	Cape Gecko	Least Concern (SARCA 2014)	14
Gekkonidae	*Pachydactylus rugosus*	Common Rough Gecko	Least Concern (SARCA 2014)	1
Gekkonidae	*Pachydactylus wahlbergii wahlbergii*	Kalahari Ground Gecko	Least Concern (SARCA 2014)	12
Gekkonidae	*Ptenopus garrulus garrulus*	Common Barking Gecko	Least Concern (SARCA 2014)	12
Gerrhosauridae	*Gerrhosaurus flavigularis*	Yellow-throated Plated Lizard	Least Concern (SARCA 2014)	1
Lacertidae	*Heliobolus lugubris*	Bushveld Lizard	Least Concern (SARCA 2014)	23
Lacertidae	*Meroles squamulosus*	Common Rough-scaled Lizard	Least Concern (SARCA 2014)	3
Lacertidae	*Nucras intertexta*	Spotted Sandveld Lizard	Least Concern (SARCA 2014)	14

Lacertidae	*Pedioplanis lineoocellata lineoocellata*	Spotted Sand Lizard	Least Concern (SARCA 2014)	37
Lacertidae	*Pedioplanis namaquensis*	Namaqua Sand Lizard	Least Concern (SARCA 2014)	4
Lamprophiidae	*Aparallactus capensis*	Black-headed Centipede-eater	Least Concern (SARCA 2014)	1
Lamprophiidae	*Atractaspis bibronii*	Bibron's Stiletto Snake	Least Concern (SARCA 2014)	4
Lamprophiidae	*Atractaspis duerdeni*	Duerden's Stiletto Snake	Least Concern (SARCA 2014)	1
Lamprophiidae	*Boaedon capensis*	Brown House Snake	Least Concern (SARCA 2014)	9
Lamprophiidae	*Lycophidion capense capense*	Cape Wolf Snake	Least Concern (SARCA 2014)	4
Lamprophiidae	*Prosymna sundevallii*	Sundevall's Shovel-snout	Least Concern (SARCA 2014)	6
Lamprophiidae	*Psammophis brevirostris*	Short-snouted Grass Snake	Least Concern (SARCA 2014)	9
Lamprophiidae	*Psammophis notostictus*	Karoo Sand Snake	Least Concern (SARCA 2014)	1
Lamprophiidae	*Psammophis trinasalis*	Fork-marked Sand Snake	Least Concern (SARCA 2014)	10
Lamprophiidae	*Pseudaspis cana*	Mole Snake	Least Concern (SARCA 2014)	7
Lamprophiidae	*Xenocalamus bicolor bicolor*	Bicoloured Quill-snouted Snake	Least Concern (SARCA 2014)	1
Leptotyphlopidae	*Leptotyphlops scutifrons scutifrons*	Peters' Thread Snake		6
Pelomedusidae	*Pelomedusa subrufa*	Central Marsh Terrapin	Least Concern (SARCA 2014)	4
Pythonidae	*Python natalensis*	Southern African Python	Least Concern (SARCA 2014)	1
Scincidae	*Acontias kgalagadi kgalagadi*	Striped Blind Legless Skink	Least Concern (SARCA 2014)	6
Scincidae	*Panaspis wahlbergi*	Wahlberg's Snake-eyed Skink	Least Concern (SARCA 2014)	1
Scincidae	*Trachylepis occidentalis*	Western Three-striped Skink	Least Concern (SARCA 2014)	12
Scincidae	*Trachylepis punctatissima*	Speckled Rock Skink	Least Concern (SARCA 2014)	12
Scincidae	*Trachylepis punctulata*	Speckled Sand Skink	Least Concern (SARCA 2014)	1
Scincidae	*Trachylepis spilogaster*	Kalahari Tree Skink	Least Concern (SARCA 2014)	38
Scincidae	*Trachylepis sulcata sulcata*	Western Rock Skink	Least Concern (SARCA 2014)	15
Scincidae	*Trachylepis variegata*	Variegated Skink	Least Concern (SARCA 2014)	49
Testudinidae	*Psammobates oculifer*	Serrated Tent Tortoise	Least Concern (SARCA 2014)	10
Testudinidae	*Stigmochelys pardalis*	Leopard Tortoise	Least Concern (SARCA 2014)	3
Typhlopidae	*Rhinotyphlops lalandei*	Delalande's Beaked Blind Snake	Least Concern (SARCA 2014)	1
Varanidae	*Varanus albigularis albigularis*	Rock Monitor	Least Concern (SARCA 2014)	13
Viperidae	*Bitis arietans arietans*	Puff Adder	Least Concern (SARCA 2014)	10

12 ANNEX 3. LIST OF AMPHIBIANS

List of amphibians which are likely to occur in the vicinity of the Hyperion Site, according to the Southern African Atlas of Frogs. Conservation is from Minter et al. (2004).

Family	Genus	Species	Common name	Red list category
Brevicepitidae	*Breviceps*	*adspersus*	Bushveld Rain Frog	Least Concern
Bufonidae	*Amietophrynus*	*gutturalis*	Guttural Toad	Least Concern
Bufonidae	*Amietophrynus*	*poweri*	Power's Toad	Least Concern
Bufonidae	*Amietophrynus*	*rangeri*	Raucous Toad	Least Concern
Bufonidae	*Poyntonophrynus*	*vertebralis*	Southern Pygmy Toad	Least Concern
Bufonidae	*Vandijkophrynus*	*gariepensis*	Karoo Toad	Least Concern
Pipidae	*Xenopus*	*laevis*	Common Platanna	Least Concern
Pyxicephalidae	*Amietia*	*angolensis*	Common or Angola River Frog	Least Concern
Pyxicephalidae	*Cacosternum*	*boettgeri*	Common Caco	Least Concern
Pyxicephalidae	*Pyxicephalus*	*adspersus*	Giant Bull Frog	Near Threatened
Pyxicephalidae	*Tomopterna*	*cryptotis*	Tremelo Sand Frog	Least Concern