HYPERION SOLAR DEVELOPMENT 2

Northern Cape Province

Final Environmental Impact Assessment Report

May 2019

DEA Reference No.: 14/12/16/3/3/2/1110

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PROJECT DETAILS

DEA Reference No.	:	14/12/16/3/3/2/1110
Title	:	Environmental Impact Assessment Process: Environmental Impact Assessment Report for Hyperion Solar Development 2, Northern Cape Province
Authors	:	Savannah Environmental (Pty) Ltd Thalita Botha Jo-Anne Thomas
Applicant	:	Cyraguard (Pty) Ltd
Report Status	:	Final Environmental Impact Assessment Report
Date	:	May 2019

When used as a reference this report should be cited as: Savannah Environmental (2018) Final Environmental Impact Assessment Report for Hyperion Solar Development 2, in the Northern Cape Province.

PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

Cyraguard (Pty) Ltd, (a subsidiary of Building Energy South Africa (Pty) Ltd), is proposing the construction of a photovoltaic (PV) solar energy facility (known as Hyperion Solar Development 2) on a site near Kathu in the Northern Cape Province. Hyperion Solar Development 2 comprises a solar energy generation facility and associated infrastructure and is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The REIPPP Programme aims to secure 14 725MW[1] of new generation capacity from Renewable Energy (RE) sources (in accordance with South Africa's Integrated Resource Plan for Electricity (IRP) 2010 – 2030)[2], while simultaneously diversifying South Africa's electricity mix, and positively contributing towards socio-economic, and environmentally sustainable growth. Hyperion Solar Development 2 will be designed to have a contracted capacity of up to 75MW, and will make use of photovoltaic (PV) solar technology.

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)), the development of Hyperion Solar Development 2 requires Environmental Authorisation (EA) from the National Department of Environmental Affairs (DEA) subject to the completion of a full Scoping and EIA process, as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for EA subject to the completion of a full Scoping and EIA process is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 2 (GNR 325).

The EIA report was made available for review from **05 April 2019 – 10 May 2019** at the following locations:

- » Kathu Public Library, 1 Hendrik van Eck Road, Kathu
- » www.savannahSA.com

[1] Source: https://www.ipp-renewables.co.za/

[2] Several updates have been made to the promulgated IRP for electricity 2010 – 2030 released in 2011, the most recent of which was released for public comment on 22 August 2018 (Draft IRP 2018). None of these updates were promulgated to replace the IRP 2010 – 2030. The original IRP for electricity 2010 – 2030 released in 2011 therefore remains applicable until such time as an updated IRP is finalised, accepted by Cabinet and promulgated.

EXECUTIVE SUMMARY

The applicant, Cyraguard (Pty) Ltd (a subsidiary of Building Energy South Africa (Pty) Ltd), is proposing the construction of a photovoltaic (PV) solar energy facility (known as Hyperion Solar Development 2) and associated infrastructure and is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The REIPPP Programme aims to secure 14 725MW[3] of new generation capacity from Renewable Energy (RE) sources (in accordance with South Africa's Integrated Resource Plan for Electricity (IRP) 2010 – 2030)[4], while simultaneously diversifying South Africa's electricity mix, and positively contributing towards socio-economic, and environmentally sustainable growth.

The Remaining Extent of the Farm Lyndoch 432 has been identified by the applicant as suitable for a solar PV energy development from a technical perspective due to the available solar resources, current land use, land availability and site-specific characteristics including accessibility.

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 (refer to **Figure 1**). The 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 national grid[5].
» 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.

[3] Source: https://www.ipp-renewables.co.za/

[4] Several updates have been made to the promulgated IRP for electricity 2010 – 2030 released in 2011, the most recent of which was released for public comment on 22 August 2018 (Draft IRP 2018). None of these updates were promulgated to replace the IRP 2010 – 2030. The original IRP for electricity 2010 – 2030 released in 2011 therefore remains applicable until such time as an updated IRP is finalised, accepted by Cabinet and promulgated.

[5] The construction of the 132kV overhead power line will be assessed as part of a separate Basic Assessment process which will consider feasible alternatives for the power line route.

- Internal access roads and fencing around the development area.
- Main access road to the site (four alternatives are proposed).

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)), the development of Hyperion Solar Development 2 requires EA from the National Department of Environmental Affairs (DEA), and is subject to the completion of a full Scoping and EIA process, as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326).

The EIA process comprises two phases – i.e. a Scoping and EIA Phase – and involves the identification and assessment of environmental impacts though specialist studies, as well as public participation. The process followed in these two phases can be described as follows:

- The **Scoping Phase** includes the identification and description of potential impacts associated with the proposed project through a desktop study considering existing available information, and consultation with affected parties and key stakeholders. This phase considers the broader project site in order to identify and delineate any environmental fatal flaws, "no-go", or sensitive areas which should be avoided. Following a public review of the Scoping Report, the Scoping Phase culminates in the preparation and submission of a Final Scoping Report and Plan of Study for EIA to the competent authority for acceptance, and approval to continue to the EIA Phase. The Final Scoping Report and Plan of Study for EIA for Hyperion Solar Development 2 was submitted to DEA on **07 December 2018**, and acceptance was received on **25 January 2019**, thus marking the start of the EIA Phase.
- The **EIA Phase** includes a detailed assessment of potentially significant positive and negative direct, indirect, and cumulative impacts identified during the Scoping Phase. The EIA Phase considers a proposed development footprint within the identified project site and includes detailed specialist investigations, field work, and public consultation. Following a public review of the EIA Report, the EIA Phase culminates in the preparation and submission of a Final EIA Report and Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the Competent Authority for review and decision-making.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of highly sensitive features within the project site by the development footprint and the undertaking of monitoring, as specified by the specialists. The potential environmental impacts associated with Hyperion Solar Development 2 identified and assessed through the EIA process include:

Ecology Impacts

During the construction phase, the impacts expected to occur include impacts on vegetation and listed protected plant species and faunal impacts. The significance of the construction phase impacts ranges from medium to low, following the implementation of the mitigation measures recommended by the specialist. No impacts of a high significance were identified prior to the implementation of mitigation.

During the operation phase, the anticipated impacts include faunal impacts, an increased erosion risk and potential for increased alien plant invasion. The significance of the impacts for the operation phase are low, following the implementation of the mitigation measures recommended by the specialist. No impacts of high significance were identified for the project prior to the implementation of mitigation.

The loss of protected tree species is an unavoidable impact associated with the project. Given that the site is not considered to be exceptional in terms of the size or density of trees present, it is the opinion of the specialist that the loss of the affected individuals should be seen as being secondary to the loss of habitat. An offset is not recommended for Hyperion Solar Development 2. This is supported by DAFF following their evaluation of the project site. DAFF has however advised that Hyperion Solar Development 2 may be subjected to an offsite mitigation condition such as greening.

It can be concluded that no impacts of high ecological significance were identified which would hinder the development of Hyperion Solar Development 2 and its associated infrastructure within the proposed development area. The proposed development is considered to be appropriate and acceptable from an ecological perspective at the proposed location, and will not result in detrimental impacts to ecosystems and habitat features present within the project site and within the surrounding properties. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Avifauna

During the construction phase of Hyperion Solar Development 2 and the access road alternatives, a loss of habitat and disturbance due to clearance of vegetation is expected to occur. The significance of these impacts can be reduced to medium with the implementation of the recommended mitigation measures.

Impacts associated with the operation phase of Hyperion Solar Development 2 include collision with PV panels and entrapment on fences. The significance of the impacts will be low with the implementation of mitigation measures.

From the results of the avifauna assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from an avifaunal perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Watercourses

During the construction phase of Hyperion Solar Development 2 and the access road alternatives, the impacts expected to occur will include the disturbance of vegetation and soil, increase of alien invasive species, increased hardened surfaces and altered runoff patterns. The significance of these impacts can be reduced to medium to low with the implementation of the recommended mitigation measures.

Impacts associated with the operation phase of Hyperion Solar Development 2 include decreased surface water quality, erosion, increased hardened surfaces and altered runoff patterns. The significance of the impacts will be medium to low with the implementation of mitigation measures.

From the results of the Watercourses Impact Assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a watercourse perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Impacts on Land Use, Soil and Agricultural Potential

Impacts have been identified for both the construction and operation phases for Hyperion Solar Development 2. The impacts associated with land use, soil and agricultural potential include an increased risk of soil erosion, potential chemical pollution and loss of land capability. The significance of the impacts is low with the implementation of the mitigation measures recommended by the specialist.

From the results of the Land Use, Soil and Agricultural Potential assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Visual Impacts

During the construction phase the undertaking of construction activities will impact on sensitive visual receptors in close proximity to Hyperion Solar Development 2. The construction phase will result in a noticeable increase in heavy vehicles utilising the roads which may cause a visual nuisance to other road users and landowners in the area. The construction phase visual impacts will be of short duration and have a low significance following the implementation of the recommended mitigation measures.

Visual impacts expected to occur during the operation phase includes impact on sensitive visual receptors, lighting impacts, visual impact of the ancillary infrastructure, and a visual impact on the sense of place in the region. The significance of the visual impacts is of low significance with the implementation of the recommended mitigation measures. The specialist has indicated support for the development of Hyperion Solar Development 2 from a visual perspective provided that recommended mitigation measures are implemented.

Impacts on Heritage Resources (Archaeological and Palaeontological)

The impact on heritage resources include the archaeology and palaeontology of the project site. Impacts to palaeontology and archaeology may occur during the construction phase, but these can be mitigated and/or managed. No sites of high significance have been identified within the project site. Impacts to graves could occur but the possibility thereof is extremely small. The landscape is characterised by mining and energy developments / infrastructure and will be able to absorb the proposed development. There are no fatal flaws in terms of heritage.

Due to the very low probability of impacts occurring, the significance of potential impacts is considered to be low with the implementation of mitigation measures. The specialist has therefore indicated support for the development of Hyperion Solar Development 2 from a heritage perspective.

Social Impacts

During the construction phase the positive impacts expected to occur include direct and indirect employment opportunities and skills development and socio-economic stimulation. The significance of these impacts are medium with the implementation of the recommended enhancement measures. The negative social impacts expected to occur during the construction phase includes an influx of construction workers and change in population, increase in crime, increased risk of HIV infections, impacts on daily living and moving patterns, nuisance impacts (i.e. noise and dust), hazard exposure and disruption to social and community infrastructure and visual impacts. The significance of the negative construction phase impacts will be medium to low with the implementation of the recommended mitigation measures.

During the operation phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development and a contribution to Local Economic Development (LED) and social upliftment. The significance of the positive operation impacts will be medium to high with the implementation of the recommended enhancement measures. The negative impacts expected during the operation phase includes a visual and sense of place. The significance of the negative operation impacts will be high with the implementation of the recommended mitigation measures.

From the results of the social impact assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a social perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures.

Traffic Impacts

During the construction phase imported elements associated with the development of Hyperion Solar Development 2 will be shipped to and transported from the nearest and most practical port. It is estimated that the total number of heavy vehicle trips would vary between 2000 and 3000 during the construction phase. The impact of this on the road network is considered to be low with the implementation of mitigation measures.

During operation, it is assumed that approximately five full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network. The significance of the traffic impacts during the operation phase will be low with the implementation of the recommended mitigation measures.

From the results of the traffic impact assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a traffic perspective.

Cumulative Impacts

Based on the specialists' cumulative assessments and findings regarding the development of Hyperion Solar Development 2 and its contribution to the overall impact of all solar energy facilities (PV and CSP) to be developed within a 30km radius, it can be concluded that Hyperion Solar Development 2 cumulative impacts are expected to be both positive and negative and will be of a low to high significance, depending on the impact under consideration. There are however no impacts or risks identified to be considered as unacceptable with the development of Hyperion Solar Development 2 and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

From the specialist investigations undertaken for Hyperion Solar Development 2, the following sensitive areas/environmental features have been identified and demarcated within the project site:

» **Ecology** – The main sensitive feature of the project site is the Vlermuisleegte River which is unsuitable for development and is therefore considered to be a no-go area for all project components apart from Access Road Alternative 1 which marginally infringes this area. The majority of the area east of the Vlermuisleegte River has a moderate to high *V. erioloba* density and is considered to be of 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. All of these areas are avoided by the project development area.

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. The majority of the development area falls within this area of low ecological sensitivity.

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. The solar field infringes on the northern portion of this ridge. This is considered to be acceptable from an ecological perspective. A small section of the north eastern corner of the development area infringes on a section of the medium sensitive area consisting of *V. erioloba* trees. No infrastructure is proposed within this area and it is therefore avoided by the development footprint.

The majority of the access road alternative corridors is located within areas of low ecological sensitivity. Sections of Alternative 2 and 4 traverse areas with a high density of V. erioloba trees. Access Road Alternative 1 and 2, as well as small sections of Alternative 3 and 4 are also located within an ESA. Approximately 1.5km of Access Road Alternative 3 falls within a CBA2.

» **Bird Habitat and Sensitive Areas** – The project site supports three main avifaunal microhabitats, i.e. the *Tarchonanthus camphoratus* scrub, *V. erioloba* woodland, and the open grassland associated with the Vlermuisleegte River. These three habitats have different sensitivities, due to the subtle differences in the avifaunal assemblages that they support. The majority of the project site to the west of the Vlermuisleegte River consists of *Tarchonanthus camphoratus* scrub which is considered to be of medium sensitivity. It is host to the typical avifauna of the Kalahari bioregion. This area experienced a devastating fire in 2009, which destroyed many of the large *V. erioloba* trees as now only found to the east of the Vlermuisleegte River. The development area and footprint is restricted to this microhabitat.

The *V. erioloba* woodland to the east of the Vlermuisleegte is considered to be of high ecological sensitivity with respect to avifauna, as it supports large *V. erioloba* trees interspersed with patches of *Acacia mellifera* and *Terminalia sericea*, which contribute towards higher habitat heterogeneity and a wider array of nesting sites, resulting in an overall greater diversity of avifauna. Data obtained from the current field study is insufficient to conclusively demonstrate differences in avifaunal assemblages between the *V. erioloba* woodland to the east, and the *Tarchonanthus* scrub to the west of the Vlermuisleegte River. However, indications from the site visit undertaken in January 2019 suggest that it is likely to be more diverse and this is a reasonable assumption as there is a known relationship between habitat heterogeneity and species richness (Harrison et al., 1997). The area to the east of the Vlermuisleegte is therefore considered to be of high ecological sensitivity and largely unsuitable for development.

The open grassland that occupies the bed of the dry Vlermuisleegte River is considered to be of very high sensitivity, as this is a restricted habitat that has elements similar to that of pans. These areas are very sensitive due to their high use and specialised avifauna that is usually associated with these features. The Vlermuisleegte River may therefore support a very different assemblage of birds compared to the scrub and woodland habitat and may even support red-listed species under favourable conditions, such as Burchell's Courser and Ludwig's Bustard. No additional development or transformation within this area is recommended. The continued use of the current access road (i.e. T26 gravel road) is considered acceptable provided that no large raptor nests of species of concern are found in the trees near the road.

The majority of the access road alternative corridors is located within areas of medium avifauna sensitivity. Sections of Alternative 2, 3 and 4 traverse areas with a high density of *V. erioloba* trees which are of high avifaunal value due to the their structural diversity and possible presence of raptor nesting sites.

» **Watercourses** – The Vlermuisleegte River is considered to be largely natural according to the Present Ecological State (PES) 1999[6], and is classified as moderately modified (Class C) according to the National Freshwater Ecosystem Priority Area (NFEPA) database. Due to agricultural activities within the floodplain associated with the river, the natural indigenous riparian vegetation has been impacted. Analysis of digital satellite imagery indicates however that some natural riparian vegetation remains within the area east of the river. The Vlermuisleegte River is considered to be of very high sensitivity and a no-go area for all infrastructure except for Access Road Alternative 1, as this road has an existing impact on the Vlermuisleegte River. The development footprint for Hyperion Solar Development 2 avoids the Vlermuisleegte River.

A perched depression wetland has been identified within the northern portion of the project site, situated within the Vlermuisleegte River. Due to the lack of habitat diversity and moderately low hydro-functionality, this depression is not considered to be of significant ecological importance on a landscape scale. However, since it forms part of the larger Vlermuisleegte River, it does potentially aid in retaining water during rainfall events (albeit limited). The depression wetland should be regarded as a no-go area for all infrastructure.

Ten (10) pan wetlands were identified scattered within the investigation area associated with access road Alternative 3, the closest of which is located approximately 45m from the proposed route location (Pan 8). Furthermore, a pan wetland (Pan 11) was identified within the investigation area associated with Access Road Alternative 4, although this system is located approximately 245m from the proposed route. The pans are considered to be mostly natural with no significant impacts to their hydrological or geomorphological properties. These pans are of some importance on a landscape scale, primarily due to the provisioning of habitat (albeit seasonally) by the pans and should be considered an area of high sensitivity. No pan wetlands were identified within the 20m access road alternatives corridors.

A 100m buffer has been applied to the Vlermuisleegte River and a 500m buffer has been applied to the depression wetland. This buffer represent the GN509 regulated area of the watercourses. Development may take place within these areas but should be avoided if possible, to avoid triggering Section 21 (c) & (i) water uses.

[6] The most recent database (i.e. DWS 2014 database) did not assess the Vlermuisleegte River and therefore the PES stated in the 1999 database was used.

» **Heritage -** The majority of the project site is considered to be sterile of archaeological materials except for a light scatter of artefacts with a few gravel clasts approximately 70m to the east of the Vlermuisleegte River (Site 1185). Other areas where stone artefacts were identified were areas which also comprised of gravel. These areas include a low gravel hill approximately 1km to the south of the proposed development area and along the banks of the Vlermuisleegte River. The Vlermuisleegte River and immediate surrounds should be considered as a no-go area as it is likely that the area close to the Vlermuisleegte River may consist of gravel that contains the artefacts which are closer to the surface, and are regarded as sensitive. A buffer of approximately 120m from the edge of the Vlermuisleegte is recommended to protect all areas considered to be potentially sensitive at the surface. The development area and footprint is located outside of the 120m buffer.

  Site 1223 fall within the north western corner of the solar field. This site is considered to be of low signification. Three (3) heritage sites were identified within the 20m access road corridor for Alternative 1. These include Site 1202, 1203 and 1204. Construction within these areas is deemed acceptable.

The developer has proposed a technically viable and suitable layout for the project and associated infrastructure which has been assessed as part of the independent specialist studies.

This layout avoids all identified areas of very high and high environmental sensitivity and therefore minimises impacts as far as possible. The layout from an environmental perspective identified through this EIA process is therefore considered as the most appropriate alternative to form part of the development footprint for the Hyperion Solar Development 2 and are considered to be acceptable within all fields of specialist study undertaken for the project. All impacts associated with the preferred layout can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures.

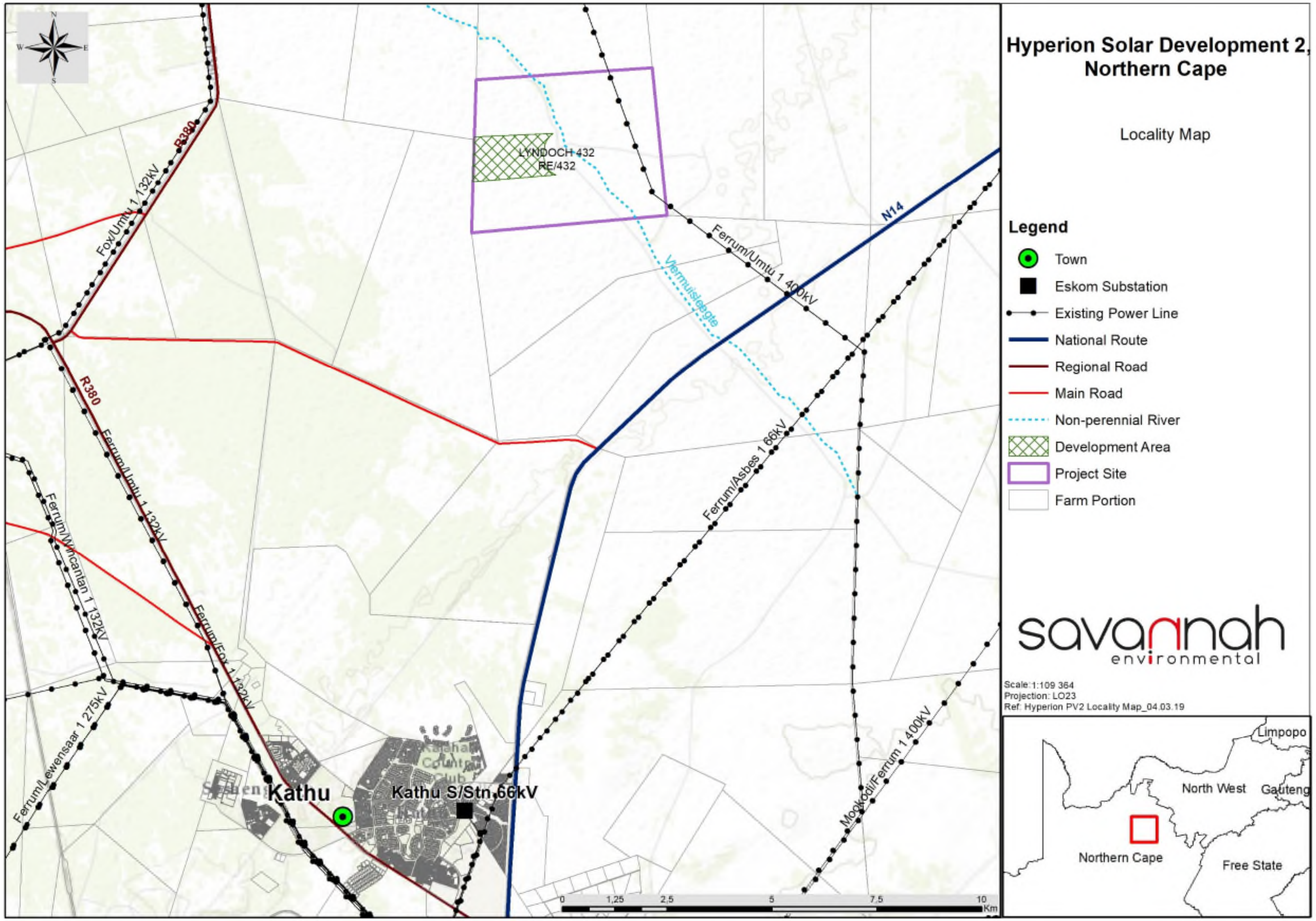

Figure 0: **Locality map illustrating the location of the project site under investigation for the establishment of Hyperion Solar Development 2.**

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Archaeological material: Remains resulting from human activities which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Commence: The start of any physical activity, including site preparation and any other activity on site furtherance of a listed activity or specified activity, but does not include any activity required for the purposes of an investigation or feasibility study as long as such investigation or feasibility study does not constitute a listed activity or specified activity.

Construction: Construction means the building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity. Construction begins with any activity which requires Environmental Authorisation.

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

Decommissioning: To take out of active service permanently or dismantle partly or wholly, or closure of a facility to the extent that it cannot be readily re-commissioned. This usually occurs at the end of the life of a facility.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation, or maintenance of an activity and are generally obvious and quantifiable.

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

'Do nothing' alternative: The 'do nothing' alternative is the option of not undertaking the proposed activity or any of its alternatives. The 'do nothing' alternative also provides the baseline against which the impacts of other alternatives should be compared.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Emergency: An undesired/ unplanned event that results in a significant environmental impact and requires the notification of the relevant statutory body, such as a local authority.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Environment: the surroundings within which humans exist and that are made up of:
i. The land, water and atmosphere of the earth;
ii. Micro-organisms, plant and animal life;
iii. Any part or combination of (i) and (ii) and the interrelationships among and between them; and
iv. The physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being.

Environmental impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment, as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management programme: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800.

Indirect impacts: Indirect or induced changes that may occur because of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place because of the activity.

Interested and affected party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups, and the public.

Method statement: A written submission to the ECO and the site manager (or engineer) by the EPC Contractor in collaboration with his/her EO.

Mitigation hierarchy: The mitigation hierarchy is a framework for managing risks and potential impacts related to biodiversity and ecosystem services. The mitigation hierarchy is used when planning and implementing development projects, to provide a logical and effective approach to protecting and conserving biodiversity and maintaining important ecosystem services. It is a tool to aid in the sustainable management of living, natural resources, which provides a mechanism for making explicit decisions that balance conservation needs with development priorities.

No-go areas: Areas of environmental sensitivity that should not be impacted on or utilised during the development of a project as identified in any environmental reports.

Perennial and non-perennial: Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.

Photovoltaic effect: Electricity can be generated using photovoltaic solar panels which are comprised of individual photovoltaic cells that absorb solar energy to directly produce electricity. The absorbed solar radiation excites the electrons inside the cells and produces what is referred to as the Photovoltaic Effect.

Pollution: A change in the environment caused by substances (radio-active or other waves, noise, odours, dust or heat emitted from any activity, including the storage or treatment or waste or substances.

Pre-construction: The period prior to the commencement of construction, this may include activities which do not require Environmental Authorisation (e.g. geotechnical surveys).

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare."

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Riparian: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).

Significant impact: An impact that by its magnitude, duration, intensity, or probability of occurrence may have a notable effect on one or more aspects of the environment.

Waste: means—

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or

b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister

Watercourse: as per the National Water Act means -
(a) a river or spring;
(b) a natural channel in which water flows regularly or intermittently;
(c) a wetland, lake or dam into which, or from which, water flows; and
(d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

Wetlands: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin et al., 1979).

ACRONYMS

BGIS	Biodiversity Geographic Information System
BNCA	Bophuthatswana Nature Conservation Act (No. 03 of 1973)
CBA	Critical Biodiversity Area
DAFF	Department of Agricultural, Forestry and Fisheries (National)
DEA	Department of Environmental Affairs (National)
DWS	Department of Water and Sanitation
CBA	Critical Biodiversity Area
CBIPPP	Coal Baseload Independent Power Producer Procurement
CR	Critically Endangered
CSIR	Council for Scientific and Industrial Research
CSP	Concentrated Solar Power
DM	District Municipality
DoE	Department of Energy
EAP	Environmental Assessment Practitioner
EGIS	Environmental Geographic Information System
EIA	Environmental Impact Assessment
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EN	Endangered
EP	Equator Principles
ESA	Ecological Support Area
GA	General Authorisation
GHG	Greenhouse Gas
IBA	Important Bird Area
IDP	Integrated Development Plan
IEM	Integrated Environmental Management
IEP	Integrated Energy Plan
IFC	International Finance Corporation
IPP	Independent Power Producer
IRP	Integrated Resource Plan
IUCN	International Union for Conservation of Nature
I&AP	Interested and Affected Party
km	Kilometre
kWh	Kilowatt hour
LC	Least Concern
LM	Local Municipality
LNG	Liquid Natural Gas
m	Metre
m^2	Square meters
m^3	Cubic meters
m amsl	Metres Above Mean Sea Level
MTS	Main Transmission Substation

MW	Megawatts
NDP	National Development Plan
NEMA	National Environmental Management Act (No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act (No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act (No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act (No. 59 of 2008)
NFA	National Forests Act (No. 84 of 1998)
NFEPA	National Freshwater Ecosystem Priority Area
NHRA	National Heritage Resources Act (No. 25 of 1999)
NT	Near Threatened
NWA	National Water Act (No. 36 of 1998)
ONA	Other Natural Area
PA	Protected Area
PV	Photovoltaic
RE	Renewable Energy
READ	North West Department of Rural, Environmental, and Agricultural Development
REIPPP	Renewable Energy Independent Power Producer Procurement
SABAP	South African Bird Atlas Project
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SAIAB	South African Institute for Aquatic Biodiversity
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SDF	Spatial Development Framework
TOPS	Threatened or Protected Species
TNCO	Transvaal Nature Conservation Ordinance (No. 12 of 1983)
UNESCO	United Nations Educational, Scientific and Cultural Organisation
VU	Vulnerable
WB	World Bank
WUL	Water Use License
WWF	World Wide Fund for Nature

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APPENDICES LIST

CHAPTER 1 INTRODUCTION

The applicant, Cyraguard (Pty) Ltd (a subsidiary of Building Energy South Africa (Pty) Ltd), is proposing the construction of a photovoltaic (PV) solar energy facility (known as Hyperion Solar Development 2) on a site near Kathu in the Northern Cape Province. Hyperion Solar Development 2 comprises a solar energy generation facility and associated infrastructure and is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. The REIPPP Programme aims to secure 14 725MW[7] of new generation capacity from Renewable Energy (RE) sources (in accordance with South Africa's Integrated Resource Plan for Electricity (IRP) 2010 – 2030)[8], while simultaneously diversifying South Africa's electricity mix, and positively contributing towards socio-economic, and environmentally sustainable growth. Hyperion Solar Development 2 will be designed to have a contracted capacity of up to 75MW, and will make use of photovoltaic (PV) solar technology.

1.1. Project Background

Hyperion Solar Development 2 is proposed on a portion of 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 (refer to **Figure 1.1**). The 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 national grid[9].
- 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.
- Temporary laydown area and batching plant.
- Main access road to the site, internal access roads and fencing around the development area.

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[7] Source: https://www.ipp-renewables.co.za/

[8] Several updates have been made to the promulgated IRP for electricity 2010 – 2030 released in 2011, the most recent of which was released for public comment on 22 August 2018 (Draft IRP 2018). None of these updates were promulgated to replace the IRP 2010 – 2030. The original IRP for electricity 2010 – 2030 released in 2011 therefore remains applicable until such time as an updated IRP is finalised, accepted by Cabinet and promulgated.

[9] The construction of the 132kV overhead power line will be assessed as part of a separate Basic Assessment process which will consider feasible alternatives for the power line route.

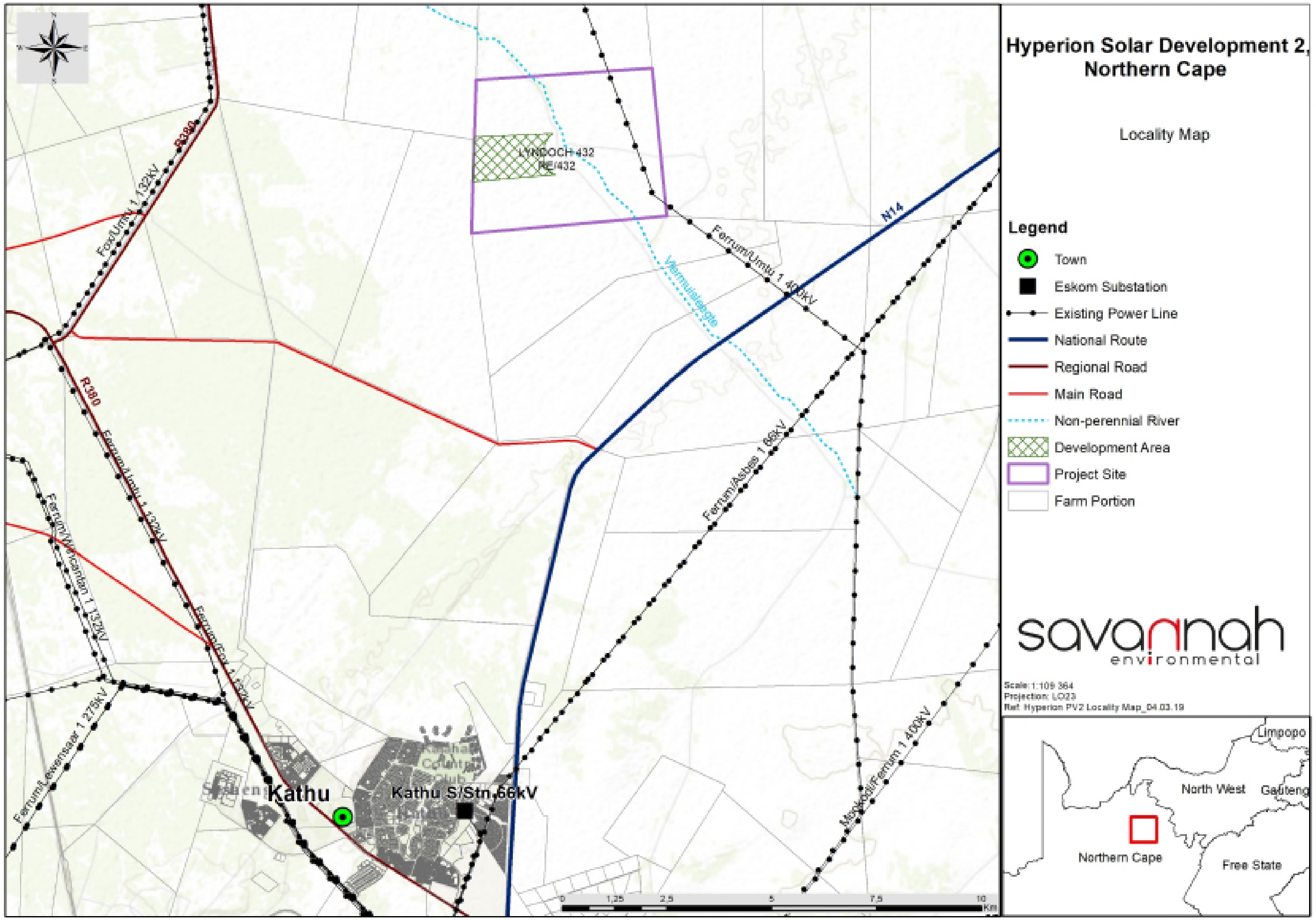

Figure 1.1: Locality map illustrating the location of the project site and development area under investigation for the establishment of Hyperion Solar Development 2.

The key infrastructure components proposed as part of Hyperion Solar Development 2 are described in greater detail in **Chapter 2** of this EIA Report.

1.2. Requirements for Environmental Authorisation (EA)

Section 24 of South Africa's National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EAs), and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the competent authority. The 2014 EIA Regulations, as amended (GNR 326) published under NEMA prescribe the process to be followed when applying for EA, while the Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)) contain those activities which may not commence without EA from the Competent Authority.

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices (Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324)), the development of Hyperion Solar Development 2 requires EA from the National Department of Environmental Affairs (DEA), and is subject to the completion of a full Scoping and EIA process, as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for EA subject to the completion of a full Scoping and EIA process is triggered by the inclusion of, amongst others, Activity 1 of Listing Notice 2 (GNR 325)[10], namely:

"The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more."

In terms of GNR 779 of 01 July 2016, the National DEA has been determined as the Competent Authority (CA) for all projects which relate to the IRP 2010 – 2030, and any updates thereto. The Provincial Northern Cape Department of Environment and Nature Conservation (DENC) is therefore a Commenting Authority on the project.

1.3. Overview of the Environmental Impact Assessment (EIA) Process

The EIA process comprises two phases – i.e. a Scoping and EIA Phase – and involves the identification and assessment of environmental impacts though specialist studies, as well as public participation. The process followed in these two phases can be described as follows:

» The **Scoping Phase** includes the identification and description of potential impacts associated with the proposed project through a desktop study considering existing available information, and consultation with affected parties and key stakeholders. This phase considers the broader project site in order to identify and delineate any environmental fatal flaws, "no-go", or sensitive areas which should be avoided. Following a public review of the Scoping Report, the Scoping Phase culminates in the preparation and submission of a Final Scoping Report and Plan of Study for EIA to the competent authority for acceptance, and approval to continue to the EIA Phase. The Final Scoping Report and

[10] Refer to **Chapter 6** for a full list of applicable listed activities.

Plan of Study for EIA for Hyperion Solar Development 2 was submitted to DEA on **07 December 2018**, and acceptance was received on **25 January 2019**, thus marking the start of the EIA Phase.

» The **EIA Phase** includes a detailed assessment of potentially significant positive and negative direct, indirect, and cumulative impacts identified during the Scoping Phase. The EIA Phase considers a proposed development footprint within the identified project site and includes detailed specialist investigations, field work, and public consultation. Following a public review of the EIA Report, the EIA Phase culminates in the preparation and submission of a Final EIA Report and Environmental Management Programme (EMPr), including recommendations of practical and achievable mitigation and management measures, to the Competent Authority for review and decision-making.

1.4. Appointment of an Independent Environmental Assessment Practitioner (EAP)

In accordance with Regulation 12 of the 2014 EIA Regulations (GNR 326) the applicant has appointed Savannah Environmental (Pty) Ltd as the independent environmental consultants responsible for managing the application for EA and supporting Scoping and EIA process, inclusive of comprehensive, independent specialist studies. The application for EA, and Scoping and EIA process, is being managed in accordance with the requirements of NEMA, the 2014 EIA Regulations (GNR 326), and all other relevant applicable legislation.

Neither Savannah Environmental nor any of its specialist consultants are subsidiaries of, or are affiliated to the applicant. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed solar facility. A signed Environmental Assessment Practitioner (EAP) declaration of interest confirming Savannah Environmental's independence is included in **Appendix L** of this EIA Report.

1.4.1. Details and Expertise of the Environmental Assessment Practitioner (EAP)

Savannah Environmental is a leading provider of integrated environmental and social consulting, advisory and management services with considerable experience in the fields of environmental assessment and management. The company is wholly woman-owned (51% black woman-owned), and is rated as a Level 2 Broad-based Black Economic Empowerment (B-BBEE) Contributor. Savannah Environmental's team have been actively involved in undertaking environmental studies over the past 13 years, for a wide variety of projects throughout South Africa, including those associated with electricity generation and infrastructure development.

This EIA process is being managed by Jo-Anne Thomas. She is supported by Thalita Botha and Nicolene Venter.

» **Jo-Anne Thomas** is a Director at Savannah Environmental (Pty) Ltd. Jo-Anne has a Master of Science Degree in Botany (M.Sc. Botany) from the University of the Witwatersrand and is registered as a Professional Natural Scientist (400024/2000) with the South African Council for Natural Scientific Professions (SACNASP). She has gained extensive knowledge and experience on potential environmental impacts associated with electricity generation and transmission projects through her involvement in related EIA processes over the past 20 years. She has successfully managed and undertaken EIA processes for infrastructure development projects throughout South Africa.

- **Thalita Botha** the principle author of this report. She holds a Bachelor degree with Honours in Environmental Management and has three and a half years of experience in the environmental field. Her key focus is on environmental impact assessments, public participation, environmental management plans and programmes, as well as mapping using ArcGIS for a variety of environmental projects. She is currently involved in several EIAs for energy generation projects across South Africa.

- **Nicolene Venter** is a Social and Public Participation Consultant at Savannah Environmental. Nicolene has a Higher Secretarial Certificate from Pretoria Technicon, and a Certificate in Public Relations from the Public Relation Institute of South Africa at Damelin Management School. Nicolene has over 21 years of experience as a Public Participation Practitioner and Stakeholder Consultant, and is a Board Member of the International Association for Public Participation Southern Africa (IAP2SA). Nicolene's experience includes managing the stakeholder engagement components of large and complex environmental authorisation processes across many sectors, with particular experience in the power sector. Most notably on large linear power lines and distribution lines, as well as renewable energy projects. Nicolene is well versed with local regulatory requirements as well as international best practice principles for community consultation and stakeholder engagement, as well as international guidelines and performance standards. Nicolene is responsible for managing the Public Participation process required as part of the EIA for this project.

Curricula Vitae (CVs) detailing the Savannah Environmental team's expertise and relevant experience are provided in **Appendix A** to this EIA Report.

1.4.2. Details of the Independent Specialist Team

A number of independent specialist consultants have been appointed as part of the EIA project team in order to adequately identify and assess potential impacts associated with the project (refer to **Table 1.1**). The specialist consultants have provided input into this final EIA Report as well as the EMPr (refer to **Appendix K**).

Table 1.1: Specialist Consultants which form part of the EIA project team.

Specialist Area of Expertise	Specialist Company	Specialists Names
Ecology and Avifauna	3Foxes Biodiversity Solutions	Simon Todd Eric Herman
Watercourses	Scientific Aquatic Services	Stephen van Staden Christel du Preez
Visual Impact Assessment	Environmental Planning and Design	Jon Marshall
Soils and Agricultural Potential Impact Assessment	TerraAfrica	Mariné Pienaar
Heritage (Archaeology and Palaeontology)	Asha Consulting (in consultation with John Almond of Natura Viva)	Jayson Orton

Specialist Area of Expertise	Specialist Company	Specialists Names
Social Impact Assessment	Dr. Neville Bews and Associates	Dr Neville Bews[11]

CVs detailing the independent specialist consultants' expertise and relevant experience are provided in **Appendix A** to this EIA Report.

1.5. Structure of this EIA Report

This final EIA Report has been prepared as part of the Scoping and EIA process being conducted in support of the application for EA for Hyperion Solar Development 2. This EIA Report has been prepared in accordance with the Plan of Study for EIA (PoSEIA), prepared as part of the Scoping Phase and accepted by DEA on 25 January 2019, and Appendix 3 of the 2014 EIA Regulations (GNR 326). It provides details of the nature and extent of the proposed project, as well as potential impacts associated with the construction, operation, and decommissioning, of the project. It describes the scope of assessment, the consultation process undertaken throughout the EIA process to date, and includes a draft EMPr which provides recommended management and mitigation measures with which to minimise impacts and enhance benefits associated with the project.

An overview of the contents of this final EIA Report, as prescribed by Appendix 3 of the 2014 EIA Regulations (GNR 326), and where the corresponding information can be found within the report is provided in **Table 1.2**.

Table 1.2: Summary of where the requirements of Appendix 3 of the 2014 NEMA EIA Regulations, as amended, (GNR 326) are provided in this final EIA Report.

Requirement	Location in this EIA Report
(a) Details of – (i) The EAP who prepared the report. (ii) The expertise of the EAP, including a curriculum vitae.	Chapter 1 Appendix A
(b) The location of the development footprint of the activity on the approved site as contemplated in the accepted Scoping Report, including – (i) The 21 digit Surveyor General code of each cadastral land parcel. (ii) Where available, the physical address and farm name. (iii) Where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	Chapter 2
(c) A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is – (i) A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken. (ii) On land where the property has not been defined, the coordinates within which the activity is to be undertaken.	Chapter 2 Chapter 10

[11] Due to unavailability, the Social Impact Assessment was undertaken by Dr Neville Bews and not Sarah Watson of Savannah Environmental as per the Plan of Study included in the Scoping Report.

Requirement	Location in this EIA Report
(d) A description of the scope of the proposed activity, including – (i) All listed and specified activities triggered and being applied for. (ii) A description of the associated structures and infrastructure related to the development.	Chapter 2 Chapter 6
(e) A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context.	Chapter 4 Chapter 6
(f) A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted Scoping Report.	Chapter 5
(g) A motivation for the preferred development footprint within the approved site as contemplated in the accepted Scoping Report.	Chapter 3 Chapter 8 Chapter 10
(h) A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted Scoping Report, including – (i) Details of the development footprint alternatives considered. (ii) Details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs. (iii) A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them. (iv) The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects. (v) The impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) Can be reversed. (bb) May cause irreplaceable loss of resources (cc) Can be avoided, managed or mitigated. (vi) The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks. (vii) Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects. (viii) The possible mitigation measures that could be applied and level of residual risk. (ix) If no alternative development footprints for the activity were investigated, the motivation for not considering such. (x) A concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted Scoping Report.	Chapter 2 Chapter 3 Chapter 6 Chapter 7 Chapter 8 Chapter 9 Chapter 10 Appendix C Appendix D – J Appendix K
(i) A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity, including – (i) A description of all environmental issues and risks that were identified during the environmental impact assessment process.	Chapter 6 Chapter 8 Chapter 9 Appendix D – J

Requirement	Location in this EIA Report
(ii) An assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures.	
(j) An assessment of each identified potentially significant impact and risk, including – (i) Cumulative impacts. (ii) The nature, significance and consequences of the impact and risk. (iii) The extent and duration of the impact and risk. (iv) The probability of the impact and risk occurring. (v) The degree to which the impact and risk can be reversed. (vi) The degree to which the impact and risk may cause irreplaceable loss of resources. (vii) The degree to which the impact and risk can be mitigated.	Chapter 8 Chapter 9 Appendix D – J
(k) Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report.	Chapter 7 Chapter 8 Chapter 9 Appendix D – J Appendix K
(l) An environmental impact statement which contains – (i) A summary of the key findings of the environmental impact assessment. (ii) A map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted Scoping Report indicating any areas that should be avoided, including buffers. (iii) A summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	Chapter 10
(m) Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.	Chapter 8 Chapter 9 Chapter 10 Appendix D – J Appendix K
(n) The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment.	Chapter 3 Chapter 8 Chapter 9 Chapter 10
(o) Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation.	Chapter 8 Chapter 9 Chapter 10 Appendix D – J Appendix K
(p) A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed.	Chapter 8 Chapter 9 Chapter 10 Appendix D – J Appendix K
(q) A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation.	Chapter 10 Appendix D – J

Requirement		Location in this EIA Report
(r)	Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded and the post construction monitoring requirements finalised.	N/A
(s)	An undertaking under oath or affirmation by the EAP in relation to – (i) The correctness of the information provided in the reports. (ii) The inclusion of comments and inputs from stakeholders and I&APs. (iii) The inclusion of inputs and recommendations from the specialist reports where relevant. (iv) Any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties.	Appendix A
(t)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts.	N/A
(u)	An indication of any deviation from the approved Scoping Report, including the plan of study, including – (i) Any deviation from the methodology used in determining the significance of potential environmental impacts and risks. (ii) A motivation for the deviation.	N/A
(v)	Any specific information that may be required by the competent authority.	N/A
(w)	Any other matters required in terms of Section 24(4)(a) and (b) of the Act.	N/A
(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to an Environmental Impact Assessment Report the requirements as indicated in such notice will apply.	N/A

CHAPTER 2 PROJECT DESCRIPTION

This Chapter provides a description of the Hyperion Solar Development 2, comprising a solar PV energy facility and associated infrastructure proposed for development. This chapter also provides the details of the project scope which includes the planning/design, construction, operation and decommissioning activities. It must be noted that the project description presented in this Chapter is subject to change to some extent based on the outcomes and recommendations of detailed engineering and other technical studies, and any licencing, permitting, and legislative requirements.

2.1. Project Site Overview

The applicant proposes the development of Hyperion Solar Development 2 on a site near Kathu, in the Northern Cape Province. The Remaining Extent of the Farm Lyndoch 432 (hereafter referred to as the project site) is located approximately 16km north of Kathu, and falls within Wards 7 of the Gamagara LM, of John Taolo Gaetsewe DM, in the Northern Cape Province. The project site is accessible via an existing gravel farm road (known as T26) which provides access to the farm off of the N14 national road and which is located south of the project site.

Four possible access road alternatives have been identified as part of the EIA process being conducted for the project. Each of the possible access road alternatives identified for the project would impact on additional properties to the project site.

These are discussed in more detail below:

» Alternative 1 - The upgrade of approximately 3.6km of the existing T26 gravel road situated between the project site and the N14. The existing road will be upgraded from approximately 5m to 9m in width.
» Alternative 2 – The establishment of a new access road approximately 3.6km in length and 9m in width. The new access road is proposed to be parallel to the existing T26 gravel road and Alternative 1.
» Alternative 3 – 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.
» Alternative 4 – The establishment of a new access road approximately 6.2km in length and 9m in width situated between the project site and the R380.

Electricity generated by the project will feed into Eskom's national electricity grid via a new 132kV single circuit power line (OHPL) which will connect the on-site substation to the national grid. The construction of the 132kV OHPL will be assessed as part of a separate Basic Assessment (BA) process which will consider feasible alternatives for the power line route.

Three (3) additional 75MW PV facilities are concurrently being considered on the same project site (Remaining Extent of the Farm Lyndoch 432) and will be known as Hyperion Solar Development 1, Hyperion Solar Development 3, and Hyperion Solar Development 4 respectively. Each of these facilities will be assessed through a separate Environmental Impact Assessment (EIA) process.

Table 2.1 provides information regarding the proposed project site identified for Hyperion Solar Development 2, and also includes information regarding the properties that may be impacted by the access road alternatives.

Table 2.1: A description of the project site identified for Hyperion Solar Development 2 and access road alternatives.

Province	Northern Cape Province	
District Municipality	John Taolo Gaetsewe District Municipality	
Local Municipality	Gamagara Local Municipality	
Ward Number(s)	Ward 7	
Nearest Town(s)	» Kathu (~16km south of the project site); » Dibeng (~18km west of the project site); » Kuruman (~34km north east of the project site) and » Hotazel (~41.6km north of the project site).	
Farm Portion(s), Name(s) and Number(s)	**Hyperion Solar Development 2:** » Remaining Extent of the Farm Lyndoch 432	
	Access Road Alternative 1: » Remaining Extent of the Farm Lyndoch 432 » Portion 1 of the Farm Cowley 457 » Portion 2 of the Farm Cowley 457 » Remaining Extent of the Farm Cowley 457	
	Access Road Alternative 2: » Remaining Extent of the Farm Lyndoch 432 » Portion 1 of the Farm Cowley 457 » Portion 2 of the Farm Cowley 457 » Remaining Extent of the Farm Cowley 457	
	Access Road Alternative 3: » Remaining Extent of the Farm Lyndoch 432 » Portion 1 of the Farm Selsden 464 » Remaining Extent of the Farm Kathu 465 » Portion 1 of the Farm Halliford 466 » The Remaining Extent of the Farm Marsh 467	
	Access Road Alternative 4: » Remaining Extent of the Farm Lyndoch 432 » Portion 1 of the Farm Selsden 464 » Remaining Extent of the Farm Selsden 464 » Remaining Extent of the Farm Halliford 466	
SG 21 Digit Code (s)	Remaining Extent of the Farm Lyndoch 432	C04100000000043200000
	Portion 1 of the Farm Cowley 457	C04100000000045700001
	Portion 2 of the Farm Cowley 457	C04100000000045700002
	Remaining Extent of the Farm Cowley 457	C04100000000045700000
	Remaining Extent of the Farm Kathu 465	C04100000000046500000
	Remaining Extent of the Farm Selsden 464	C04100000000046400000
	Portion 1 of the Farm Selsden 464	C04100000000046400001
	Remaining Extent of the Farm	C04100000000046600000

	Halliford 466		
	Portion 1 of the Farm Halliford 466	C04100000000046600001	
	Remaining Extent of the Farm Marsh 467	C04100000000046700000	
Current Zoning	Agriculture		
Current land use	Grazing (mainly cattle)		
Site Extent (project site)	~1600ha		
Development Footprint (PV facility)	~180ha		
Site Co-ordinates (project site)		**Latitude:**	**Longitude:**
	North-eastern extent	27°32'12.31'' S	23°06'23.35'' E
	North-western extent	27°34'06.94'' S	23°06'36.08'' E
	South-eastern extent	27°34'20.63'' S	23°03'46.03'' E
	South-western extent	27°32'21.53'' S	23°03'49.88'' E
	Centre point	27° 32'43.22" S	23°04'19.01" E
Access Road Alternative 1 (centre of 20m road corridor)		**Latitude:**	**Longitude:**
	Start (intersection to the N14)	27°35'47.55''S	23°07'19.27''E
	Middle	27°34'59.28''S	23°06'39.12''E
	End (perimeter road)	27°34'11.15''S	23°05'58.79''E
Access Road Alternative 2 (centre of 20m road corridor)		**Latitude:**	**Longitude:**
	Start (intersection to the N14)	27°35'53.47'' S	23°07'9.44'' E
	Middle	27°35'02.76'' S	23°06'33.3212'' E
	End (perimeter road)	27°34'11.30'' S	23°05'56.52'' E
Access Road Alternative 3 (centre of 20m road corridor)		**Latitude:**	**Longitude:**
	Start (intersection to the R380)	27°35'35.97'' S	22°57'54.81'' E
	Middle	27°36'20.80'' S	23°02'24.75'' E
	End (perimeter road)	27°34'20.91'' S	23°03'44.91'' E
Access Road Alternative 4 (centre of 20m road corridor)		**Latitude:**	**Longitude:**
	Start (intersection to the R380)	27°32'37.95'' S	23°00'03.34'' E
	Middle	27°32'54.08'' S	23°01'57.02'' E
	End (perimeter road)	27°33'10.05'' S	23°03'49.03'' E

A locality map illustrating the location of the Hyperion Solar Development 2 project site and access road alternatives is provided in **Error! Reference source not found.**.

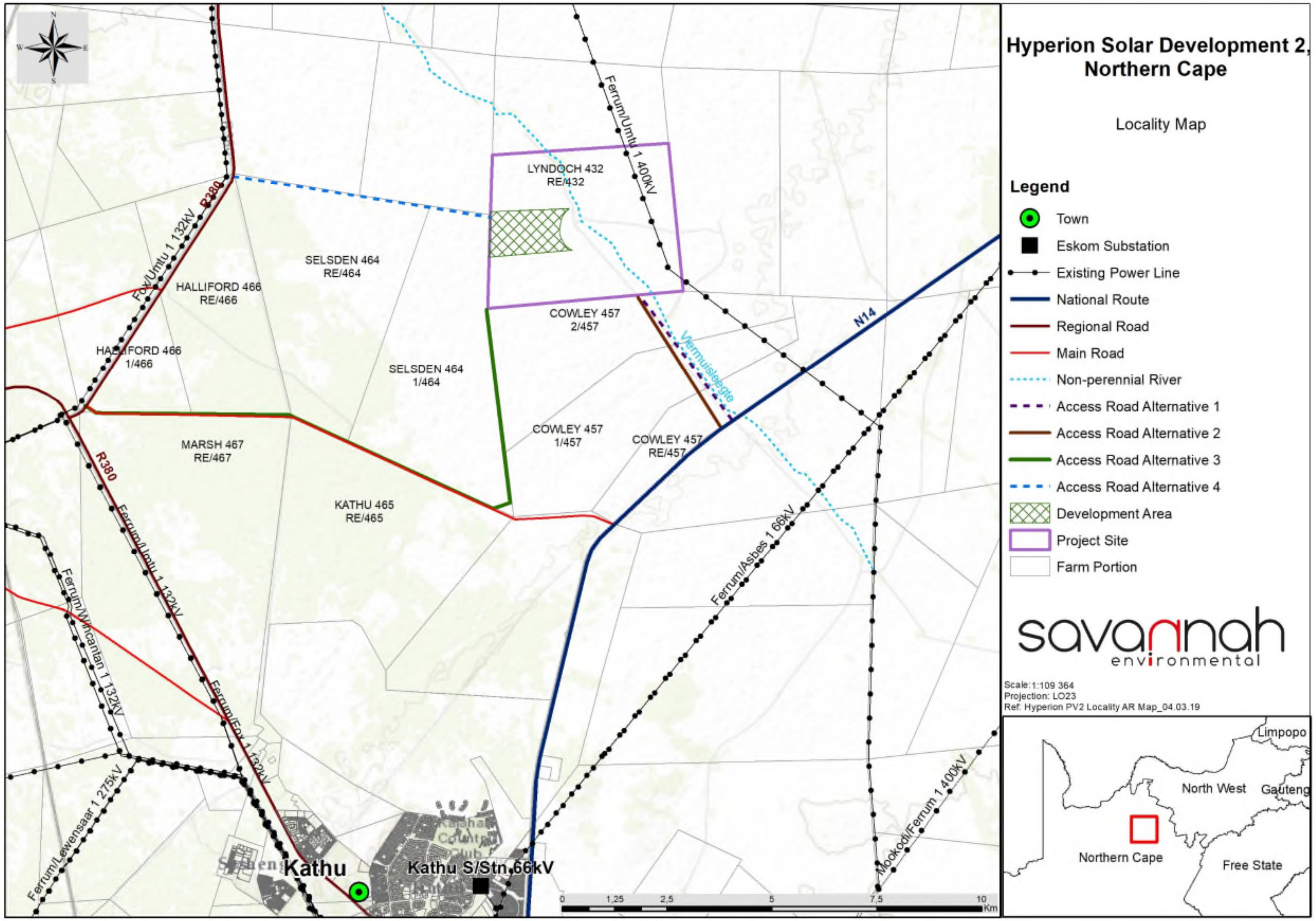

Figure 2.1: Locality Map illustrating the location of the Hyperion Solar Development 2 project site and access road alternatives.

2.2. Layout Selection Process

An Environmental Sensitivity Map which illustrates potentially sensitive areas identified within the project site was compiled for the project as part of the Scoping Phase (refer to **Figure 2.2**). The Scoping Phase environmental sensitivity map provided an illustration of sensitivity within the project site. The detail was based on the desktop review of the available baseline information for the study area, specialist inputs and limited field surveys. The environmental sensitivity map was intended to inform the location and layout of the PV facility and associated infrastructure, and was to be used as a tool by the developer to, as far as possible, avoid those areas flagged to be of potential high sensitivity. Specific sensitivities identified within the scoping study are summarised below.

Ecology:

» *Very High Sensitivity (No-go Area):* The Vlermuisleegte River which is considered an important corridor for landscape connectivity. The river is characterised by a high density of large *Acacia erioloba* trees, and is therefore unsuitable for development. This area has been regarded as a no-go area for all project components except for the existing T26 gravel road.

» *High Sensitivity:* These areas are considered to be of high sensitivity due to the high density of *A. erioloba* trees identified within this area. An important impact associated with the proposed development would be the loss of relatively large numbers of *A. erioloba* and *A. haematoxylon*. Although the density of these species in the area is high, the loss of the individuals within the proposed development footprint would not compromise the local populations of these species.

» *Medium Sensitivity:* The majority of the area east of the Vlermuisleegte River has a moderate *A. erioloba* density and are considered to be of medium sensitivity. 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. The eastern boundary of the development area infringes on a section of the medium sensitive area consisting of *A. erioloba* trees. A low ridge (i.e. gravel hill) in the central part of the area west of the Vlermuisleegte River is considered to be of medium sensitivity as it has higher plant diversity than the surrounding area and is a relatively rare habitat in context of the project site.

» *Low Sensitivity:* The majority of the western half of the project site is considered to be of low sensitivity due to the lower abundance of protected tree species and dominance of *T. camphoratus* which is generally an indicator of poor veld condition. No species of high conservation concern were observed in this area and is considered potentially suitable for development.

The development footprint for the PV facility avoids areas of very high and high ecological sensitivities and has therefore complied with the recommendation made by the specialist.

Watercourses:

» *Very High Sensitivity (No-go Area):* The Vlermuisleegte River is considered to be largely natural according to the Present Ecological State (PES) 1999[12], and is classified as moderately modified (Class C) according to the National Freshwater Ecosystem Priority Area (NFEPA) database. Due to agricultural activities within the floodplain associated with the river, the natural indigenous riparian vegetation has been impacted. Analysis of digital satellite imagery indicates however that some natural riparian vegetation remains within the area east of the river.

  A depression wetland has been identified within the northern portion of the project site, situated within the Vlermuisleegte River. This depression is considered to be in a natural or good ecological condition (Class AB). A second depression wetland was identified approximately 2.5km east of the proposed Access Road Alternative 2[13] and the N14 national route. This wetland is well vegetated and is considered to be moderately modified (Class C) with no apparent impacts which might occur from the adjacent road infrastructure. These depression wetlands could be considered of increased ecological importance and sensitivity, and should be regarded as a no-go area for all infrastructure.

  The presence of these watercourses within and surrounding the project site is not considered a fatal flaw to the project. All watercourses should however be considered as no-go areas for any future new developments, **with the exception** of the Access Road Alternative 1 which will be an upgrade of the existing T26 gravel road.

» *High Sensitivity Area:* A 32m buffer has been applied to the extent of all watercourses identified within the project site and along the access road alternatives (i.e. depression wetlands and the Vlermuisleegte River). The 32m buffer represents the 32m regulated area associated with a watercourse as stipulated by the NEMA EIA Regulations of 2014 (as amended). No infrastructure should be placed in these areas of high sensitivity. Access roads should only be allowed within these areas if it is absolutely unavoidable to circumnavigate these watercourses.

» *Medium Sensitivity:* A 100m buffer has been applied to the Vlermuisleegte River and a 500m buffer has been applied to the two depression wetlands. These buffers represent the GN509 regulated area of the watercourses. Development may take place within these areas but should be avoided if possible, to avoid triggering Section 21 (c) & (i) water uses.

» *Low Sensitivity:* The remaining areas within the project site and along the access roads are considered to be of low sensitivity from a watercourse conservation point of view.

[12] The most recent database (i.e. DWS 2014 database) did not assess the Vlermuisleegte River and therefore the PES stated in the 1999 database was used.

[13] This alternative has been realigned after the scoping phase to avoid the Kathu Forest based on correspondence with the Department of Forestry and Fisheries (DAFF) and is now referred to as Access Road Alternative 3 in the EIA Report.

The development footprint for the PV facility avoids areas of very high and high sensitivities and has therefore complied with the recommendation made by the specialist.

Avifauna:

- *Very High Sensitivity:* The Vlermuisleegte River traverse the centre of the project site. The river consists of open grassland *and Terminalia sericea* trees generally associated with the *A. erioloba* woodland, which is considered to be a restricted habitat that has elements similar to that of pans. These areas are very sensitive due to their high use and specialised avifauna that is usually associated with these features. The Vlermuisleegte River may support a very different assemblage of birds compared to the scrub and woodland habitat and may even support red-listed species under favourable conditions, such as Burchell's Courser and Ludwig's Bustard. No additional development or transformation is recommended within this area. The continued use of the existing access road is considered acceptable provided that no large raptor nests of species of concern are found in the trees near the road.

- *High Sensitivity:* The *A. erioloba* woodland east of the Vlermuisleegte River is considered to be of high sensitivity with respect to avifauna, as it supports large *Acacia* trees interspersed with patches of *A. mellifera* and *T. sericea*, which contribute towards a higher habitat heterogeneity and wider array of nesting sites resulting in an overall greater diversity of avifauna. This area is not affected by the proposed development area. Data obtained from during the Scoping Phase is insufficient to illustrate any potential differences in avifaunal assemblages between the Acacia woodland to the east, and the *Tarchonanthus* scrub to the west of the Vlermuisleegte River. Findings from the site visit suggest that it is likely to be more diverse and this is a reasonable assumption as there is a known relationship between habitat heterogeneity and species richness (Harrison *et al*., 1997). The area east of the Vlermuisleegte is considered to be a high sensitivity and largely unsuitable for development.

- *Medium Sensitivity:* The remaining area of the project site to the west of the Vlermuisleegte River consists of *T. camphoratus* scrub. This area represents typical avifauna of the Kalahari bioregion, while also supporting protected tree species such as *A. haematoxylon*, and low numbers of *A. erioloba*. This area of the project site experienced a devastating fire in 2009, which destroyed many of the large *Acacia* trees as found to the west of the Vlermuisleegte River. With time (perhaps decades), large *A. erioloba* trees may again become prominent across the *Tarchonanthus* scrub. The sensitivity rating of this area is a reflection of the current vegetation composition and not the long-term potential.

Heritage:

- *Very High Sensitivity (No-go Area):* The majority of the project site is considered to be sterile of archaeological materials except for a light scatter of artefacts with a few gravel clasts approximately 70m to the east of the Vlermuisleegte River (Site 1185). Other areas where stone artefacts were identified, were areas which also comprised of gravel. These areas include a low gravel hill approximately 1km to the south of the proposed development area and along the banks of the Vlermuisleegte River. The Vlermuisleegte River and immediate surrounds should be considered as a no-go area as it is likely that the area close to the Vlermuisleegte River may consist of gravel that contains the artefacts which are closer to the surface, and are regarded as sensitive. A buffer of approximately 120m from the edge of the Vlermuisleegte is recommended to protect all areas considered to be potentially sensitive at the surface.

» *Low Sensitivity:* It is likely that the area close to the Vlermuisleegte River would be the most sensitive palaeontological area within the project site. The palaeontological sensitivity within this area is however still generally low due to the expected sparse distribution of fossils. The palaeontological sensitivity within the remaining areas are expected to be very low.

The development footprint for the PV facility avoids areas of very high heritage sensitivities and has therefore complied with the recommendation made by the specialist.

Soils, Land Use, Land Capability and Agricultural Potential:

» *Low Sensitivity:* The potential of the site for dryland agriculture is low. The project site only has potential for livestock farming. The site has grazing capacity of approximately 21 to 30 hectares per Large Stock Unit (ha/LSU) and therefore, the entire project site can be used to feed 53 to 76 head of cattle. The proposed development area for Hyperion Solar Development 2, has the capacity for 7 to 9 head of cattle to graze on. Considered in isolation, the development area is not a viable unit for livestock farming but in combination with the remaining area of the project site, it is large enough to function as a sustainable cattle farm.

  Following the land capability classification data obtained from the DAFF, the site has low to moderately low land capability (therefore, only suitable for grazing with certain management practices required).

Visual:

» A homestead is located approximately 600m from the proposed development area. This homestead is inhabited by the landowner and his family, and it has been confirmed that he is in agreement with the proposed development. There is also a group of buildings approximately 3.4km south of the development area. It is possible that this could include a single homestead. A 500m no development buffer around the homestead and these buildings are recommended by the Visual Specialist in order to ensure that the proposed development does not completely dominate views from the homestead. This has been incorporated into the proposed layout by the developer. The development area avoids the suggested 500m visual buffer.

The development footprint for the PV facility is located outside of the 500m buffer area and has therefore complied with the recommendation made by the specialist.

Development Area:

While the findings of the desktop Scoping Study indicated that no environmental fatal flaws associated with the proposed development of Hyperion Solar Development 2 on a portion of the Remaining Extent of the Farm Lyndoch 432 had been identified at the time, the recommendation was made that the development areas for the establishment of the facility be considered outside of the identified areas of high sensitivity as far as possible, in order to ensure that the proposed development does not have a detrimental impact on the environment.

With an understanding of which areas within the project site were considered sensitive to the development of the proposed facility, the project applicant prepared a detailed infrastructure layout. **Figure 2.3** provides an overview of the layout identified for the project in relation to the sensitivities identified as part of the Scoping Phase environmental sensitivity mapping. In terms of this proposed layout, it is clear that the development footprint identified for Hyperion Solar Development 2 is located completely outside of any identified areas of high sensitivity.

This layout, including access road alternatives identified during the EIA process has been assessed within this final EIA Report. The detailed specialist studies which have been conducted as part of the EIA Phase are in line with the Plan of Study accepted by the DEA. Specialists' recommendations are included in **Chapter 10** of this EIA Report (as well as within the detailed specialist reports contained in **Appendix D** to **Appendix J**), and the recommendation for a final layout is made. Specialists' recommendations for mitigation and management measures which would be applicable to the final preferred layout and which are required to ensure it retains an acceptable level of environmental impact have also been incorporated into the EMPr prepared for the project, and attached as **Appendix K** to this final EIA Report.

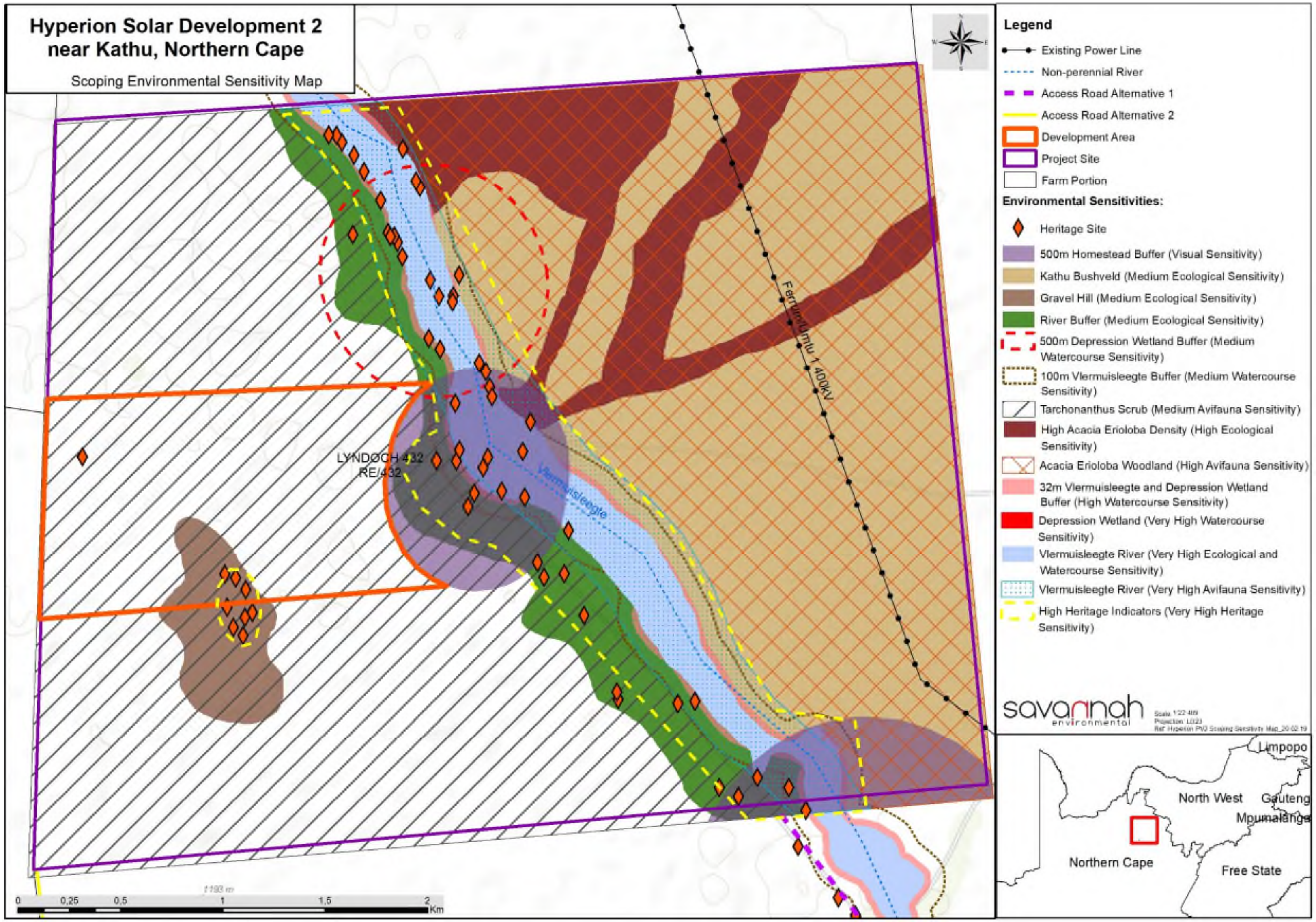

Figure 2.2: Scoping Phase Environmental Sensitivity Map prepared for Hyperion Solar Development 2.

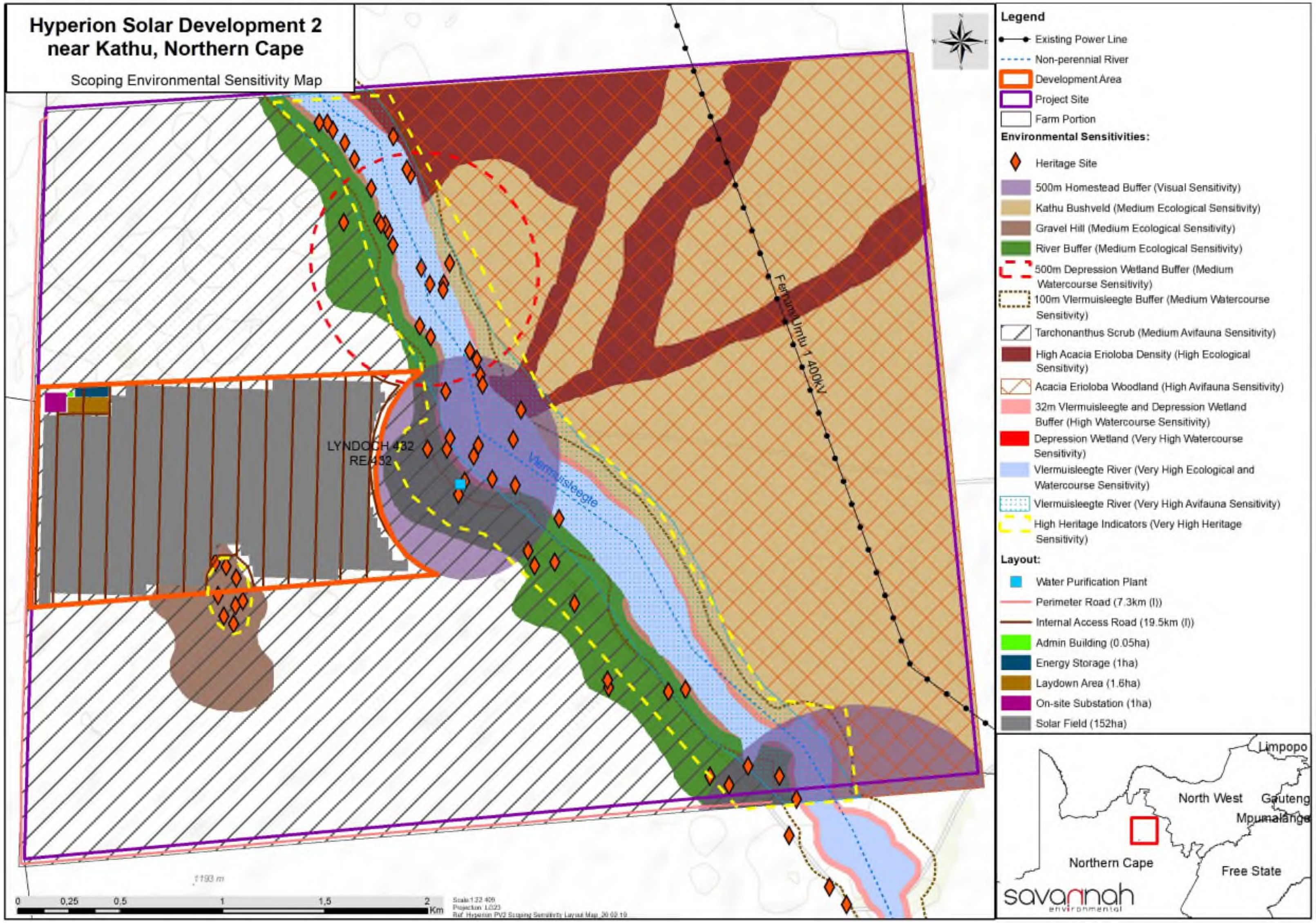

Figure 2.3: **Project layout prepared in response to the Scoping Phase Environmental Sensitivity Map prepared for Hyperion Solar Development 2.**

2.3. Technology considered for the Solar Facility and the Generation of Electricity

The Hyperion Solar Development 2 will have a generation capacity of 75MW and will make use of PV technology. Solar energy facilities which utilise PV technology, use the energy from the sun to generate electricity through a process known as the Photovoltaic Effect. This effect refers to photons of light colliding with electrons, and therefore placing the electrons into a higher state of energy to create electricity (refer to **Figure 2.4**).

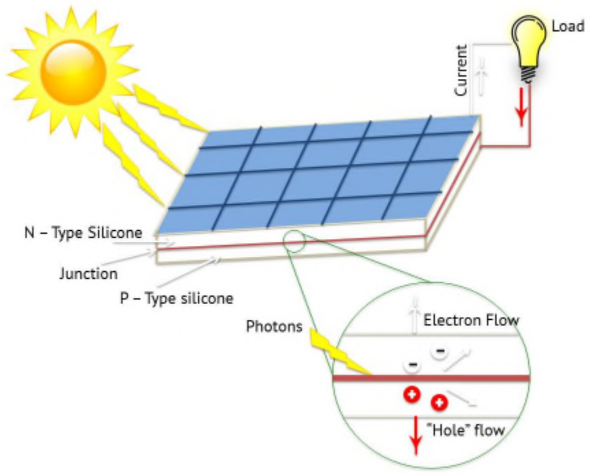

Figure 2.4: Diagram illustrating the Photovoltaic Effect (Source: Centre for Sustainable Energy).

Generating electricity using the Photovoltaic Effect is achieved through the use of the following components:

PV Cells

A PV cell is made of silicone that acts as a semi-conductor used to produce the Photovoltaic Effect. PV cells are arranged in multiples / arrays and placed behind a protective glass sheet to form a PV panel (refer to **Figure 2.5**). Each PV cell is positively charged on one side and negatively charged on the opposite side, with electrical conductors attached to either side to form a circuit. This circuit captures the released electrons in the form of an electric current (i.e. Direct Current (DC[14])).

[14] DC (direct current) is the unidirectional flow or movement of electric charge carriers (which are usually electrons). The intensity of the current can vary with time, but the general direction of movement stays the same at all times. As an adjective, the term DC is used in reference to voltage whose polarity never reverses. In a DC circuit, electrons emerge from the negative, or minus, pole and move towards the positive, or plus, pole. Nevertheless, physicists define DC as traveling from plus to minus. (sourced from https://whatis.techtarget.com/definition/DC-direct-current).

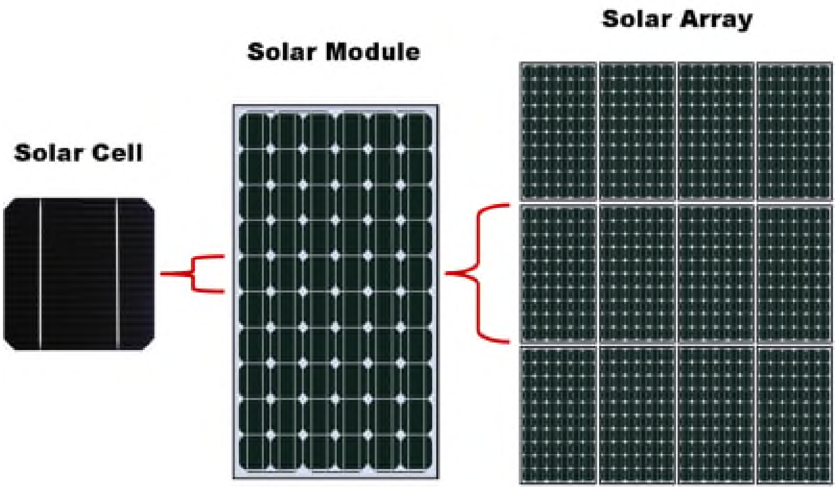

Figure 2.5: Overview of a PV cell, module and array / panel (Source: pveducation.com).

Inverters

Inverters are used to convert electricity produced by the PV cells from DC into AC[15], to enable the facility to be connected to the national electricity grid. In order to connect a large solar facility such as the one being proposed to the national electricity grid, numerous inverters will be arranged in several arrays to collect, and convert power produced by the facility.

Transformers

Transformers are required to transform (i.e. step-up) the power generation by the PV facility from a low voltage to a higher voltage to allow for it to be integrated into the national electricity grid.

Support Structures

PV panels will be fixed to a support structure. PV panels can either utilise fixed / static support structures, or single or double axis tracking support structures (refer to **Figure 2.6**). PV panels which utilise fixed / static support structures are set at an angle (fixed-tilt PV system) so as to optimise the amount of solar irradiation. With fixed / static support structures the angle of the PV panel is dependent on the latitude of the proposed development, and may be adjusted to optimise for summer and winter solar radiation characteristics. PV panels which utilise tracking support structures track the movement of the sun throughout the day so as to receive the maximum amount of solar irradiation.

PV panels are designed to operate continuously for more than 25 years, mostly unattended and with low maintenance.

[15] An alternating current (AC) occurs when charge carriers in a conductor or semiconductor and periodically reverse their direction of movement. The voltage of an AC power source can be easily changed by means of a power transformer. This allows the voltage to be stepped up (increased) for transmission and distribution (sourced from https://whatis.techtarget.com/definition/alternating-current-AC).

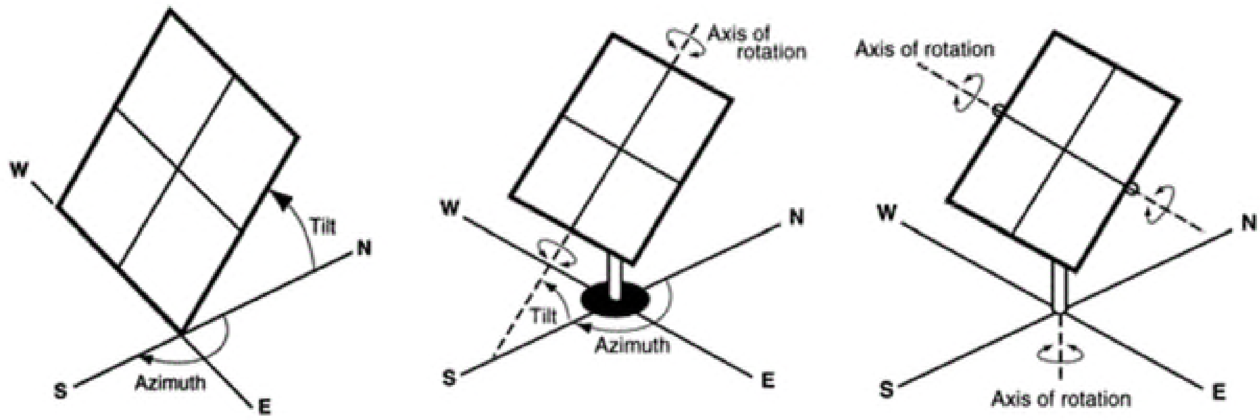

Figure 2.6: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

2.4. Description of the Project Infrastructure

A summary of the associated infrastructure proposed as part of Hyperion Solar Development 2 is provided in **Table 2.2**, and described in more detail under the sub-headings below. **Figure 2.7** and **Figure 2.8** provides an overview of the layout proposed for the project.

Table 2.2: Planned infrastructure proposed as part of Hyperion Solar Development 2

Infrastructure	Dimensions/ Details
Solar Facility	» Photovoltaic (PV) technology. » Solar panels up to 6m in height. » Fixed-tilt, single-axis tracking, or dual-axis (double-axis) tracking systems. » On-site inverters (to convert the power from DC to AC), and power transformers. » PV structures / modules up to 152ha in extent (depending on the type of support structure selected for implementation (i.e. static vs tracking)).
Energy Storage	» Up to 1ha in extent. » Storage capacity of up to 300MWh. » Batteries will be stored in battery storage units.
Supporting Infrastructure	» On-site buildings and structures, including a maintenance building and office building, ablutions and guard house and security building to occupy an area up to 0.05ha in extent. » Perimeter security fencing and access gates up to 3m in height. » Temporary laydown area up to 1.6ha in extent, for the storage of materials during the construction. » Batching plant, to be located within the laydown area.
On-site substation	» On-site substation with a 132kV capacity. » Will occupy an area up to 1ha in extent.
Grid Connection	» A single 132kV power line is required for grid connection to national grid.
Access road	» Main access road – four access road alternatives are being considered: ∗ Alternative 1 - The upgrade of approximately 3.6km of the existing T26 gravel road situated between the project site and the N14. The existing road will be upgraded from approximately 5m to 9m in width.

Infrastructure	Dimensions/ Details
	* Alternative 2 - 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. * Alternative 3 – The establishment of a new access road approximately 5.1km in length and 9m in width and the upgrade approximately 10.3km of the existing T25 gravel road from approximately 5m in width to 9m in width. * Alternative 4 – The establishment of a new access road approximately 6.2km in length and 9m in width situated between the project site and the R380. » Internal access road – 6m wide and approximately 19.5km in length (to be gravel). » Perimeter road –The use of the existing perimeter road 6m in width and approximately 7.4km in length.
Water Supply	» Approximately 10 000m³ of water is required over a 12 month period during construction. » Approximately 50 000m³ of water per year is required for operation (25 years). Water will be sourced from three existing borehole located on the property during construction and operation. » The following water supply option is currently being considered: * Water will be sourced from two existing boreholes located on the property during construction and operation. A water purification plant may be installed to purify the borehole water to potable standards. The purification plant will be located adjacent to the existing boreholes.
Services required	» Refuse material disposal - all refuse material generated from the proposed development will be collected by a private contractor and will be disposed of at a licensed waste disposal site off site. This service will be arranged with the municipality when required. » Sanitation – during construction chemical toilets will be used and will be emptied by the municipality. During operation, the facility will utilise conservancy tanks. A contractor will be appointed to empty the tanks and to dispose of the sewage at a licensed waste disposal site. » Water supply – water will be sourced from up to three existing boreholes located on the property. If required, these boreholes will be licensed with the DWS post preferred bidder status. » Electricity supply – agreements with the Gamagara Local Municipality will be established for the supply of electricity to the PV facility.

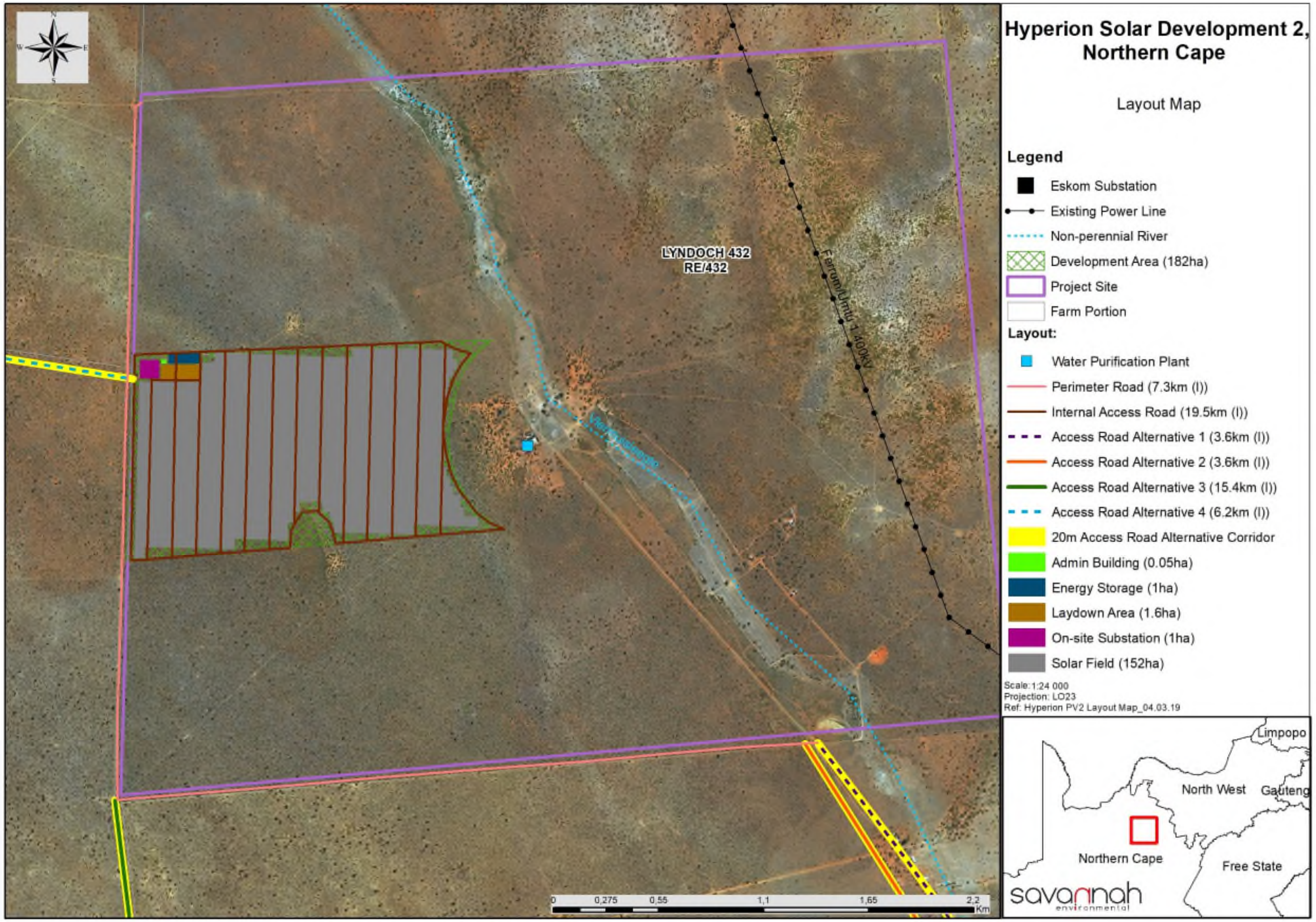

Figure 2.7: Map illustrating the proposed project layout prepared for Hyperion Solar Development 2.

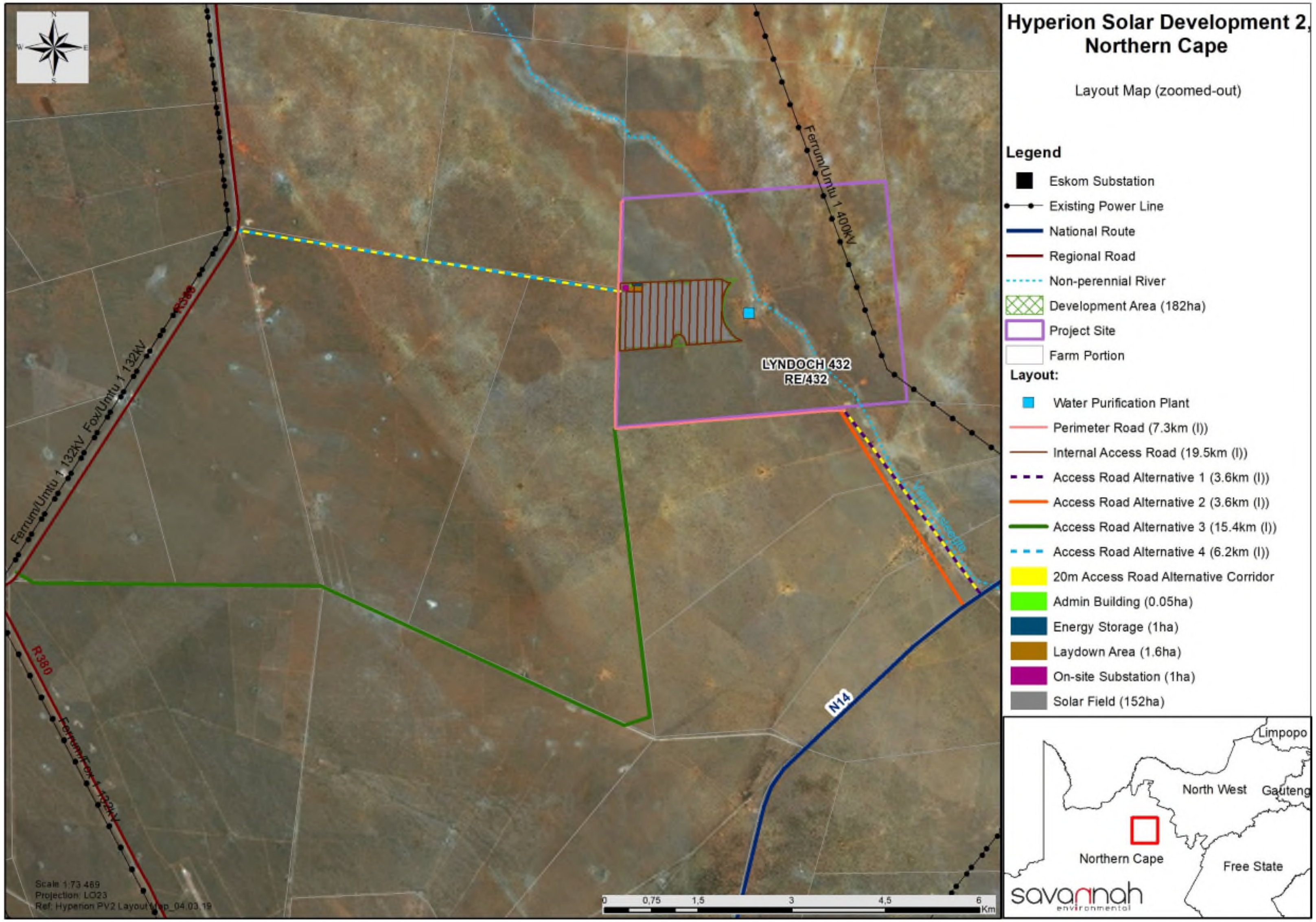

Figure 2.8: **A zoomed-out map illustrating the proposed project layout prepared for Hyperion Solar Development 2.**

2.4.1. Project Footprint

An area of approximately 180ha (equivalent to 11.3% of the total project site) is required for the development of Hyperion Solar Development 2. The PV structures / modules will occupy an area up to 152ha in extent, while supporting infrastructure such as the main and internal roads (up to 11.7ha), on-site buildings and structures (up to 0.05ha), energy storage (up to 1ha) and an on-site substation (up to 1ha) will occupy the remaining extent. During construction, a temporary laydown area approximately 1.6ha in extent will be required.

Three (3) additional 75MW PV facilities with a development footprint of approximately 180ha in extent each, are being considered on the same project site (Remaining Extent of the Farm Lyndoch 432). The development areas of the four (4) proposed solar energy facilities (including the proposed Hyperion Solar Development 2) would comprise ~45% of the total extent of the project site should all proceed to construction.

The type of technology selected for implementation, outcomes of the EIA process, and the completion of additional technical studies (e.g. geotechnical and other surveys) to be conducted as part of the detailed design phase will ultimately influence the final project layout and development footprint. This would however fall within the project assessed within this EIA. The final facility design is required to be approved by DEA prior to any construction activities commencing on-site. Should any substantive changes or deviations from the original scope or layout of the project reflected in the EIA process occur, DEA would need to be notified thereof, and where applicable additional approval may need to be obtained.

2.4.2. Details of the proposed PV infrastructure

Hyperion Solar Development 2 will be designed to have a nett generating capacity (i.e. contracted capacity) of up to 75MW. The project will make use of fixed-tilt, single-axis tracking, and/or double-axis tracking PV technology. PV technology is considered by the developer to be more suitable than Concentrated Solar Power (CSP) technology as it has relatively negligible water requirements, is not associated with the generation of effluent, is more competitive from an economic / cost perspective, and has a reduced visual impact.

The project will comprise solar panels which, once installed, will stand up to 6m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground. If centralised inverter stations are used, Mega Volt (MV) distribution transformers are located internally, whereas string inverters are containerised with switchgear.

The main transformer capacity varies according to detailed design and client / project specific requirements. It is anticipated however that 1 x 80MVA transformation capacity will be applicable, stepping up from 11kV to 132kV for evacuation into the Eskom electricity grid.

2.4.3. Water Supply

Hyperion Solar Development 2 will utilise water during both the construction and operation phases of development. Water is required during construction for use in the batching plant, dust suppression and potable water will be required on site for the construction crew. During operations, water is required to clean the PV panels, for human consumption, and for use in the auxiliary buildings (i.e. for use in the office building, ablutions, and canteen, etc.). Approximately 10 000m³ of water per year is required over a 12 to 18-month period during construction, and approximately 50 000m³ of water per year is required per year over the 25-year operational lifespan of the project. Water will be sourced from up to three (3) existing boreholes located on the project site and within close proximity to the landowner's house. The estimated coordinates for these boreholes are: 1) 27°33'21.24"S, 23° 5'4.50"E 2) 27°33'25.21"S, 23° 5'8.38"E and 3) 27°33'12.82"S, 23° 5'9.79"E.

A water purification plant may be constructed. The water purification plant will be required for the purposes of purifying water, to be drawn from the three existing boreholes located on the project site, to drinking standards for use during construction and operation. Should any waste be generated by the water purification plant, the waste will be removed by a licenced contractor appointed. The purification plant will be approximately 12m^2 in extent and will be located adjacent to the landowner's house.

2.4.4. Panel Cleaning

It is anticipated that the PV panels will be washed twice a year during operation. Only clean water (i.e. with no cleaning products), or non-hazardous biodegradable cleaning products will be utilised for the washing of panels. Wastewater generated by washing panels will either be collected and recycled for future use, or alternatively, in the event that an environmentally friendly non-hazardous biodegradable cleaning product is utilised, wastewater can be allowed to run-off under the panels.

2.4.5. Energy Storage

The battery storage mechanism will have a storage capacity of up to 300MWh. There are different battery technologies which can be utilised for energy storage. Energy generated by the project can be stored in the Li-ion batteries, Lead Acid batteries, Salt Batteries, Vanadium Redox Flow batteries or other technologies for use when the facility is no longer generating electricity (i.e. at night or on cloudy days). The battery mechanism can also be used to stabilise power generation variability, and assist with power system frequency regulation. **Figure 2.9** provides an example of battery storage units.

Figure 2.9: Example of battery storage units installed by Tesla (Source: fastcompany.com).

2.4.6. Effluent and Wastewater

During construction, chemical toilets will be used on site. These will be serviced regularly and effluent will be disposed of at a registered wastewater treatment works. It is expected that approximately 360m^3 of effluent will be generated during the construction phase. Any other effluent discharge during construction will be collected in sealed containers / tanks, and collected by a registered service provider (i.e. the Local Municipality (LM) / Contractor) to be disposed of at a nearby and approved facility off-site.

Apart from normal sewage from site and operation staff, no effluent will be produced during operation. Sewage will be collected and treated as per normal standards using a septic or conservancy tank. Approximately 365 000 litres of effluent will be generated during the operation phase. In cases where the LM does not permit the use of septic tanks, sewage will be stored in a conservancy tank and collected by a registered service provider (the LM / Contractor) to be treated at a nearby and approved facility off-site.

2.4.7. Waste

Solid waste generated during construction will mainly be in the form of construction material, excavated substrate and domestic solid waste. Waste will be disposed of in either waste skips and/or scavenger proof recycling bins (where possible) and temporarily placed in a central location for removal by an appropriate contractor. Where possible, waste will be recycled. Non-recyclable solid construction waste will be temporarily held in skips or other appropriate waste containers to be disposed of at an appropriately licensed landfill site. Any other waste and excess material will be removed once construction is complete and disposed of at a registered waste facility. It is anticipated that no waste will be associated with the battery storage mechanism proposed.

During construction, use of the following hazardous substances are anticipated: paint, grease, petrol / diesel for trucks, cranes, bulldozers etc. Limited amounts of transformer oils and chemicals. Dangerous goods required to be stored during construction (e.g. limited quantities of fuel, oil, lubricants etc.) will be stored in compliance with relevant legislation (i.e. stored on covered and bunded areas / bin, and disposed of at a registered hazardous waste site). Hazardous waste will be appropriately stored and disposed of.

2.5. Proposed Activities during the Project Development Stages

A series of activities are proposed as part of the design, pre-construction, construction, operation, and decommissioning phases associated with the development of Hyperion Solar Development 2. These are discussed in more detail under the respective sub-headings below.

2.5.1. Design and Pre-Construction Phase

Pre-planning
Several post-authorisation factors are expected to influence the final design of the facility and could result in small-scale modifications of the PV array or associated infrastructure. While an objective of the Engineering, Procurement and Construction (EPC) Contractor, who will be responsible for the overall construction of the project, will be to comply with the approved facility design as far as possible, it should be understood that the construction process is dynamic and that unforeseen changes to the project specifications may take place. This EIA Report therefore describes the project in terms of the best available knowledge at the time. The final facility design is required to be approved by the DEA. Importantly, should there be any substantive changes or deviations from the original scope or layout of the project, the DEA will need to be notified and where relevant, approval obtained.

Conduct Surveys
Prior to initiating construction, a number of surveys will be required including, but not limited to confirmation of the micro-siting footprint (i.e. the precise location of the PV panels, substation and the plant's associated infrastructure) and a geotechnical survey. Geotechnical surveys are executed by geotechnical engineers and geologists to acquire information regarding the physical characteristics of soil and rocks underlying a proposed project site. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

2.5.2. Construction Phase

The construction phase will take approximately 12 to 18 months to complete, and will entail a series of activities including:

Procurement and employment
At the peak of construction, the project is likely to create a maximum of 500 employment opportunities. These employment opportunities will be temporary, and will last for a period of approximately 12 to 18 months (i.e. the length of construction). Employment opportunities generated during the construction phase will include low skilled, semi-skilled, and skilled opportunities. Solar PV projects make use of high

levels of unskilled and semi-skilled labour so there will be good opportunity to use local labour. Employment opportunities for the proposed PV facility will peak during the construction phase, and significantly decline during the operation phase. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

The majority of the labour force is expected to be sourced from the surrounding towns, and no labour will be accommodated on-site during the construction period.

Establishment of an Access Road to the Site

Access to the project site will be established for the construction of the PV facility. Access to the project site is possible through the use of existing unsurfaced farm roads such as the T26, which can be accessed from the N14 national road. Within the development footprint itself, access will be required from new / existing roads for construction purposes (and limited access for maintenance during operation). The final layout will be determined following the identification of site related sensitivities.

Undertake Site Preparation

Site preparation activities will include clearance of vegetation. These activities will require the stripping of topsoil which will need to be stockpiled, backfilled and / or spread on site.

Transport of Components and Equipment to Site

The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment required during the construction phase of the solar facility. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTA)[16] by virtue of the dimensional limitations. Typical civil engineering construction equipment will need to be brought to the site (e.g. excavators, trucks, graders, compaction equipment, cement trucks, etc.) as well as components required for the mounting of the PV support structures, construction of the substation and site preparation.

Establishment of Laydown Areas on Site

Laydown and storage areas will be required for typical construction equipment. Once the required equipment has been transported to site, a dedicated equipment construction camp and laydown area (1.6ha in extent) will need to be established adjacent to the workshop area. The equipment construction camp serves to confine activities and storage of equipment to one designated area, to limit the potential ecological impacts associated with this phase of the development. The laydown area will be used for the assembly of the PV panels, and the general placement / storage of construction equipment. It is anticipated that the temporary laydown area will be included within the ~182ha development area.

Erect PV Cells and Construct Substation and Invertors

The construction phase involves installation of the PV solar panels, structural and electrical infrastructure required for the operation of the PV facility. In addition, preparation of the soil and improvement of the

[16] A permit will be required in accordance with Section 81 of the NRTA which pertains to vehicles and loads which may be exempted from provisions of Act.

access roads are likely to continue for most of the construction phase. For array installations, vertical support posts will be driven into the ground. Depending on the results of the geotechnical report, a different foundation method, such as screw pile, helical pile, micropile or drilled post/piles could be used. The posts will hold the support structures (tables) on which the PV modules would be mounted. Brackets will attach the PV modules to the tables. Trenches are to be dug for the underground AC and DC cabling, and the foundations of the inverter enclosures and transformers will be prepared. While cables are being laid and combiner boxes are being installed, the PV tables will be erected. Wire harnesses will connect the PV modules to the electrical collection systems. Underground cables and overhead circuits will connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure, and ultimately the PV facility's on-site substation.

The construction of the substation will require a survey of the development area, site clearing and levelling and construction of access road(s) (where applicable), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, and rehabilitation of any disturbed areas, and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include a power line for connection to the Eskom national grid, workshop, storage and laydown areas, gatehouse and security complex, as well as a temporary contractor's equipment camp. The 132kV overhead power line will be assessed as part of a separate Basic Assessment Process.

The establishment of the ancillary infrastructure and support buildings will require the clearing of vegetation and levelling of the development footprint, and the excavation of foundations prior to construction. Laydown areas for building materials and equipment associated with these buildings will also be required.

Undertake Site Rehabilitation

Once construction is completed and all construction equipment has been removed, the development area will be rehabilitated where practical and reasonable. In addition, on full commissioning of the PV facility, any access points which are not required during operation must be closed and rehabilitated accordingly.

2.5.3. Operation Phase

The proposed PV facility is expected to operate for a minimum of 25 years. The facility will operate continuously, 7 days a week, and will include battery storage of up to 300MWh. The battery mechanism stores excess renewable energy generated, dispatching excess power as and when required. This will allow operations to continue for a period during high cloud cover and at night. The battery mechanism can also be used to stabilise power generation variability, and assist with power system frequency regulation. While the solar facility will be largely self-sufficient, monitoring and periodic maintenance activities will be required. Key elements of the Operation and Maintenance (O&M) plan include monitoring and reporting the performance of the solar facility, conducting preventative and corrective maintenance, receiving visitors, and maintaining security. Where replacement of panels is required as part of maintenance, existing disturbed areas within the site will be used for storage of equipment, and broken panels will be appropriately disposed of or recycled.

The operation phase of the PV facility will create approximately 65 full-time equivalent employment positions. The number of low-skilled and semi-skilled personnel will comprise 70%, and skilled personnel will comprise 30% of the workforce during the operation phase. Employees that can be sourced from the local municipal area include the less skilled and semi-skilled personnel (such as safety and security staff and certain maintenance crew). Highly skilled personnel may need to be recruited from outside the local area.

2.5.4. Decommissioning Phase

Depending on the continued economic viability of the solar farm following the initial 25-year operation lifespan, the facility will either be decommissioned, or the operation phase will be extended. If it is deemed financially viable to extend the operation phase, existing components would either continue to operate or be dissembled and replaced with new, more efficient technology / infrastructure available at the time. If the decision is made to decommission the solar energy facility, the following decommissioning activities will take place:

Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate the required decommissioning equipment.

Disassembly and Removal of Existing Components

When the PV facility is ultimately decommissioned, the equipment to be removed will depend on the land use proposed for the project site at the time. All above ground facilities that are not intended for future use at the project site will be removed. Much of the above ground wire, steel, and PV panels of which the system is comprised are recyclable materials, and would be recycled to the extent feasible. The components of the solar energy facility would be de-constructed and recycled, or disposed of in accordance with applicable regulatory requirements. The project site will be rehabilitated where required, and can potentially be returned to a beneficial land-use.

Future plans for the site and infrastructure after decommissioning

The generation capacity of the facility would have degraded by approximately 15% over the 25-year operational lifespan. The solar energy facility will potentially have the opportunity to generate power for a Merchant Market operation (i.e. the client would sell power on a bid basis to the market). Another option for the site after decommissioning is for agricultural activities to resume.

CHAPTER 3 CONSIDERATION OF ALTERNATIVES

In accordance with the requirements of Appendix 3 of the 2014 EIA Regulations (GNR 326), an EIA Report must contain a consideration of alternatives, which can include site (i.e. development footprint), activity, technology and site access alternatives, as well as the "do-nothing" alternative. Alternatives are required to be assessed in terms of social, biophysical, economic and technical factors.

The DEA Guideline for determining alternatives states that the key criteria for consideration when identifying alternatives are that they should be "practicable", "feasible", "relevant", "reasonable" and "viable". Essentially there are two types of alternatives:

» Incrementally different (modifications) alternatives to the project.
» Fundamentally (totally) different alternatives to the project.

In this instance, 'the project' refers to a 75MW PV facility and associated infrastructure proposed to be developed by an Independent Power Producer (IPP) and is intended to form part of the DoE's REIPPP Programme. This Chapter provides an overview of the various alternatives considered for Hyperion Solar Development 2 as part of the EIA Process.

3.1. Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level, and as a result project-specific EIAs are limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DoE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[17], and will continue to be addressed as part of future revisions thereto. In this regard, the need for renewable energy power generation (including solar and wind) has been identified as part of the technology mix for power generation in the country in the next 20 years. The site is considered most suitable for the development of a PV facility as the local solar resource is amongst the highest in the country and there are no other sustainable renewable energy resources suitable for power generation in the project area. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

3.2. Consideration of Incrementally Different Alternatives

Incrementally different alternatives relate specifically to the project under investigation. "Alternatives", in relation to a proposed activity, means different ways of meeting the general purposes and requirements of the activity, which may include alternatives to:

» The property on which, or location where the activity is proposed to be undertaken.
» The type of activity to be undertaken.

[17] The Integrated Resource Plan (IRP) is legislated policy which regulates power generation planning.

- The design or layout of the activity.
- The technology to be used in the activity.
- The operational aspects of the activity.

In addition, the option of not implementing the activity (i.e. the "do-nothing" alternative) must also be considered.

These alternatives are discussed under the respective subheadings below.

3.2.1. Property or Location Alternatives

The placement of a PV facility is strongly dependent on several factors including climatic conditions (solar radiation levels), topography, the location of the site, and in particular the location in a planned node for renewable projects, availability of grid connection, the extent of the project site, and the need and desirability for the project (discussed in Detail in Chapter 5). The applicant considers the proposed site to be highly favourable and the most suitable site for the development of a PV solar facility due to the following site characteristics:

- **Solar resource**: The economic viability of a solar facility is directly dependent on the annual direct solar irradiation values. The Kathu region and other parts of the Northern Cape Province are characterised as having the highest solar irradiation values in South Africa (and which are comparable on a global scale). The Global Horizontal Irradiation (GHI) for the proposed project site is in the region of approximately 2 227.5kWh/m^2/annum, which is well suited to the development of a commercial PV facility.
- **Topography**: A surface area with favourable topography facilitates the work involved in construction and maintenance of the PV facility. The proposed project site is characterised as having flat topography with slopes of 0 – 3% across the full extent.
- **Site extent:** The project site is approximately 1600ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities. The development footprint of the facility (Hyperion Solar Development 2) would occupy an area equivalent to approximately 11.3% of the full project site. The development areas of the proposed four (4) PV facilities proposed on the site[18] would comprise ~45% of the total extent of the project site.
- **Site access**: Access to the Remaining Extent of the Farm Lyndoch 432 i.e. the project site can be obtained via the T26 gravel road which can be accessed from the N14 national route located approximately 6km south of the project site and the T25 gravel road which can also be accessed from the N14 national route. Four (4) alternative access road alignments are however being investigated in this EIA Report (refer to Section 3.2.3 below) to minimise impacts on the environment.
- **Grid access:** A key factor in the siting of any project is that the project must have a viable grid connection. Grid connection options are available within the surrounding area and includes, amongst others the existing Ferrum Substation which is located approximately 16km south of the project site.

[18] The development of up to four (4) PV facilities is being proposed on the Remaining Extent of the Farm Lyndoch 432 (the project site). Each project is considered within a separate EIA process and separate EIA Reports have been drafted.

» **Land suitability:** The current land use of the site is an important consideration in site selection in terms of limiting disruption to existing land use practices. There is no cultivated agricultural land within the affected property (as a result of low agricultural potential) which could be impacted upon by the proposed PV facility. The affected property is currently used for livestock grazing, and the majority of farming practices can continue in tandem to the operation of the facility once the construction and commissioning of the project is complete.

» **Geographic location**: The proposed project site is located within an area which has become a node for renewable energy projects, with three existing operational solar facilities in close proximity to the project site. i.e.: Kathu Solar Project (100MW CSP), Sishen Solar Farm (75MW PV), Kathu Solar Farm (75MW PV) and Adams Solar PV 2 (75MW PV).
» **Landowner support**: The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowner does not view the development as a conflict with their current and intended land use practices.

Based on these considerations, the applicant considers the proposed project site as highly preferred in terms of the development of a PV facility, and expects that the development will be able to draw on synergies with the projects proposed and / or currently operational within the vicinity of the project site. No feasible site alternatives are proposed as part of this EIA process.

3.2.2. Design and Layout Alternatives

Hyperion Solar Development 2 will have a development footprint of approximately 180ha, to be located within the development area of approximately 182ha. Specialist field surveys and assessments were undertaken as part of the EIA process in order to provide the developer with site specific information regarding the larger project site considered for the development (refer to **Appendices D-J**). Areas to be avoided by the development were identified, specifically relating to ecological and hydrological features and sensitivities present within the project site. The identified sensitivities were utilised as a tool by the developer to identify and locate the development footprint of the PV facility within the project site and development area. This was undertaken with the aim of avoiding possible highly sensitivity areas within the development footprint so as to limit impacts associated with the development.

This preferred location of the development footprint (180ha) within the project site (i.e. 1600ha in extent) is considered as the most feasible and appropriate location for Hyperion Solar Development 2, based on the following considerations:

i) the proposed development footprint avoids high environmental sensitivities identified,
ii) the landowner provided consent for the development footprint of the PV facility within that particular portion of the project site to be constructed and operated, and
iii) the development footprint is considered suitable for the development of a PV facility from a technical perspective to ensure the success of the development.

As the project site complies with the above characteristics, this is considered to be the most reasonable and feasible alternative development footprint for Hyperion Solar Development 2. No feasible alternative layouts have been identified for consideration in the EIA process.

3.2.3. *Access Road Alternatives*

During the scoping phase, two access road alternatives were considered for the establishment of Hyperion Solar Development 2 (refer to **Figure 3.1**). These included:

» Alternative 1: the upgrade of the existing T26 gravel road to be 9m in width, situated south of the project site along the Vlermuisleegte River. Approximately 3.6km of this access road will be required to be upgraded.
» Alternative 2: the construction of a new access road, and the formalisation of an informal access road between the project site and the existing T25 gravel road. The informal access road currently consists of a two-tyre track serving as a fire break in some places. This access road alternative will be approximately 5km in length.

During a Focus Group Meeting held with the Department of Agriculture, Forestry and Fisheries (DAFF) on 08 November 2018 (refer to **Appendix C7** for the minutes of the meeting), it was indicated that the proposed Access Road Alternative 2 traverses a section of the Kathu Forest which is considered as a no-go area due to its protected status. The DAFF proposed that Alternative 2 be realigned to avoid the protected area (now Alternative 3 in EIA phase described below) and also indicated an additional alternative which should be considered for the project (i.e. Alternative 4 in the EIA Phase as described below). Based on the outcome of the meeting and consultations with affected landowners, the following four access road alternatives were identified for consideration for Hyperion Solar Development 2 within the EIA studies (refer to **Figure 3.2**):

» Alternative 1:
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 approximate 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 all four alternatives has been considered and assessed during the EIA Phase in order to determine the most preferred route from an environmental perspective.

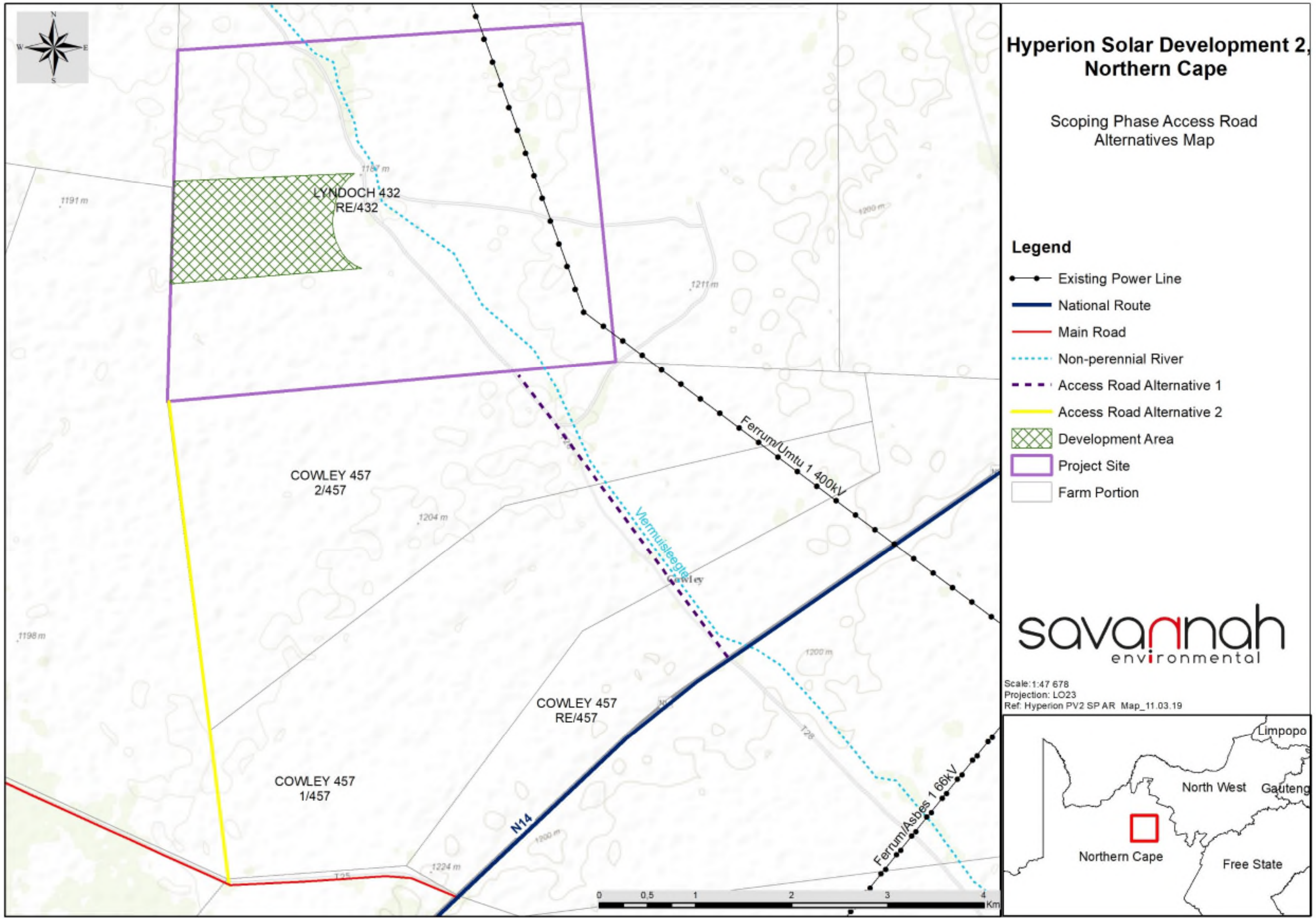

Figure 3.1: Layout map illustrating the access road alternatives considered during the Scoping Phase for Hyperion Solar Development 2.

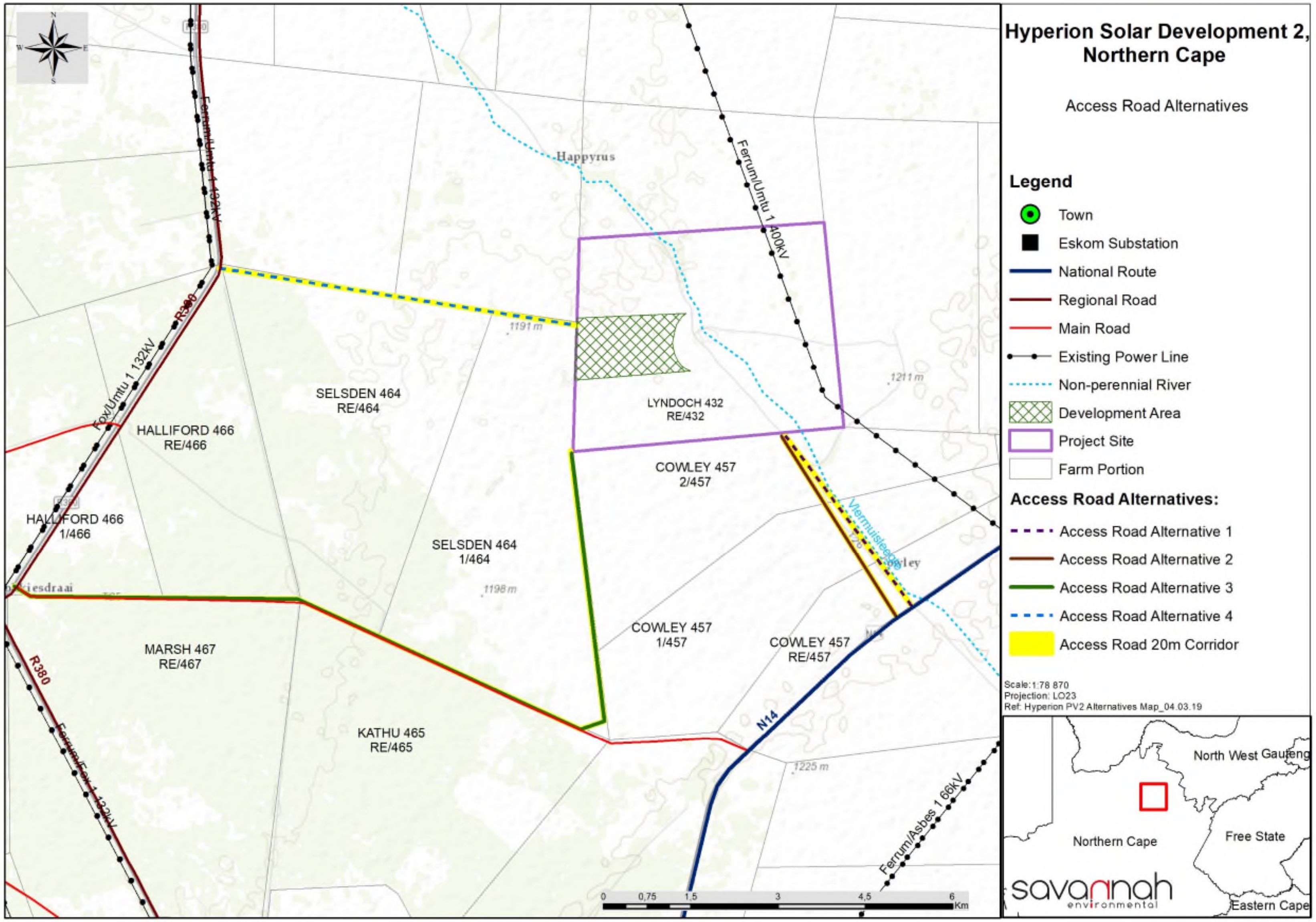

Figure 3.2: **Layout map illustrating the access road alternatives and 20m corridors to be considered and assessed for Hyperion Solar Development 2.**

3.2.4. Technology Alternatives

Few technology options are available for solar facilities, and the selection of those that are preferred are usually differentiated by weather, resource and terrain-related conditions that prevail on the project site, to optimise the final economic solution. Solar energy is considered to be the most suitable renewable energy technology for this site, based on the site location, ambient conditions and energy resource availability. Solar PV was determined as the most suitable option for the proposed site as large volumes of water are not required for power generation purposes compared to Concentrated Solar Power (CSP) technology. PV is also preferred when compared to CSP technology because of the substantially lower visual profile. In addition, from a policy perspective, the requirement for PV technology as part of the power generation mix within the IRP far exceeds that for CSP. There is therefore a greater need for the development of these projects.

Two PV solar energy technology alternatives are being considered for the proposed project and include:

- » Fixed mounted PV systems (static / fixed-tilt panels).
- » Single-axis tracking or double-axis tracking systems (with solar panels that rotate around a defined axis to follow the sun's movement).

The primary difference between technologies available, which affect the potential for environmental impacts, relate to the extent of the facility, or land-take (disturbance or loss of habitat), as well as the height of the facility (visual impacts). For example, fixed mounted PV systems are able to occupy a smaller extent and have a lower height when compared to tracking PV systems, which require both a larger extent of land, and are taller in height. For the purpose of this EIA Report, worst-case scenarios have been considered and assessed and includes a development footprint of up to a 180ha in extent and solar panels up to 6m in height.

Both technologies are considered to be environmentally acceptable for implementation from an environmental perspective. The PV panels are designed to operate continuously for more than 25 years, mostly unattended and with low maintenance. The impacts associated with the construction, operation, and decommissioning of the facility are anticipated to be the same irrespective of the PV technology selected for implementation. The technology preference will therefore be determined on the basis of technical considerations. The worst-case scenario in terms of land take has been considered (i.e. the largest area required) within this EIA process so that either technology can be implemented.

3.2.5. The 'Do-Nothing' Alternative

The 'do-nothing' alternative is the option of not constructing Hyperion Solar Development 2. Should this alternative be selected, there would be no environmental impacts on site as a result of construction and operation activities associated with a PV facility. The 'do-nothing' alternative has been assessed as part of the EIA Phase (refer to **Chapter 8** and **Chapter 10** of this final EIA Report).

CHAPTER 4 POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which Hyperion Solar Development 2 is being proposed. It identifies legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks, and instruments which may be applicable, or may have relevance to the proposed project, and which have been considered as part of the EIA process.

4.1. Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy, and is informed by ongoing strategic planning undertaken by the DoE. The hierarchy of policy and planning documentation that supports the development of Independent Power Producer (IPP) projects is illustrated in **Figure 4.1**. These policies are discussed in more detail in the relevant subsections, along with provincial and local policies or plans that have relevance to the development of the project.

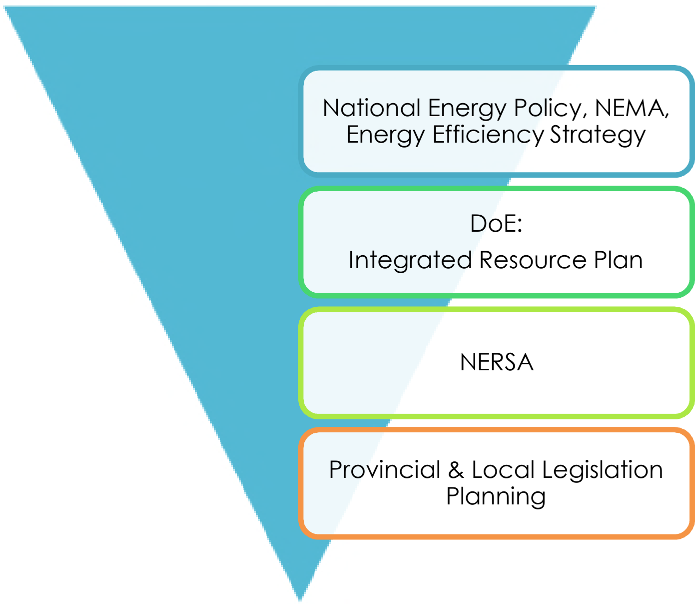

Figure 4.1: Hierarchy of Electricity Policy and Planning Documentation.

4.2. Regulatory Hierarchy

The regulatory hierarchy for energy generation projects consists of three tiers of authorities who exercise control through both statutory and non-statutory instruments, namely National, Provincial and Local levels.

At **National Level**, the main regulatory agencies are:

- **Department of Energy (DoE):** DoE is responsible for policy relating to all energy forms, and is responsible for compiling and approving the Integrated Resource Plan (IRP) for Electricity.
- **National Energy Regulator of South Africa (NERSA):** NERSA is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for IPP projects to generate electricity.

- **Department of Environmental Affairs (DEA):** DEA is responsible for environmental policy and is the controlling authority in terms of NEMA and the 2014 EIA Regulations (GNR 326). The DEA is the competent authority for this project (as per GNR 779 of 01 July 2016), and is charged with granting the relevant EA for the project.
- **South African Heritage Resources Agency (SAHRA):** SAHRA is a statutory organisation established under the National Heritage Resources Act (No. 25 of 1999) (NHRA), as the national administrative body responsible for the protection of South Africa's cultural heritage.
- **South African National Roads Agency Limited (SANRAL):** SANRAL is responsible for the regulation and maintenance of all national roads and routes.
- **Department of Water and Sanitation (DWS):** DWS is responsible for effective and efficient water resources management to ensure sustainable economic and social development. DWS is also responsible for evaluating and issuing licenses pertaining to water use (i.e. Water Use Licenses (WULs) and / or registration of General Authorisations (GAs)).
- **Department of Agriculture, Forestry and Fisheries (DAFF):** DAFF is the custodian of South Africa's agricultural, forestry, and fishery resources and is primarily responsible for the formulation and implementation of policies governing the Agriculture, Forestry and Fisheries Sector. DAFF is also responsible for the issuing of permits for the disturbance or destruction of protected tree species.
- **Department of Mineral Resources (DMR):** Approval from the DMR will be required to use land surface contrary to the objects of the Mineral and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. In terms of the MPRDA approval from the Minister of Mineral Resources is required to ensure that proposed activities do not sterilise a mineral resource that may occur on site.
- **Department of Rural Development and Land Reform (DRDLR):** DRDLR is dedicated to the social and economic development of rural South Africa, and is responsible for providing a framework for rural development.

At **Provincial Level**, the main regulatory agencies are:

- **Northern Cape Department of Environment, and Nature Conservation (DENC):** This Department is the commenting authority for this project and is also responsible for issuing any biodiversity and conservation-related permits. DENC's involvement relates specifically to sustainable resource management, conservation of protected species and land care.
- **Northern Cape Department of Roads and Public Works (NCDRPW):** This Department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
- **Ngwao Boswa Kapa Bokone (NBKB):** NBKB, the Northern Cape Provincial Heritage Resources Authority is responsible for the identification, conservation and management of heritage resources, as well as commenting on heritage related issues within the Province.

At **Local Level** the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. The project is proposed in the **Gamagara Local Municipality (LM)**, and **John Taolo Gaetsewe District Municipality (DM)**.

4.3. National Policy

4.3.1. The National Energy Act (No. 34 of 2008)

The purpose of the National Energy Act (No. 34 of 2008) is to ensure that diverse energy resources are available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, while taking into account environmental management requirements and interactions amongst economic sectors, as well as matters relating to renewable energy. The National Energy Act also provides for energy planning, increased generation and consumption of renewable energies, contingency energy supply, holding of strategic energy feedstocks and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure. The Act provides measures for the furnishing of certain data and information regarding energy demand, supply and generation, and for establishing an institution to be responsible for promotion of efficient generation and consumption of energy and energy research.

The Act provides the legal framework which supports the development of power generation facilities, such as Hyperion Solar Development 2.

4.3.2. White Paper on the Energy Policy of South Africa, 1998

The South African Energy Policy, published by the then Department of Minerals and Energy (DME) in December 1998 identifies five key objectives, namely:

» Increasing access to affordable energy services.
» Improving energy sector governance.
» Stimulating economic development.
» Managing energy-related environmental impacts.
» Securing supply through diversity.

In order to meet these objectives and the developmental and socio-economic objectives of South Africa, the country needs to optimally use available energy resources. The South African Government is required to address what can be done to meet these electricity needs both in the short and long-term. The White Paper identifies key objectives for energy supply, such as increasing access to affordable energy services, managing energy-related environmental impacts and securing energy supply through diversifying South Africa's electricity mix.

This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology), more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with addressing the following challenges:

» Ensuring that economically feasible technologies and applications are implemented.
» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options.
» Addressing constraints on the development of the renewable industry.

Therefore, the policy supports the advancement of renewable energy sources at ensuring energy security through the diversification of supply, which is in line with the proposed solar PV facility.

4.3.3. White Paper on the Renewable Energy Policy, 2003

The White Paper on Renewable Energy Policy supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The White Paper on Renewable Energy Policy recognises the significance of the medium and long-term potential of renewable energy. The main aim of the policy is to create the conditions for the development and commercial implementation of renewable technologies. The position of the White Paper on Renewable Energy is based on the integrated resource planning criterion of:

"Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options."

The White Paper on Renewable Energy sets out the Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

South Africa relies heavily on coal to meet its energy needs because it is well-endowed with coal resources in particular. However, South Africa is endowed with renewable energy resources that can be sustainable alternatives to fossil fuels, but which have so far remained largely untapped. This White Paper fosters the uptake of renewable energy in the economy and has a number of objectives that include:

» Ensuring that equitable resources are invested in renewable technologies.
» Directing public resources for implementation of renewable energy technologies.
» Introducing suitable fiscal incentives for renewable energy.
» Creating an investment climate for the development of renewable energy sector.

The objectives of the White Paper are considered in six focal areas, namely:

i) Financial instruments.
ii) Legal instruments.
iii) Technology development.
iv) Awareness raising.

v) Capacity building and education.
vi) Market based instruments and regulatory instruments.

The policy supports the investment in renewable energy facilities as they contribute towards ensuring energy security through the diversification of energy supply, reducing Greenhouse Gas (GHG) emissions and the promotion of renewable energy sources.

4.3.4. The Electricity Regulation Act (No. 04 of 2006) (ERA)

The Electricity Regulation Act (No. 04 of 2006) as amended by the Electricity Regulation Act (No. 28 of 2007), replaced the Electricity Act (No. 41 of 1987), as amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry.

The ERA establishes a national regulatory framework for the electricity supply industry and made NERSA custodian and enforcer of the National Electricity Regulatory Framework. The ERA also provides for licences and registration as the manner in which the generation, transmission, distribution, reticulation, trading, and import and export of electricity is regulated.

4.3.5. Integrated Energy Plan (IEP), November 2016

The purpose and objectives of the Integrated Energy Plan (IEP) are derived from the National Energy Act (No. 34 of 2008). The IEP takes into consideration the crucial role that energy plays in the entire economy of the country and is informed by the output of analyses founded on a solid fact base. It is a multi-faceted, long-term energy framework which has multiple aims, some of which include:

» To guide the development of energy policies and, where relevant, set the framework for regulations in the energy sector.
» To guide the selection of appropriate technologies to meet energy demand (i.e. the types and sizes of new power plants and refineries to be built and the prices that should be charged for fuels).
» To guide investment in and the development of energy infrastructure in South Africa.
» To propose alternative energy strategies which are informed by testing the potential impacts of various factors such as proposed policies, introduction of new technologies, and effects of exogenous macro-economic factors.

A draft version of the IEP was released for comment on 25 November 2016. The purpose of the IEP is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development. The development of the IEP is an ongoing continuous process. It is reviewed periodically to take into account changes in the macroeconomic environment, developments in new technologies and changes in national priorities and imperatives, amongst others.

The 8 key objectives of the integrated energy planning process are as follows:

» Objective 1: Ensure security of supply.
» Objective 2: Minimise the cost of energy.
» Objective 3: Promote the creation of jobs and localisation.
» Objective 4: Minimise negative environmental impacts from the energy sector.
» Objective 5: Promote the conservation of water.

- » Objective 6: Diversify supply sources and primary sources of energy.
- » Objective 7: Promote energy efficiency in the economy.
- » Objective 8: Increase access to modern energy.

The IEP recognises the potential of renewable energy for power generation in South Africa, and therefore supports the development of the proposed SEF.

4.3.6. Integrated Resource Plan (IRP) for Electricity 2010 - 2030

The Integrated Resource Plan (IRP) for Electricity 2010 – 2030 is a subset of the IEP and constitutes South Africa's National electricity plan. The primary objective of the IRP is to determine the long term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. The IRP also serves as input to other planning functions, including amongst others, economic development and funding, and environmental and social policy formulation.

The current iteration of the IRP, led to the Revised Balanced Scenario (RBS) that was published in October 2010. Following a round of public participation which was conducted in November / December 2010, several changes were made to the IRP model assumptions. The document outlines the proposed generation new-build fleet for South Africa for the period 2010 to 2030. This scenario was derived based on a cost-optimal solution for new-build options (considering the direct costs of new build power plants), which was then "balanced" in accordance with qualitative measures such as local job creation.

The Policy-Adjusted IRP reflected recent developments with respect to prices for renewables. In addition to all existing and committed power plants, the plan includes 9.6GW of nuclear, 6.25GW of coal, 17.8GW of renewables, and approximately 8.9GW of other generation sources such as hydro, and gas.

On 27 August 2018 the Draft IRP 2018 was released for comment. The Draft IRP 2018 is based on least-cost supply and demand balance and takes into account security of supply and the environment (i.e. with regards to minimising negative emissions and water usage). According to the Draft IRP 2018, key input assumptions that changed from the promulgated IRP 2010 – 2030 (2011) include, amongst others, technology costs, electricity demand projection, fuel costs and Eskom's existing fleet performance and additional commissioned capacity. For the period ending 2030, the Draft IRP 2018 proposes a number of policy adjustments to ensure a practical plan that will be flexible to accommodate new, innovative technologies that are not currently cost competitive, the minimisation of the impact of decommissioning of coal power plants, and the changing demand profile. The recommended updated Plan is as depicted in **Figure 4.2**.

Based on the Draft IRP 2018 there is currently 1 474MW of installed PV capacity, while an additional 814MW has been committed between 2020 and 2022, and an additional 5 670MW capacity has been allocated between 2025 and 2030. This plan is yet to be finalised and promulgated.

	Coal	Nuclear	Hydro	Storage (Pumped Storage)	PV	Wind	CSP	Gas / Diesel	Other (CoGen, Biomass, Landfill)	Embedded Generation
2018	39 126	1 860	2 196	2 912	1 474	1 980	300	3 830	499	Unknown
2019	2 155					244	300			200
2020	1 433				114	300				200
2021	1 433				300	818				200
2022	711				400					200
2023	500									200
2024	500									200
2025					670	200				200
2026					1 000	1 500		2 250		200
2027					1 000	1 600		1 200		200
2028					1 000	1 600		1 800		200
2029					1 000	1 600		2 850		200
2030			2 500		1 000	1 600				200
TOTAL INSTALLED	33 847	1 860	4 696	2 912	7 958	11 442	600	11 930	499	2600
Installed Capacity Mix (%)	44.6	2.5	6.2	3.8	10.5	15.1	0.9	15.7	0.7	

Installed Capacity
Committed / Already Contracted Capacity
New Additional Capacity (IRP Update)
Embedded Generation Capacity (Generation for own use allocation)

Figure 4.2: Proposed Updated plan for the Period Ending 2030 (Source: Draft IRP 2018).

4.3.7. New Growth Path (NGP) Framework, 23 November 2010

The purpose of the New Growth Path (NGP) Framework is to provide effective strategies towards accelerated job-creation through the development of an equitable economy and sustained growth. The target of the NGP is to create 5 million jobs by 2020. With economic growth and employment creation as the key indicators identified in the NGP. The framework seeks to identify key structural changes in the economy that can improve performance in term of labour absorption and the composition and rate of growth.

To achieve this, government will seek to, amongst other things, identify key areas for large-scale employment creation, as a result of changes in conditions in South Africa and globally, and to develop a policy package to facilitate employment creation in these areas.

4.3.8. The National Development Plan (NDP) 2030

The National Development Plan (NDP) 2030 is a plan prepared by the National Planning Commission in consultation with the South African public which is aimed at eliminating poverty and reducing inequality by 2030. The NDP aims to achieve this by drawing on the energies of its people, growing and inclusive economy, building capabilities, enhancing the capacity of the state and promoting leaderships and partnerships throughout society.

While the achievement of the objectives of the NDP requires progress on a broad front, three priorities stand out, namely:

» Raising employment through faster economic growth.
» Improving the quality of education, skills development and innovation.
» Building the capability of the state to play a developmental, transformative role.

In terms of the Energy Sector's role in empowering South Africa, the NDP envisages that, by 2030, South Africa will have an energy sector that promotes:

» Economic growth and development through adequate investment in energy infrastructure. The sector should provide reliable and efficient energy service at competitive rates, while supporting economic growth through job creation.
» Social equity through expanded access to energy at affordable tariffs and through targeted, sustainable subsidies for needy households.
» Environmental sustainability through efforts to reduce pollution and mitigate the effects of climate change.

Although electricity generation from coal is still seen as part of the energy mix within the NDP, the plan sets out steps that aim to ensure that, by 2030, South Africa's energy system looks very different to the current situation: coal will contribute proportionately less to primary-energy needs, while gas and renewable energy resources – especially wind, solar, and imported hydroelectricity – will play a much larger role.

4.3.9. Climate Change Bill, 2018

On 08 June 2018 the Minister of Environmental Affairs published the Climate Change Bill ("the Bill") for public comment. The Bill provides a framework for climate change regulation in South Africa aimed at governing South Africa's sustainable transition to a climate resilient, low carbon economy and society. The Bill provides a procedural outline that will be developed through the creation of frameworks and plans. The following objectives are set within the Bill:

a) Provide for the coordinated and integrated response to climate change and its impacts by all spheres of government in accordance with the principles of cooperative governance;
b) Provide for the effective management of inevitable climate change impacts through enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to building social, economic, and environmental resilience and an adequate national adaptation response in the context of the global climate change response;
c) Make a fair contribution to the global effort to stabilise greenhouse gas concentrations in the atmosphere at a level that avoids dangerous anthropogenic interference with the climate system within a timeframe and in a manner that enables economic, employment, social and environmental development to proceed in a sustainable manner.

Hyperion Solar Development 2 comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.

4.3.10. *National Climate Change Response Policy, 2011*

South Africa's National Climate Change Response Policy (NCCRP) establishes South Africa's approach to addressing climate change, including adaptation and mitigation responses. The NCCRP formalises Government's vision for a transition to a low carbon economy, through the adoption of the 'Peak, Plateau and Decline' (PPD) GHG emissions trajectory whereby South Africa's emissions should peak between 2020 and 2025, plateau for approximately a decade, and then decline in absolute terms thereafter, and based on this the country has pledged to reduce emissions by 34% and 42% below Business As Usual (BAU) emissions in 2020 and 2025, respectively.

As an integral part of the policy, a set of near-term priority flagship programmes will be implemented to address the challenges of climate change, one of which includes the Renewable Energy Flagship Programme. This flagship programme includes a scaled-up renewable energy programme, based on the current programme specified in the IRP 2010, and using the evolving South African Renewables Initiative led by the Department of Public Enterprise and Department of Trade and Industry (DTI), as a driver for the deployment of renewable energy technologies. The programme will be informed by enhanced domestic manufacturing potential and the implementation of energy efficiency and renewable energy plans by local government.

The development of Hyperion Solar Development 2 is aligned with the Renewable Energy Flagship Programme identified under South Africa's NCCRP and could therefore be argued to be aligned with the country's approach to addressing climate change.

4.3.11. *Strategic Integrated Projects (SIPs) and the Green Economy Accord (2011)*

The Presidential Infrastructure Coordinating Committee (PICC) is integrating and phasing investment plans across 18 Strategic Infrastructure Projects (SIPs) which have five core functions: to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services and support the integration of African economies. A balanced approach is being fostered through greening of the economy, boosting energy security, promoting integrated municipal infrastructure investment, facilitating integrated urban development, accelerating skills development, investing in rural development and enabling regional integration. SIP 8 and 9 of the energy SIPs supports the development of the SEF:

» SIP 8: Green energy in support of the South African economy: Support sustainable green energy initiatives on a national scale through a diverse range of clean energy options as envisaged in the Integrated Resource Plan (IRP 2010 – 2030) and supports renewable energy facilities.
» SIP 9: Electricity generation to support socio-economic development: The proposed Hyperion Solar Development 2 is a potential SIP 9 Project as electricity will be generated and social and economic upliftment, development and growth will take place within the surrounding communities in terms of the DoE's requirements under the REIPPP Programme.

Hyperion Solar Development 2 could be registered as a SIP project once selected as a preferred bidder under the REIPPP Programme. The project would then contribute to the above-mentioned SIPs.

The Green Economy Accord (signed on 17 November 2011) is also relevant to the development of the Hyperion Solar Development 2 as the facility will provide new prospects for economic activity that were not previously pursued, as well as a reduction in terms of climate change.

4.4. Provincial Policy and Planning Context

4.4.1. Northern Cape Provincial Spatial Development Framework (PSDF) 2012

The Northern Cape Provincial Spatial Development Framework (PSDF) 2012 states that the overarching goal for the Province is to enable sustainability through sustainable development. The Province considers social and economic development as imperative in order to address the most significant challenge facing the Northern Cape, which is poverty.

The PSDF considers the release of greenhouse gas (GHG) emissions created by human activity as the key cause of global warming, which in turn could result in major negative effects and disasters in the short- and medium-term. This effect would increasingly undermine human development gains. Innovative strategies would have to be implemented to reduce the impact of global deterioration.

The PSDF identifies key sectoral strategies and plans which are considered to be the key components of the PSDF. Sectoral Strategy 19 refers to a provincial renewable energy strategy. Within the PSDF a policy has been included which states that renewable energy sources (including the utilisation of solar energy) are to comprise 25% of the Province's energy generation capacity by 2020.

The overall energy objective for the Province also includes promoting the development of renewable energy supply schemes which are considered to be strategically important for increasing the diversity of domestic energy supply and avoiding energy imports, while also minimising the detrimental environmental impacts. The implementation of sustainable renewable energy is also to be promoted within the Province through appropriate financial and fiscal instruments.

Considering the need for the development of renewable energy facilities in order to achieve the objective of sustainability the development of the proposed solar energy facility within the Northern Cape and within the study area is considered to be aligned with the Northern Cape PSDF.

4.5. Local Policy and Planning Context

4.5.1. John Taolo Gaetsewe District Municipality Final Draft Integrated Development Plan (IDP) 2018 – 2019 (2017)

The vision of the John Taolo Gaetsewe District Municipality (DM) as contained within its Final Draft IDP 2018 – 2019 is:

"*Working together for a better life for all in the district*."

The mission statement of John Taolo Gaetsewe DM reflects what the DM will do in an on-going manner to strive towards achieving its vision. The mission of the John Taolo Gaetsewe DM is:

"*Accelerating the implementation of integrated development initiatives and providing support to local municipalities*."

In terms of development priorities the Final Draft 2018 – 2019 IDP determined that the results of the 2016 Community Survey suggested that the number of people residing within the DM is increasing, as a direct result of mining related activities. Implications for the DM in this regard include:

- » The scope and extent of the DM's Spatial Development Framework (SDF).
- » Service delivery demands placed on the DM and its local municipalities.
- » The grading of the local municipalities, and the resources (i.e. grants and subsidies) made available to them.

The activities of the DM need to reflect its population demographics, both in terms of service delivery, as well as in terms of employment equity. Gender, racial and disability population demographics have been identified as being of particular importance in this regard. As a result, special interest groups, such as the youth, women and persons with disabilities require specific focus in the strategic priorities of the DM.

The implementation of Hyperion Solar Development 2 would contribute towards addressing some of the John Taolo Gaetsewe DM's development priorities through the creation of new employment opportunities which could support a portion of the increasing population, while the increase in revenue from the project could assist in the municipality in addressing service delivery demands.

4.5.2. John Taolo Gaetsewe District Municipality Phase 5 Draft Spatial Development Framework (SDF) (2017)

The main economic sectors applied within the John Taolo Gaetsewe DM include eco-tourism, agriculture, mining and community services. Even though the development of renewable energy is not specifically mentioned as part of the framework, the development of a solar energy facility within the area will add to the current economic sectors. That specifically includes community services, as the development of a solar energy facility will aid in the provision of electricity, as well as employment opportunities and skills development on a local level.

The SDF states that one of the key objectives for the DM is to attract new business. With the development of a SEF within the area, other developers might be encouraged to consider the area as a viable location for further development. This could attract new business to the area and promote financial and socio-economic development within the DM.

4.5.3. Gamagara Local Municipality Integrated Development Plan (IDP) 2017 – 2022 (2017)

The vision for the Gamagara Local Municipality (LM) as contained within the IDP 2017 – 2022 is as follows:

"*Build prosperous and sustainable communities*."

The Mission of the Gamagara LM is as follows:

"*To provide universal, sustainable services to the community in order to attain a safe and healthy environment, as well as socio-economic development by exploiting economic benefits and strengthening stakeholder relations*."

The following strength, weaknesses, threats and opportunities (SWOT analysis) have been identified for the Gamagara LM:

Strengths:	**Weaknesses:**
» High potential for economic growth: ∗ The municipality is at the centre of all economic activities around the mining industry in the region. The industrial area growth and development is phenomenal as many small industries and big industry come to the area so as to serve the mining needs in the area. ∗ Small businesses have the potential to grow and serve the improving commercial and mining economic set-up. These businesses either provide mines with equipment or the sub-contract to big contractors in the mine. » High tourism potential: ∗ Gamagara has a vast number of heritage sites that still need to be exploited. These include religious monuments and heritage sites, the oasis of the Kalahari, the caves, etc. » Political maturity and stability: ∗ Co-operation between political parties in delivering services is a progressive one. ∗ Ward Committees are functional and meeting their obligations as required. ∗ There is strong political leadership and support to the municipal functioning.	» Infrastructure: ∗ Inadequate infrastructure to cater for the rapid development in the municipality. ∗ Ageing infrastructure. » Ineffective internal systems and controls: ∗ Communicating available systems and controls to junior officials is lacking, and leading to some of the crucial tasks not being performed accordingly e.g. delegation of power. ∗ Culture of non-payment is prevalent in the municipality because credit control policy is not fully implemented. ∗ The municipality does not have a culture of retaining skilled personnel due to inconsistent implementation of policies or lack of induction of new employees. ∗ Lack of by-laws to guide and enforce compliance e.g. credit control.
Opportunities:	**Threats:**
» Developmental potential: ∗ Integration of stakeholder contribution to the development of the municipality is possible e.g. sector departments, mining industry, commercial industry, agricultural industry and tourism industry. ∗ There is a potential to acquire more land for development. ∗ Improve infrastructure and create jobs. » Internal systems could be improved: ∗ Can improve on the credit control system to encourage culture of payment for services and increase municipal revenue. ∗ Improve customer care and uphold to the Batho Pele Principle. ∗ Enhance the Local Economic Development (LED) and Tourism markets by disseminating the LED and Tourism strategy to members of the community using various methods of awareness.	» National and international economic trends may destabilise the municipality to achieve its goals. » Retrenchments from the mines may affect the municipal revenue. » Influx of job seekers in the area is causing infrastructure system failure as they overload the system.

The implementation of Hyperion Solar Development 2 would contribute somewhat towards addressing some of the weaknesses and threats identified for the Gamagara LM. Specifically, with regards to contributing towards Local Economic Development (LED) market, municipal revenue, and job creation.

4.6. International Policy and Planning Context

4.6.1. United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)

Climate change is one of the major global challenges of the 21st century that require global response. The adverse impacts of climate change include persistent drought and extreme weather events, rising sea levels, coastal erosion and ocean acidification, further threatening food security, water, energy and health, and more broadly efforts to eradicate poverty and achieving sustainable development. Combating climate change would require substantial and sustained reductions in GHG emissions, which together with adaptation, can limit climate change risks. The convention responsible for dealing with climate change is the United Nations Framework Convention on Climate Change (UNFCCC).

The UNFCCC was adopted in 1992 and entered into force in 1994. It provides the overall global policy framework for addressing the climate change issue and marks the first international political response to climate change. The UNFCCC sets out a framework for action aimed at stabilizing atmospheric concentrations of GHGs to avoid dangerous anthropogenic interference with the climate system.

The UNFCCC has established a variety of arrangements to govern, coordinate and provide for oversight of the arrangements described in the documentation. The oversight bodies take decisions, provide regular guidance, and keep the arrangements under regular review in order to enhance and ensure their effectiveness and efficiency. The Conference of Parties (COP), established by Article 7 of the Convention, is the supreme body and highest decision-making organ of the Convention. It reviews the implementation of the Convention and any related legal instruments, and takes decisions to promote the effective implementation of the Convention.

COP 21 was held in Paris from 30 November to 12 December 2015. From this conference, an agreement to tackle global warming was reached between 195 countries. This Agreement was open for signature and subject to ratification, acceptance or approval by States and regional economic integration organizations that are Parties to the Convention from 22 April 2016 to 21 April 2017, and thereafter open for accession.

The Paris Agreement, in enhancing the implementation of the Convention, including its objective, aims to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty, including by:

(a) Holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change.
(b) Increasing the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development, in a manner that does not threaten food production.
(c) Making finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

In order to achieve the long-term temperature goal set out in Article 2 of the Agreement, Parties aim to reach global peaking of GHG emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

The Paris Agreement requires all Parties to put forward their best efforts through "Nationally Determined Contributions" (NDCs) and to strengthen these efforts in the years ahead. This includes requirements that all Parties report regularly on their emissions and on their implementation efforts. In 2018, Parties will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of NDCs. There will also be a global stocktake every 5 years to assess the collective progress towards achieving the purpose of the Agreement and to inform further individual actions by Parties.

In working towards this goal, advanced economies have already included renewables in their energy mix and have planned to increase their use in order to meet their mitigation goals: Japan aims to derive 22 – 24% of its electricity production from renewable sources by 2030 and the European Union plans for them to reach 27% of its final energy consumption. Developing countries are also playing their part, including South Africa which has included a goal of 17.8GW of renewables by 2030 within the IRP.

South Africa signed the Agreement in April 2016, and ratified the agreement on 01 November 2016. The Agreement was assented to by the National Council of Provinces on 27 October 2016, and the National Assembly on 1 November 2016. The Agreement came into force internationally on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention accounting in total for at least an estimated 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval or accession with the Depositary.

COP 23 was held in Bonn, Germany from 06 to 17 November 2017, and is the second COP to be held since COP 21. One of the key outcomes of COP 23 was the launch of the "Powering Past Coal Alliance", led by the UK and Canada. More than 20 countries joined the alliance, including Denmark, Finland, Italy, New Zealand, Ethiopia, Mexico, and the Marshall Islands; as well as the United States (US) states of Washington and Oregon. The alliance notes that analysis shows that coal phase-out is needed by no later than 2030 in the OECD and EU28, and by no later than 2050 in the rest of the world to meet the Paris Agreement; however it does not commit signatories to any particular phase-out date. It also does not commit the signatories to ending the financing of unabated coal-fired power stations, but rather just restricting it.

4.6.2. The Equator Principles III (June, 2013)

The Equator Principles (EPs) III constitute a financial industry benchmark used for determining, assessing, and managing projects environmental and social risks. The EPs are primarily intended to provide a minimum standard for due diligence to support responsible risk decision-making. The EPs are applicable to large infrastructure projects and apply globally to all industry sectors.

The EPs comprise the following principles:

Principle 1: Review and Categorisation

Principle 2: Environmental and Social Assessment.
Principle 3: Applicable Environmental and Social Standards.
Principle 4: Environmental and Social Management System and Equator Principles Action Plan
Principle 5: Stakeholder Engagement
Principle 6: Grievance Mechanism
Principle 7: Independent Review
Principle 8: Covenants
Principle 9: Independent Monitoring and Reporting
Principle 10: Reporting and Transparency.

When a project is proposed for financing, the Equator Principle Financial Institution (EPFI) will categorise it based on the magnitude of its potential environmental and social risks and impacts.

Projects can be categorized as follows:

Category A: Projects with potential significant adverse environmental and social risks and / or impacts that are diverse, irreversible or unprecedented.
Category B: Projects with potential limited adverse environmental and social risks and / or impacts that are few in number, generally site-specific, largely reversible and readily addressed through mitigation measures.
Category C: Projects with minimal or no adverse environmental and social risks and / or impacts.

Based on the above-mentioned criteria, Hyperion Solar Development 2 can be anticipated to be categorised as a Category B project.

Category A and Category B projects require that an assessment process be conducted to address the relevant environmental and social impacts and risks associated with the project. Such an assessment may include the following where applicable:

» An assessment of the baseline environmental and social conditions.
» Consideration of feasible environmentally and socially preferable alternatives.
» Requirements under host country laws and regulations, applicable international treaties and agreements.
» Protection and conservation of biodiversity (including endangered species and sensitive ecosystems in modified, natural and Critical Habitats) and identification of legally protected areas.
» Sustainable management and use of renewable natural resources (including sustainable resource management through appropriate independent certification systems).
» Use and management of dangerous substances.
» Major hazards assessment and management.
» Efficient production, delivery and use of energy.
» Pollution prevention and waste minimisation, pollution controls (liquid effluents and air emissions), and solid and chemical waste management.
» Viability of Project operations in view of reasonably foreseeable changing weather patterns / climatic conditions, together with adaptation opportunities.
» Cumulative impacts of existing Projects, the proposed Project, and anticipated future Projects.
» Respect of human rights by acting with due diligence to prevent, mitigate and manage adverse human rights impacts.

» Labour issues (including the four core labour standards), and occupational health and safety.
» Consultation and participation of affected parties in the design, review and implementation of the Project.
» Socio-economic impacts.
» Impacts on Affected Communities, and disadvantaged or vulnerable groups.
» Gender and disproportionate gender impacts.
» Land acquisition and involuntary resettlement.
» Impacts on indigenous peoples, and their unique cultural systems and values.
» Protection of cultural property and heritage.
» Protection of community health, safety and security (including risks, impacts and management of Project's use of security personnel).
» Fire prevention and life safety.

Such an assessment should propose measures to minimise, mitigate, and offset adverse impacts in a manner relevant and appropriate to the nature and scale of the proposed Project. In terms of the EPs South Africa is a non-designated country, and as such the assessment process for projects located in South Africa evaluates compliance with the applicable International Finance Corporation (IFC) Performance Standards on Environmental and Social Sustainability, and Environmental Health and Safety (EHS) Guidelines.

Hyperion Solar Development 2 is currently being assessed in accordance with the requirements of the 2014 EIA Regulations, as amended (GNR 326), published in terms of Section 24(5) of NEMA, which is South Africa's national legislation providing for the authorisation of certain listed activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.

4.6.3. IFC's Performance Standards on Environmental and Social Sustainability (January 2012)

The IFC's Performance Standards on Environmental and Social Sustainability were developed by the IFC and were last updated on 1 January 2012. The overall objectives of the IFC Performance Standards are:

» To fight poverty.
» To do no harm to people or the environment.
» To fight climate change by promoting low carbon development.
» To respect human rights;
» To Promote gender equity;
» To provide information prior to project development, free of charge and free of external manipulation;
» To collaborate with the project developer to achieve the PS;
» To provide advisory services; and
» To notify countries of any Trans boundary impacts as a result of a Project.

The Performance Standards comprise the following:

Performance Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
Performance Standard 2: Labour and Working Conditions.
Performance Standard 3: Resource Efficiency and Pollution Prevention.

Performance Standard 4:	Community Health, Safety and Security.
Performance Standard 5:	Land Acquisition and Involuntary Resettlement.
Performance Standard 6:	Biodiversity Conservation and Sustainable Management of Living Natural Resources.
Performance Standard 7:	Indigenous Peoples.
Performance Standard 8:	Cultural Heritage.

Performance Standard 1 establishes the importance of:

i) Integrated assessment to identify the social and environmental impacts, risks, and opportunities of projects.
ii) Effective community engagement through disclosure of project-related information and consultation with local communities on matters that directly affect them.
iii) The management of social and environmental performance throughout the life of a project through an effective Environmental and Social Management System (ESMS).

Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an ESMS appropriate to the nature and scale of the project and commensurate with the level of its environmental and social risks and impacts be established and maintained. Performance Standard 1 is the overarching standard to which all the other standards relate. Performance Standard 2 through 8 establish specific requirements to avoid, reduce, mitigate or compensate for impacts on people and the environment, and to improve conditions where appropriate. While all relevant social and environmental risks and potential impacts should be considered as part of the assessment, Performance Standard 2 through 8 describe potential social and environmental impacts that require particular attention specifically within emerging markets. Where social or environmental impacts are anticipated, the developer is required to manage them through its ESMS consistent with Performance Standard 1.

Given the nature of Hyperion Solar Development 2 it is anticipated at this stage of the EIA process that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project.

CHAPTER 5. NEED AND DESIRABILITY

One of the objectives of the EIA process is to motivate for "*the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted Scoping Report*", as per Appendix 3 of the 2014 EIA Regulations, as amended. The need and desirability of a development needs to consider whether it is the right time and right place for locating the type of land-use / activity being proposed. Need and desirability is therefore equated to the wise use of land, and should be able to answer the question of what the most sustainable use is of land within the proposed development site.

This Chapter provides an overview of the suitability of Hyperion Solar Development 2 being developed at the preferred location from a national, regional, and site specific perspective.

5.1. Need and Desirability from an International Perspective

From an international perspective the need and desirability of Hyperion Solar Development 2 can be described through the project's alignment with internationally recognised and adopted agreements, protocols, and conventions. South Africa is signatory to a number of international treaties and initiatives, including the United Nation's Development Programme's (UNDP's) Sustainable Development Goals (SDGs). The SDGs address social and economic development issues such as poverty, hunger, health, education, climate change, gender equality, water, sanitation, energy, urbanization, environment and social justice. The SDGs comprise 17 global goals set by the United Nations. The 17 SDGs are characterised by 169 targets, and 304 indicators.

Goal 7 of the SGDs relates to "Affordable and Clean Energy", with the aim of the goal being to ensure access to affordable, reliable, sustainable and modern energy for all. The following targets and indicators have been set for Goal 7:

Targets		Indicators	
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services.	7.1.1 7.1.2	Proportion of population with access to electricity. Proportion of population with primary reliance on clean fuels and technology.
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix.	7.2.1	Renewable energy share in the total final energy consumption.
7.3	By 2030, double the global rate of improvement in energy efficiency.	7.3.1	Energy intensity measured in terms of primary energy and GDP.
7.A	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.	7.A.1	Mobilized amount of United States dollars per year starting in 2020 accountable towards the $100 billion commitment.
7.B	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island	7.B.1	Investments in energy efficiency as a percentage of GDP and the amount of foreign direct investment in financial transfer for infrastructure and technology to sustainable development

Targets	Indicators
developing States, and land-locked developing countries, in accordance with their respective programmes of support.	services.

The development of Hyperion Solar Development 2 would contribute positively towards Goal 7 of the SGDs through the following means:

» By generating up to 75MW of affordable and clean energy.
  * A study published by the CSIR on 14 October 2016 ("Cost of new power generators in South Africa Comparative analysis based on recent IPP announcements", Dr Tobias Bischof-Niemz and Ruan Fourie) which took into consideration the results of the cost prices bid successfully under the DoE's REIPPP and Coal Baseload IPP Procurement (CBIPPP) Programmes found that solar PV and wind were 40% cheaper than new baseload coal (i.e. R0.62/kWh for PV and wind vs R1.03 for coal).
  * PV technology is one of the cleanest electricity generation technologies, as it is not a consumptive technology and does not result in the release of emissions during its operation.
» By contributing towards South Africa's total generation capacity, specifically through the utilisation of renewable energy resources.

5.2. Need and Desirability from a National Perspective

Hyperion Solar Development 2 is proposed in specific response to a national government initiative, namely the DoE's REIPPP Programme. This programme was initiated in order to give effect to the requirements of the IRP with regards to renewable energy targets. As a result, the need and desirability of the project from a national perspective can largely be assimilated from the project's alignment with national government policies, plans, and programmes which have relevance to energy planning and production (as discussed in detail in **Chapter 4**). The following key plans have been developed by government to take into account South Africa's current energy production and projected future demands, and provides the necessary framework within which energy generation projects can be developed:

» Integrated Energy Plan (IEP)
» Integrated Resource Plan (IRP)

The above-mentioned energy plans have been extensively researched and are updated on an ongoing basis to take into consideration changing scenarios, new information, developments in new technologies, and to reflect updated demands and requirements for energy production within the South African context. These plans form the basis of South Africa's energy generation sector planning and dictate national priorities for energy production.

The IEP is intended to provide a roadmap of South Africa's future energy landscape which guides future energy infrastructure investments and policy development. The latest iteration of the IEP (25 November 2016) contained the following statement regarding solar power in South Africa:

"*South Africa experiences some of the highest levels of solar radiation in the world and this renewable resource holds great potential for the country. The daily solar radiation in South Africa varies between 4.5 and 6.5 kilowatt hours per square meter (kWh/m²) (16 and 23 megajoules per square meter [MJ/m²]) (Stassen, 1996), compared to about 3.6kWh/m² in parts of the United States and about 2.5kWh/m² in*

Europe and the United Kingdom. The total area of high radiation in South Africa amounts to approximately 194 000km², including the Northern Cape, which is one of the best solar resource areas in the world. With electricity production per square kilometre of mirror surface in a solar thermal power station being 30.2MW, and just 1% of the high radiation area in the country being made available for solar power generation, the generation potential is approximately 64GW. Solar energy has the potential to contribute quite substantially to South Africa's future energy needs. This would, however, require large investments in transmission lines from the areas of high radiation to the main electricity consumer centres."

In terms of electricity generation, the IEP states that South Africa should continue to pursue a diversified energy mix which reduces reliance on a single or a few primary energy sources, and includes the following statement regarding solar energy's contribution to the diversified energy mix:

» *Solar should play a much more significant role in the electricity generation mix than it has done historically, and constitutes the greatest share of primary energy (in terms of total installed capacity) by 2050. The contribution of solar in the energy mix comprises both CSP and solar PV. Solar PV includes large scale installations for power generation which supply to the grid and individual, off-grid solar home systems and rooftop panels.*
» *Several interventions which could enhance the future solar energy landscape are recommended as follows: – Large scale CSP projects with proven thermal storage technologies and hybridisation / industrial steam application projects should be incentivised in the short to medium term. In the long term the existing incentives could be extended to promote locally developed CSP technology storage solutions and large scale solar fuel projects.*
» *A thorough solar resource assessment for South Africa should continue to be undertaken in the Northern Cape Province and extended to other provinces deemed to have high solar radiation levels.*
» *Investments should be made to upgrade the grid in order to accommodate increasing solar and other renewable energy contributions.*

The IRP for Electricity 2010 – 2030 is a subset of the IEP, and constitutes South Africa's current gazetted energy plan[19]. The purpose of the plan is to ensure sustainable electricity development which takes into consideration technical, economic, and social constraints, and identifies investments in the electricity sector which are required to meet the country's forecasted electricity demands at minimum costs. The IRP 2010 - 2030 includes 9.6GW of nuclear, 6.25GW of coal, **17.8GW of renewables**, and approximately 8.9GW of other generation sources such as hydro, and gas in addition to all existing and committed power plants.

On 22 August 2018 the Draft IRP 2018 was released for comment. The latest update of the IRP includes estimates that **7.82GW of PV**, 9GW of wind, 10.94GW of gas (CCGT / CCGE / OCGT), and 0.025GW of landfill gas would be required by the end of 2030[20]. This demonstrates government's commitment to the ongoing development of renewable energy.

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[19] Despite there having been numerous draft revisions proposed to it, the Integrated Resource Plan for Electricity 2010 – 2030 remains the current iteration of the IRP.

[20] These figures reflect capacities for the Least Cost Plan (IRP1) by year 2030 without Annual Build Limits on RE (IRP3).

In line with government policy to reduce GHG emissions, the IRP update uses the moderate decline constraint for GHG emissions. Although this is subject to change following recent correspondence received from DEA indicating that carbon budget methodology must be used instead of emissions decline constraints, the consideration of GHG emissions in the determination of the energy generation mix indicates government's commitment to international obligations under the Paris Agreement.

In response to the IRP, the DoE initiated a number of IPP Procurement Programmes to secure electricity generated by a range of resources from the private sector (i.e. from IPPs). Under these Programmes, IPPs are invited to submit proposals for the finance, construction, operation, and maintenance of electricity generation facilities for the purpose of entering into an Implementation Agreement with the DoE and a Power Purchase Agreement (PPA) with Eskom as the buyer. IPPP Programmes include the REIPPP, the Co-generation IPPP Programme, the Liquefied Natural Gas (LNG) to Power IPPP Programme, and the CBIPPPP (refer to **Table 5.1**).

Table 5.1: Overview of IPPP Programmes and their current allocation (MW).

IPP Procurement Programme	Technology	MW	Total
Renewables	Onshore Wind	6 360 MW	14 725MW
	Concentrated solar thermal	1 200 MW	
	Solar Photovoltaic	4 725 MW	
	Biomass	210 MW	
	Biogas	110 MW	
	Landfill Gas	25 MW	
	Small hydro	195 MW	
	Small Projects	400 MW	
	Solar Parks	1 500MW	
Coal Baseload	Coal	2 500MW	2 500MW
Cogeneration	Cogeneration	800MW	800MW
Gas	Gas	3 000MW	3 000MW

Renewable energy resources are valuable in contributing towards electricity generation and diversifying South Africa's electricity mix, while contributing towards South Africa's response to Climate Change. Under the REIPPPP the DoE intends to secure 14 725MW of electricity from renewable energy generation facilities utilising either Onshore Wind, Concentrated Solar Thermal, Solar PV, Biomass, Biogas, Landfill Gas, or Hydro across a number of bidding windows, while simultaneously contributing towards socio-economic development. A total of 2 291.83MW of PV generated electricity has been awarded to preferred bidders across four (4) rounds of bidding to date, with 2 433.17MW still remaining to be allocated in subsequent bidding rounds. Preferred bidders identified under any IPPP Programme, including the REIPPP Programme, are required to satisfy a number of economic development requirements, including amongst others, job creation, local content, skills development, enterprise and supplier development, and socio-economic development. In addition to electricity generation and supply, IPPP Programmes therefore also contribute positively towards socio-economic development of a region, over and above job creation.

The need for new power generation from PV has therefore been identified and assessed by government at a national scale considering the national energy requirements as well as international commitments under the Paris Agreement, and provision has been made for the inclusion of new PV power generation capacity in South Africa's' energy mix. The implementation of Hyperion Solar Development 2 therefore has the potential to contribute positively towards the identified need, while simultaneously contributing to job creation and socio-economic development, identified as a need for the country within the NDP.

Hyperion Solar Development 2 will make use of renewable energy technology, and would contribute positively towards reducing South Africa's GHG emissions and ensure compliance with all applicable legislation and permitting requirements. In addition, by making use of PV technology, the project would have reduced water requirements when compared with other generation technologies in alignment with one of the vision 2030 themes of the DWS's National Water Resource Strategy 2 (2013) (i.e. transitioning to a low carbon economy through stimulating renewable energy and retrofitting buildings).

5.3. Need and Desirability of the project from a Regional Perspective

South Africa's electricity generation mix has historically been dominated by coal. This can be attributed to the fact that South Africa has abundant coal deposits, which are relatively shallow with thick seams, and are therefore easy and comparatively cost effective to mine. In 2016 South Africa had a total generation capacity of 237 006GWh. Approximately 85.7% (equivalent to 203 054GWh) of this figure was generated by coal, and only 0.9% (equivalent to 2 151GWh) was generated by solar (refer to **Figure 5.1**).

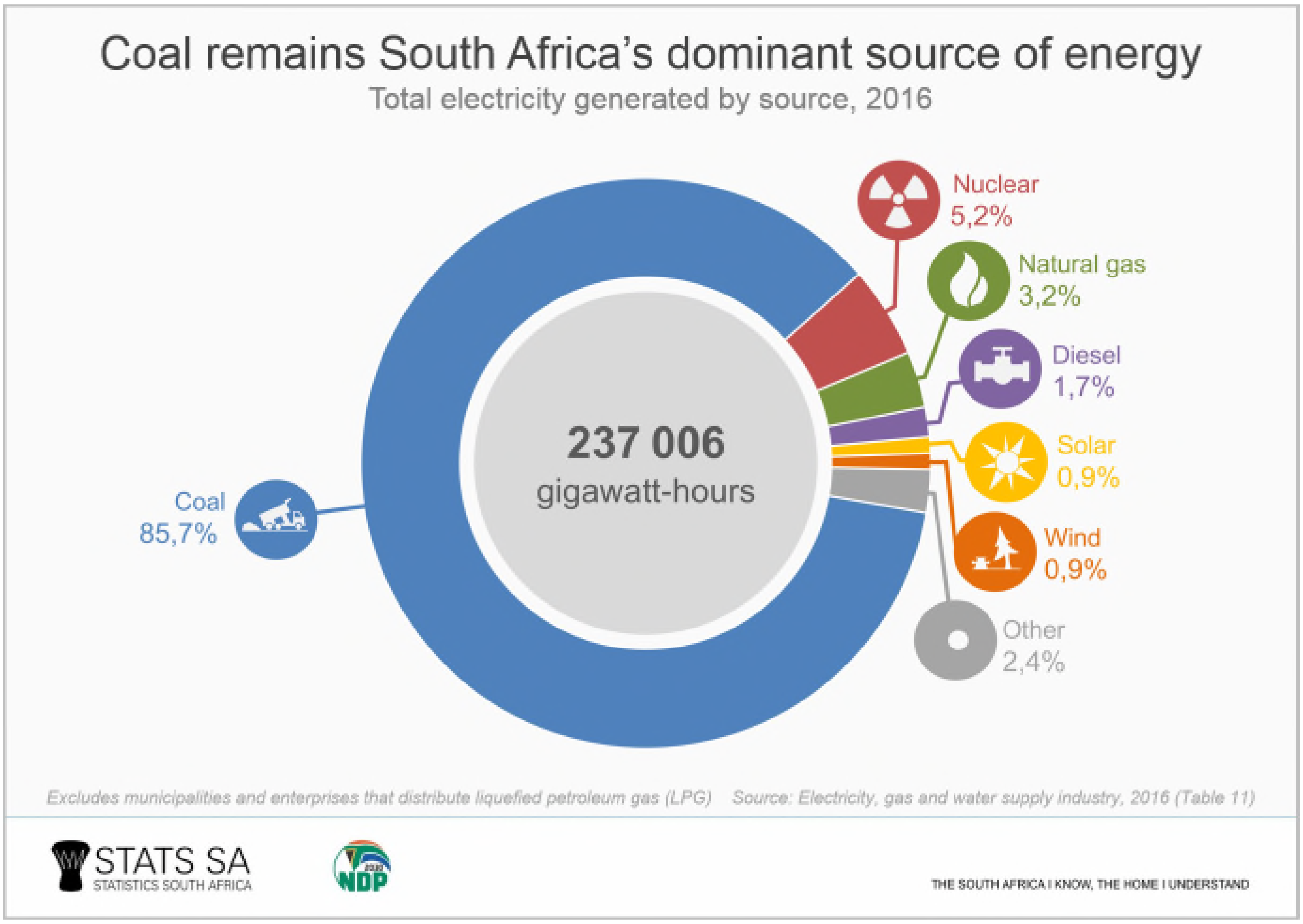


Figure 5.1: Overview of South Africa's electricity generation by source (Source: StatsSA 2016 Electricity, gas and water supply industry).

Whereas the majority of South Africa's electricity generation infrastructure is currently located within Mpumalanga Province due to the location of coal resources within this province, the Northern Cape Province has been identified as an area where the development of solar facilities is a feasible and suitable option for electricity generation. The project site is therefore suitably located for the proposed development.

The Kathu area has been earmarked as a hub for the development of solar energy projects due to the viability of the solar resource for the area. The overarching objective for the solar facility is to maximise electricity production through exposure to the solar resource. From a regional site selection perspective, this region is considered to be preferred for solar energy development by virtue of its annual solar irradiation values. The GHI for the area derived from the World Bank Group's Global Solar Atlas is approximately 2 227.5kWh/m²/annum, equivalent to the highest GHI values in the country (refer to **Figure 5.2**).

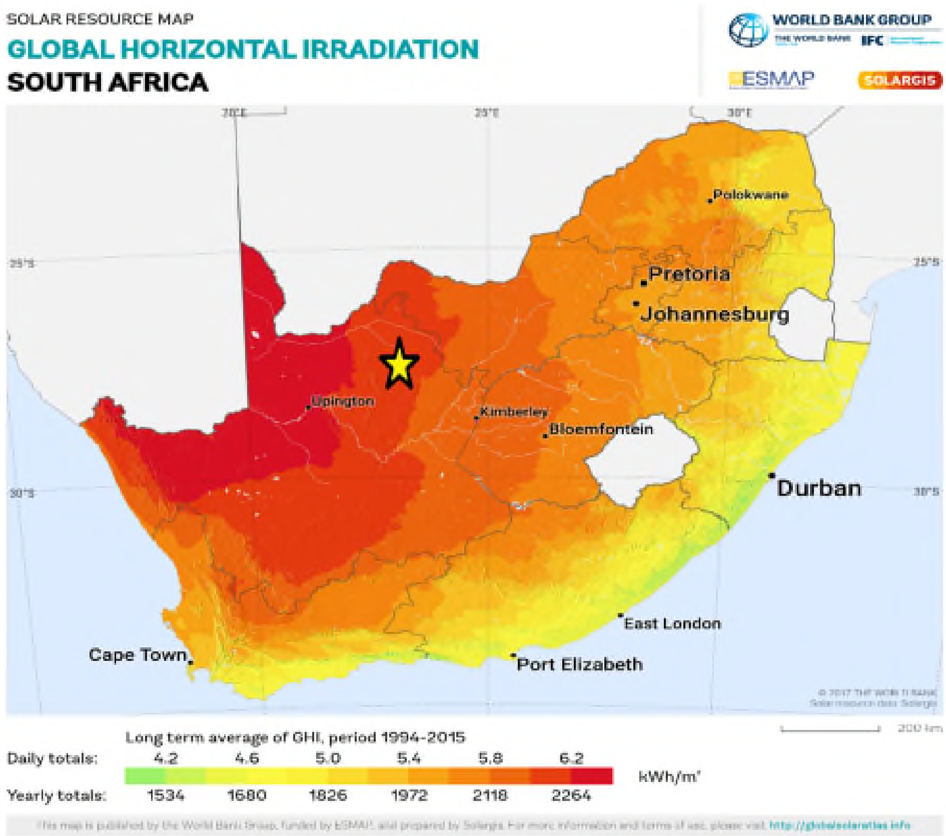


Figure 5.2: Solar irradiation map for South Africa, the proposed position of Hyperion Solar Development 2 is shown by the yellow star on the map. (Source: World Bank Groups Global Solar Atlas).

5.4. Receptiveness of the proposed project site to development of Hyperion Solar Development 2

The placement of a solar PV facility is strongly dependent on several factors including climatic conditions (solar radiation levels), topography, the location of the site particularly in the location of a developed node for solar projects, availability of grid connection, the extent of the site and the need and desirability for the project. From a local level perspective, the project site has specifically been identified by the applicant as being highly desirable from a technical perspective for the development of a solar facility due to the following site characteristics:

» **Solar resource**: The economic viability of a solar facility is directly dependent on the annual direct solar irradiation values. The Northern Cape Province is characterised as having the highest solar irradiation values in South Africa (and which are comparable on a global scale). The Global Horizontal Irradiation (GHI) for the proposed project site is in the region of approximately 2 227.5kWh/m^2/annum, which is ideally suited to the development of a commercial PV Facility.

» **Topography**: A surface area with favourable topography facilitates the work involved in construction and maintenance of the PV Facility. The proposed project site is characterised as having flat topography with slopes of 0 – 3% across the full extent of the site.
» **Site extent:** The larger project site is approximately 1600ha in extent, which is sufficient for the installation of the facility allowing for avoidance of site sensitivities. The development area of the facility would occupy an area equivalent to approximately 11.3% of the full project site. The development areas of four (4) PV facilities proposed on the site[21] would comprise ~45% of the total extent of the project site.
» **Site access**: Access to the Remaining Extent of the Farm Lyndoch 432 (i.e. the project site) can be obtained via the T26 gravel road which can be accessed from the N14 national route located approximately 6km south of the project site and the T25 gravel road which can also be accessed from the N14 national route. Four alternative access road alignments are however being investigated in this EIA Report (refer to Section 3.2.3 of Chapter 3 of this report) to minimise impacts on the environment.
» **Grid access:** A key factor in the siting of any project is that the project must have a viable grid connection. Grid connection options are available within the surrounding area and includes, amongst others the existing Ferrum Substation which is located approximately 16km south of the project site.
» **Land suitability:** The current land use of the site is an important consideration in site selection in terms of limiting disruption to existing land use practices. There is no cultivated agricultural land within the affected properties (as a result of low agricultural potential) which could be impacted upon by the proposed PV facility. The affected property is currently used for livestock grazing and the majority of farming practices can continue in tandem to the operation of the PV facility once the construction and commissioning of the project is complete.
» **Geographic location**: The proposed project site is located within an area which has become a node for renewable energy projects, with the following existing solar facilities in close proximity to the project site: Kalahari Solar Power Project, Sishen Solar Farm, Kathu Solar Farm and Adams Solar PV 2. The proposed project therefore compliments existing and future land use (refer to **Figure 5.3**).
» **Landowner support**: The selection of a site where the landowner is supportive of the development of renewable energy is essential for ensuring the success of the project. The landowner does not view the development as a conflict with his current land use practices.

[21] The development of up to four (4) PV facilities is being proposed on a portion of the Remaining Extent of the Farm Lyndoch 432 (the project site). Each project is considered within a separate EIA process and separate EIA Reports have been drafted.

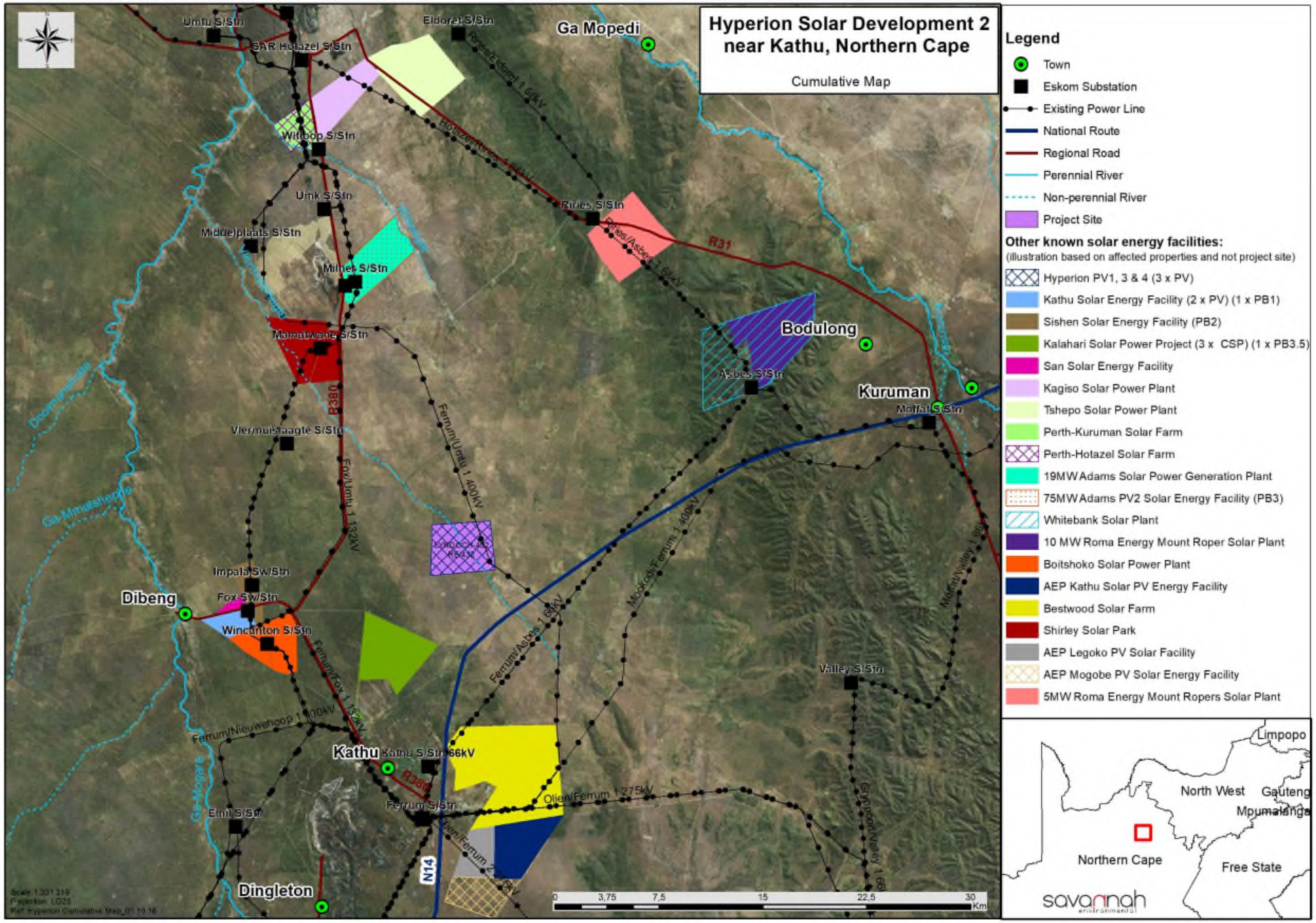


Figure 5.3: Map showing the location of solar energy facilities in relation to the proposed project site.

5.4.1. Benefits of Renewable Energy and the Need and Desirability thereof

The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa; these include:

Socio-economic upliftment of local communities: The proposed project has the potential to create much needed employment for unskilled locals during the construction phase. Training opportunities will also be afforded to qualified local people who can be up-skilled to undertake certain roles during the construction and operation phases. In terms of the needs of the local community, the LM and DM IDPs identified the need to facilitate economic development by creating an environment which is conducive for business development, economic growth, sustainable employment opportunities and growth in personal income levels of communities; unlock opportunities to increase participation amongst all sectors of society in the mainstream economy to create decent job opportunities; promote Local Economic Development; and enhance rural development and agriculture. A study undertaken by the Department of Energy, National Treasury and DBSA (June 2017) found that employment opportunities created during the construction phase of the projects implemented to date had created 40% more job years for South African citizens than anticipated. The study also found that significantly more people from local communities were employed during construction than was initially planned, confirming the potential benefits for local communities associated with the implementation of renewable energy projects.

The project has the potential to make a positive contribution towards the identified community needs. In terms of the economic development requirements of the REIPPP Programme, the project will commit benefits to the local community, in the form of job creation, localisation, and community ownership. In accordance with the DoE bidding requirements of the REIPPP Programme, a percentage of the revenue generated per annum during operation will be made available to local communities through a social beneficiation scheme. Therefore, the potential for creation of employment and business opportunities, and the opportunity for skills development for local communities is significant. Secondary social benefits can be expected in terms of additional spend in nearby towns due to the increased demand for goods and services. These socio-economic benefits would include an increase in the standard of living for local residents within the area as well as overall financial and economic upliftment.

Increased energy security: Given that renewables can often be deployed in a short timeframe and in a decentralised manner close to consumers, they offer the opportunity for improving grid strength and supply quality in the short-term, while reducing expensive distribution losses. As a result of the power constraints in the first half of 2015, power generators meant to be the "barely-ever-used" safety net for the system (diesel-fired gas turbines) were running at >30% average load factor in the first half of 2015. Load shedding occurred during 82 days in the first half of 2015 (out of 181 days). Results of a CSIR Energy Centre study for the period January to June 2015 (CSIR, August 2015), concluded that the already implemented renewable projects (wind and solar) within the country avoided 203 hours of so-called 'unserved energy'. During these hours the supply situation was such that some customers' energy supply would have had to be curtailed ('unserved') had it not been for the renewables. The avoidance of unserved energy cumulated into the effect that during 15 days from January to June 2015 load shedding was avoided entirely, delayed, or a higher stage of load shedding prevented due to the contribution of renewable wind and PV projects[22]. During the first half of 2017, the average daily contribution of renewable energy to the power system was approximately 3.6 %"(NERSA, 2017). Maximum daily wind, solar PV and CSP energy of 47 GWh was available on 25 December 2017 (CSIR, 2018).

Resource saving: It is estimated that the achievement of the targets in the Renewable Energy White Paper will result in water savings of approximately 16.5 million kilolitres per annum. As an already water-stressed nation, it is critical that South Africa engages in a variety of water conservation measures, particularly due to the detrimental effects of climate change on water availability. Renewable energy also translates into revenue savings, as fuel for renewable energy facilities is free while compared to the continual purchase of fuel for conventional power stations. Results of a CSIR Energy Centre study for January – June 2015 (CSIR, August 2015) have quantified the contribution from renewable energy to the national power system and the economy over the first 6 months of 2015 compared to the 12 months of 2014:

2015 (6 months)	**2014 (12 months)**
R3.60 billion saving in diesel and coal fuel costs	R3.64 billion saving in diesel and coal fuel costs
200 hours of unserved energy avoided, saving at least an additional R1.20 billion–R4.60 billion for the economy	120 hours of unserved energy avoided, saving at least an additional R1.67 billion for the economy
Generated R4.0 billion more financial benefits than cost	Generated R0.8 billion more financial benefits than cost

Exploitation of significant renewable energy resource: At present, valuable renewable resources including biomass by-products, solar radiation and wind power remain largely unexploited. The use of these energy flows will strengthen energy security through the development of a diverse energy portfolio in South Africa.

Economics: As a result of the excellent renewable energy resources and competitive procurement processes, both wind power and solar PV power have now been proven as cheaper forms of energy generation in South Africa than coal power. They offer excellent value for money to the economy and citizens of South Africa while benefitting society as a whole through the development of clean energy. This is supported by the Draft IRP 2018 released for comment which follows the least cost option.

Pollution reduction: The release of by-products through the burning of fossil fuels for electricity generation have a particularly hazardous impact on human health and contribute to ecosystem degradation. The use of solar radiation or wind for power generation is a non-consumptive use of a natural resource which produces zero emissions during its operation.

Climate friendly development: The uptake of renewable energy offers the opportunity to address energy needs in an environmentally responsible manner and thereby allows South Africa to contribute towards mitigating climate change through the reduction of GHG emissions. South Africa is estimated to currently be responsible for approximately 1% of global GHG emissions (and circa half of those for which Africa is responsible) and is currently ranked 9th worldwide in terms of per capita carbon dioxide emissions. Since its

[22] (http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE157_MEDIA_REL?MEDIA_RELEASE_NO=7526896)

inception the REIPPP Programme has achieved carbon emission reductions[23] of 25.3 million tonnes of CO_2 (IPP Office, March 2018). The development of Hyperion Solar Development 2, and the associated electricity generated as a result of the facility, will result in considerable savings on tons of CO_2 emissions.

Support for international agreements: The effective deployment of renewable energy provides a tangible means for South Africa to demonstrate its commitment to its international agreements under the Kyoto Protocol, and for cementing its status as a leading player within the international community.

Employment creation: The development, procurement, installation, maintenance and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. By the end of March 2018 the REIPPP Programme had created 35 702 job years (equivalent of a full time employment opportunity for one person for one year) for South African citizens including people from communities local to IPP operations (IPP Office, March 2018).

Acceptability to society: Renewable energy offers a number of tangible benefits to society including reduced pollution concerns, improved human and ecosystem health and climate friendly development.

Support to a new industry sector: The development of renewable energy offers the opportunity to establish a new industry within the South African economy, which will create jobs and skill local communities which have potential for further renewable energy projects.

Protecting the natural foundations of life for future generations: Actions to reduce our disproportionate carbon footprint can play an important part in ensuring our role in preventing dangerous anthropogenic climate change; thereby securing the natural foundations of life for generations to come. This is the basis of sustainable development.

[23] Carbon emission reduction is calculated based on a displacement of power, from largely coal-based to more environmentally friendly electrical energy generation, using a gross Eskom equivalent emissions factor of 1.015 tons CO_2/MWh.

CHAPTER 6. APPROACH TO UNDERTAKING THE EIA PROCESS

An EIA process refers to a process undertaken in accordance with the requirements of the relevant EIA Regulations (i.e. the 2014 EIA Regulations, as amended (GNR 326)), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process culminates in the preparation and submission of a Final EIA Report (including an EMPr) to the Competent Authority for decision-making.

The EIA process is illustrated in **Figure 6.1**.

Figure 6.1: The Phases of an EIA Process

The development of Hyperion Solar Development 2 requires EA in accordance with the requirements of Section 24 of NEMA and the 2014 EIA Regulations (GNR 326). The applicant has appointed Savannah Environmental (Pty) Ltd, as the independent environmental consultants responsible for undertaking the EIA process required in support of the application for EA for Hyperion Solar Development 2. An application for EA was prepared and submitted to DEA, and the project was assigned Application Reference number: **14/12/16/3/3/2/1110**.

This Chapter provides a brief overview of NEMA and the 2014 EIA Regulations (GNR 326), as amended and their application to Hyperion Solar Development 2, as well as details of the EIA process followed for this project.

6.1. Relevant legislative permitting requirements

The legislative permitting requirements applicable to Hyperion Solar Development 2 as identified at this stage in the process are described in more detail under the respective subheadings.

6.1.1. National Environmental Management Act (No. 107 of 1998) (NEMA)

NEMA is South Africa's key piece of national environmental legislation that provides for the authorisation of certain controlled activities known as "listed activities". In terms of Section 24(1) of NEMA, the potential impact on the environment associated with listed activities must be considered, investigated, assessed and reported on to the Competent Authority (the decision-maker) charged by NEMA with granting of the relevant EA. Due to the fact that Hyperion Solar Development 2 is a power generation project and therefore relates to the IRP 2010 – 2030, the National DEA has been determined as the Competent Authority in terms of GNR 779 of 01 July 2016. The Provincial Northern Cape DENC is a Commenting Authority on the project.

The need to comply with the requirements of the EIA Regulations published under NEMA ensures that developers are provided the opportunity to consider the potential environmental impacts of their activities early in the project development process, and also allows for an assessment to be made as to whether environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the Competent Authority with sufficient information in order for an informed decision to be taken regarding the project.

The EIA process being conducted for Hyperion Solar Development 2 is being undertaken in accordance with Section 24 (5) of NEMA. Section 24 (5) of NEMA pertains to EAs, and requires that the potential consequences for, or impacts of, listed or specified activities on the environment be considered, investigated, assessed, and reported on to the Competent Authority. Listed Activities are activities identified in terms of Section 24 of NEMA which are likely to have a detrimental effect on the environment, and which may not commence without EA from the Competent Authority subject to the completion of an environmental assessment process (either a Basic Assessment (BA) or full Scoping and EIA).

Table 6.1 contains all the listed activities identified in terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notice 1 (GNR 327), Listing Notice 2 (GNR 325), and Listing Notice 3 (GNR 324) which may be triggered by the proposed development of Hyperion Solar Development 2, and for which EA has been applied:

Table 6.1: Listed activities identified in terms of the Listing Notices (GNR 327, 325 and 324).

Notice Number	Activity Number	Description of listed activity
Listing Notice 1 (GNR 327) 08 December 2014	11 (i)	The development of facilities or infrastructure for the transmission and distribution of electricity – (i) outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts. **The project includes the construction of a new 132kV on-site substation to evacuate electricity generated by the project into the national electricity grid. The on-site substation will have a capacity of 132kV, and will be located outside of an urban area.**
Listing Notice 1 (GNR 327) 08 December 2014	12(ii)(a)(c)	The development of – (ii) Infrastructure or structures with a physical footprint of 100 square metres or more Where such development occurs- (a) within a watercourse (c) within 32 metres of a watercourse. **The upgrade of the access road Alternative 1 will be directly within the Vlermuisleegte watercourse and will be over 100 square metres.**
Listing Notice 1 (GNR 327)	19	The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of

Notice Number	Activity Number	Description of listed activity
08 December 2014		soil, san, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse. **Access Road Alternative 1 will be routed into the Vlermuisleegte River, and watercourse crossings will be required to be upgraded and/or constructed within.**
Listing Notice 1 (GNR 327) 08 December 2014	24 (ii)	The development of a road – (ii) with a reserve wider than 13.5m, or where no reserve exists where the road is wider than 8m. **The construction of the solar energy facility will require the construction and upgrading of an existing two-tyre track to provide access to the facility as well as the construction of new access roads up to 9m in width.**
Listing Notice 1 (GNR 327) 08 December 2014	28 (ii)	Residential, mixed, retail, commercial, industrial or institutional developments where such land was used for agriculture, game farming, equestrian purposes or afforestation on or after 01 April 1998 and where such development: (ii) will occur outside an urban area, where the total land to be developed is bigger than 1ha. **The total area of land to be developed for the solar energy facility is larger than 1 hectare. The site is currently used for agricultural purposes. The total extent of the development footprint is 180ha.**
Listing Notice 1 (GNR 327) 08 December 2014	48 (i)(a)(c)	The expansion of – (ii) infrastructure or structures with a physical footprint of 100 square metres or more; (a) within a watercourse (c) within 32 metres of a watercourse. **The upgrading of Access Road Alternative 1 within 32m and within the Vlermuisleegte River will require the widening of the road by 4m for approximately 2.5km.**
Listing Notice 2 (GNR 325) 08 December 2014	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more. **The project comprises a renewable energy generation facility, which will utilise photovoltaic (PV) technology and will have a generation capacity of up to 75MW. The development is located outside of an urban area and is proposed to be ground-mounted.**

Notice Number	Activity Number	Description of listed activity
Listing Notice 2 (GNR 325) 08 December 2014	15	The clearance of an area of 20ha or more of indigenous vegetation[24]. **The project requires the clearance of an area up to 180ha (equivalent to the development footprint) of vegetation. The project is proposed on an agricultural property where the pre-dominant land use is livestock grazing, and is therefore likely to comprise indigenous vegetation. The project would therefore result in the clearance of an area of land greater than 20ha of indigenous vegetation.**
Listing Notice 3 (GNR 324) 08 December 2014	4(g)(ee)	The development of a road wider than 4 meters with a reserve less than 13,5 meters (g) in Northern Cape (ee) within Critical biodiversity areas identified in bioregional plans adopted by the competent authority or in bioregional plans. **The development of a newly proposed access road (Alternative 3) wider than 4 meters is required for the solar energy facility. A section of Alternative 3 is located within a critical biodiversity area identified in the Northern Cape Critical Biodiversity Areas (CBA) Map.**
Listing Notice 3 (GNR 324) 08 December 2014	12(g)(ii)	The clearance of an area of 300m² or more of indigenous vegetation. (g) in the Northern Cape (ii) within critical biodiversity areas identified in bioregional plans **The clearance of approximately 12 240m² of indigenous vegetation will be required for Access Road Alternative 3. A section of the access road is located within a critical biodiversity area as identified in the Northern Cape Critical Biodiversity Areas (CBA) Map.**
Listing Notice 3 (GNR 324) 08 December 2014	18(g)(ii)(ee)	The widening of a road by more than 4 metres or lengthening of a road by more than 1 km (g) in Northern Cape (ii) outside urban areas (ee) critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans. **The Access Road Alternative 3 will require widening of more**

[24] "Indigenous vegetation" as defined by the 2014 EIA Regulations (GNR 326) refers to vegetation consisting of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.

Notice Number	Activity Number	Description of listed activity
		than 4m. A section of the access road is located within a critical biodiversity area as identified in the Northern Cape Critical Biodiversity Areas (CBA) Map.

6.1.2. National Water Act (No. 36 of 1998) (NWA)

In accordance with the provisions of the National Water Act (No. 36 of 1998) (NWA), all water uses must be licensed with the Competent Authority (i.e. the Regional Department of Water and Sanitation (DWS) or the relevant Catchment Management Agency (CMA)). Water use is defined broadly, and includes taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation.

Table 6.2 contains Water Uses associated with the proposed project and identified in terms of the NWA which require licensing either in the form of a General Authorisation (GA), or in the form of a Water Use License (WUL). The table also includes a description of those project activities which relate to the applicable Water Uses.

Table 6.2: List of Water Uses published under Section 21 of NWA, as amended.

Notice No.	Activity No.	Description of Water Use
NWA (No. 36 of 1998)	Section 21 (a)	Taking water from a groundwater resource **Hyperion Solar Development 2 will utilise water during both construction and operation. Water is required during construction for dust suppression, and potable water will be required on site for the construction crew. During operation, water is required to clean the PV panels, for human consumption, and for use in the auxiliary buildings (i.e. for use in the office building, ablutions, and canteen, etc.). Approximately 10 000m³ of water is required per year over a 12-month period during construction, and approximately 50 000m³ of water is required per year over the 25 year operation of the project. Water is proposed to be sourced from up to three existing boreholes located in the project site.**
NWA (No. 36 of 1998)	Section 21 (c)	Impeding or diverting the flow of water in a watercourse **Infrastructure associated with Hyperion Solar Development 2 will be located within the GN 509 regulated area of a watercourse (100m zone surrounding the identified river).**
NWA (No. 36 of 1998)	Section 21 (i)	Altering the bed, banks, course or characteristics of a watercourse. **Infrastructure associated with Hyperion Solar Development 2 will be located within the GN 509 regulated area of a watercourse (100m zone surrounding the identified river).**
NWA (No. 36 of 1998)	Section 21 (g)	Disposing of waste in a manner which may detrimentally impact on a water resource. **Discharge of waste into a septic tank /conservancy tank may**

Notice No.	Activity No.	Description of Water Use
		be required for the ablution facility.

In terms of the above, application would need to be made for a Water Use License (WUL) in accordance with the requirements of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GNR 267), or a General Authorisation (GA) registered in accordance with the requirements of Revision of General Authorisation for the Taking and Storing of Water (GNR 538). The process of applying for a WUL or GA registration will only be completed once a positive EA has been received and the project selected as a Preferred Bidder, in line with the requirements of the DWS.

6.1.3. *National Heritage Resources Act (No. 25 of 1999) (NHRA)*

The National Heritage Resources Act (No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources and to empower civil society to conserve heritage resources for future generations. Section 38 of the NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

Section 38: Heritage Resources Management

1). *Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –*
   - a. *the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
   - b. *the construction of a bridge or similar structure exceeding 50m in length;*
   - c. *any development or other activity which will change the character of a site –*
     - i). *exceeding 5 000m² in extent; or*
     - ii). *involving three or more existing erven or subdivisions thereof; or*
     - iii). *involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
     - iv). *the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*

   Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed development, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GNR 668).

6.2. Overview of the Scoping and EIA Process being undertaken for the project.

In terms of NEMA, the 2014 EIA Regulations (GNR 326), and Listing Notices 1 (GNR 327), 2 (GNR 325), and 3 (GNR 324)), the development of Hyperion Solar Development 2 requires EA from DEA subject to the completion of a full Scoping and EIA process, as prescribed in Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326). The need for a full Scoping and EIA process to be conducted in support of the application for EA is due to the fact that listed activities contained within Listing Notice 2 (GNR 325) are triggered.

6.3. Scoping Phase

The Scoping Phase of the EIA process refers to the process of identifying potential issues associated with the proposed project, and defining the extent of studies required during the EIA Phase. This is achieved through an evaluation of the proposed project, involving the project proponent, specialists with relevant experience, and a public consultation process with key stakeholders (including government authorities) and Interested and Affected Parties (I&APs).

In accordance with Appendix 2 of the 2014 EIA Regulations (GNR 326), the objectives of the Scoping Phase are to, through a consultative process:

» Identify the relevant policies and legislation relevant to the activity.
» Motivate the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location.
» Identify and confirm the preferred activity and technology alternative through an identification of impacts and risks, and a ranking process of such impacts and risks.
» Identify and confirm the preferred site, through a detailed site selection process. This includes an identification of impacts and risks inclusive of identification of cumulative impacts and a ranking process of all the identified alternatives focusing on the geographical, physical, biological, social, economic, and cultural aspects of the environment.
» Identify the key issues to be addressed in the assessment phase.
» Agree on the level of assessment to be undertaken, including the methodology to be applied, the expertise required as well as the extent of further consultation to be undertaken to determine the impacts and risks which the activity may impose on the preferred site through the life of the activity (including the nature, significance, consequence, extent, duration and probability of the impacts), to inform the location of the development footprint within the preferred site.
» Identify suitable measures to avoid, manage or mitigate identified impacts and to determine the extent of the residual risks that need to be managed and monitored.

The Scoping Study for Hyperion Solar Development 2 considered the broader project site in order to identify and delineate any environmental fatal flaws, "no-go", or sensitive areas which should be avoided. This was undertaken through specialist studies and a process of consultation. The preparation and release of a Scoping Report for a 30-day public review period provided stakeholders and I&APs with an opportunity to verify that the issues they had raised during the Scoping process had been captured and adequately considered, and provided a further opportunity for additional key issues to be raised for consideration. The Final Scoping Report incorporated all issues and responses raised during the Scoping Phase prior to submission to the DEA. The Final Scoping Report and Plan of Study for EIA was submitted to DEA on 07 December 2018, and acceptance was received on 25 January 2019, thus marking the start of the EIA Phase (refer to **Appendix B**). Additional information requested by the DEA in the Acceptance of the Scoping Report and the location of the requested information in this EIA Report is detailed in **Table 6.2**

Table 6.2: DEA requirements and reference to Section in the EIA Report.

DEA requirement for EIA	Response / Location in this EIA Report
Technical Details of the proposed facility and design alternative:	
i. The EIAr must provide the technical details for the proposed facility in a table format as well as their description and/or dimensions. A sample for the minimum information required is listed under point 2 of the EIA information required for PV facilities below.	**Chapter 2, Table 2.2** of this EIA Report provides the technical details for Hyperion Solar Development 2, including their description and/or dimensions.
ii. Further, the EIAr must include the design alternatives for the proposed 75MW PV facility.	**Chapter 3** of this EIA Report provides a description of the various alternatives considered for Hyperion Solar Development 2. The design alternative proposed for the project is considered to be the most reasonable and feasible alternative for the development and therefore no design alternatives were identified or assessed.
Application for re-zoning i. The EIAr must include proof indicating that an application for the re-zoning has been lodged with the National Department of Agriculture as development on agricultural land needs to be approved by the National Department of Agriculture in terms of the subdivision of Agricultural Land Act 70 of 1970 (SALA).	A rezoning application will be undertaken as a separate process by the developer once the project has been selected as a preferred bidder project in the Department of Energy's Renewable Energy Independent Power Producer Procurement (REIPPP) Programme.
The EIAr must also provide the following	
i. Clear description of all associated infrastructure. This description must include, but not limited to the following: » Power lines; » Internal roads infrastructure; and » All supporting onsite infrastructure such as laydown area, guard house and control room etc. » All necessary details regarding all possible locations and sizes of the proposed satellite substation and the main substation. » Information on services required on the site, e.g. sewage, refuse removal, water and electricity, agreements with suppliers and confirmation of capacity been obtained must be provided.	The Hyperion Solar Development 2 and all associated infrastructure has been described in **Chapter 2** of this EIA Report. Information on services required on the site, e.g. sewage, refuse removal, water and electricity, agreements with suppliers and confirmation of capacity will be provided with the Final EIA Report. Licensed contractors for such services will be utilised when and if required should insufficient capacity is in fact confirmed by the Municipality.
Need and Desirability of the proposed development: The Department has noted that there are other projects of similar nature in the area, therefore; your EIAr must provide detailed description of the need and desirability of the proposed development taking into account cumulative impacts as a result of similar development in the area.	The need and desirability of the project has been described in detail in **Chapter 5** of this EIA Report which considers other projects operating and under construction in the area. **Chapter 9** of this final EIA Report assesses the potential for cumulative impacts associated with the project and other projects in the area.
A copy of the final site layout map and alternatives: All available biodiversity information must be used in the finalisation of the layout map. **The layout map must indicate the following:** » PV positions and its associated infrastructure;	A copy of the final site layout map which indicates the information requested by DEA in the Acceptance of Scoping is provided in **Appendix N** of this final EIA Report.

DEA requirement for EIA	Response / Location in this EIA Report
» Permanent laydown area footprint; » Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible); » Wetlands, drainage lines, rivers, stream and water crossing of roads and cables indicating the type of bridging structures that will be used; » The location of sensitive environmental features on site e.g. CBAs, heritage sites, wetlands, drainage lines etc. that will be affected by the facility and its associated infrastructure; » Substation(s) and/or transformer(s) sites including their entire footprint; » Connection routes (including pylon positions) to the distribution/transmission network; » All existing infrastructure on the site, especially roads; » Buffer areas; » Buildings, including accommodation; and » All "no-go" areas.	
Topographical and Sensitive Maps	
i. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process must be on an A3 page and must have a clear legend.	An A3 environmental sensitivity map is provided in **Appendix N** to this EIA Report.
ii. A topographical map combining the final layout map superimposed (overlain) on the environmental sensitivity map must be submitted with the final EIAr.	A layout map overlain by environmental sensitivities is provided in **Appendix N** to this EIA Report.
Shapefile of the preferred Development layout: A shapefile of the preferred development layout/footprint must be submitted to this Department. The shapefile must be created using the Hartebeesthoek 94 Datum and the data should be in Decimal Degree Format using the WGS 84 Spheroid. The shapefile must include at a minimum the following extensions i.e. .shp; .shx; .dbf; .prj; and, .xml (Metadata file). If specific symbology was assigned to the file, then the .avl and/or the .lyr file must also be included. Data must be mapped at a scale of 1:10 000 (please specify if an alternative scale was used). The metadata must include a description of the base data used for digitizing. The shapefile must be submitted in a zip file using the EIA application reference number as the title. The shape file must be submitted to: Postal Address: Department of Environmental Affairs	Shapefiles of the preferred development layout / footprint will be submitted to the DEA with a copy of the final EIA Report.

DEA requirement for EIA	Response / Location in this EIA Report
Private Bag X447, Pretoria 0001 Physical address: Environment House, 73 Steve Biko Road, Pretoria For Attention: Muhammad Essop Integrated Environmental Authorisations Strategic Infrastructure Developments Telephone Number: (012) 399 9406 Email Address: MEssop@environment.gov.za	
The Environmental Management Programme (EMPr) to be submitted as part of the EIAr must include the following: i. All recommendations and mitigation measures recorded in the EIAr and the specialist studies conducted.	The EMPr prepared for the project is attached as **Appendix K** to this EIA Report, copies of which have been submitted to DEA for its review and comment. i. The EMPr contains all recommendations and mitigation measures recorded in the EIA Report and the specialist studies conducted (refer to **Appendix D to J** of this EIA Report).
ii. A good quality final site layout map with clear legend.	ii. A copy of the final site layout map is included in **Appendix A** of the EMPr prepared for the project and attached as **Appendix K** to this EIA Report.
iii. Measures as dictated by the final site layout map and micro-siting.	iii. Measures as dictated by the final site layout map are included in the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
iv. An environmental sensitivity map indicating environmental sensitive areas and features identified during the EIA process.	iv. A copy of the environmental sensitivity map is included in **Appendix A** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
v. A map combining the final layout map superimposed (overlain) on the environmental sensitivity map.	v. A map which superimposes the final layout map over the environmental sensitivity map is included in **Appendix A** of the EMPr, prepared for the project and attached as **Appendix K** of this EIA Report.
vi. An alien invasive management plan to be implemented during construction and operation of the facility. The plan must include mitigation measures to reduce the invasion of alien species and ensure that the continuous monitoring and removal of alien species is undertaken.	vi. A map which superimposes the final layout map over the environmental sensitivity map is included in **Appendix A** of the EMPr, prepared for the project and attached as **Appendix K** of this EIA Report.
vii. A plant rescue and protection plan which allows for the maximum transplant of conservation important species from areas to be transformed. This plan must be compiled by a vegetation specialist familiar with the site and be implemented prior to commencement of the construction phase.	vii. A plant rescue and protection plan has been prepared for the project, and is included in **Appendix D** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
viii. A re-vegetation and habitat rehabilitation plan to be implemented during the construction and operation of the facility. Restoration must be undertaken as soon as possible after completion of construction activities to reduce the amount of	viii. A re-vegetation and habitat rehabilitation plan has been prepared for the project, and is included in **Appendix E** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.

DEA requirement for EIA	Response / Location in this EIA Report
habitat converted at any one time and to speed up the recovery to natural habitats.	
ix. A traffic management plan for the site access roads to ensure that no hazards would result from the increased truck traffic and that traffic flow would not be adversely impacted. This plan must include measures to minimize impacts on local commuters e.g. limiting construction vehicles travelling on public roadways during the morning and late afternoon commute time and avoid using roads through densely populated built-up areas so as not to disturb existing retail and commercial operations.	ix. A traffic management plan has been prepared for the project, and is included in **Appendix I** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
x. A storm water management plan to be implemented during the construction and operation of the facility. The plan must ensure compliance with applicable regulations and prevent off-site migration of contaminated storm water or increased soil erosion. The plan must include the construction of appropriate design measures that allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows. Drainage measures must promote the dissipation of storm water run-off.	x. A storm water management plan has been prepared for the project, and is included in **Appendix G** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
xi. A fire management plan to be implemented during the construction and operation of the facility.	xi. A fire management plan has been prepared for the project, and is included in **Appendix J** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.
xii. Measures to protect archaeological sites, artefacts, paleontological fossils or graves from construction and operational impacts.	xii. Measures to protect archaeological sites, artefacts, paleontological fossils or graves have been identified and are included in the EMPr prepared for the project, and attached as **Appendix K** to this EIA Report.
The EAP must provide detailed motivation if any of the above requirements is not required by the proposed development and not included in the EMPr.	Where there are deviation from DEA's requirements stipulated in the Acceptance of Scoping, a motivation has been provided.
You are hereby reminded that should the EIAr fail to comply with the requirements of this acceptance letter, the proposed Hyperion Solar Development 2 and associated infrastructure will be refused in terms of the EIA Regulations 2014, as amended.	Savannah Environmental is cognisant of the requirements stipulated in the Acceptance of Scoping and have addressed these in this EIA Report (as detailed within this table).
Public Participation Ensure that all relevant stakeholders' comments are submitted to the Department with the final EIAr. This includes but is not limited to the Department of Environmental Affairs: Biodiversity and Conservation Directorate, the Department of Agriculture, Forestry and Fisheries (DAFF), Department of Environment and Nature Conservation, the South African Civil Aviation Authority (SACAA), the Department of Transport, Gamagara Local Municipality, Department of Water and Sanitation	Comments received to date from all relevant stakeholders, have been included within this Comments and Responses Report. Proof of correspondence to and from these stakeholders are included in Appendix C5 and Appendix C6 of the EIA Report.

DEA requirement for EIA	Response / Location in this EIA Report
(DWS), the South African National Roads Agency Limited (SANRAL), the South African Heritage Resources Agency (SAHRA), the Endangered Wildlife Trust (EWT), Department of Mineral Resources, National Energy Regulator of South Africa (NERSA), National Department of Energy, South African National Defence Force, Eskom, Cape Nature and Birdlife South Africa.	
Proof of all correspondence must be included in the EIAr. Should you be unable to obtain comments, proof should be submitted to the Department of the attempts that were made to obtain comments.	Proof of correspondence with various stakeholders will be attached in **Appendix C4** (organs of state correspondence) and **Appendix C5** (stakeholder correspondence) of the final EIA Report. Proof of attempts to obtain comments will be attached in **Appendix C4** (organs of state correspondence) and **Appendix C5** (stakeholder correspondence) of the final EIA Report.
The applicant is hereby reminded to comply with the requirements of Regulation 45 with regard to the time period allowed for complying with the requirements of the Regulations, and Regulations 43 and 44 with regard to the allowance of a comment period for interested and affected parties on all reports submitted to the competent authority for decision-making. The reports referred to are listed in Regulation 43(1).	Savannah Environmental is cognisant of the need to comply with Regulations 43, 44 and 45 of the 2014 EIA Regulations (GNR 326). » **Regulation 43 (GNR 326):** This EIA Report has been made available for a 30-day public review period from **05 April 2019 to 10 May 2019**. The EIA Report has been distributed to relevant Organs of State and a copy has been made available at the Kathu Public Library, 1 Hendrik van Eck Road, Kathu. The EIA Report which has been submitted to the national DEA, the Northern Cape DENC, and relevant Organs of State is also available for download from www.savannahsa.com or on CD on request from Savannah Environmental (Pty) Ltd. » **Regulation 44 (GNR 326):** Comments from I&APs received to date are included in the Comments and Response (C&R) Report attached as **Appendix C8** to this EIA Report. » **Regulation 45 (GNR 326):** Acceptance of Scoping was received from DEA on **29 January 2019**. In accordance with Regulation 23(1)(a) (GNR 326) the applicant must within 106 days of the acceptance of the Scoping Report submit to the authority an EIA Report inclusive of any specialist reports, and an EMPr, which must have been subjected to a public participation process of at least 30-days and which includes the incorporation of comments received, including any comments of the Competent Authority. The EIA Report has been released for a 30-day public review period from **05 April 2019 to 10 May 2019**. Comments received during this 30-day public

DEA requirement for EIA	Response / Location in this EIA Report
	review period will be incorporated into the C&R Report to be attached as **Appendix C8** to the Final EIA Report. The Final EIA Report inclusive of specialist studies and an EMPr is due to be submitted by **10 May 2019**.
Furthermore, it must be reiterated that, should an application for Environmental Authorisation be subject to the provisions of Chapter II, Section 38 of the National Heritage Resources Act, Act 25 of 1999, then this Department will not be able to make nor issue a decision in terms of your application for Environmental Authorisation pending a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage recourses authority as described in Chapter II, Section 38(8) of the National Heritage Resources Act, Act 25 of 1999. Comments from SAHRA and/or the provincial department of heritage must be provided in the EIAr.	Savannah Environmental acknowledges that should the application be subject to Section 38 of the National Heritage Resources Act, Act 25 of 1999, the Department will require a letter from the pertinent heritage authority categorically stating that the application fulfils the requirements of the relevant heritage resources authority. Comments from SAHRA and/or the provincial department of heritage have been requested.
You are requested to submit two (2) electronic copies (CD/DVD) and one (1) hard copy of the EIAr to the Department as per Regulation 23(1) of the NEMA, EIA Regulations, 2014 as amended.	Two (02) electronic copies and one (01) hard copy of the EIA Report have been submitted to the DEA's EIA Administration Section as required.
You are hereby reminded of Section 24F(1)(a) of the National Environmental Management Act, Act No 107 of 1998, as amended, which stipulates that no activity may commence prior to an Environmental Authorisation being granted by this Department.	The applicant is cognisant of the need to comply with Section 24F(1)(a) of NEMA with regards to commencing with listed activities. No activities have or will commence on site prior to EA being granted by the DEA.
EIA INFORMATION REQUIRED FOR PHOTOVOLTAIC SOLAR POWER (PV) ENERGY FACILITIES	
a. General site information The following general site information is required: » Descriptions of all affected farm portions » 21 digit Surveyor General codes of all affected farm portions » Copies of deeds of all affected farm portions » Photos of areas that give a visual perspective of all parts of the site » Photographs from sensitive visual receptors (tourism routes, tourism facilities, etc.) » Solar plant design specifications including: ∗ Type of technology ∗ Structure height ∗ Surface area to be covered (including associated infrastructure such as roads) ∗ Structure orientation ∗ Laydown area dimensions (construction	Refer to **Chapter 2**, **Table 2.1** and **Table 2.2** of this EIA Report for the general site information.

<table>
<tr><th>DEA requirement for EIA</th><th>Response / Location in this EIA Report</th></tr>
<tr><td>period and thereafter)
* Generation capacity
» Generation capacity of the facility as a whole at delivery points

This information must be indicated on the first page the EIAr. It is also advised that it be double checked as there are too many mistakes in the applications that have been received that take too much time from authorities to correct.</td><td></td></tr>
<tr><td>b. Sample of technical details for the proposed facility

<table>
<tr><th>Component</th><th>Description / dimensions</th></tr>
<tr><td>Height of PV panels</td><td></td></tr>
<tr><td>Area of PV</td><td></td></tr>
<tr><td>Number of inverters required</td><td></td></tr>
<tr><td>Area occupied by inverter / transformer stations / substations</td><td></td></tr>
<tr><td>Capacity of on-site substation</td><td></td></tr>
<tr><td>Area occupied by both permanent and construction laydown areas</td><td></td></tr>
<tr><td>Area occupied by buildings</td><td></td></tr>
<tr><td>Length of internal roads</td><td></td></tr>
<tr><td>Width of internal roads</td><td></td></tr>
<tr><td>Proximity to grid connection</td><td></td></tr>
<tr><td>Height of fencing</td><td></td></tr>
<tr><td>Type of fencing</td><td></td></tr>
</table></td><td>Refer to Chapter 2, Table 2.2 of this final EIA Report for the technical details of the proposed facility.</td></tr>
<tr><td><u>3. Site maps and GIS information</u>

Site maps and GIS information should include at least the following:
» All maps / information layers must also be provided in ESRI Shapefile format
» All affected farm portions must be indicated
» The exact site of the application must be indicated (the areas that will be occupied by the application)
» A status quo map / layer must be provided that includes the following:
* Current use of land on the site including:</td><td>Refer to Appendix N of this EIA Report for site maps and GIS information[25].</td></tr>
</table>

[25] All information applicable to Hyperion Solar Development 2 has been included in **Appendix N** of this EIA Report. Where required information were not applicable to the project, the information were excluded from the maps.

DEA requirement for EIA	Response / Location in this EIA Report
▪ Buildings and other structures ▪ Agricultural fields ▪ Grazing areas ▪ Natural vegetation areas (natural veld not cultivated for the preceding 10 years) with an indication of the vegetation quality as well as fine scale mapping in respect of Critical Biodiversity Areas and Ecological Support Areas ▪ Critically endangered and endangered vegetation areas that occur on the site ▪ Bare areas which may be susceptible to soil erosion ▪ Cultural historical sites and elements ∗ Rivers, streams and water courses ∗ Ridgelines and 20m continuous contours with height references in the GIS database ∗ Fountains, boreholes, dams (in-stream as well as off-stream) and reservoirs ∗ High potential agricultural areas as defined by the Department of Agriculture, Forestry and Fisheries ∗ Buffer zones (also where it is dictated by elements outside the site): ▪ 500m from any irrigated agricultural land ▪ 1km from residential areas ∗ Indicate isolated residential, tourism facilities on or within 1km of the site » A slope analysis map / layer that include the following slope ranges: ∗ Less than 8% slope (preferred areas for PV and infrastructure) ∗ between 8% and 12% slope (potentially sensitive to PV and infrastructure) ∗ between 12% and 14% slope (highly sensitive to PV and infrastructure) ∗ steeper than 18 % slope (unsuitable for PV and infrastructure) » A site development proposal map(s) / layer(s) that indicate: ∗ Foundation footprint ∗ Permanent laydown area footprint ∗ Construction period laydown footprint ∗ Internal roads indicating width (construction period width and operation period width) and with numbered sections between the other site elements which they serve (to make commenting on sections possible) ∗ River, stream and water crossing of roads	

DEA requirement for EIA	Response / Location in this EIA Report
and cables indicating the type of bridging structures that will be used ∗ Substation(s) and / or transformer(s) sites including their entire footprint. ∗ Cable routes and trench dimensions (where they are not along internal roads) ∗ Connection routes to the distribution / transmission network (the connection must form part of the EIA even if the construction and maintenance thereof will be done by another entity such as ESKOM) ∗ Cut and fill areas at PV sites along roads and at substation / transformer sites indicating the expected volume of each cut and fill ∗ Borrow pits ∗ Spoil heaps (temporary for topsoil and subsoil and permanently for excess material) ∗ Buildings including accommodation With the above information authorities will be able to assess the strategic and site impacts of the application.	
4. Regional map and GIS information The regional map and GIS information should include at least the following: » All maps / information layers must also be provided in ESRI Shapefile format » The map / layer must cover an area of 20km around the site » Indicate the following: ∗ roads including their types (tarred or gravel) and category (national, provincial, local or private) ∗ Railway lines and stations ∗ Industrial areas ∗ Harbours and airports ∗ Electricity transmission and distribution lines and substations ∗ Pipelines ∗ Waters sources to be utilised during the construction and operational phases ∗ A visibility assessment of the areas from where the facility will be visible ∗ Critical Biodiversity Areas and Ecological	Refer to **Appendix N** of this final EIA Report for regional maps and GIS information [26].

[26] All information applicable to Hyperion Solar Development 2 has been included in **Appendix N** of this EIA Report. Where required information were not applicable to the project, the information were excluded from the maps.

DEA requirement for EIA	Response / Location in this EIA Report
Support Areas * Critically Endangered and Endangered vegetation areas * Agricultural fields * Irrigated areas * An indication of new road or changes and upgrades that must be done to existing roads in order to get equipment onto the site including cut and fill areas and crossings of rivers and streams	
5. Important stakeholders Amongst other important stakeholders, comments from the National Department of Agriculture, Forestry and Fisheries must be obtained and submitted to the Department. Any application, documentation, notification etc. should be forwarded to the following officials: Ms Mashudu Marubini Delegate of the Minister (Act 70 of 1970) E-mail: MashuduMa@daff.gov.za Tel 012- 319 7619 Ms Thoko Buthelezi AgriLand Liaison office E-mail: ThokoB@daff.gov.za Tel 012- 319 7634	 Comments from the National Department of Agriculture, Forestry and Fisheries (DAFF) have been requested (refer to Appendix C4 for proof). Comments from Regional DAFF have been received on 26 November 2018 and were included in the Final Scoping Report and the EIA Report in **Appendix C4 and C6**. Comments from Jacoline Mans have been received on 27 March 2019 and have been included Report in **Appendix C4** and **C6.**
All hardcopy applications / documentation should be forwarded to the following address: Physical address: Delpen Building Cnr Annie Botha and Union Street Office 270 Attention: Delegate of the Minister Act 70 of 1970 Postal Address: Department of Agriculture, Forestry and Fisheries Private Bag X120 Pretoria 0001 Attention: Delegate of the Minister Act 70 of 1970	Hard copies of documentation submitted to DAFF have been submitted to the Postal Address as provided. Refer to **Appendix C4** for a copy of the proof of delivery of hard copy documentation to DAFF.
In addition, comments must be requested from Eskom regarding grid connectivity and capacity. Request for comment must be submitted to: Mr John Geeringh Eskom Transmission Megawatt Park D1Y38 PO Box 1091	Comments have been requested from Eskom. Refer to **Appendix C4** of this final EIA Report for proof of correspondence submitted to Eskom, and to **Appendix C6** for copies of correspondence / comments received from Eskom.

DEA requirement for EIA	Response / Location in this EIA Report
JOHANNESBURG 2000 Tel: 011 516 7233 Fax: 086 661 4064 John.geeringh@eskom.co.za	
B. AGRICULTURE STUDY REQUIREMENTS	
» Detailed soil assessment of the site in question, incorporating a radius of 50 m surrounding the site, on a scale of 1:10 000 or finer. The soil assessment should include the following: * Identification of the soil forms present on site * The size of the area where a particular soil form is found * GPS readings of soil survey points * The depth of the soil at each survey point * Soil colour * Limiting factors * Clay content * Slope of the site * A detailed map indicating the locality of the soil forms within the specified area, * Size of the site » Exact locality of the site » Current activities on the site, developments, buildings » Surrounding developments / land uses and activities in a radius of 500m of the site » Access routes and the condition thereof » Current status of the land (including erosion, vegetation and a degradation assessment) » Possible land use options for the site » Water availability, source and quality (if available) » Detailed descriptions of why agriculture should or should not be the land use of choice » Impact of the change of land use on the surrounding area » A shape file containing the soil forms and relevant attribute data as depicted on the map.	Refer to **Appendix G** of this final EIA Report for the independent Soils, Land Use, Land Capability and Agricultural Potential Impact Assessment conducted for the project.

6.4. EIA Phase

As per the EIA Regulations (GNR 326) the objectives of the EIA Phase are to, through a consultative process:

» Determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context.

- Describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the development footprint on the approved site as contemplated in the accepted Scoping Report.
- Identify the location of the development footprint within the approved site as contemplated in the accepted Scoping Report based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment.
- Determine the:
  - Nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - Degree to which these impacts:
    - Can be reversed
    - May cause irreplaceable loss of resources
    - Can be avoided, managed or mitigated
- Identify the most ideal location for the activity within the development footprint of the approved site as contemplated in the accepted Scoping Report based on the lowest level of environmental sensitivity identified during the assessment.
- Identify, assess, and rank the impacts the activity will impose on the development footprint on the approved site as contemplated in the accepted Scoping Report through the life of the activity;
- Identify suitable measures to avoid, manage or mitigate identified impacts.
- Identify residual risks that need to be managed and monitored.

This final EIA Report assesses potential positive and negative, direct, indirect, and cumulative impacts associated with all phases of the project life cycle including pre-construction, construction, operation and decommissioning. In this regard the EIA Report aims to provide the relevant authorities with sufficient information to make an informed decision regarding the proposed project.

6.4.1. Tasks completed during the EIA Phase

The EIA Phase for Hyperion Solar Development 2 has been undertaken in accordance with the 2014 EIA Regulations (GNR 326) published in terms of Section 24(5) of NEMA.

Key tasks undertaken during the EIA Phase to date include:

- Consultation with relevant decision-making and regulating authorities (at national, provincial and local levels).
- Undertaking a public participation process throughout the EIA process in accordance with the requirements of Regulations 39 to 44 of the 2014 EIA Regulations (GNR 326) in order to identify any additional issues and concerns associated with the proposed project.
- Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with the requirements of Regulation 44 of the 2014 EIA Regulations (GNR 326).
- Undertaking independent specialist studies in accordance with the requirements of Regulation 23(5) and Appendix 6 of the 2014 EIA Regulations (GNR 326).
- Preparation of an EIA Report in accordance with the requirements of Regulation 23 and Appendix 3 of the 2014 EIA Regulations (GNR 326).

The following subsections outline the activities within the EIA process that have been undertaken to date.

6.4.2. Authority Consultation

The National DEA is the Competent Authority for this application. A record of all authority consultation undertaken is included in this final EIA Report. Consultation with the regulating authorities (i.e. DEA and DENC) has continued throughout the EIA process.

The following steps are to be undertaken as part of this EIA process:

- Make the EIA Report available for a 30-day public and authority review period.
- Notification and consultation with stakeholders, I&APs and Organs of State that may have jurisdiction over the project, including provincial and local government departments, and State Owned Enterprises.
- Incorporating comments received during the 30-day public review period to prepare a Final EIA Report.
- Submission of the Final EIA Report to DEA for decision making.
- Provide an opportunity for DEA and DENC representatives to visit and inspect the proposed site and project area.

A record of the authority consultation during the EIA process to date is included in **Appendix C**.

Comments have been received from the DEA on Hyperion Solar Development 2, dated 13 May 2019. These comments have been included in **Appendix C6** and **Appendix B** and included and responded to in the comments and responses report (**Appendix C8**). The table below also includes the comments received and the EAP's responses to the comments.

DEA Comments	**EAP Response**
However, the Department draws your attention to the following: Please ensure all project components namely all four access road alternatives are included in section 5 of the application form.	The application form has been updated to reflect all access road alternatives and has been submitted with the final EIA Report.
Please confirm the area to be cleared for the construction of access road alternative two (2) in section 7 of the application form.	The application form submitted in December 2018 indicated that Access Road Alternative 2 will traverse a CBA2. Access Road Alternative 2 was renamed to Access Road Alternative 3 during the EIA Phase. The application has been updated to reflect this change and has been submitted with the final EIA Report. Approximately 12 240m^2 of indigenous vegetation will be cleared for Access Road Alternative 3.
Please ensure that maps illustrate all the project components inclusive of all four access road alternatives.	A layout map of Hyperion Solar Development 2 including all four access road alternatives has been compiled and included in **Appendix N** of the final EIA Report.

Please provide details of the offsite mitigation measures that are to be implemented to mitigate impacts of clearance of *Vachellia erioloba* and *Vachellia haematoxylon* species.	The Ecological Impact Assessment (refer to section 3.6, **Appendix D** of the final EIA Report) includes details of the offsite mitigation measures to be implemented for Hyperion Solar Development 2 as well as guidelines to be considered.
Ensure that the layout plan for each of the Hyperion developments project encompasses the entire Hyperion development footprint with the specific Hyperion development project highlighted to give an overall representation of the infrastructure for the proposed development.	A layout map indicating the project site with the development footprint for all four Hyperion Solar Developments have been compiled and included in **Appendix N** of the final EIA Report.
A layout plan overlaid by all the sensitive features including the Critical Biodiversity Area two (CBA 2) which shows the location of all the proposed development infrastructure together with the existing structures must be submitted with the final EIAr	The environmental sensitivity and layout map has been updated to include the location of the CBA 2 and has been included as Figure 10.3 in Chapter 10 and in **Appendix N** of the final EIA Report.
Further ensure that all features are clearly indicated on the legend of the sensitivity layout plan.	The legend of the sensitivity layout map clearly indicates all infrastructure and features identified.
Furthermore, you are reminded to ensure that all issues raised and comments received during the circulation of the draft EIAr from registered I&APs and organs of state which have jurisdiction in respect of the proposed activity are adequately addressed in the final EIAr	All written comments received during the 30-day review and comment period of the draft EIAr have been captured in the C&RR and the issues / comments raised have been adequately addressed. Please refer to **Appendix C8** of the final EIAr.
Also ensure that proof of correspondence with the various stakeholders during the draft EIAr must be included in the final EIAr.	Proof of correspondence with registered I&APs are included in **Appendix C5** and proof of correspondence with Organs of State are included in **Appendix C4** of the final EIAr
Should you be unable to obtain comments, proof of the attempts that were made to obtain comments must be submitted to the Department for consideration.	Proof of reminders to submit comments are included in **Appendices C4 and C5** of the final EIAr.
The Public Participation Process must be conducted in terms of Regulations 39, 40, 41, 42, 43 & 44 of the EIA Regulations 2014, as amended.	The Public Participation Process is being conducted in accordance with Regulations 39, 40 41, 42, 43 and 44 of the 2014 EIA Regulations (GNR 326) as amended. An overview of the Public Participation Process is provided in Chapter 6, Section 6.4.3 of the Final EIA Report.
You are further reminded that the final EIR to be submitted to this Department must comply with all the requirements in terms of the scope of assessment and content of Environmental Impact Assessment Report in accordance with Appendix 3 and Regulation 23(1) of the amended EIA Regulations, 2014.	The Final EIA Report complies with the requirements in terms of the scope of assessment and has been compiled in accordance with Appendix 3 and Regulation 23(1) of the EIA Regulations 2014.
Further note that in terms of Regulation 45 of the EIA Regulations 2014, this application will lapse if the applicant fails to meet any of the timeframes prescribed in terms of the these Regulations, unless an extension has been granted in terms of Regulation 3(7).	The applicant is cognisant of Regulation 45 of the EIA Regulations of 2014 (as emended). All prescribed timeframes have been met by the applicant.

You are hereby reminded of Section 24F of the National Environmental Management Act, Act No 107 of 1998, as amended, that no activity may commence prior to an environmental authorisation being granted by the Department.	The applicant is cognisant of the need to comply with Section 24F of NEMA with regards to commencing with listed activities. No activities have or will commence on site prior to environmental authorisation being granted by the DEA.

6.4.3. Public Involvement and Consultation

The public participation process has been undertaken in accordance with the requirements of Regulations 39 to 44 of the 2014 EIA Regulations (GNR 326). The aim of the public participation process is primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project is made available to potential stakeholders and I&APs.
» Participation by I&APs is facilitated in such a manner that all potential stakeholders and I&APs are provided with a reasonable opportunity to comment on the proposed project.
» Comments received from stakeholders and I&APs are recorded and incorporated into the EIA process.

In order to accommodate the varying needs of stakeholders and I&APs within the study area, as well as capture their inputs regarding the project, various opportunities for stakeholders and I&APs to be involved in the EIA Phase have been provided, as follows:

» Opportunity for review of the EIA Report for a 30-day period from **05 April 2019** to **10 May 2019.** Comments received from I&APs during this period has been captured within a Comments and Response Report and, included within the Final EIA Report
» Focus Group Meetings were held during the 30-day public review period.
» One-on-one consultation, where required i.e. with DAFF, NC DENC, DWS.
» Telephonic consultation sessions (consultation with various parties from the EIA project team, including the Public Participation Consultant, and EIA Consultants).
» Written, faxed or e-mail correspondence.

Comments of from I&APs received to date are included in the Comments and Response (C&R) Report attached as **Appendix C8** to this final EIA Report. Comments raised by I&APs during the EIA process have been synthesised into this Comments and Responses (C&R) Report. The C&R Report includes responses from members of the EIA project team and / or project proponent. The key issues emanating from the public participation process thus far are summarised below in **Table 6.4**.

Table 6.4: Summary of key issues raised during the public participation process.

Summary of main issues raised by I&APs	Summary of response from EAP
The DAFF indicated that the proposed development may have significant impacts on *Vachellia erioloba* and *Vachellia haematoxylon*. The Department further advised that once the threshold of 2000 protected trees are exceeded, a biodiversity offset may be required to compensate for the loss of large numbers of protected trees. Offsets must be in the form of land formally declared as Nature Reserves or Protected Area.	The development of the four Hyperion Solar Developments within the same property may have a significant impact on *Vachellia erioloba* and *Vachellia haematoxylon* given that (as per the fauna and flora specialist scoping report dated September 2018), it is stated that the project site has a high abundance of *V. erioloba* and *V. haematoxylon*, and that relatively large numbers of *Acacia haematoxylon* (2000-6000) would potentially be lost within each development footprint.

	In order to establish a way forward regarding whether an offset is required, a site visit with the DAFF and the NC DENC was undertaken on 26 February 2019. It was determined that a possible biodiversity offset may be required. It was further explained that this was not an official response, and that the results of the site meeting would need to be brought to the attention of Jacoline Mans' colleagues at DAFF and NC DENC to determine a more definitive way forward. DAFF confirmed on 27 March 2019 that an offset will not be required for Hyperion Solar Development 2 but that the project may be subject to an offsite mitigation condition such as greening. Confirmation has been included in **Appendix C6** of this EIA Report.
Alternative 2 access road proposed during the Scoping Phase is not feasible nor is it supported, because it passes through a portion of Kathu Forest Protected Woodland and may have unwanted, additional dust impacts on trees in the Woodland. The report mentioned that this access alternative is located within a Critical Biodiversity Area, probably attributed to the Kathu Forest Protected Woodland.	Alternative 2 has been realigned to avoid the protected Kathu Forest and is now proposed as Access Road Alternative 3 in this EIA Report.
Schalk Burger advised that some of the farms he owns, will be influenced by Access Road Alternative 2. Alternative 2 is proposed to meet T25 at a sharp (almost 90 degrees) bend. Taking into consideration that T25 already has very high traffic, the proposed Alternative will be hazardous. An entrance can't be made on that sharp bend, since you don't have a clear view of oncoming traffic on the other side of the bend. Traffic also moves quite fast on that part of the road.	Alternative 2 has been realigned to avoid the sharp entrance to the T25 gravel road and is now proposed as Access Road Alternative 3 in this EIA Report.
The proposed activities triggers *Section 21 (a) of the National Water Act, 1998 (Act 36 of 1998)*, for taking water from a water resource, as it was indicated in the report that water supply will be from two boreholes.	The requirement for a water use license prior to construction of the solar energy facility will be included in the Environmental Management Programme (EMPr). The actual activities to be triggered will however be fully determined once a positive decision on the EA has been received, and the project is selected as a Preferred Bidder, which is in line with the requirements of the Department.

Public participation documentation from the process to date is included in **Appendix C**.

6.4.4. Assessment of Issues Identified as part of the EIA Process

In accordance with the approved Plan of Study for EIA, issues which required investigation during the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in **Table 6.5**.

Table 6.5: Specialist Studies undertaken as part of the EIA Phase.

Specialist Study	Specialist Company	Specialist Name	Appendix
Ecology (Flora and Fauna)	3Foxes Biodiversity Solutions	Simon Todd	Appendix D

Avifauna	3Foxes Biodiversity Solutions	Simon Todd and Eric Hermann	Appendix E
Watercourses	Scientific Aquatic Services	Stephen van Staden Christel du Preez	Appendix F
Soils and Agricultural Potential Impact Assessment	TerraAfrica	Mariné Pienaar	Appendix G
Visual	Environmental Planning and Design	Jon Marshall	Appendix H
Heritage (Archaeology and Palaeontology)	Asha Consulting (in consultation with John Almond of Natura Viva)	Jayson Orton	Appendix I
Social	Dr Neville Bews and Associates[27]	Dr Neville Bews	Appendix J

Identified impacts are assessed in terms of the following:

» The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high)
» The **duration**, wherein it is indicated whether:
  * The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
  * The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
  * Medium-term (5–15 years) – assigned a score of 3
  * Long term (> 15 years) - assigned a score of 4
  * Permanent - assigned a score of 5
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment
  * 2 is minor and will not result in an impact on processes
  * 4 is low and will cause a slight impact on processes
  * 6 is moderate and will result in processes continuing but in a modified way
  * 8 is high (processes are altered to the extent that they temporarily cease)
  * 10 is very high and results in complete destruction of patterns and permanent cessation of processes
» The **probability of occurrence**, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
  * Assigned a score of 1–5, where 1 is very improbable (probably will not happen)
  * Assigned a score of 2 is improbable (some possibility, but low likelihood)
  * Assigned a score of 3 is probable (distinct possibility)
  * Assigned a score of 4 is highly probable (most likely)
  * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures)
» The **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high
» The **status**, which is described as either positive, negative or neutral

[27] Due to unavailability, the Social Impact Assessment was undertaken by Dr Neville Bews and not Sarah Watson of Savannah Environmental as per the Plan of Study included in the Scoping Report.

» 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

The **significance** is determined by combining the criteria in the following formula:

S = (E+D+M) P; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area)
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated)
» **60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area)

As the developer has the responsibility to avoid or minimise impacts and plan for their management (in terms of the requirements of NEMA and the 2014 EIA Regulations (GNR 326)), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An EMPr has been prepared for the project and is attached as **Appendix K** to this final EIA Report.

6.4.5. Assumptions and Limitations

The following assumptions and limitations are applicable to the studies undertaken within this EIA Phase:

» All information provided by the developer and I&APs to the environmental team was correct and valid at the time it was provided.
» It is assumed that the development site identified by the developer and their engineers represents a technically suitable site for the establishment of the proposed solar energy generation facility and associated infrastructure.
» It is assumed that the grid connection solution is both technically feasible and viable, and that the developer has consulted with Eskom in this regard.
» Conclusions of specialist studies undertaken and this overall Impact Assessment assume that any potential impacts on the environment associated with the proposed development will be avoided, mitigated, or offset.
» This EIA Report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

Refer to the specialist studies provided in **Appendices D – J** for limitations specific to the independent specialist studies.

6.5. Legislation and Guidelines that have informed the preparation of this EIA Report

The following legislation and guidelines have informed the scope and content of this final EIA Report:

» NEMA
» The 2014 EIA Regulations (GNR 326), and Listing Notices published under Chapter 5 of NEMA (GNR 327, GNR 325, and GNR 324).
» International guidelines – the Equator Principles and the IFC Performance Standards and EHS Guidelines.

Several other Acts, standards or guidelines have also informed the project process and the scope of issues addressed and assessed in this EIA Report. A review of legislative requirements applicable to the proposed project is provided in **Table 6.6**.

Table 6.6: Relevant legislative permitting requirements applicable to Hyperion Solar Development 2

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that: "*Everyone has the right –* » *To an environment that is not harmful to their health or well-being, and* » *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:* ∗ *Prevent pollution and ecological degradation,* ∗ *Promote conservation, and* ∗ *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development*."	Applicable to all authorities	There are no permitting requirements associated with this Act. The application of the Environmental Right however implies that environmental impacts associated with proposed developments are considered separately and cumulatively. It is also important to note that the "right to an environment clause" includes the notion that justifiable economic and social development should be promoted, through the use of natural resources and ecologically sustainable development.
National Environmental Management Act (No 107 of 1998) (NEMA)	The 2014 EIA Regulations have been promulgated in terms of Chapter 5 of NEMA. Listed activities which may not commence without EA are identified within the Listing Notices (GNR 327, GNR 325 and GNR 324) which form part of these Regulations (GNR 326). In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be assessed and reported on to the competent authority charged by NEMA with granting of the relevant environmental authorisation. In terms of the Listing Notices (GNR 327, GNR 325 and GNR 324), a full Scoping and EIA Process is required to be undertaken for the proposed project.	DEA – Competent Authority Northern Cape DENC – Commenting Authority	The listed activities triggered by the proposed project have been identified and are being assessed as part of the EIA process currently underway for the project. The Scoping and EIA process will culminate in the submission of a Final EIA Report to the competent and commenting authority in support of the application for EA.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Environmental Management Act (No 107 of 1998) (NEMA)	In terms of the "Duty of Care and Remediation of Environmental Damage" provision in Section 28(1) of NEMA every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment. In terms of NEMA, it is the legal duty of a project proponent to consider a project holistically, and to consider the cumulative effect of a variety of impacts.	DEA Northern Cape DENC	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application during the EIA Phase through the consideration of potential cumulative, direct, and indirect impacts. It will continue to apply throughout the life cycle of the project.
Environment Conservation Act (No. 73 of 1989) (ECA)	The Noise Control Regulations in terms of Section 25 of the ECA contain regulations applicable for the control of noise in the Provinces of Limpopo, North West, Mpumalanga, Northern Cape, Eastern Cape, and KwaZulu-Natal Provinces. The Noise Control Regulations cover the powers of a local authority, general prohibitions, prohibitions of disturbing noise, prohibitions of noise nuisance, use of measuring instruments, exemptions, attachments, and penalties. In terms of the Noise Control Regulations, no person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, machine, device or apparatus or any combination thereof (Regulation 04).	DEA Northern Cape DENC Gamagara LM	Noise impacts are expected to be associated with the construction phase of the project. Provided that appropriate mitigation measures are implemented, construction noise is likely to present a significant intrusion to the local community. There is therefore no requirement for a noise permit in terms of the legislation.
National Water Act (No. 36 of 1998) (NWA)	A water use listed under Section 21 of the NWA must be licensed with the Regional DWS, unless it is listed in	Regional DWS	Although the development footprint of Hyperion Solar Development 2 avoids all

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	Schedule 1 of the NWA (i.e. is an existing lawful use), is permissible under a GA, or if a responsible authority waives the need for a licence. Water use is defined broadly, and includes consumptive and non-consumptive water uses, taking and storing water, activities which reduce stream flow, waste discharges and disposals, controlled activities (activities which impact detrimentally on a water resource), altering a watercourse, removing water found underground for certain purposes, and recreation. Consumptive water uses may include taking water from a water resource (Section 21(a)), and storing water (Section 21(b)). Non-consumptive water uses may include impeding or diverting of flow in a watercourse (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).		watercourses, the development area traverse a 500m buffer surrounding a depression wetland. The impact on watercourses have been assessed and are included in **Appendix F** of the EIA Report. In the event that water required for the project is sourced from a borehole on-site Section 21(a) of the NWA would be triggered, and the project proponent would need to apply for or Water Use License (WUL) or register a General Authorisation (GA) with the DWS.
Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)	In accordance with the provisions of the MPRDA a mining permit is required in accordance with Section 27(6) of the Act where a mineral in question is to be mined, including the mining of materials from a borrow pit.	DMR	Any person who wishes to apply for a mining permit in accordance with Section 27(6) must simultaneously apply for an Environmental Authorisation in terms of NEMA. No borrow pits are expected to be required for the construction of the project, and as a result a mining permit or EA is not required to be obtained.
	Section 53 of the MPRDA states that any person who intends to use the surface of any land in any way which may be contrary to any object of the Act, or which is likely to impede any such object must apply to the Minister for		In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources to ensure that the proposed development does not sterilise a

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	approval in the prescribed manner.		mineral resource that might occur on site.
National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)	The National Dust Control Regulations (GNR 827) published under Section 32 of NEM:AQA prescribe the general measures for the control of dust in all areas, and provide a standard for acceptable dustfall rates for residential and non-residential areas. In accordance with the Regulations (GNR 827) any person who conducts any activity in such a way as to give rise to dust in quantities and concentrations that may exceed the dustfall standard set out in Regulation 03 must, upon receipt of a notice from the air quality officer, implement a dustfall monitoring programme. Any person who has exceeded the dustfall standard set out in Regulation 03 must, within three months after submission of the dustfall monitoring report, develop and submit a dust management plan to the air quality officer for approval.	Northern Cape DENC / John Taolo Gaetsewe DM	In the event that the project results in the generation of excessive levels of dust the possibility could exist that a dustfall monitoring programme would be required for the project, in which case dustfall monitoring results from the dustfall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed. However granted that appropriate mitigation measures are implemented, the proposed project is not anticipated to result in significant dust generation.
National Heritage Resources Act (No. 25 of 1999) (NHRA)	Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance. Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites. Section 36 of the NHRA provides for the conservation and care of cemeteries and graves by SAHRA where this is not the responsibility of any other authority. Section 38 of the NHRA lists activities which require	SAHRA Ngwao Boswa Kapa Bokone (NBKB)	A full Heritage Impact Assessment (HIA) (with field work) has been undertaken as part of the EIA Phase (refer to **Appendix I** of this EIA Report). Three heritage sites have been identified within the 20m corridor for Access Road Alternative 1. Construction within this area is deemed acceptable. Should a heritage resource be impacted upon, a permit may be required from SAHRA or Ngwao Boswa Kapa Bokone (NBKB) in accordance with of Section 48 of

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	developers or any person who intends to undertake a listed activity to notify the responsible heritage resources authority and furnish it with details regarding the location, nature, and extent of the proposed development. Section 44 of the NHRA requires the compilation of a Conservation Management Plan as well as a permit from SAHRA for the presentation of archaeological sites as part of tourism attraction.		the NHRA, and the SAHRA Permit Regulations (GNR 668). This will be determined once the final location of the project and its associated infrastructure within the project site has been determined.
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Section 53 of NEM:BA provides for the MEC / Minister to identify any process or activity in such a listed ecosystem as a threatening process. Three government notices have been published in terms of Section 56(1) of NEM:BA as follows: » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). It provides for listing threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), and vulnerable (VU) or protected. The first national list of threatened terrestrial ecosystems has been gazetted, together with supporting information on the listing process including the purpose and rationale for listing ecosystems, the criteria used to identify listed ecosystems, the implications of listing ecosystems, and summary statistics and national maps of listed ecosystems (NEM:BA: National list of ecosystems that are threatened and in need of protection, (Government Gazette 37596,	DEA Northern Cape DENC	Under NEM:BA, a permit would be required for any activity which is of a nature that may negatively impact on the survival of a listed protected species.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	GNR 324), 29 April 2014).		
National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)	Chapter 5 of NEM:BA pertains to alien and invasive species, and states that a person may not carry out a restricted activity involving a specimen of an alien species without a permit issued in terms of Chapter 7 of NEM:BA, and that a permit may only be issued after a prescribed assessment of risks and potential impacts on biodiversity is carried out. Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).	DEA Northern Cape DENC	Restricted Activities and the respective requirements applicable to persons in control of different categories of listed invasive species are contained within the Alien and Invasive Species Regulations (GNR 598) published under NEM:BA, together with the requirements of the Risk Assessment to be undertaken.
Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)	Section 05 of CARA provides for the prohibition of the spreading of weeds. Regulation 15 of GNR 1048 published under CARA provides for the classification of categories of weeds and invader plants, and restrictions in terms of where these species may occur. Regulation 15E of GNR 1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.	DAFF	CARA will find application throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies need to be developed and implemented. In addition, a weed control and management plan must be implemented. The permission of DAFF will be required if the Project requires the draining of vleis, marshes or water sponges on land outside urban areas. However this is not anticipated to be required for the project. In terms of Regulation 15E (GNR 1048) where Category 1, 2 or 3 plants occur a land user is required to control such plants by means of one or more of the following methods:

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			» Uprooting, felling, cutting or burning. » Treatment with a weed killer that is registered for use in connection with such plants in accordance with the directions for the use of such a weed killer. » Biological control carried out in accordance with the stipulations of the Agricultural Pests Act (No. 36 of 1983), the ECA and any other applicable legislation. » Any other method of treatment recognised by the executive officer that has as its object the control of plants concerned, subject to the provisions of sub-regulation (4). » A combination of one or more of the methods prescribed, save that biological control reserves and areas where biological control agents are effective shall not be disturbed by other control methods to the extent that the agents are destroyed or become ineffective.
National Forests Act (No. 84 of 1998) (NFA)	According to this Act, the Minister may declare a tree, group of trees, woodland or a species of trees as protected. Notice of the List of Protected Tree Species under the National Forests Act (No. 84 of 1998) was published in GNR 734. The prohibitions provide that "no person may cut, damage, disturb, destroy or remove any protected tree, or	DAFF	A licence is required for the removal of protected trees. It is therefore necessary to conduct a survey that will determine the number and relevant details pertaining to protected tree species present on the project site for the submission of relevant permits to authorities prior to the disturbance of these individuals.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister".		The ecological specialist study undertaken as part of the EIA Phase included a site visit which allowed for the identification of any protected tree species which may require a license in terms of the NFA within the project site (refer to **Appendix D** of this EIA Report). xx 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.
National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)	Chapter 4 of the NVFFA places a duty on owners to prepare and maintain firebreaks, the procedure in this regard, and the role of adjoining owners and the fire protection association. Provision is also made for the making of firebreaks on the international boundary of the Republic of South Africa. The applicant must ensure that firebreaks are wide and long enough to have a reasonable chance of preventing a veldfire from spreading to or from neighbouring land, it does not cause soil erosion, and it is reasonably free of inflammable material capable of carrying a veldfire across it. Chapter 5 of the Act places a duty on all owners to acquire equipment and have available personnel to fight fires. Every owner on whose land a veldfire may start or burn or from whose land it may spread must have such equipment, protective clothing and trained personnel for extinguishing fires, and ensure that in his or her absence	DAFF	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of the project, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and personnel for firefighting purposes.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	responsible persons are present on or near his or her land who, in the event of fire, will extinguish the fire or assist in doing so, and take all reasonable steps to alert the owners of adjoining land and the relevant fire protection association, if any.		
Hazardous Substances Act (No. 15 of 1973) (HAS)	This Act regulates the control of substances that may cause injury, or ill health, or death due to their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger, to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and products. » Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc., nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared as Group I or Group II substance » Group IV: any electronic product, and » Group V: any radioactive material. The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.	Department of Health (DoH)	It is necessary to identify and list all Group I, II, III, and IV hazardous substances that may be on site and in what operational context they are used, stored or handled. If applicable, a license would be required to be obtained from the Department of Health (DoH).
National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)	The Minister may by notice in the Gazette publish a list of waste management activities that have, or are likely to have, a detrimental effect on the environment.	DEA – hazardous waste Northern Cape DENC – general waste	No listed activities are triggered by the project and therefore no Waste Management License is required to be obtained. General and hazardous waste

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	The Minister may amend the list by – » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. In terms of the Regulations published in terms of NEM:WA (GNR 912), a BA or EIA is required to be undertaken for identified listed activities. Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that: » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unlit for the safe storage of waste. » Adequate measures are taken to prevent accidental spillage or leaking. » The waste cannot be blown away. » Nuisances such as odour, visual impacts and breeding of vectors do not arise, and » Pollution of the environment and harm to health are prevented.		handling, storage and disposal will be required during construction and operation. The National Norms and Standards for the Storage of Waste (GNR 926) published under Section 7(1)(c) of NEM:WA will need to be considered in this regard.
National Road Traffic Act (No. 93 of 1996) (NRTA)	The technical recommendations for highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on	SANRAL – national roads Northern Cape DoT	An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits will be required for vehicles carrying abnormally heavy or abnormally dimensioned loads. Transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded,

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges, and culverts. The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.		some of the substation components may not meet specified dimensional limitations (height and width).
	Provincial Policies / Legislation		
Northern Cape Nature Conservation Act (Act No. 9 of 2009)	This Act provides for the sustainable utilisation of wild animals, aquatic biota and plants; provides for the implementation of the Convention on International Trade in Endangered Species of Wild Fauna and Flora; provides for offences and penalties for contravention of the Act; provides for the appointment of nature conservators to implement the provisions of the Act; and provides for the issuing of permits and other authorisations. Amongst other regulations, the following may apply to the current project: » Boundary fences may not be altered in such a way as to prevent wild animals from freely moving onto or off of a property; » Aquatic habitats may not be destroyed or damaged; » The owner of land upon which an invasive species is found (plant or animal) must take the necessary steps to eradicate or destroy such species; The Act provides lists of protected species for the Province.	Northern Cape Department of Environment and Nature Conservation (DENC).	A collection/destruction permit must be obtained from Northern Cape Nature Conservation for the removal of any protected plant or animal species found on site. The Ecological Impact Assessment (**Appendix D**) did not identify any species protected under this Act within the development footprint.

6.5.1. *Best Practice Guidelines Birds & Solar Energy (2017)*

The Best Practice Guidelines Birds & Solar Energy (2017) proposed by the Birds and Renewable Energy Specialist Group (BARESG) (convened by BirdLife South Africa and the Endangered Wildlife Trust) contain guidelines for assessing and monitoring the impact of solar generation facilities on birds in Southern Africa. The guidelines recognise the impact that solar energy may have on birds, through for example the alteration of habitat, the displacement of populations from preferred habitat, and collision and burn mortality associated with elements of solar hardware and ancillary infrastructure; and the fact that the nature and implications of these effects are poorly understood.

The guidelines are aimed at EAPs, avifaunal specialists, developers and regulators and propose a tiered assessment process, including:

(i) Preliminary avifaunal assessment – an initial assessment of the likely avifauna in the area and possible impacts, preferably informed by a brief site visit and by collation of available data; also including the design of a site-specific survey and monitoring project should this be deemed necessary.
(ii) Data collection – further accumulation and consolidation of the relevant avian data, possibly including the execution of baseline data collection work (as specified by the preliminary assessment), intended to inform the avian impact study.
(iii) Impact assessment – a full assessment of the likely impacts and available mitigation options, based on the results of systematic and quantified monitoring if this was deemed a requisite at preliminary assessment.
(iv) Monitoring – repetition of baseline data collection, plus the collection of mortality data. This helps to develop a complete before and after picture of impacts, and to determine if proposed mitigation measures are implemented and are effective, or require further refinement. Monitoring may only be necessary for projects with the potential for significant negative impacts on birds (i.e. large area affected and / or vulnerable species present).

In terms of the guidelines the quantity and quality of baseline data required to inform the assessment process at each site should be set in terms of the size of the site and the predicted impacts of the solar technology in question, the anticipated sensitivity of the local avifauna (for example, the diversity and relative abundance of priority species present, proximity to important flyways, wetlands or other focal sites) and the amount of existing data available for the area.

Data collection could vary from a single, short field visit (Regime 1, for e.g. at a small or medium sized site with low avifaunal sensitivity), to a series of multi-day survey periods, including the collection of various forms of data describing avian abundance, distribution and movement and spread over 12 months (Regime 3, for e.g. at a large developments located in a sensitive habitat, or which otherwise may have significant impacts on avifauna). **Table 6.7** is taken from the best practise guidelines and provides a summary of the recommended assessment regimes in relation to proposed solar energy technology, project size, and likely risk).

Table 6.7: Recommended avian assessment regimes in relation to proposed solar energy technology, project size, and known impact risks.

Type of technology*	Size**	Avifaunal Sensitivity***		
		Low	Medium	High
All except CSP power tower	Small (< 30ha)	Regime 1	Regime 1	Regime 2
	Medium (30 – 150ha)	Regime 1	Regime 2	Regime 2
	Large (> 150ha)	Regime 2****	Regime 2	Regime 3
CSP power tower	All	Regime 3		

Regime 1: One site visit (peak season); minimum 1 – 5 days.
Regime 2: Pre- and post-construction; minimum 2 – 3 x 3 – 5 days over 6 months (including peak season); carcass searches.
Regime 3: Pre- and post-construction; minimum 4 – 5 x 4 – 8 days over 12 months, carcass searches.

* Different technologies may carry different intrinsic levels of risk, which should be taken into account in impact significance ratings

** For multi-phased projects, the aggregate footprint of all the phases should be used. At 3ha per MW, Small = < 10MW, Medium = 10 – 50MW, Large = > 50MW.

*** The avifaunal sensitivity is based on the number of priority species present, or potentially present, the regional, national or global importance of the affected area for these species (both individually and collectively), and the perceived susceptibility of these species (both individually and collectively) to the anticipated impacts of development. For example, an area would be considered to be of high avifaunal sensitivity if one or more of the following is found (or suspected to occur) within the broader impact zone:
1) Avifaunal habitat (e.g. a wetlands, nesting or roost sites) of regional or national significance.
2) A population of a priority species that is of regional or national significance.
3) A bird movement corridor that is of regional or national significance.
4) A protected area and / or Important Bird and Biodiversity Area.
An area would be considered to be of medium avifaunal sensitivity if it does not qualify as high avifaunal sensitivity, but one or more of the following is found (or suspected to occur) within the broader impact zone
1) Avifaunal habitat (e.g. a wetland, nesting or roost sites) of local significance.
2) A locally significant population of a priority species.
3) A locally significant bird movement corridor.
An area would be considered to be of low avifaunal sensitivity if it is does not meet any of the above criteria.

**** Regime 1 may be applied to some large sites, but only in instances where there is abundant existing data to support the assessment of low sensitivity.

For the purposes of Hyperion Solar Development 2 the project has been classified as **Regime 2 site**. Two sets of monitoring (i.e. a wet and a dry monitoring season) of 3 days each (i.e. 2 x 3 days over 6 months) have been undertaken as part of the independent Avifauna Impact Assessment conducted as part of the EIA process (i.e. 13 to 16 August 2018 and 29 to 31 January 2019). The results from the monitoring have been used to inform both the development footprint and Avifauna Impact Assessment report, attached as **Appendix E** to this final EIA Report.

6.5.2. *The IFC EHS Guidelines*

The IFC EHS Guidelines are technical reference documents with general and industry specific examples of Good International Industry Practice (GIIP). The following IFC EHS Guidelines have relevance to the proposed project:

» IFC EHS General Guidelines

» IFC EHS Guidelines for Electric Power Transmission and Distribution

The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines, however no Industry Sector EHS Guidelines have been developed for PV solar power to date. The application of the General EHS Guidelines should be tailored to the hazards and risks associated with a project, and should take into consideration site-specific variables which may be applicable, such as host country context, assimilative capacity of the environment, and other project factors. In instances where host country regulations differ from the standards presented in the EHS Guidelines, whichever is the more stringent of the two in this regard should be applied.

The General EHS Guidelines include consideration of the following:

- Environmental:
  - Air Emissions and Ambient Air Quality
  - Energy Conservation
  - Wastewater and Ambient Water Quality
  - Water Conservation
  - Hazardous Materials Management
  - Waste Management
  - Noise
  - Contaminated Land
- Occupational Health and Safety:
  - General Facility Design and Operation
  - Communication and Training
  - Physical Hazards
  - Chemical Hazards
  - Biological Hazards
  - Radiological Hazards
  - Personal Protective Equipment (PPE)
  - Special Hazard Environments
  - Monitoring
- Community Health and Safety:
  - Water Quality and Availability
  - Structural Safety of Project Infrastructure
  - Life and Fire Safety (L&FS)
  - Traffic Safety
  - Transport of Hazardous Materials
  - Disease Prevention
  - Emergency Preparedness and Response
- Construction and Decommissioning:
  - Environment
  - Occupational Health & Safety
  - Community Health & Safety

6.5.3. *IFC's Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)*

While no Industry Sector EHS Guidelines have been developed for PV Solar Power, the IFC has published a Project Developer's Guide to Utility-Scale Solar Photovoltaic Power Plants (IFC, 2015). Chapter 8 of the Project Developer's Guide pertains to Permits, Licensing and Environmental Considerations, and states that in order to deliver a project which will be acceptable to international lending institutions, environmental and social assessments should be carried out in accordance with the requirements of the key international standards and principles, namely the Equator Principles and IFC's Performance Standards.

Some of the key environmental considerations for solar PV power plants contained within the Project Developer's Guide include:

6.5.3.1. Construction Phase Impacts

Construction activities lead to temporary air emissions (dust and vehicle emissions), noise related to excavation, construction and vehicle transit, solid waste generation and wastewater generation from temporary building sites and worker accommodation. In addition, Occupational Health and Safety (OHS) is an issue that needs to be properly managed during construction in order to minimise the risk of preventable accidents leading to injuries and / or fatalities. Proper OHS risk identification and management measures should be incorporated in every project's management plan and standard Engineering, Procurement and Construction (EPC) contractual clauses.

Response:
Impacts associated with the construction phase of development have been identified and assessed as part of the detailed independent specialist studies undertaken as part of the EIA process. Where applicable appropriate mitigation measures with which to minimise the significance of construction phase impacts have been identified and included in the EMPr prepared for the project and attached as **Appendix K** to this **final** EIA Report.

6.5.3.2. Water Usage

Although water use requirements are typically low for solar PV plants, clusters of PV plants may have a high cumulative water use requirement in arid areas where local communities rely upon scarce groundwater resources. In such scenarios, water consumption should be estimated and compared to local water abstraction by communities (if any), to ensure no adverse impacts on local people. O&M methods in relation to water availability and use should be carefully reviewed where risks of adverse impacts to community usage are identified.

Response:
Hyperion Solar Development 2 would require 10 000m³ of water during the 12 month construction period, and approximately 50 000m³ of water per year over the 25 year operational lifespan. The following option is being considered for the project. This include

» Sourcing water from two existing boreholes located on the property during construction and operation. A water purification plant may be installed to purify the borehole water to potable standards.

The recommendation that measures with which to minimise the projects water requirements must be investigated by the project developer has been made in the overall conclusion of the EIA Report (refer to **Chapter 10** of this EIA Report) and is included in the EMPr prepared for the project, and attached as **Appendix K** to this **final** EIA Report.

6.5.3.3. Land Matters

As solar power is one of the most land-intensive power generation technologies, land acquisition procedures and in particular the avoidance or proper mitigation of involuntary land acquisition / resettlement are critical to the success of the project. This includes land acquired either temporarily or permanently for the project site itself and any associated infrastructure – i.e., access roads, powerlines, construction camps (if any) and switchyards. If involuntary land acquisition is unavoidable, a Resettlement Action Plan (RAP) (dealing with physical displacement and any associated economic displacement) or Livelihood Restoration Plan (LRP) (dealing with economic displacement only) will be required. This is often a crucial issue with respect to local social license to operate, and needs to be handled with due care and attention by suitably qualified persons.

Response:
Hyperion Solar Development 2 is proposed on a portion of the Remaining Extent of the Farm Lyndoch 432. A landowner / lease agreement will be entered into between the project developer and landowner to provide for the utilisation of the land for the development of Hyperion Solar Development 2. No involuntary land acquisition or resettlement is required or will take place as a result of the project.

6.5.3.4. Landscape and Visual Impacts

Key impacts can include the visibility of the solar panels within the wider landscape and associated impacts on landscape designations, character types and surrounding communities. Common mitigation measures to reduce impacts can include consideration of layout, size and scale during the design process and landscaping / planting in order to screen the modules from surrounding receptors. Note that it is important that the impact of shading on energy yield is considered for any new planting requirements. Solar panels are designed to absorb, not reflect, irradiation. However, glint and glare should be a consideration in the environmental assessment process to account for potential impacts on landscape / visual and aviation aspects.

Response:
Potential visual impacts associated with the development of Hyperion Solar Development 2 have been assessed as part of the Visual Impact Assessment specialist study conducted as part of the EIA process. Measures with which to avoid, or if avoidance is not possible minimise, and mitigate any negative visual impacts have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix K** to this **final** EIA Report.

6.5.3.5. Ecology and Natural Resources

Potential impacts on ecology can include habitat loss / fragmentation, impacts on designated areas and disturbance or displacement of protected or vulnerable species. Receptors of key consideration are likely to include nationally and internationally important sites for wildlife and protected species such as bats, breeding birds and reptiles. Ecological baseline surveys should be carried out where potentially sensitive habitat, including undisturbed natural habitat, is to be impacted, to determine key receptors of relevance to each site. Mitigation measures can include careful site layout and design to avoid areas of high ecological value or translocation of valued ecological receptors. Habitat enhancement measures could be considered where appropriate to offset adverse impacts on sensitive habitat at a site, though avoidance of such habitats is a far more preferable option.

Response:
Potential ecological impacts associated with the development of Hyperion Solar Development 2 have been assessed as part of the Ecology Impact Assessment (refer to **Appendix D**) and Avifauna Impact Assessment (refer to **Appendix E**) conducted as part of the EIA process. Measures with which to avoid, or if avoidance is not possible minimise, and mitigate any negative ecological impacts have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix K** to this EIA Report. Areas of ecological sensitivity are reflected in an environmental sensitivity map prepared for the project (refer to **Chapter 10** and **Appendix N**) and have been utilised to inform the development footprint so that such areas are suitably avoided.

6.5.3.6. Cultural Heritage

Potential impacts on cultural heritage can include impacts on the setting of designated sites or direct impacts on below-ground archaeological deposits as a result of ground disturbance during construction. Where indicated as a potential issue by the initial environmental review / scoping study, field surveys should be carried out prior to construction to determine key heritage and archaeological features at, or in proximity to, the site. Mitigation measures can include careful site layout and design to avoid areas of cultural heritage or archaeological value and implementation of a 'chance find' procedure that addresses and protects cultural heritage finds made during a project's construction and/or operation phases.

Response:
Heritage impacts associated with the development of Hyperion Solar Development 2 have been assessed as part of the Heritage Impact Assessment conducted as part of the EIA process, which includes consideration of heritage, archaeological, and palaeontological resources. Measures with which to avoid, or if avoidance is not possible minimise, and mitigate any negative heritage impacts (including those on heritage, archaeology, and palaeontology) have been identified, and are contained within the EMPr prepared for the project and attached as **Appendix K** to this EIA Report. Areas of heritage sensitivity are reflected in an environmental sensitivity map prepared for the project (refer to **Chapter 10** and **Appendix N**) and have been utilised to inform the development footprint so that such areas are suitably avoided.

6.5.3.7. Transport and Access

The impacts of transportation of materials and personnel should be assessed in order to identify the most appropriate transport route to the site while minimising the impacts on project-affected communities. The requirement for any oversized vehicles / abnormal loads should be considered to ensure access is appropriate. Onsite access tracks should be permeable and developed to minimise disturbance to agricultural land. Where project construction traffic has to traverse local communities, traffic management plans should be incorporated into the environmental and social management plan and EPC requirements for the project.

Response:
Access to the Remaining Extent of the Farm Lyndoch 432 i.e. the project site can be obtained via the T26 gravel road which can be accessed from the N14 national route located approximately 6km south of the project site and the T25 gravel road which can also be accessed from the N14 national route. Within the facility development footprint, access will be required from new / existing roads for construction purposes (and limited access for maintenance during operation). Four access road alternatives have been assessed. The final layout has been

determined following the identification of site related sensitivities.

The national, regional, secondary and proposed internal access roads will be used to transport all components and equipment required during the construction phase of the solar facility. Some of the components (i.e. substation transformer) may be defined as abnormal loads in terms of the National Road Traffic Act (No. 93 of 1996) (NRTO) by virtue of the dimensional limitations. A permit will be required in accordance with Section 81 of the National Road Traffic Act (No. 93 of 1996) (NRTA) which pertains to vehicles and loads which may be exempted from provisions of Act.

6.5.3.8. Drainage / Flooding

A review of flood risk should be undertaken to determine if there are any areas of high flood risk associated with the site. Existing and new drainage should also be considered to ensure run-off is controlled to minimise erosion.

Response:
A stormwater management plan has been prepared for the project, and is included in **Appendix G** of the EMPr, prepared for the project and attached as **Appendix K** to this EIA Report.

6.5.3.9. Consultation and Disclosure

It is recommended that early stage consultation is sought with key authorities, statutory bodies, affected communities and other relevant stakeholders. This is valuable in the assessment of project viability, and may guide and increase the efficiency of the development process. Early consultation can also inform the design process to minimise potential environmental impacts and maintain overall sustainability of the project. The authorities, statutory bodies and stakeholders that should be consulted vary from country to country but usually include the following organisation types:

» Local and / or regional consenting authority.
» Government energy department / ministry.
» Environmental agencies / departments.
» Archaeological agencies / departments.
» Civil aviation authorities / Ministry of Defence (if located near an airport).
» Roads authority.
» Health and safety agencies / departments.
» Electricity utilities.
» Military authorities.

Community engagement is an important part of project development and should be an on-going process involving the disclosure of information to project-affected communities. The purpose of community engagement is to build and maintain over time a constructive relationship with communities located in close proximity to the project and to identify and mitigate the key impacts on project-affected communities. The nature and frequency of community engagement should reflect the project's risks to, and adverse impacts on, the affected communities.

Response:
A Public Participation Process as prescribed by Chapter 6 of the 2014 EIA Regulations (GNR 326) is being conducted as part of the EIA process being undertaken for the project. This Public Participation Process includes

consultation with key authorities, affected and surrounding landowners, local communities, and other relevant stakeholders. The following stakeholders have been identified and registered as I&APs as part of the EIA process to date:

» Local and / or regional consenting authority.
  * National DEA
  * Northern Cape DENC
  * John Taolo Gaetsewe DM
  * Gamagara LM
» Government energy department / ministry.
  * DoE
  * NERSA
» Environmental agencies / departments.
  * National DEA
  * Northern Cape DENC
  * DAFF
  * DWS
  * DMR
  * BirdLife South Africa
  * Wildlife and Environment Society of South Africa (WESSA)
» Archaeological agencies / departments.
  * SAHRA
  * Ngwao Boswa Kapa Bokone
» Civil aviation authorities / Ministry of Defence (if located near an airport).
  * South African Civil Aviation Authority (CAA).
» Roads authority.
  * South African National Roads Agency Limited (SANRAL)
  * Northern Cape Department of Roads and Public Works (NCDRPW)
» Health and safety agencies / departments.
  * DoH
» Electricity utilities.
  * Eskom
» Military authorities.
  * South African National Defence Force (SANDF)

6.5.3.10. Environmental and Social Management Plan (ESMP)

Whether or not an ESIA or equivalent has been completed for the site, an ESMP should be compiled to ensure that mitigation measures for relevant impacts of the type identified above (and any others) are identified and incorporated into project construction procedures and contracts. Mitigation measures may include, for example, dust suppression during construction, safety induction, training and monitoring programs for workers, traffic management measures where routes traverse local communities, implementation of proper waste management procedures, introduction of periodic community engagement activities, implementation of chance find procedures for cultural heritage, erosion control measures, fencing off of any vulnerable or threatened flora species, and so forth. The ESMP should indicate which party will be responsible for (a) funding, and (b) implementing each action, and how this will be monitored and reported on at the project level. The plan should be commensurate to the nature and type of impacts identified.

Response:
Impacts associated with the construction phase of development have been identified and assessed as part of the

independent specialist studies undertaken as part of the EIA process. Appropriate mitigation measures with which to minimise the significance of negative impacts have been identified and are included in the EMPr prepared for the project and attached as **Appendix K** to this **final** EIA Report.

CHAPTER 7. DESCRIPTION OF THE RECEIVING ENVIRONMENT

This Chapter provides a description of the environment that may be affected by Hyperion Solar Development 2. The information is provided in order to assist the reader in understanding the receiving environment within which the project is proposed, and features of the biophysical, social, and economic environment that could be directly or indirectly affected by, or alternatively could impact on, the proposed development. This information has been sourced from existing available information and the on-site specialist investigations conducted as part of the EIA, and aims to provide the context within which this EIA is being conducted. The full impact assessments undertaken by the independent specialists, including detailed descriptions of the affected environment, are attached as **Appendices D to J** of this final EIA Report.

7.1. Regional Setting: Description of the Broader Study Area

The Northern Cape Province is located in the north-western extent of South Africa and constitutes South Africa's largest province; occupying an area 372 889km² in extent, equivalent to nearly a third (30.5%) of the country's total land mass. It is also South Africa's most sparsely populated province with a population of 1 145 861 people, and a population density of 3.1/km². The capital city is Kimberley, and other important towns include Upington, Springbok, Kuruman, De Aar, and Sutherland. It is bordered by the Western Cape, and Eastern Cape Provinces to the south, and south-east; Free State, and North West Provinces to the east; Botswana and Namibia, to the north; and the Atlantic Ocean to the west. The Northern Cape is the only South African province which borders Namibia, and therefore plays an important role in terms of providing linkages between Namibia and the rest of South Africa. The Orange River, which is South Africa's largest river, is a significant feature and is also the main source of water in the Province, while also constituting the international border between the Northern Cape and Namibia.

The Northern Cape makes the smallest contribution to South Africa's economy (contributing only 2% to South Africa's Gross Domestic Product per region (GDP-R) in 2007). The Northern Cape is rich in minerals including alluvial diamonds, iron ore, and copper. The province is also rich in asbestos, manganese, fluorspar, semi-precious stones and marble. The mining sector is the largest contributor to the provincial GDP. The Northern Cape's mining industry is of national and international importance, as it produces approximately 37% of South Africa's diamond output, 44% of its zinc, 70% of its silver, 84% of its iron-ore, 93% of its lead and 99% of its manganese. According to the fourth reviewed IDP of the Gamagara LM, the town of Kathu is considered to be the administrative and economic hub of the municipality which is located within the centre of the Gamagara Mining Corridor.

The province has fertile agricultural land in the Orange River Valley, especially at Upington, Kakamas and Keimoes, where grapes and fruit are cultivated intensively. The agricultural sector employs approximately 19.5% of the total formally employed individuals (LED Strategy). The sector is experiencing significant growth in value-added activities, including game-farming, while food production and processing for the local and export market is also growing significantly (PGDS, July 2011). Approximately 96% of the land is used for stock farming, including cattle and sheep or goats, as well as game farming, while approximately 2% of the province is used for crop farming, mainly under irrigation in the Orange River Valley and Vaalharts Irrigation Scheme (LED Strategy).

The Northern Cape offers unique tourism opportunities including wildlife conservation destinations, natural features, historic sites, festivals, cultural sites, stars gazing, adventure tourism, agricultural tourism, ecotourism, game farms, and hunting areas, etc. The Province is home to the Richtersveld Botanical and Landscape World Heritage Site, which comprises a United Nations Educational, Scientific and Cultural Organisation (UNESCO) World Heritage Site under the World Heritage Convention. The Northern Cape is also home to two Transfrontier National Parks, namely the Kgalagadi Transfrontier Park, and the Richtersveld /Ai-Ais Transfrontier Park, as well as five national parks, and six provincial reserves. The Northern Cape also plays a significant role in South Africa's science and technology sector, as it is home to the Square Kilometre Array (SKA), the Southern African Large Telescope (SALT), and the Karoo Array Telescope (MeerKAT).

The Northern Cape comprises five (5) Districts, namely Frances Baard, Johan Taolo Gaetsewe, Namakwa, Pixley Ka Seme, and ZF Mgcawu (refer to **Figure 7.1**).

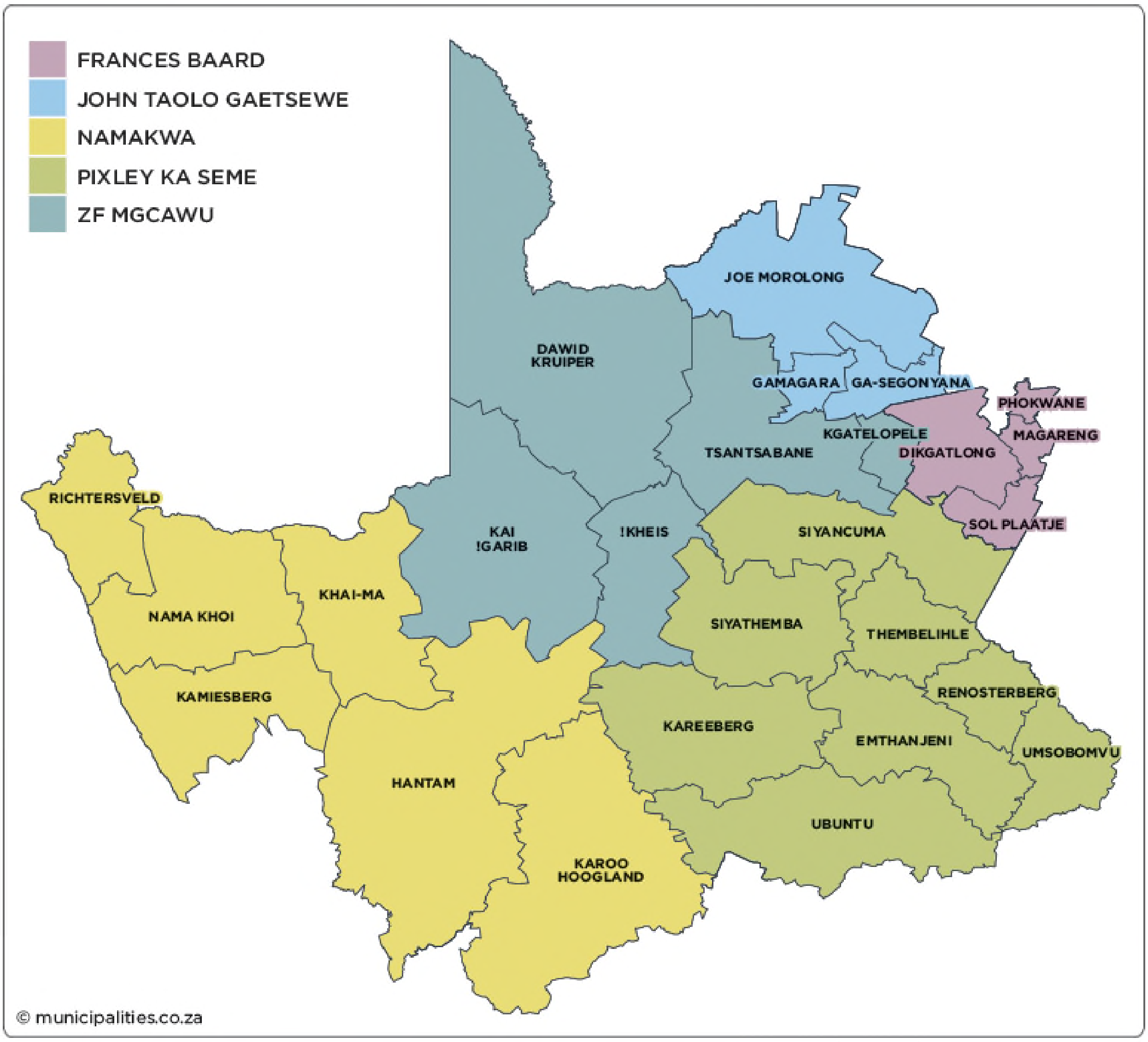


Figure 7.1: Districts of the Northern Cape Province (Source: Municipalities of South Africa).

The John Taolo Gaetsewe DM (previously known as the Kgalagadi DM) is situated in the north-eastern extent of Northern Cape Province, and is bordered by ZF Mgcawu DM to the south-west, and south; Frances Baard DM to the south-east; Dr Ruth Segomotsi Mompati DM of North West Province to the east; and Botswana to the north. It is the second smallest DM in the Province in terms of land mass (27 283km², equivalent to 7.32% of the total Provincial land mass), and third largest in terms of population (224 799, equivalent to 19.62% of the total Provincial population), with the second highest population density of 8.2/km².

The John Taolo Gaetsewe DM comprises 186 towns and settlements, approximately 80% of which includes villages. Predominant towns within the DM include: Bankhara-Bodulong, Dibeng, Hotazel, Kathu, Kuruman, Mothibistad, Olifantshoek, Santoy, and Van Zylsrus. It is characterised by a mixture of land uses, of which agriculture and mining are dominant. The main economic sectors within the DM include agriculture, mining, and retail. The DM holds potential as a viable tourist destination and has numerous growth opportunities in the industrial sector.

The DM comprises 3 Local Municipalities, namely: Gamagara, Ga-Segonyana, and Joe Morolong Local Municipalities. In 2006 the boundaries of the John Taolo Gaetsewe DM were demarcated to include the once north-western part of Gamagara and Olifantshoek, along with its surrounds, into the Gamagara LM (refer to **Figure 7.2**).

Figure 7.2: Local Municipalities of the John Taolo Gaetsewe District (Source: Municipalities of South Africa).

The Gamagara LM is situated approximately 200km north east of Upington and 280km north west of Kimberley in the southern to south-western extent of the John Taolo Gaetsewe DM. It is bordered by the Gamagara LM to the north, the Ga-Segonyana LM to the east, and the Tsantsabane LM of the ZF Mgcawu DM of the Northern Cape Province to the south and west. The Gamagara LM has the smallest population

(41 617) compared to the other LM in the John Taolo Gaetsewe, and is the second most densely populated LM of the John Taolo Gaetsewe DM with a population density of 16/km².

The Gamagara LM comprises five towns, namely: Kathu, Shesheng, Dibeng, Dingleton, and Olifantshoek. Kathu is the largest town, and is also the administrative centre of the Gamagara LM. Olifantshoek is the second largest town, and is located near the Gamagara River to the north west of Kathu, and Dingleton is the smallest of the five towns, and is located in the centre of the mining activities directly south of Kathu.

7.2. Regional Setting: Location and description of the Project Site

The closest towns to the proposed development include Kathu, located approximately 16km south. Other towns in proximity of the project site include Dibeng located approximately 18km west of the project site, and Kuruman located approximately 34km north west of the project site. Built infrastructure in the form of farm homesteads and workers quarters occur within and around the project site, and may be impacted on (i.e. in terms of nuisance and / or visual impacts) as a result of the proposed project.

The Kathu Forest situated north of the town of Kathu has been declared a protected woodland in terms of Section 12(1) (c) of the National Forests Act (No. 84 of 1998) (NFA) in 1995. The Kathu Forest is a unique woodland of exceptionally large camel-thorn trees (*Vachellia erioloba*). The woodland is approximately 4000ha in extent and comprises one of only two such woodlands in the world.

Prominent/major road systems within the area include the N14 located approximately 6km south of the project site, the R380 located approximately 9km west of the project site and the R31 located approximately 25km north of the project site. Current access to the project site is obtained via the T26 gravel road that joins the N14 located south of the project site.

The project site is located approximately 16km north of the existing Ferrum Substation and approximately 14km from the Existing Kathu Substation. There are also a significant number of power lines within the general vicinity, including:

» Ferrum/Umtu 400kV power line which traverses the north-eastern corner of the project site;
» Ferrum/Asbes 66kV power line situated approximately 8.2km south east of the project site;
» Fox/Umtu 132kV power line situated approximately 9km west of the project site;
» Ferrum/Umtu 132kV power line situated approximately 13km south west of the project site; and
» Mookodi/Ferrum 400kV power line situated approximately 14km south east of the project site.

A map illustrating the regional setting of the Hyperion Solar Development 2 project site within the broader study area is included as **Figure 7.3**.

Photographs of the Hyperion Solar Development 2 project site are included in **Table 7.1**. These photographs provide a visual illustration of the project site and the environment which may be affected by the proposed development.

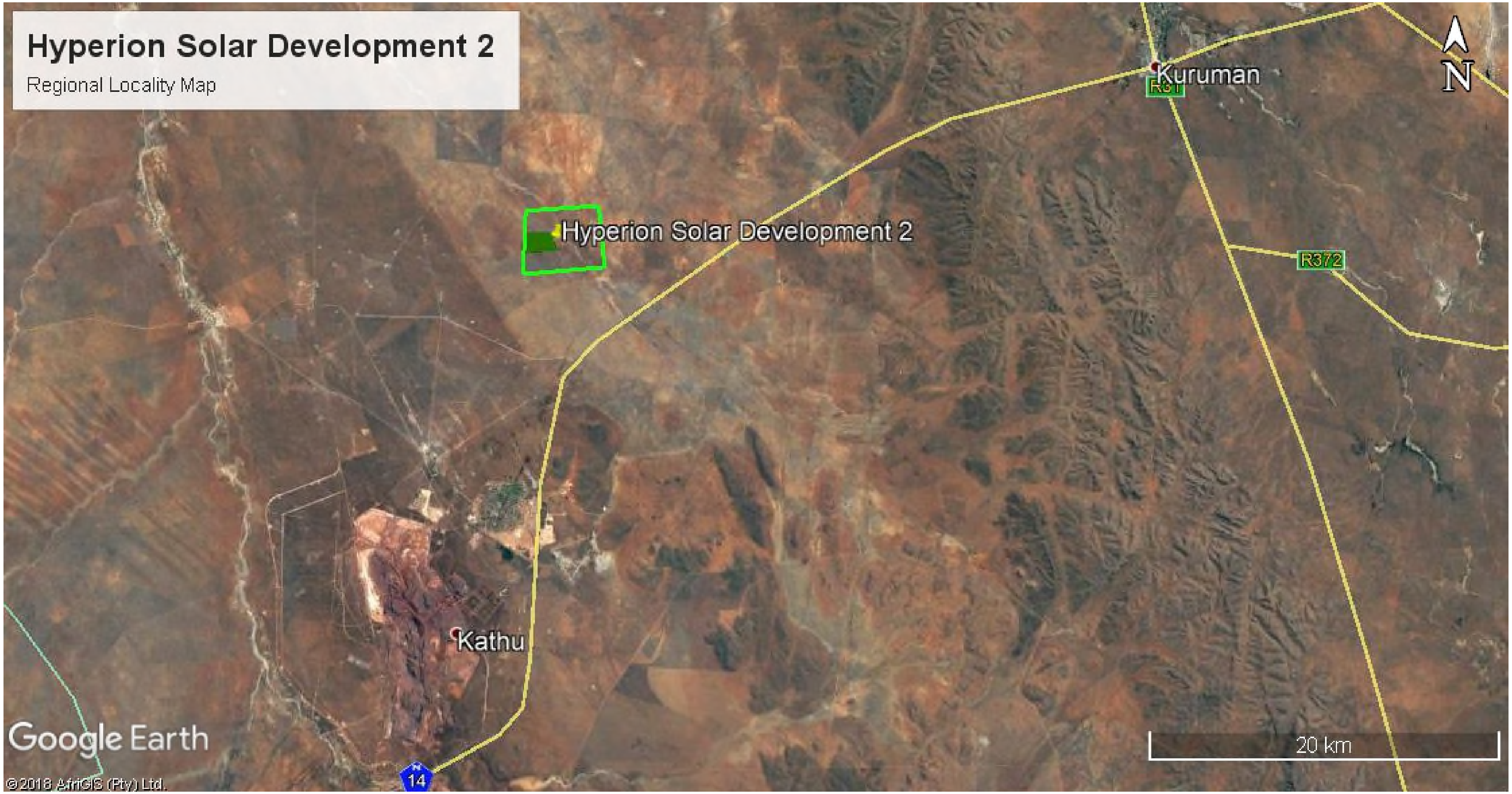
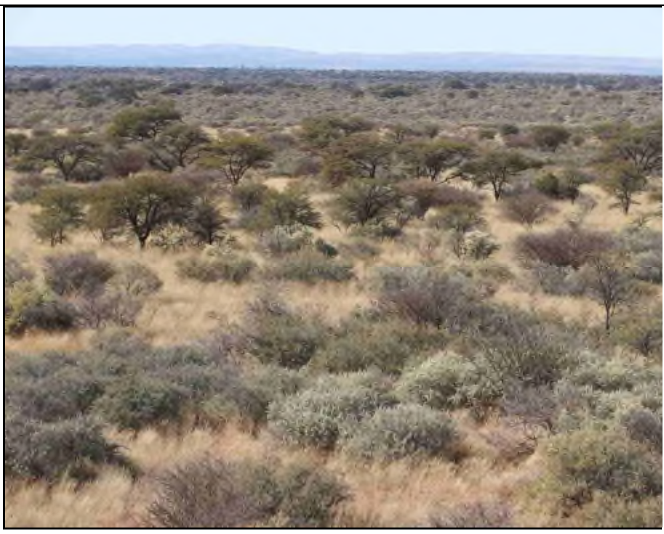


Figure 7.3: Map indicating the regional setting of the Hyperion Solar Development 2 project site.

Table 7.1: Photographs of the Hyperion Solar Development 2 project site.

	
The western part of the project site, showing an area with *Vachellia erioloba*.	Vegetation of the Vlermuisleegte River, showing the large *Vachellia erioloba* trees that characterise the river bed.
	
Tarchonanthus camphoratus scrubland within the western half of the project site. The habitat does support some large *Vachellia erioloba* trees, but these occur at a much lower density compared to the eastern half of the project site.	Open grassland associated with the dry bed of the Vlermuisleegte River that bisects the project site.

7.3. Climatic Conditions

The Kathu area is typically characterised as having a local steppe climate (BSh) with little rainfall. The area receives a mean annual average rainfall of approximately 395mm. Precipitation is highest in March with an average of 74mm; and lowest in July with an average of 3mm. Minimal rain occurs between May to September. The average annual temperature in Kathu is 18.9°C. January is the hottest month of the year with an average temperature of 25.3°C, while July is the coldest month of the year with an average temperature of 10.8°C (refer to **Figure 7.4**). Frost is frequent to very frequent during winter, with up to 37 mean frost days per year. Droughts and floods are a regular occurrence at both provincial and local scales, and play a significant role in almost every aspect of the social, economic, and ecological environment within the Province.

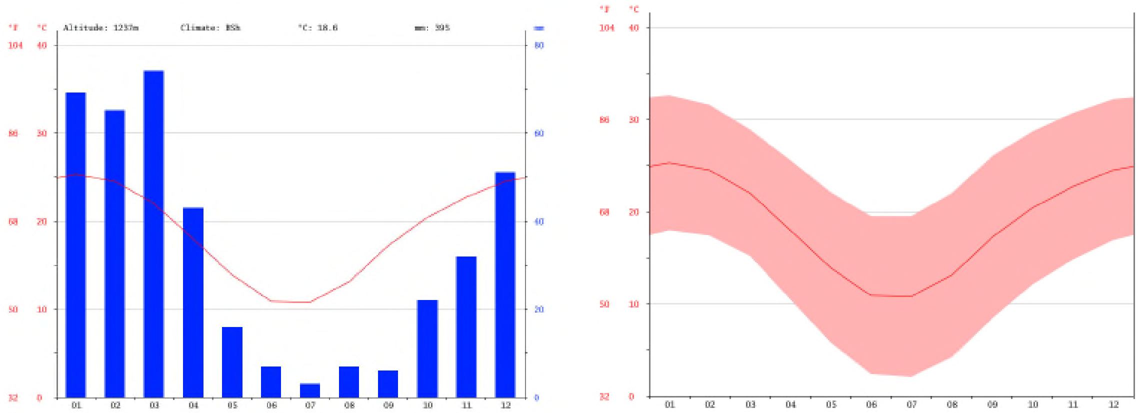


Figure 7.4: Climate and Temperature graphs for Kathu, Northern Cape Province (Source: en.climate-data.org).

7.4. Biophysical Characteristics of the Study Area and Project Site

The following section provides an overview of the biophysical characteristics of the project site.

7.4.1. Landscape Features

The landscape within the project site can be described as flat to very slightly undulating and consists of two terrain units where terrain unit 4 represent the vast flat areas that dominates the landscape and terrain unit 5 represent areas of slight depression where endorheic pans can develop. The project site consists of land type Ah9. Access Road Alternative 1 and 2 is located within this land type. The main landscape feature within the project site is the Vlermuisleegte (non-perennial river) which traverses the centre of the project site and is situated below the level of the surrounding plains. These plains are covered in red sand and grass with some larger *Vachellia erioloba* species.

The landscape along Access Road Alternative 3 and 4 is very similar to that of the project site and can also be described as flat to very slightly undulating, consisting of two terrain units where terrain unit 4 represents the flat areas that dominates the landscape and terrain unit 5 areas of slight depression where endorheic pans can develop. Access Road Alternative 3 and 4 traverse an area consisting of Ag110 and Ah9 land types. **Figure 7.5** provides a profile of the two terrain types present within the project site and along Access Road Alternative 3 and 4.

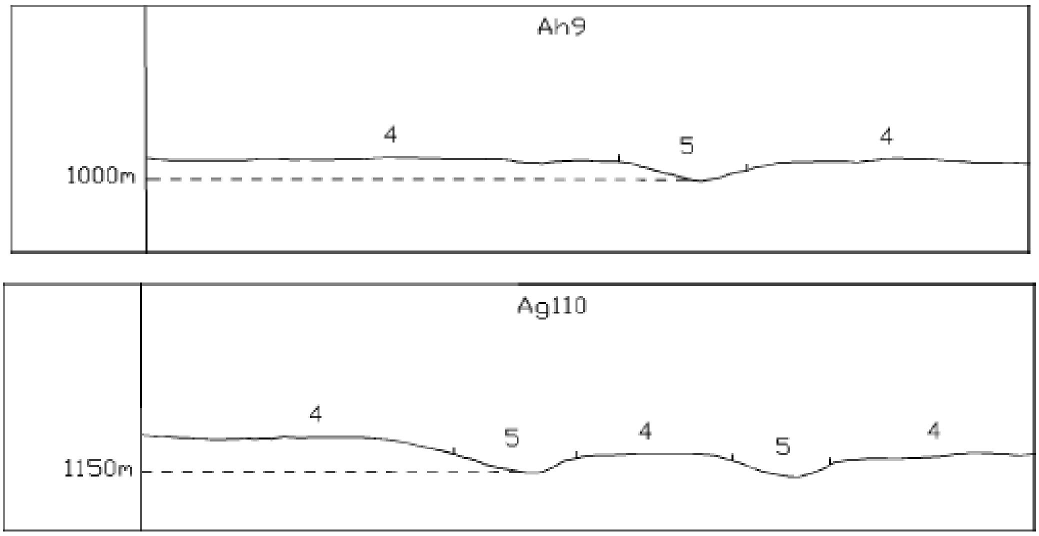


Figure 7.5: Terrain units within Ah9 and Ag110 land types (described in Section 7.4.3 below).

7.4.2. Geology

The Kathu area is largely underlain by Late Cenozoic continental sediments of the Kalahari Group (Partridge *et al.* 2006). Much of the broader study area comprises of thick calcretes of the Mokolanen Formation which could be up to 5 million years old and which are overlain by gravels of the Obobogorop Formation and red Kalahari aeolian sands of the Gordonia Formation. Substantial calcretised deposits including possible unconsolidated alluvium, palaeo-*vlei* or pan deposits and alluvial gravels are associated with the Vlermuisleegte River.

Small sections of inliers of the Precambrian (Proterozoic) basaltic to andesitic lavas of the Ongeluk Formation (Postmasburg Group) are exposed in the north-central and southern portions of the project site. These volcanic rocks form the basement to the Cenozoic Kalahari Group sediments in the region.

7.4.3. Soil, Land types and Agricultural Potential

A land type is defined as an area with a uniform terrain type, macroclimate and broad soil pattern. The area under investigation is covered by the following land types (refer to **Figure 7.6**):

» *Ah9* - The texture of soil in this land type is dominated by sand with the clay fraction estimated as to be less than 10%. Deep Hutton and Clovelly soil forms (deeper than 120cm) constitutes the largest portion of this land type with very limited possibility for finding shallow, rocky soils of the Mispah and Glenrosa forms over the entire land type area (an estimated 3.5%).
» *Ag110* - The texture of soil in this land type is dominated by sand and sandy loam with the clay fraction estimated as to be less than 15%. This land type mainly consists of shallow soil profiles of the Hutton and Mispah soil forms with an estimated 18.5% of areas in this land type consisting of deeper soil profiles of the Hutton form.

The project site has a low to low-moderate land capability, and is poorly suited for arable agriculture. Although the soil forms present within the project site are suitable for arable agriculture in other areas of the country, the project site has a dry, semi-arid climate with erratic rainfall patterns which are not appropriate for dryland crop production. The most suitable land use is livestock grazing with management measures such as controlled grazing, in place. The grazing capacity of the veld for the development area and access road alternatives is 21 – 30 hectares per large animal unit (ha/LSU) or large stock unit (Morgenthal et al., 2005). The entire project site (~1600ha) has the capacity for 53 to 76 head of cattle to graze on. The proposed development area has the capacity for 6 to 19 head of cattle to graze on. Considered in isolation, the development area is not a viable unit for livestock farming but in combination with the remaining area of the project site, it is large enough to function as a sustainable cattle farm.

7.4.4. Hydrology and Geohydrology

The project site is situated within the Lower Vaal Water Management Area (WMA) 10, Quaternary Catchment D41K (Molopo Catchment) and the Southern Kalahari Ecoregion. The project site is furthermore located in an area defined as an upstream management catchment (FEPACODE 4). Upstream management catchments are required to prevent the downstream degradation of FEPAs and Fish Support Areas (FSAs).

The episodic Vlermuisleegte River bisects the centre of the project site and is located east of the proposed Access Road Alternative 1 (refer to **Figure 7.7**). This river drains in a south-eastern to north-western direction and is considered to be largely natural according to the Present Ecological State (PES) 1999. In contrary, the river is classified as moderately modified (Class C) according to the National Freshwater Ecosystem Priority Area (NFEPA) database. Agricultural fields occur within the floodplain associated with the Vlermuisleegte River. This is most likely due to the episodic nature of the river, and the fact that the river consists of enriched, deep soils deposited through alluvial processes. Due to these agricultural activities, the natural indigenous riparian vegetation has been removed. However, analysis of digital satellite imagery indicates that some natural riparian vegetation remains within the area east of the river.

A depression wetland has been identified within the northern portion of the project site, situated within Vlermuisleegte River. This depression is considered to be in a natural or good ecological condition (Class B). Due to the lack of habitat diversity and moderately low hydro-functionality, this depression is not considered to be of significant ecological importance on a landscape scale.

Ten (10) pan wetlands were identified scattered within the investigation area associated with access road Alternative 3, the closest of which is located approximately 45m from the proposed route location (Pan 8). Furthermore, a pan wetland (Pan 11) was identified within the investigation area associated with Access Road Alternative 4, although this system is located approximately 245m from the proposed route. The pans are considered to be mostly natural with no significant impacts to their hydrological or geomorphological properties. Some disturbance to the vegetation was evident primarily due to the trampling and grazing of livestock within and surrounding the pans. This has caused a slight change in ecosystem processes within the pans. These pans are of some importance on a landscape scale, primarily due to the provisioning of habitat (albeit seasonally) by the pans.

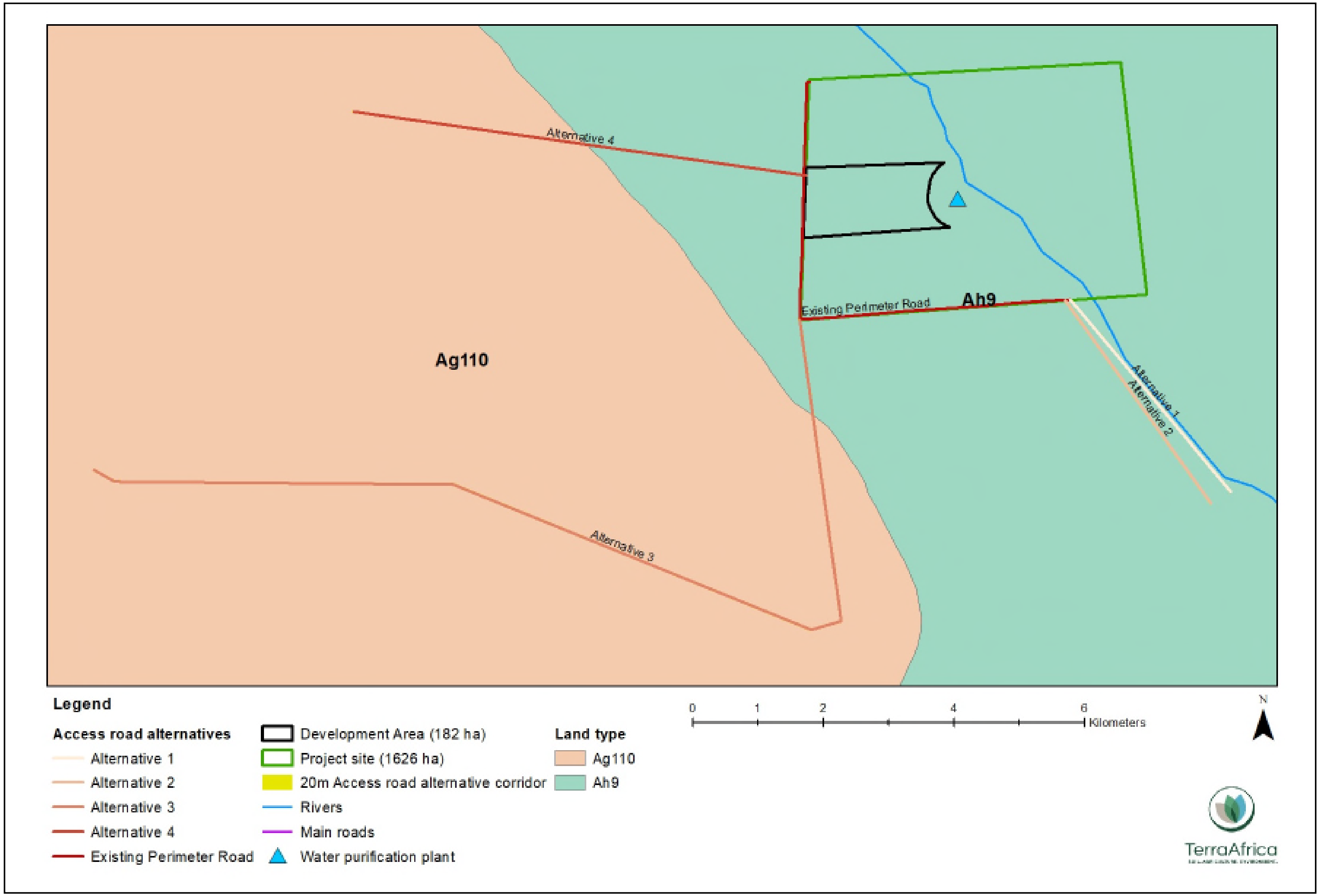


Figure 7.6: Land type map for the project site and access road alternatives.

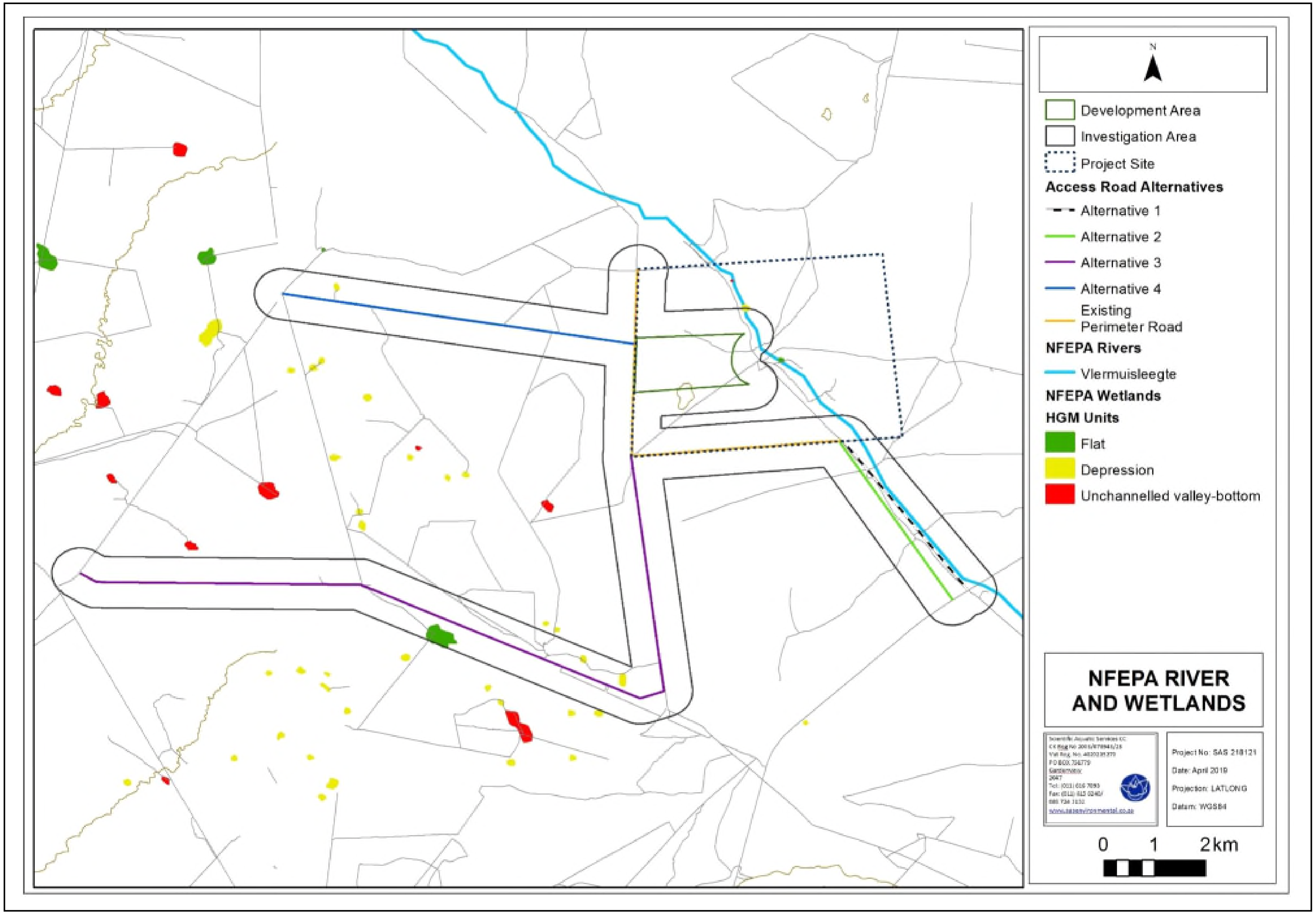


Figure 7.7: Locality and extent of the desktop delineated watercourses associated with the project site and access road alternatives.

7.4.5. *Ecological Profile of the Broader Study Area and the Project Site*

i. Broad-Scale Vegetation Patterns

The vegetation within and surrounding the project site comprises Kathu Bushveld. This vegetation type extends from Kathu and Dibeng in the south through to Hotazel and to the Botswana border between Van Zylsrus and McCarthysrus. The project site also consists of 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 – this area is largely dominated by *Tarchonanthus camphoratus* and *Acacia haematoxylon* with a few areas where *V. erioloba* and/or *A. mellifera* become dominant.
» The Vlermuisleegte River – non-perennial river which has largely been in-filled with sand. It is characterised by a high density of large *V. erioloba* trees.
» The area east of the Vlermuisleegte River - the vegetation within this area is generally more open and largely dominated by *V. erioloba* with some localised areas dominated by *A. mellifera* or *Terminalia sericea*.

Table 7.2: Key species associated with the project site.

Growth Form	Key Species
Dominant tree species	*Tarchonanthus camphoratus*, *Acacia haematoxylon, Vachellia erioloba* and *Acacia mellifera.*
Common woody species	*Zizyphus mucronata, Gymnosporia buxifolia, Acacia mellifera subsp. detinens, Searsia ciliata, Ehretia rigida subsp. rigida, Diospyros lycioides subsp. lycioides* and *Grewia flava.*
Grass layer	*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*
Shrubs	*Asparagus laricinus*, *Asparagus retrofractus*, *Felicia muricata* subsp. *cinerascens*, *Pentzia calcarea*, *Acacia hebeclada*, *Hermannia tomentosa*, *Gnidia polycephala* and *Lantana rugosa*.
Forbs	*Dicoma schinzii*, *Geigeria ornativa*, *Elephantorrhiza elephantina*, *Indigofera daleoides* var. *daleoides* and *Gisekia pharnacioides* var. *pharnacioides*.

Although no endemic species are restricted to the Kathu Bushveld vegetation type, a number of Kalahari endemics are known to occur in this vegetation type such as *A. luederitzii* var *luederitzii, Anthephora argentea*, *Megaloprotachne albescens*, *Panicum kalaharense* and *Neuradopsis bechuanensis*.

The vegetation types of South Africa are categorised according to their conservation status, which is assessed according to the degree of transformation and rates of conservation. The status of a habitat or vegetation type is based on how much of its original area remains intact, relative to various thresholds. On a national scale these thresholds are determined by the best available scientific approaches (Driver et al. 2005) (refer to **Table 7.3**). The level at which an ecosystem becomes Critically Endangered (CR) differs from one ecosystem to another and varies from 16% to 36% (Driver et al. 2005).

Table 7.3: Determining ecosystem status (from Driver et al. 2005). *BT = biodiversity target (the minimum conservation requirement.

Habitat Remaining (%)	80 – 100	Least Threatened	LT
	60 – 80	Vulnerable	VU
	*BT – 60	Endangered	EN
	0 – *BT	Critically Endangered	CR

The National List of Ecosystems that are Threatened and in need of protection (GNR 1002 of 2011), published under the National Environment Management: Biodiversity Act (No. 10 of 2004) (NEM:BA), lists national vegetation types that are afforded protection on the basis of rates of transformation.

According to Mucina and Rutherford (2006) less than 2% of the Kathu Bushveld vegetation type has been transformed, mainly due to mining activity. The conservation status of this vegetation unit is classified as Least Threatened. The vegetation type is however, poorly conserved and does not currently fall within any formal conservation areas.

ii. Listed Plant Species

Three tree species protected under the National Forests Act (No. 84 of 1998) (NFA) 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. The density of *Vachellia erioloba* at the site varies between 2.5 and 70 trees/ha, with an average density of 22 trees/ha.

Apart from these two species, it is possible that Devils' Claw is present at the project 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 Kathu area.

iii. Critical Biodiversity Areas (CBA) and Broad-Scale Processes

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for retaining biodiversity, and supporting continued ecosystem functioning and services. The purpose of the CBA is to spatially indicate the location of critical or important areas for biodiversity in the landscape. The CBA, through the underlying land management objectives that define the CBA, prescribes the desired ecological state in which the Northern Cape Province would like to keep this biodiversity. As a result, the desired ecological state or land management objective determines which land-use activities are compatible with each CBA category, based on the perceived impact of each activity on biodiversity pattern and process.

The majority of the project site lies within an area classified as Other Natural Areas (ONA) according to the Northern Cape Province Critical Biodiversity Areas (CBA) Map (refer to **Figure 7.8**). The Vlermuisleegte corridor is however classified as an Ecological Support Area (ESA) and would be marginally impacted by the proposed development. A small section of the north eastern corner of the development area also falls within this ESA.

Access Road Alternative 1 is aligned within the Vlermuisleegte River ESA. 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. Access Road Alternative 2 is also located within the Vlermuisleegte ESA. Access Road Alternative 3 infringes on a small section of CBA 2 associated with the Camelthorn Forest north of Kathu. Access Road Alternative 4 is mostly located within other natural areas, except towards the Kathu-Hotazel road, where there are some areas of ESA that would be affected.

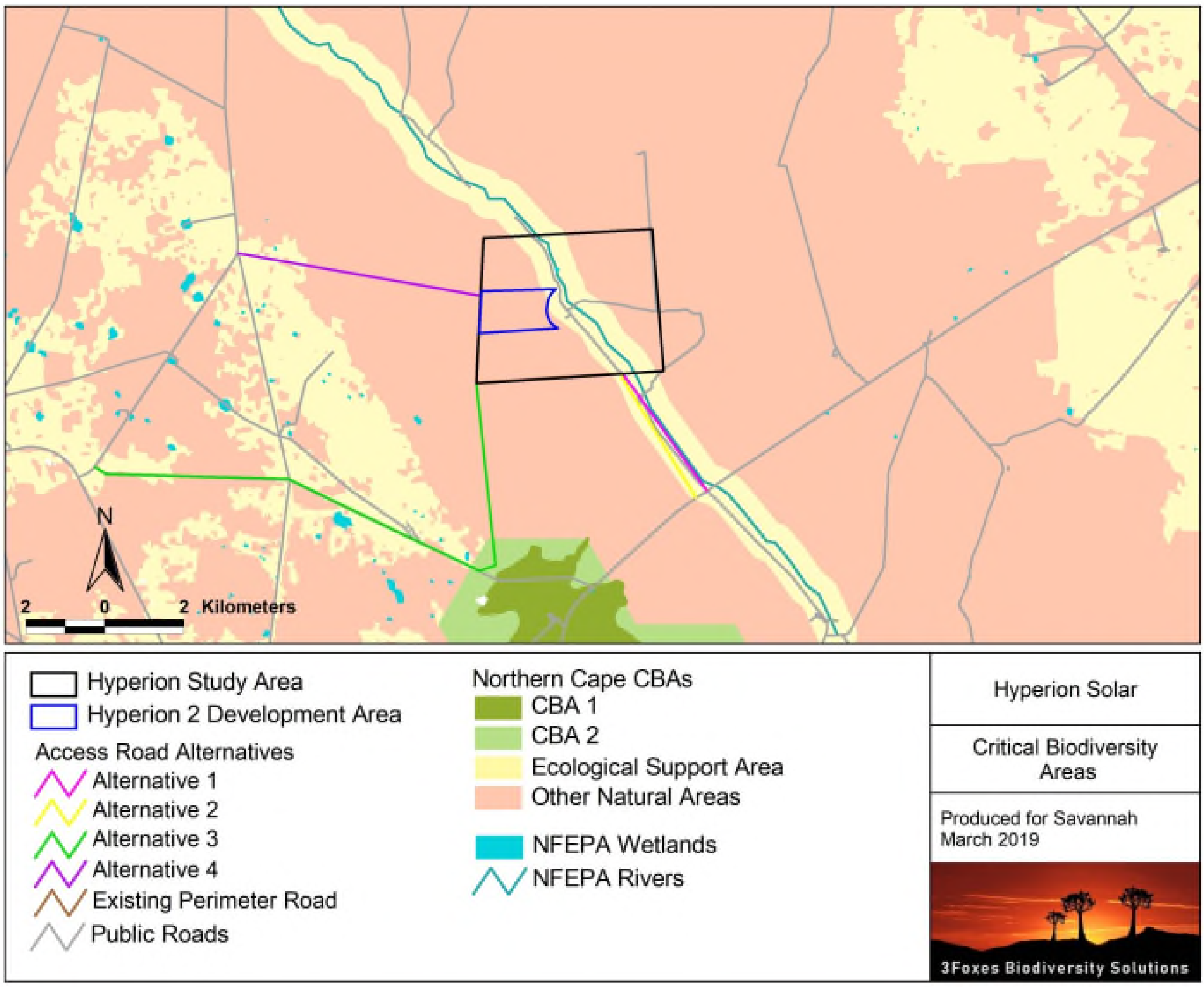


Figure 7.8: Critical Biodiversity Areas Map in relation to the project site and access roads.

iv. Faunal Communities

Terrestrial Mammals

The potential diversity of mammals within the project site is moderate. Although more than 50 species of terrestrial mammals are known from the broader study area, the extent and habitat diversity of the project site is too low to support a very wide range of mammals. Species observed within the project site 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, Multimammate Mouse, Bushveld Gerbil, Hairy footed Gerbil, Pouched Mouse and Grey Climbing Mouse. Listed terrestrial mammal species that potentially occur in the area are included in **Table 7.4**.

Table 7.4: Species listed as conservation worthy within the IUCN Red List (2015). Abbreviations: EN=Endangered, DD=Data Deficient, VU=Vulnerable, NT=Near Threatened, LC=Least Concerned.

Scientific Name	Common Name	IUCN Status
Hyaena brunnea	Brown Hyaena	NT
Felis nigripes	Black-footed Cat	VU
Panthera pardus	Leopard	VU
Smutsia temminckii	Ground Pangolin	VU
Atelerix frontalis	South African Hedgehog	VU

Reptiles

The potential diversity of reptilian species within the greater area is relatively low with up to 50 reptile species. 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 considered important for reptiles. No species of conservation concern are known to occur in the area. The habitat diversity within the project site is also 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 in the broader study area in the past include Serrated Tent Tortoise, Cape Cobra, Ground Agama, Spotted Sand Lizard, Variable Skink, Bibron's Blind Snake, Western Rock Skink, Cape Gecko, Speckled Rock Skink, Striped Skaapsteker and Boomslang.

Amphibians

The potential diversity of amphibian species is regarded as moderate for an arid area, with 10 species having distribution that includes the project site. 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 project 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 project 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 and Bushveld Rain Frog, both of which are likely to occur at the project site.

The only species of conservation concern which occurs in the wider area is the Giant Bullfrog. 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 at the project site.

v. Avifauna

The bird assemblage recorded within the project site is typical of the Kalahari bioregion. Based on information derived from the South African Bird Atlas Project (SABAP1) approximately 220 bird species are expected to occur within the project site and the surrounding area of which 97 species were recorded within the project site during the site visits.

An average of 4.9 species were recorded per point count, with an average of 8.9 individual birds during a site survey undertaken from 13 August 2018 to 16 August 2018 (i.e. in the dry season). An average of 9.8

species were recorded per point count, with an average of 16 individual birds during a site survey undertaken from 29 January 2019 to 31 January 2019 (i.e. in the wet season).

The majority of the species detected (70%) consist of small passerines species, compared to non-passerines (30%). Five near-endemic species reported for the broader study area include Fiscal Flycatcher, Karoo Thrush Fairy Flycatcher, Black-headed Canary and Black Harrier of which only the former two widespread species are relatively common in the broader study area. The endemic Pied Starling is considered an uncommon species in the area, occurring more regularly to the east near Kuruman. The two biome-restricted species that occur in the area, namely, the Kalahari Scrub-robin and Burchell's Sandgrous are common and have widespread distributions through the bioregion.

The most abundant species recorded during point counts at the project site was the Scaly-feathered Finch, Black-chested Prinia, Kalahari Scrub-robin, and Chestnut-vented Warbler. Scaly-feathered Finch showed a marked decline in detectability in summer, whereas the other three species showed the converse. The remaining species had significantly lower encounter rates, with the most common of these being Violet-eared Waxbill, Ant-eating Chat, Fork-tailed Drongo, Yellow Canary, and Brown-crowned Tchagra. During summer the avifauna of the site was augmented with several migratory species such as cuckoos, shrikes, swallows, bee-eaters, nightjars and buttonquails, amongst others. The majority of these species had low detection rates as they are widely distributed across the landscape.

Very few species and individuals were recorded along the walked line transects, and included the following (with the number of detections in parenthesis), Burchell's Sandgrouse, Red-crested Korhaan, Orange River Francolin, Gabar Goshawk and Pale Chanting Goshawk. Due to the low detection rates of these species, no seasonal patterns in detectability were discernible.

The Critically Endangered White-backed Vulture, the Endangered Martial Eagle, the Vulnerable Lanner Falcon and the Near-Threatened Kori Bustard are considered the most important priority species in the area, although these species are not known to breed nor are frequently observed in the area on a regular basis. No sensitive breeding or roosting sites of any red-listed species were observed at the site during the field survey. **Table 7.5** provides a list of Red listed species recorded in the broader study area during SABAP1.

Important avifaunal habitat types

Broad-scale vegetation patterns influence the distribution and abundance of bird species holistically, while vegetation structure, rather than plant species composition, has a greater influence on local avifauna populations and species assemblages (Harrison *et al*., 1997). The project site supports four avifaunal microhabitats;

» *Tarchonanthus camphoratus* dominated scrubland:
  The *Tarchonanthus camphoratus* scrubland dominates the western half of the project site and is the result of a devastating veld fire in 2009 that transformed an open *Vachellia erioloba* woodland to a scrubland. The *Tarchonanthus camphoratus* scrubland support a low density of *Vachellia erioloba* trees and a high density of *Acacia haematoxylon* trees.

» Arid riparian grassland associated with the Vlermuisleegte:

The riparian grassland supports an almost pan-like habitat that may support a different assemblage of bird species compared to the scrub and woodland.

» *Vachellia erioloba* woodland and dense *Acacia mellifera* savanna:
The *Vachellia erioloba* woodland which occurs on the eastern half of the project site, together with extensive *Acacia mellifera* dominated savanna. The *Vachellia erioloba* woodland has a markedly higher density of large *Vachellia erioloba* trees interspersed with patches of *Acacia mellifera*, giving rise to higher structural diversity. A few dense stands of *Terminalia sericea* trees also occur and are generally associated with the *Vachellia erioloba* woodland.

Conservation Areas, Protected Areas and Important Bird Areas (IBA)

The project site is situated approximately 156km south east of the Spitskop Dam which is considered to be an IBA. There are no other formal protected areas or any IBAs and Biodiversity Areas in close proximity to the project site.

Table 7.5: Red-listed species recorded in the broader study area during SABAP1 (1987-1991), ranked according to their red-list status. No species have been reported during SABAP2 (2007 on-going), most likely due to poor coverage in the area. Only Kori Bustard (3 sightings, 4 individuals) has been recorded at the study site, during the summer survey (29 to 31 January 2019).

English Name	Taxonomix Name	Red-list status	Regional endemism	Estimated importance of local population	Preferred habitat	Probability of occurrence
Vulture, White-backed	*Gyps africanus*	Critically Endangered	-	Low	Savanna	Moderate
Bateleur	*Terathopius ecaudatus*	Endangered	-	Low	Savanna	Low
Bustard, Ludwig's	*Neotis ludwigii*	Endangered	Near-endemic	Low	Semi-arid shrublands	Low
Eagle, Martial	*Polemaetus bellicosus*	Endangered	-	Low	Savanna and shrublands	Moderate
Harrier, Black	*Circus maurus*	Endangered	-	Low	Fynbos, Karoo and grassland	Low
Courser, Burchell's	*Cursorius rufus*	Vulnerable	Near-endemic	Low	Shrubland plains	Moderate
Eagle, Verreaux's	*Aquila verreauxii*	Vulnerable	-	Low	Mountainous and rocky areas	Low
Falcon, Lanner	*Falco biarmicus*	Vulnerable	-	Moderate	Widespread	High
Secretarybird	*Sagittarius serpentarius*	Vulnerable	-	Low	Open savanna and grassland	Low
Stork, Black	*Ciconia nigra*	Vulnerable	-	Low	Water bodies	Low
Bustard, Kori	*Ardeotis kori*	Near-threatened	-	Moderate	Open savanna	Moderate
Duck, Maccoa	*Oxyura maccoa*	Near-Threatened	-	Low	Water bodies	Low
Roller, European	*Coracias garrulus*	Near-Threatened	-	Low	Open savanna	Moderate
Stork, Abdim's	*Ciconia abdimii*	Near-threatened	-	Low	Grassland and savanna	Low

7.5. Visual Quality

7.5.1. Landscape Features

Landscape character is defined as "a distinct, recognisable and consistent pattern of elements in the landscape that makes one landscape different from another". Landscape Character is a composite of a number of influencing factors including:

- Landform and drainage;
- Nature and density of development; and
- Vegetation patterns.

i. Landform and drainage

The Vlermuisleegte River is considered to be the main regional drainage feature located in the vicinity of the project site which is a non-perennial river that traverses the centre of the project site. The valley floor falls from southeast to northwest at a gentle gradient of approximately 1:200.

The visual implications of landform include:

- The N14 located approximately 6km to the south at an elevation approximately 30m higher than the proposed project. It is highly likely that the project will be visible from this road.
- The shallow gradient is likely to indicate that the project will be viewed largely in elevation with little or no extended overview.

ii. Nature and Density Development

The population density of the area immediately surrounding the proposed development varies. Kathu is the largest town of five towns within the Gamagara Local Municipality. Rural homesteads were found to have an average occupancy of 3.5 people. This indicates that there is a rural homestead for approximately every 0.75km^2. Kathu is primarily a rural service centre. It is likely that a proportion of its economy is derived from local mining operations as well as its position on the N14 as it acts as a transit stop for travellers including tourists. The town of Kathu also has a regional airport, located approximately 11.7km to the west of the proposed project site.

Given the Province's dry conditions and dependence on irrigation, many Northern Cape farmers are branching out into value-added activities such as game farming. This is apparent in rural areas surrounding the proposed development as low intensity grazing appears to be mixed with game farming, hunting operations and bush lodges.

Apart from agriculture, mining is the largest industrial activity in the area, especially within the area surrounding Kathu. The Mamatwan Manganese Mine operated by Anglo American is located west of Kathu and south of the proposed project site. In addition to Mamatwan Mine, there are numerous areas of degraded land. It is possible that these areas have resulted from informal mining operations. All major mining activities are a significant distance from the project site and are unlikely to have a significant influence on the character of the landscape surrounding the project.

Visual implications of landcover include the potential that homesteads on adjacent farms could have tourism importance if they have been developed with bush lodges and are used for game viewing or hunting operations.

iii. Vegetation Patterns

The proposed project is located in a relatively natural area according to Mucina and Rutherford (2006). Vegetation types within the broader study area include:

- Kuruman Thornveld;
- Kathu Bushveld; and
- Kuruman Mountain Bushveld.

All vegetation types are usually open tree and shrub cover with a sparse grass layer. Visual implications include;

- Where the viewer is amongst natural vegetation, it is possible that there will be a degree of screening provided by the natural vegetation.
- Where the viewer is set back from natural vegetation or where ground elevation provides a slightly elevated overview of the landscape, the extent of screening provided by natural vegetation is likely to be limited.

7.5.2. Visual Receptors

Visual Receptors are defined as "individuals and/or defined groups of people who have the potential to be affected by the proposal".

It is possible that an area might be sensitive due to an existing use of the area. The nature of an outlook is generally more critical to areas that are associated with recreation, tourism and in areas where outlook is critical to land values.

Possible visual receptors within the landscape, which due to use, could be sensitive to landscape change include:

- *Point Receptors*: include homesteads that are scattered throughout the area. It is likely that the focus for this area is agricultural production. Unless farms have diversified into the tourism market it is unlikely that this group of receptors will be overly sensitive to the likely landscape change as long as it does not impact on agricultural productivity.
- *Linear Receptors*: include the N14,the R380 and or local routes through the area. The N14 is a primary tourism route. Local routes surrounding the proposed development is likely to be mainly used by local people and relate to agricultural activities. The R380 provides access to mining areas around Hotazel, which is approximately 41.6km to the north of the proposed project site. This road also links to northern Namibia and probably carries a proportion of tourism traffic. There are existing local roads, which include a minor road that runs to the south and south west of the site and which provides a link between the N14 and the R380 (known as the T25 road).
- *Kathu (Sishen) Airport*: located approximately 11.7km to the southwest of the proposed array. The airport is a regional airport with daily flights to and from O R Tambo. The main concern that is likely with regard to the airport is the potential of glint and glare affecting flights particularly on approach to the airport.

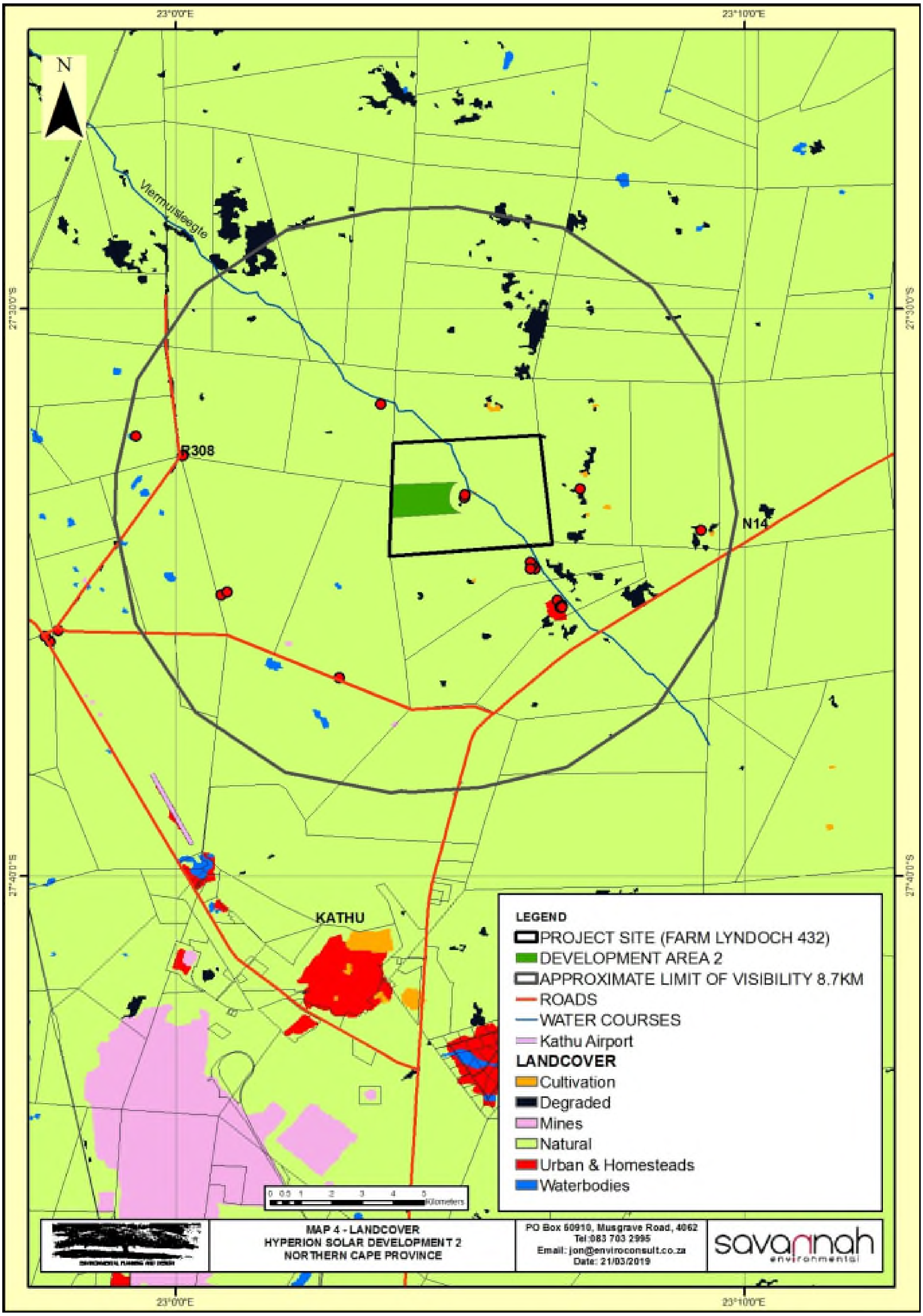


Figure 7.9: Land cover and broad land use patterns map of the project site and surrounding area.

7.6. Social Characteristics of the Broader Study Area and the Project Site

The following is a baseline summary of the socio-economic profile of the Gamagara Local Municipality within which the Hyperion Solar Development 2 is proposed:

» The Gamagara LM covers an area of land approximately 2 619km² in extent, and comprises five towns, namely: Kathu, Shesheng, Dibeng, Dingleton, and Olifantshoek. The town of Kathu is the largest within the LM and the administrative centre of the LM.
» Between 2001 and 2011 the Gamagara LM experienced a positive population growth rate of 5.8% per year, almost doubling in size from 23 202 people in 2001 to 41 617 people in 2011.
» The Gamagara LM is male dominated, with males comprising approximately 54.6% of the LM population.
» Black Africans comprise the predominant population group within the Gamagara LM, John Taolo Gaetsewe DM, and Northern Cape Province.
» The Gamagara LM, John Taolo Gaetsewe DM, and Northern Cape Provincial population age structures are youth dominated. A considerable proportion of the respective populations therefore comprise individuals of the economically active population between the ages of 15 – 64.
» The Gamagara LM has a dependency ratio of 28.1, which is considerably lower than the John Taolo Gaetsewe DM (38.8), Northern Cape Province (35.8), and South Africa (34.5) as a whole.
» The majority of 31.2% of the Gamagara LM population aged 20 years and older have received some form of secondary schooling, while 29.5% have completed Matric, and 5.2% have received some form of higher education. Such figures imply that the LM population can be expected to have a relatively low-skill level and would either require employment in low-skill sectors, or skills development opportunities in order to improve the skills level of the area.
» The unemployment rate of the Gamagara LM is lower than that of the John Taolo Gaetsewe DM, Northern Cape and South Africa as a whole. In addition, the proportion of economically inactive individuals within the Gamagara LM is lower than in the John Taolo Gaetsewe DM.
» Household income levels in the LM are higher than the DM, province and South Africa as a whole, with a lower proportion of low income earners, and higher proportion of high income earners. The area can therefore be expected to have a lower poverty level with associated social consequences such as not being able to pay for basic needs and services, and poor living conditions than that of the DM and Northern Cape Province.
» The primary economic activities within the Gamagara LM include mining, game farming, and business services.
» The Gamagara LM and John Taolo Gaetsewe DM are poorly serviced in terms of public sector health facilities. There are only 3 public sector dentists within the John Taolo Gaetsewe DM, and no public sector optometrists.
» The majority of households within the Gamagara LM comprise formal brick dwellings.
» The majority of households within the Gamagara LM are well serviced with regards to electricity, water, sanitation, and refuse removal.

7.7. Heritage Resources

7.7.1. Heritage and archaeology

The modern town of Kathu dates back to the 1970s when iron ore mining commenced in the area. The former Crown Colony of British Bechuanaland was annexed by the Cape Colony on 16th November 1895. A year later, in December 1896 and January 1897, uprisings collectively known as the Langeberg Rebellion broke out in the area. Over the following months the Tlhaping and Tlharo took root in the Langeberg Mountains, west of modern-day Kathu, and were only suppressed by the Government in August 1897. The discontent among the Tlhaping and Tlharo people had arisen years earlier when, in 1884, approximately 75% of their land was taken away from them. Two years later the Land Commission met to settle land claims after the demise of the Boer Republics of Stellaland and Goshen, but little was done to help the Tlhaping and Tlharo people. Although ten (10) Native Reserves were proclaimed, 1400 square miles of crown land was made available for white settlement which created further friction and unhappiness. In addition to the loss of land, the Tswana chiefs were also losing their authority. Eventually, on 27 November 1896, seventeen head of cattle strayed out of the Taungs Reserve and were shot which appears to have been the critical moment when the rebellion began.

Several Kathu sites, together known as the Kathu Complex, have been formally graded as a Grade 1 heritage resource indicating that the collection of sites has been accorded national significance. An endemic camel-thorn tree forest was registered as a National Heritage site in 1995 and situated north of the town of Kathu. This forest has also been declared a protected woodland in terms of Section 12(1) (c) of the NFA (No. 84 of 1998). The area surrounding Kathu is most well-known for the extensive deposits of Early Stone Age (ESA) material that have been described in literature. The archaeological resources within and beyond the proposed declaration area are under continued threat from development in the vicinity. Archaeology within the surrounding area tends to be physically associated with gravel deposits. South of Kathu, the surface sands are underlain directly by calcrete rather than gravel. The lack of known archaeological sites near the project site does not indicate a lack of archaeological deposits north of Kathu. This paucity is more of a reflection of this area being largely unexamined by archaeologists.

The following features of heritage significance have been identified within close proximity to the project site:

» Kathu Pan;
» Kathu Townlands;
» Nature and density of development; and
» Vegetation patterns

These sites indicate that archaeological materials are fairly widespread around Kathu and the area is best regarded as an archaeological landscape rather than a collection of individual sites.

a) Kathu Pan:

The Kathu Pan was discovered in 1974 and is the most studied and best-known heritage site in the area. The site is a natural sinkhole located within a large pan that, under natural conditions, would have filled with water during the summer (owing to the rising water table during the summer rainy season) and become a valuable water supply for prehistoric populations (Van Zinderen Bakker 1995). A sequence of

Early Stone Age (ESA) deposits including some Fauresmith material and evidence for the onset of the Middle Stone Age (MSA) some 500 000 years ago (Wilkins 2013) have been identified at the site. Wilkins *et al.* (2012) have studied fracture patterns on points from the site and determined that they were used in a hafted manner as spear tips. The site has also yielded very early evidence for blade production (Wilkins & Chazan 2012). Faunal remains, including remains of species such as hippopotamus have been preserved at the site which is unusual for Kathu.

b) Kathu Townlands:

The Kathu Townlands is situated across the surface of a low rise within the boundary of the town of Kathu. It was first reported in 1980 and had initial excavations carried out by Beaumont in 1982 and 1990 (Beaumont 1990). Due to the proposed development on the site, mitigation work was carried out to enable a better understanding of the deposits identified on the site (Walker *et al.* 2013). The archaeological material occurred within a dense accumulation of banded iron formation (BIF) rubble with a sandy matrix directly over bedrock. The artefacts from both the Beaumont and Walker excavations lack evidence of water transport, but damage to the artefacts does indicate mechanical damage through redeposition subsequent to the ESA occupation (Walker *et al.* 2014).

c) Bestwood:

Archaeological sites were first reported at Bestwood by Dreyer (2008) after which further research was undertaken by Chazan *et al.* (2012). Bestwood 1 and Bestwood 2 provide an indication of a larger landscape of artefacts that have been exposed by sand quarrying activity within in a sandy valley. A third site, Bestwood 3, is located on the hilltop along the east side of this valley. Initial investigation at Bestwood 1 revealed a lithic industry characterised by well-made hand-axes, well-retouched scrapers, occasional blades and a great diversity of core types (Chazan *et al.* 2012:331).

Excavations at Bestwood 1 demonstrated that material is present *in situ* in a single horizon beneath the covering sands Walker *et al.* (2013). This horizon is similar to the surface exposures at Bestwood 3 and Uitkoms 1 in terms of artefacts. Considering these observations (as well as other currently unpublished work done at Bestwood), it seems that the archaeological deposit extends beyond the limits of the quarries, across the landscape and connects the two hilltop exposures as a continuous horizon.

d) Uitkoms:

Various archaeological artefacts have been identified within the farm Uitkoms situated north east of Kathu. Beaumont has named these occurrences as Uitkoms 1, 2, 3 and 4. Uitkoms 1 appears to be similar to Kathu Townlands 1 in terms of artefact density and debitage frequency, but occurs on a hilltop. Uitkoms 4 is largely buried beneath surface sands in a manner similar to Bestwood 1 and 2, where bifaces are very similar to those from the quarries, but with a formal tool incidence about a thousand times higher (Beaumont 2008b:3). In 2006, two road cuttings along the N14 towards Kuruman contain ESA artefacts in a thin rubble of jaspilite and below red sand. One of these, Uitkoms 3, suggests that the Uitkoms 1 extends over the north western side of the Kathu hill. Uitkoms 2 could represent the extreme western limit of a site that may range over two upslope hills on Hartnolls (Beaumont, 2007).

7.7.2. Palaeontology (Fossils)

The project site is underlain by Late Cenozoic continental sediments of the Kalahari Group, thick calcretes of the Mokolanen Formation and gravels of the Obobogorop Formation and red Kalahari aeolian sands of the Gordonia Formation. Small inliers of Precambrian (Proterozoic) basaltic to andesitic lavas of the Ongeluk Formation crop out in the north-central and southern portions of the project site. These volcanic rocks form the basement to the Cenozoic Kalahari Group sediments in the region.

Proterozoic (Precambrian) volcanic bedrocks of the Ongeluk Formation are entirely unfossiliferous. The overlying Kalahari Group deposits in the surrounding Kathu area are considered to be of generally low palaeontological sensitivity (Almond 2014, 2015a, 2015b, Pether 2011), although localised areas of high sensitivity may occur. The main palaeontological heritage concern associated with the project site would be Quaternary mammalian remains (bones, teeth and horncores), trace fossils and plant fossils associated with solution hollows as well as ancient pan or *vlei* deposits along drainage lines, such as have been recorded from the well-known Kathu Pan site situated approximately 5.5.km north west of town of Kathu (Beaumont 1990, Beaumont 2004, Beaumont *et al.* 1984) (See also Almond 2013a, 2013b).

The geology of the Kathu region is indicated on 1:250 000 geological map 2722 Kuruman for which a sheet explanation has not yet been published (refer to **Figure 7.10**). The project site, Access Road Alternative 1 and 2 are located within a moderate fossil sensitivity. Access Road Alternative 3 and 4 falls within areas of moderate and high fossil sensitivity. Based on the specialist's own field experience from other projects, suggests that it should better be regarded as of generally low sensitivity with the possibility of small pockets of high sensitivity occurring in places.

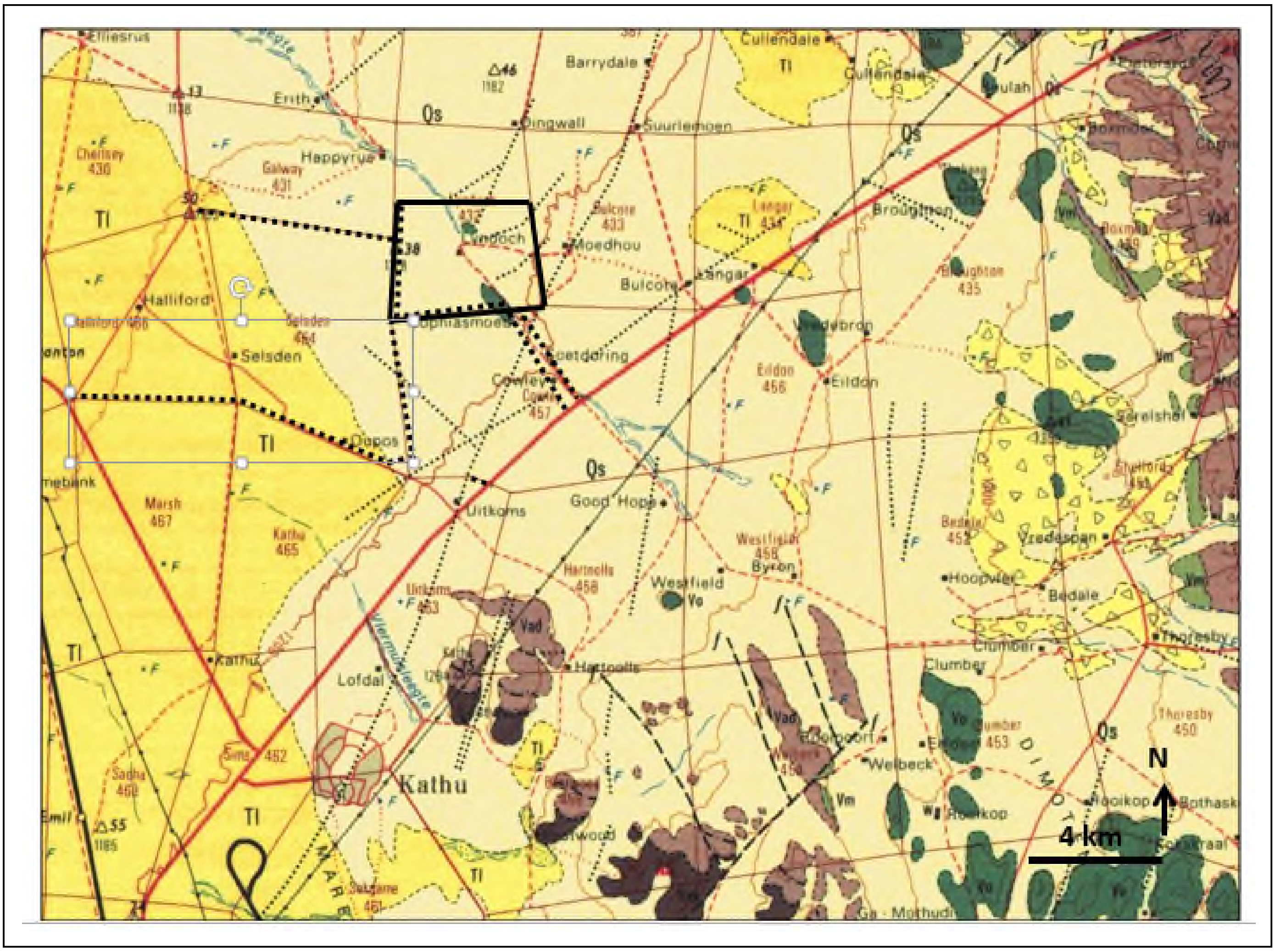


Figure 7.10 Extract from 1: 250 000 geological map[28] 2722 Kuruman (Council for Geoscience, Pretoria) indicating the location of the Hyperion Solar Development 2 near Kathu, Northern Cape (black polygon) together with access road alternatives (black dotted lines). Note that the road and railway networks shown here are out of date.

[28] Geological units represented within the broader study region on sheet 2722 Kuruman include the following (Some of these units are only represented subsurface within the study area itself): Vo (dark green) – Ongeluk Formation lavas (Postmasburg Group); Tl (dark yellow) – calcretes ("surface limestone") of the Kalahari Group; Qs (pale yellow) – aeolian sands of the Gordinia Formation, Kalahari Group; Blue stippled areas = pans and water courses (usually dry).

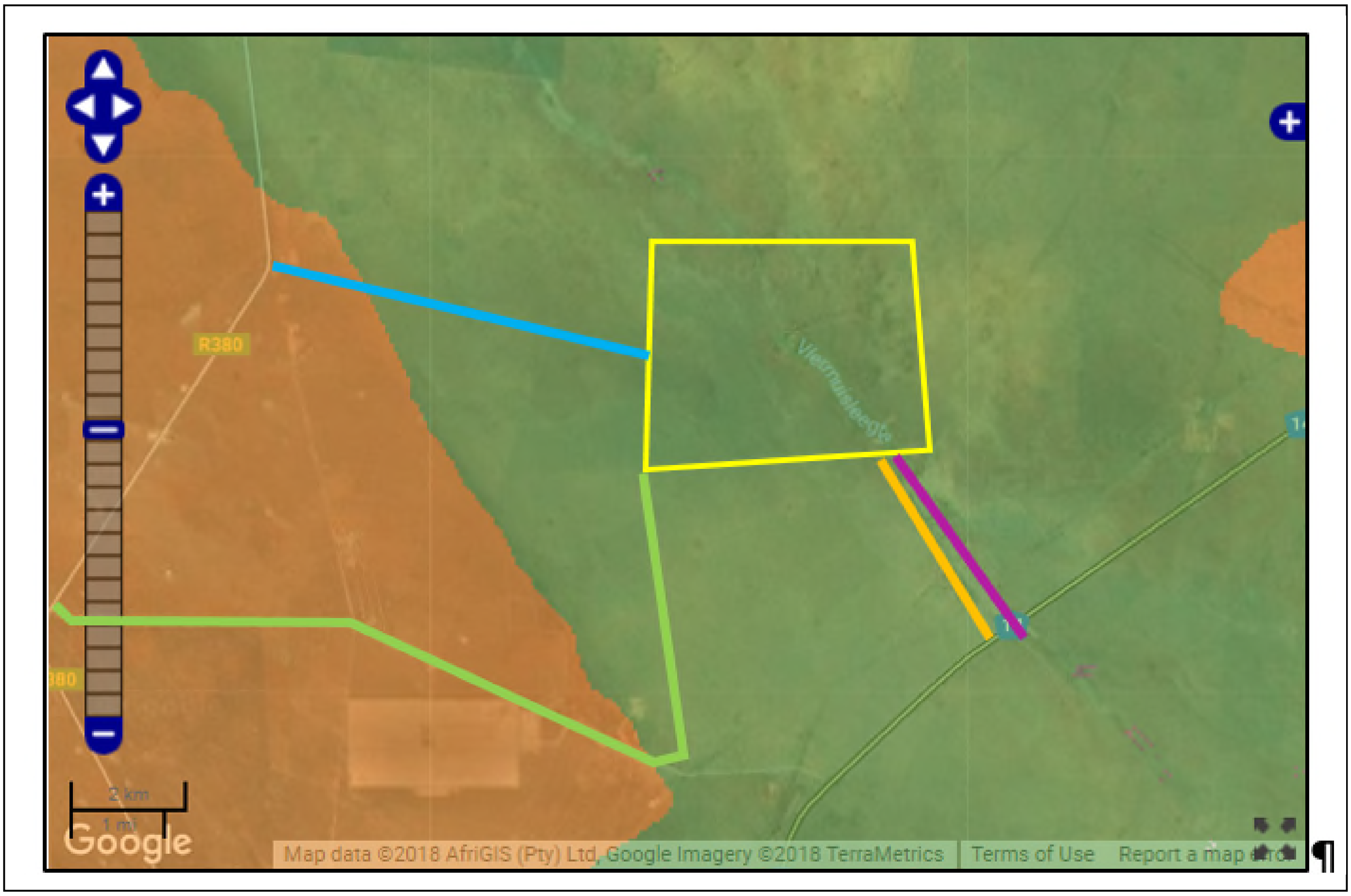


Figure 7.11: Extract from the SAHRIS Palaeosensitivity Map showing the entire project site to be of moderate sensitivity (green shading). The yellow polygon indicates the project site, while the purple line indicates Access Road Alternative 1, the orange line indicates Access Road Alternative 2, the green line indicates Access Road Alternative 3, the blue line indicates Access Road Alternative 4.

CHAPTER 8. ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, indirect, and cumulative) expected to be associated with the development of Hyperion Solar Development 2 and its associated infrastructure. This assessment has considered the construction of a PV facility with a contracted capacity of up to 75MW within a development footprint of approximately 180ha in extent. The 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 (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
- On-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and distribution power transformers.
- A 132kV on-site substation up to 1ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- A new 132kV power line between the on-site substation and the national grid[29].
- 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 up to 1ha in extent.
- Internal access roads, perimeter road and fencing around the development area.
- Main access road to the development area. Four alternatives are currently being considered in this regard:
  - Alternative 1: 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
  - 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.
  - 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 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 to be considered within the EIA process.

[29] The construction of the 132kV overhead power line will be assessed as part of a separate Basic Assessment process which will consider feasible alternatives for the power line route.

The full extent of the project site was considered through the EIA process by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desktop evaluations and field surveys. A development footprint for the PV facility within the project site was proposed by the developer through consideration of the sensitive environmental features and areas identified through the EIA process.

A layout for Hyperion Solar Development 2 was designed within this development footprint and avoids no-go, very high and high sensitivity areas identified in the scoping phase (refer to **Figure 8.1**). Therefore, the layout/development footprint of Hyperion Solar Development 2 is considered as *least intrusive* on the environment at the proposed location, and most suitable for the EIA investigation. Four (4) access road alternatives, each with a 20m corridor, were provided by the developer for consideration in the EIA. A comparative assessment of the alternatives for the project is undertaken as part of the impact assessment in order to identify the preferred alternatives from an environmental perspective.

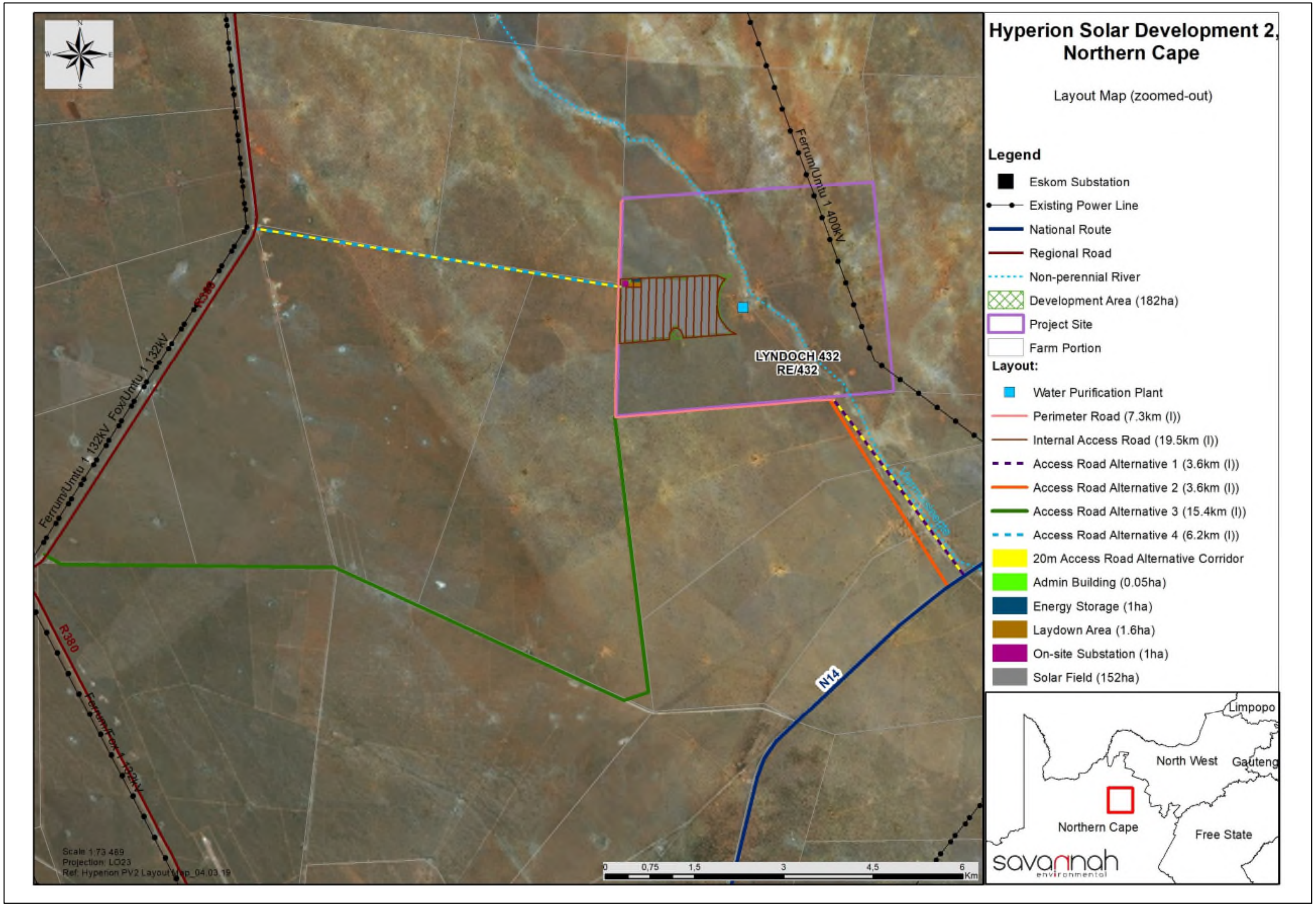


Figure 8.1: **Map illustrating the project layout considered within the project site for Hyperion Solar Development 2 as well as the access road alternatives.**

The development of Hyperion Solar Development 2 will comprise the following phases:

» *Pre-Construction and Construction* – will include pre-construction surveys; site preparation; establishment of access roads, laydown areas, and facility infrastructure; construction of foundations involving excavations; the transportation of components/construction equipment to site, manoeuvring and operating vehicles for unloading and installation of equipment; laying cabling; and commissioning of new equipment and site rehabilitation. The construction phase for Hyperion Solar Development 2 is estimated at 18 months.
» *Operation* – will include the operation of the solar PV energy facility and the generation of electricity, which will be fed into the national grid via the facility on-site substation and an overhead power line. The operation phase of Hyperion Solar Development 2 is expected to be approximately 25 years (with maintenance).
» *Decommissioning* – depending on the economic viability of the PV facility, the length of the operation phase may be extended beyond a 25-year period. At the end of the project's life, decommissioning will include site preparation, disassembling of the components of the solar energy facility, clearance of the relevant infrastructure at the site and appropriate disposal thereof, and rehabilitation. Note that impacts associated with decommissioning are expected to be similar to those associated with construction activities. Therefore, these impacts are not considered separately within this chapter.

Environmental issues associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, impacts to sites of heritage value, soil contamination and erosion, and nuisance from the movement of vehicles transporting equipment and materials during decommissioning.

Environmental impacts associated with the operation phase includes mismanagement of the facility which may result in an increase in alien invasive species and possibly result in erosion. Other impacts associated with the operation phase include visual impacts, night time lighting impacts, soil contamination and erosion and potential invasion by alien and invasive plant species.

8.1. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of Hyperion Solar Development 2 relate to the direct loss of vegetation and species of special concern, disturbance of animals and loss of habitat, and impacts on soils. In order to assess the impacts associated with Hyperion Solar Development 2, it is necessary to understand the extent of the affected area.

The project footprint being assessed for Hyperion Solar Development 2 requires an area of approximately 180ha (equivalent to 11.3% of the project site), of which the PV structures / modules will occupy an area of approximately 152ha in extent, while supporting infrastructure such as internal roads (up to 11.7ha), on-site buildings and structures (up to 0.05ha), energy storage (up to 1ha) and an on-site substation (up to 1ha) will occupy the remaining extent. During construction, a temporary laydown area approximately 1.6ha in extent will be required.

Four main access road alternative corridors (each with a width of 20m) are being proposed for the development. The main access road will be located within the corridor.

8.2. Potential Impacts on Ecology (Ecology, Flora and Fauna)

The majority of the ecological impacts associated with the development would occur during the construction phase as a result of the disturbance associated with site clearance, excavations, the operation of heavy machinery at the site and the presence of construction personnel. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix D** for more details).

8.2.1 Results of the Ecological Impact Assessment

An ecological sensitivity map (refer to **Figure 8.2**) of the larger 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 of the site as well as knowledge obtained from the site surveys undertaken in July 2018, January 2019 and February 2019. 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 accordingly:

» Areas of very high sensitivity:
  The Vlermuisleegte River which is considered an important corridor for landscape connectivity. The river is characterised by a high density of large *V. erioloba* trees, and is therefore unsuitable for development. This area has been regarded as a no-go area for all project components except for the existing T26 gravel road. The development area for Hyperion Solar Development 2 is situated outside of this sensitive area.

» Areas of high to moderate sensitivity:
  The majority of the project site east of the Vlermuisleegte River has a moderate to high *V. erioloba* density and is considered to be either of medium or high sensitivity. This eastern part of the project 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. The development footprint for the solar PV facility avoids the area east of the Vlermuisleegte River.

» Areas of medium sensitivity:
  The eastern boundary of the development area infringes on a small section of the medium sensitive area consisting of *V. erioloba* trees. This is considered to be acceptable from an ecological perspective. A low ridge (i.e. gravel hill) in the central part of the area west of the Vlermuisleegte River is considered to be of medium sensitivity as it has higher plant diversity than the surrounding area and is a relatively rare habitat in context of the project site. The development footprint for the solar PV facility avoids

» Areas of low sensitivity:
  The majority of the western half of the project site is considered to be of low sensitivity due to the lower abundance of protected tree species and dominance of *T. camphoratus* 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. The majority of the development footprint of the solar PV facility falls within this area.

From an ecology perspective Access Road Alternative 1 would result in the least overall habitat loss and additional disturbance compared to the other three access road alternatives. Access Road Alternative 2 would generate a relatively low overall impact, although the density of protected trees is relatively high along some sections of the corridor. Access Road Alternative 3 would generate the greatest extent of habitat loss and traverses several areas with relatively high densities of *V. erioloba*. Access Road Alternative 4 traverses areas of low sensitivity and is considered to represent an acceptable alternative.

8.2.2 Description of Ecological Impacts

Potential impacts on the ecology of the project site due to Hyperion Solar Development 2 would stem from a variety of activities and risk factors associated with the construction and operation phases of the project. The potential impacts associated with the development are explored in context of the features and characteristics of the site and the likelihood that each impact would occur given the characteristics of the site and the extent and nature of the development.

» *Impacts on vegetation and protected plant species*
Several protected species occur at the project site which may be impacted by the development, most notably *V. erioloba and V. haematoxylon*. The density of these species within the development footprint is however low. Vegetation clearing during construction will lead to the loss of currently intact habitat within the development footprint and is an inevitable consequence of the development. As this impact is certain to occur it is 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 is therefore assessed for the construction phase and operational phase.

» *Impact on CBAs and broad-scale ecological processes*
Transformation of intact habitat 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 during the operation phase of the project.

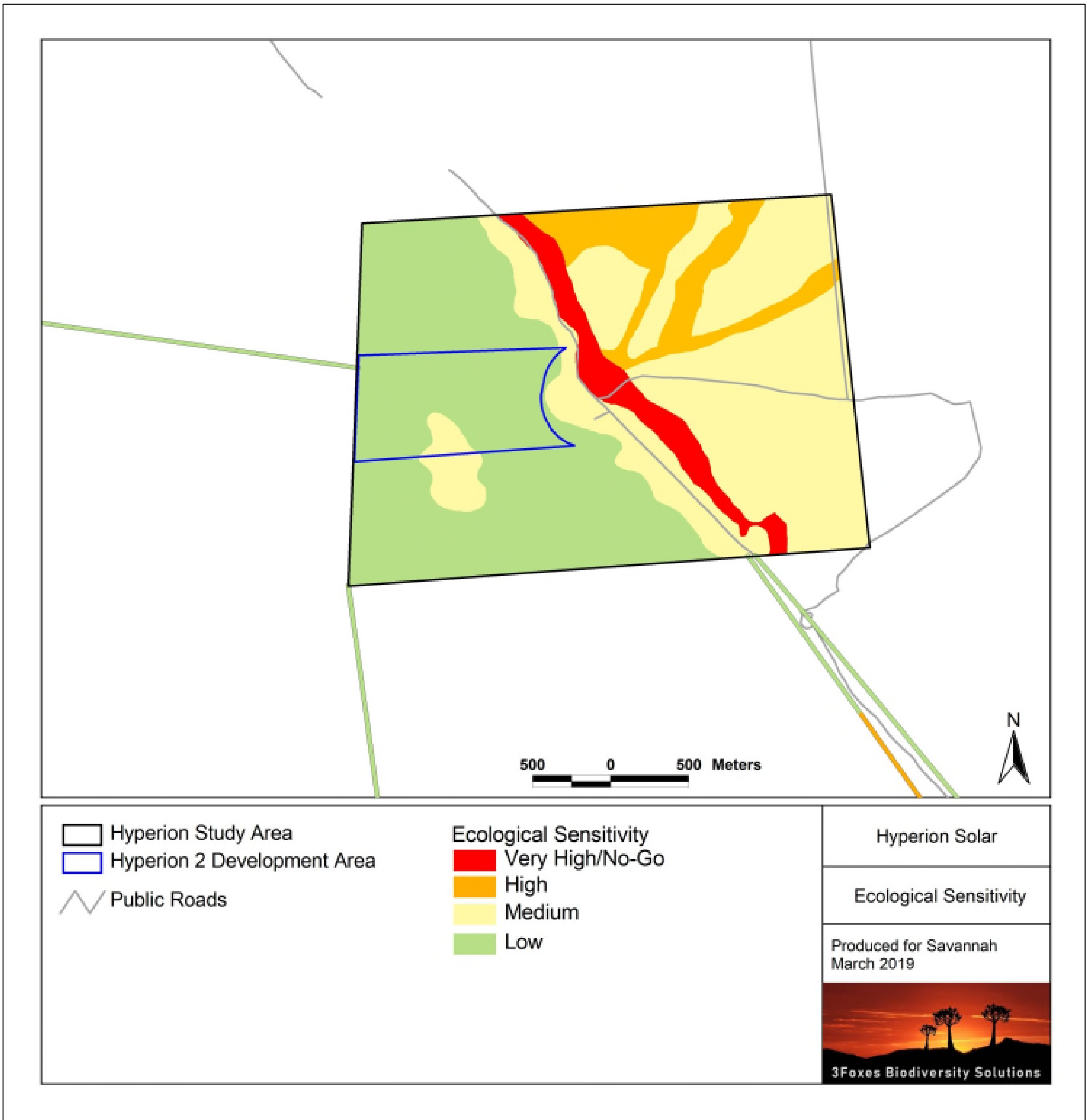


Figure 8.2: **Map illustrating the ecological sensitivity within the Hyperion Solar Development 2 project site overlain with the proposed development footprint and access road alternatives.**

8.2.3 Impact tables summarising the significance of impacts on ecology during construction and operation (with and without mitigation)

The impacts assessed below apply to the development area and the 20m access roads corridors assessed for Hyperion Solar Development 2. Due to the current development footprint, which already avoids highly sensitive features, the significance of the impacts after mitigation is moderate to low.

Construction Phase Impacts

Nature: Impacts on vegetation and listed or protected plant species resulting from construction activities of the facility 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)	Low to Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (50)**
Status (positive or negative)	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. » 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.		
Residual Impacts: 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.		

Nature: Direct Faunal Impacts Due to Construction Activities of the facility 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 Moderate (5)	Low (4)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (32)**	**Low (28)**
Status (positive or negative)	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 are 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, 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.

Residual Impacts:

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.

xx

Operation Phase Impacts

Nature: *Faunal Impacts due to operation of the facility*

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 (positive or negative)	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) 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.

Residual Impacts:
Disturbance from maintenance activities will occur at a low level with the result that disturbance would be largely restricted to the site.

Decommissioning Phase Impacts

Nature: *Habitat degradation due to erosion and Alien Plant Invasion*
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	Low (4)	Minor to Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (36)**	**Low (21)**
Status (positive or negative)	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 revegetated of any remaining bare areas with indigenous perennial shrubs and succulents 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 plant 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.

Residual Impacts:
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.

Nature: Direct faunal impacts due to decommissioning activities 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)	Minor to Low (3)
Probability	Highly Probable (4)	Probable (3)
Significance	**Low (28)**	**Low (18)**
Status (positive or negative)	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.		
Residual Impacts: 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.		

8.2.4 Comparative Assessment of Access Road Alternatives

Access Road Alternative 1 is preferred from an ecological perspective due to the fact that the upgrading of an existing access route would result in the least overall habitat loss and additional disturbance. Access Road Alternative 2 is considered acceptable and would generate a relatively low overall impact, although the density of protected trees is relatively high along some sections of the alignment. Access Road Alternative 3 is the longest access road alternative and is considered least preferred as it would generate the greatest extent of habitat loss. This alternative also traverses several areas with relatively high densities of *V. erioloba*. Access Road Alternative 4 is located within an area of low ecological sensitivity and is considered to be an acceptable alternative.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Ecology	» Least overall habitat loss and additional disturbance. » Located within a low sensitive area. » **Preferred**.	» Relatively low overall impact. » High density of protected trees within the corridor. » Located within an area considered to be of low and medium sensitivity. » Acceptable.	» Longest access road alternative. » Would generate the greatest extent of habitat loss. » Relatively high densities of *V. erioloba* along alignment. » Least preferred.	» Located within a low sensitive area. » Acceptable.

8.2.5 *Implications for Project Implementation*

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of ecological impacts associated with Hyperion Solar Development 2 can be reduced to moderate to low. From the outcomes of the ecological studies undertaken, it is concluded that the PV facility and associated infrastructure can be developed. On-site mitigation is viewed as the most practical and appropriate action, and viable options for reducing the overall impact of the development on these areas is detailed below:

» A pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions, must be undertaken prior to the commencement of the construction phase.
» Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant provincial authorities, i.e. the Northern Cape Department of Environment and Nature Conservation (DENC), must be obtained before the individuals are disturbed.
» 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.
» 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.

8.3. Potential Impacts on Avifauna

The significance of the impacts on avifauna expected with the development of the Hyperion Solar Development 2 project has been assessed as medium to low, depending on the impact being considered, with the implementation of mitigation measures. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

8.3.1 Results of the Avifauna Impact Assessment

Important avian microhabitats play an integral role within the landscape, providing nesting, foraging and reproductive benefits to the local avifauna. In order to ensure that the development does not have a long term negative impact on the local avifauna, it is important to delineate these avian microhabitats within the project site. **Figure 8.3** was generated by integrating avian microhabitats present on the project site and avifaunal information collected during the winter and summer field survey.

Habitat units comprising potential avifauna sensitive elements have been identified within the project site and development area. These sensitive elements have been classified as being of a medium, high and very high (no-go) sensitivity due to the subtle differences in the avifaunal assemblages that they support, especially with respect to red-listed species. These sensitive elements are described below.

» Areas of very high sensitivity:
The Vlermuisleegte River traverse the centre of the project site. The river is considered to be a restricted habitat that has elements similar to that of pans. These areas are very sensitive due to their high use and specialised avifauna that is usually associated with these features. The Vlermuisleegte River may support a very different assemblage of birds compared to the scrub and woodland habitat and may even support red-listed species under favourable conditions, such as Burchell's Courser and Ludwig's Bustard. No additional development or transformation is recommended within this area. The continued use of the existing access road is considered acceptable provided that no large raptor nests of species of concern are found in the trees near the road. Although no such nests were identified during the winter and summer surveys, the potential for a nest to remain undetected may exist.

» Areas of high sensitivity:
The *V. erioloba* woodland east of the Vlermuisleegte River is considered to be of high sensitivity with respect to avifauna, as it supports large *Acacia* trees interspersed with patches of *A. mellifera* and *T. sericea*, which contribute towards a higher habitat heterogeneity and wider array of nesting sites resulting in an overall greater diversity of avifauna. This area is not affected by the proposed development area. Data obtained from the current study is insufficient to conclusively illustrate any potential differences in avifaunal assemblages between the Acacia woodland to the east, and the *Tarchonanthus* scrub to the west of the Vlermuisleegte River. Findings from the site visit suggest that it is likely to be more diverse and this is a reasonable assumption as there is a known relationship between habitat heterogeneity and species richness (Harrison *et al*., 1997). The area east of the Vlermuisleegte is considered to be a high sensitivity and largely unsuitable for development. The development footprint for Hyperion Solar Development 2 is located west of the Vlermuisleegte River and avoids all areas of high sensitivity.

» Areas of medium sensitivity:
The remaining area of the project site to the west of the Vlermuisleegte River consists of *T. camphoratus* scrub. This area represents typical avifauna of the Kalahari bioregion, while also supporting protected tree species such as *V. haematoxylon*, and low numbers of *V. erioloba*. This area of the project site experienced a devastating fire in 2009, which destroyed many of the large *Vachellia* trees as found to the east of the Vlermuisleegte River. With time, large *V. erioloba* trees may again become prominent across the *Tarchonanthus* scrub. The sensitivity rating of this area is a

reflection of the current vegetation composition and not the long-term potential. The entire development area for Hyperion Solar Development 2 is located within this area of medium sensitivity.

Access Road Alternative 1, 3 and 4 traverse areas of medium sensitivity. Alternative 3 also traverses several areas with high *V. erioloba* density and which are of high avifaunal value due to their structural diversity and possible presence of raptor nesting sites. Access Road Alternative 2 is considered generally undesirable from an avifaunal perspective as it would impact the Vlermuisleegte River corridor which has been identified as an important area for avifauna. This alternative also traverses an area of high sensitivity. Access Road Alternative 4 does not traverse a large extent of high value habitat.

8.3.2 Description of Avifaunal Impacts

Negative avifauna impacts expected to occur with the development of Hyperion Solar Development 2 includes a loss of habitat loss and displacement of birds, collision trauma caused by PV panels and habitat destruction and disturbance.

» *Loss of habitat and disturbance of small passerines*
For the smaller passerine species the most important impacts will involve displacement from the area encompassed by the development footprint as a result of habitat destruction. The loss of habitat will be permanent while disturbance may be continuous during the operational phase of the solar PV facility. The impacts in general can be expected to be minimal as the populations of these smaller species are far less susceptible to the associated impacts than larger species.

» *Habitat loss, disturbance and collision risk of medium terrestrial birds and raptors*
Small to medium-sized non-passerines that may be impacted to some extent due to habitat loss and displacement include resident raptors such as Gabar Goshawk, Pale Chanting Goshawk, and the ground-dwelling Burchell's Sandgrouse, Orange River Francolin and Red-crested Korhaan. These species may also be susceptible to collisions with associated infrastructure such as the PV panels and site fencing, but this is not expected to have a major impact on most of these species. Red-crested Korhaan and Orange River Francolin may, however, be at more risk based on the recent research (Visser, 2016).

» *Habitat loss, disturbance and collision risk of large terrestrial birds and raptors*
The group of primary concern is the medium to large non-passerines, which include the large terrestrial birds and diurnal raptors. Many of these are also red-listed, such as such as White-backed Vulture, Martial eagle, Verreaux's Eagle, Kori Bustard, and Secretarybird. Besides the loss of potential habitat that these species will experience, disturbances during construction and maintenance of the facility is also expected to have a negative impact.

The construction phase will result in the direct loss of habitat due to clearing of vegetation and avifaunal microhabitats for the solar fields, road infrastructure, perimeter fencing, auxiliary buildings and associated infrastructure. Disturbances will be caused by increased traffic of vehicles, and particularly heavy machinery used for clearing vegetation and road construction. During the operational phase the impacts that can be expected to include direct bird mortalities through collisions with PV panels and entrapment along perimeter fencing, and disturbances in the form of vehicular and personnel traffic during maintenance of solar fields and other infrastructure. Night lighting may also disturb nocturnal birds, those attracted to the facility to prey on insects drawn to lights, and those flying over the facility at night.

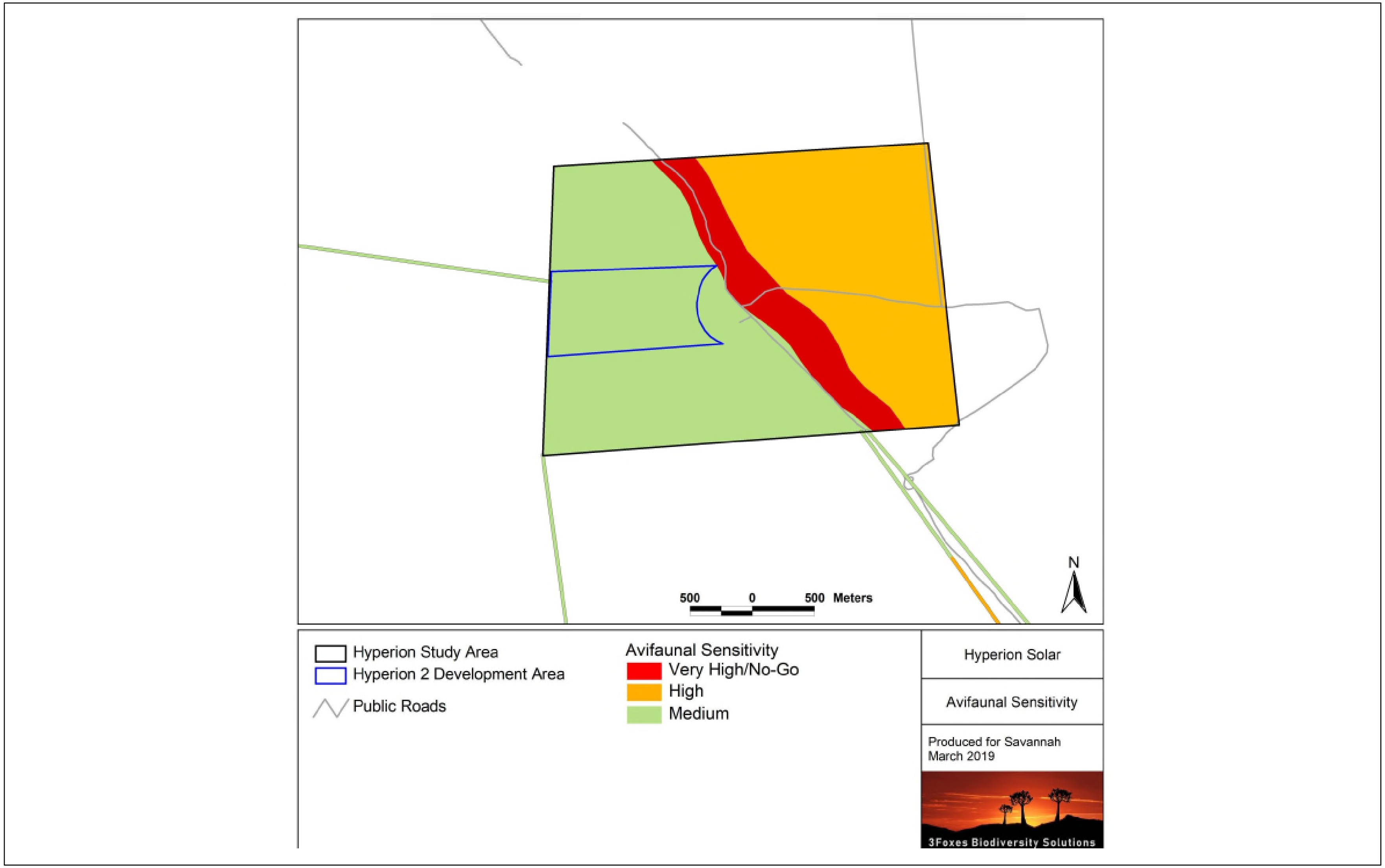


Figure 8.3: **Map illustrating the avifaunal sensitivity within the Hyperion Solar Development 2 project site overlain with the proposed development footprint and access road alternatives.**

8.3.3 *Impact tables summarising the significance of impacts on avifauna during construction and operation (with and without mitigation)*

The impacts assessed below apply to the development area and the 20m access roads corridors assessed for Hyperion Solar Development 2. Due to the current development footprint, which already avoids highly sensitive features, the significance of the impacts after mitigation is moderate to low.

Construction Phase Impacts

Nature: *Loss of habitat and disturbance due to the solar energy facility*

Loss of natural habitat and displacement of birds through physical transformation, modifications, removals and land clearance. The loss of habitat will be permanent while disturbance may be continuous during the operational phase of Hyperion Solar Development 2.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low to Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**Medium (45)**	**Medium (40)**
Status (positive or negative)	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 habitat is unavoidable and is a definite outcome of the development.	

Mitigation:

» The use of laydown areas within the footprint of the development should be used where feasible, to avoid habitat loss and disturbance to adjoining areas.
» The bed of the Vlermuisleegte River should be considered to be a no-go area for infrastructure apart from where there are already existing access roads through this area which can be used for access.
» All building waste produced during the construction phase should be removed from the development site and be disposed of at a designated waste management facility. Similarly, all liquid wastes should be contained in appropriately sealed vessels/ponds within the footprint of the development, and be disposed of at a designated waste management facility after use. Any liquid and chemical spills should be dealt with accordingly to avoid contamination of the environment.
» Pre-construction environmental induction for all construction staff on site to ensure that basic environmental principles are adhered to, and awareness about not harming or hunting ground-dwelling species (e.g. bustards, korhaans, thick-knees and coursers), and owls, which are often persecuted out of superstition.
» This induction should also include awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, remaining within demarcated construction areas etc.
» All construction vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed outside of the construction area.
» All construction vehicles should adhere to a low speed limit (40km/h on site) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest along roads.
» Any avifauna threatened by the construction activities should be removed to safety by an appropriately qualified person.
» Reservoirs or ponds (evaporative or other) should be covered with fine mesh or other exclusion material in order to exclude and prevent birds from accessing potentially contaminated water contained therein.
» If holes or trenches need to be dug, these should not be left open for extended periods of time as ground-dwelling avifauna or their flightless young may fall in and become trapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter.

- No construction activity should occur near to active raptor nests should these be discovered prior to or during the construction phase. If there are active nests near construction areas, these should be reported to ECO and should be monitored until the birds have finished nesting and the fledglings left the nest.
- The perimeter fence around the facility should be designed with potential impacts on ground-dwelling avifauna in mind. Double-fence designs where the inner electric fence is positioned within one (1) meter of the outer mesh fence may result in medium-sized non-passerine species colliding with either fence when trapped between these (Visser, 2016). Single-fence designs, whereby the electrical fencing component is attached to the inside of the mesh fence, are considered preferable as ground-dwelling birds cannot be trapped between these components.

Residual Impacts:
As the loss of currently intact habitat is an unavoidable consequence of the development, the habitat loss associated with the development remains a residual impact even after mitigation and avoidance of more sensitive areas. The sensitivity of the affected habitat is however low and the overall residual impact on avifaunal habitat loss remains low.

Operation Phase Impacts

Nature: Collisions with PV Panels
Resident raptors such as Pale Chanting Goshawk, and the Red-crested Korhaan may also be susceptible to collisions with associated infrastructure such as the PV panels, entrapment along perimeter fencing, and disturbance due to traffic and night lighting.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Moderate (5)	Low (4)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes to a large degree, but it may be more difficult to prevent collisions and impacts related to the perimeter fence where double-fencing is used as opposed to single-fencing.	

Mitigation:
- All incidents of collision with panels should be recorded as meticulously as possible, including data related to the species involved, the exact location of collisions within the facility, and suspected cause of death. Post-construction monitoring with the aid of video surveillance should be considered, as this will contribute towards understanding bird interactions with solar panels.
- The bed of the Vlermuisleegte River should be considered to be a no-go area to avoid disturbance to avifauna, apart from where there are already existing access roads through this area which can be used for access. The area to the east of the river should also be avoided so as to limit disturbance to avifauna.
- 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. The use of lighting at night should be kept to a minimum, so as not to unnecessarily attract invertebrates to the solar facility and possibly their avian predators, and to minimise disturbance to birds flying over the facility at night.
- If birds nest on the infrastructure of the facility and cannot be tolerated due to operational risks of fire, electrical shorts, soiling of panels or other concerns, birds should be prevented from accessing nesting sites by using mesh or other manner of excluding them. Birds should not be shot, poisoned or harmed as this is not an effective control method and has negative ecological consequences. Birds with eggs or nestlings should be allowed to fledge their young before nests are removed.
- If there are any persistent problems with avifauna, then an avifaunal specialist should be consulted for advice on further mitigation.

» Any movements by vehicle and personnel should be limited to within the footprint of power lines and other associated infrastructure, especially during routine maintenance procedures. » Reservoirs or ponds (evaporative or other) should be covered with fine mesh or other exclusion material in order to exclude and prevent birds from accessing potentially contaminated water contained therein. » All vehicles accessing the site should adhere to a low speed limit (40km/h max) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest on roads at night. » Maintenance of the perimeter fencing must ensure that it minimises impacts on ground-dwelling species susceptible to entrapment between the fencing components, where double-fence designs are used (though not recommended). If double-fence designs must be used instead of preferred single-fence designs, the space between the outer mesh fence and inner electrical fence should be kept clear of vegetation which may attract ground-dwelling species to forage there, while also ensuring that there are no gaps/holes in these fences that will allow ground-dwelling birds to enter the space between the two fences.
Residual Impacts: Although high rates of mortality due to collisions have not been recorded in South Africa, there is some risk that this may occur, in addition to some potential mortality associated with entrapment of ground-dwelling birds along perimeter fencing (double-fence designs only).

Decommissioning Phase Impacts

Nature: *Loss of habitat and disturbance*
Habitat loss due to clearing of solar field, and disturbance due to traffic and presence of personnel.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Minor to Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	The disturbance impact can be mitigated to an extent as it will be transient and have no long term impact.	

Mitigation:

» All infrastructure should be removed from the development site and disposed of in the appropriate manner.
» All waste produced during decommissioning must be disposed of at a designated waste management facility.
» Environmental induction for all personnel on site to ensure that basic environmental principles are adhered to, and awareness about not harming or hunting ground-dwelling species (e.g. bustards, korhaans, thick-knees and coursers), and owls, which are often persecuted out of superstition.
» This induction should also include awareness as to no littering, appropriate handling of pollution and chemical spills, avoiding fire hazards, minimizing wildlife interactions, and remaining within demarcated decommissioning areas.
» All decommissioning vehicles should adhere to clearly defined and demarcated roads. No off-road driving to be allowed in undisturbed natural areas outside of the decommissioning area.
» The bed of the Vlermuisleegte River should be considered to be a no-go area to avoid disturbance to avifauna, apart from where there are already existing access roads through this area which can be used for access. The area to the east of the river should also be avoided so as to limit disturbance to avifauna.
» All vehicles should adhere to a low speed limit (40km/h on site) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest along roads.
» Any avifauna threatened by the activities should be removed to safety by the Environmental Officer or

appropriately qualified environmental officer. » If holes or trenches need to be dug, these should not be left open for extended periods of time as ground-dwelling avifauna or their flightless young may become entrapped in them. Holes should only be dug when they are required and should be used and filled shortly thereafter. » No activity should occur near to active raptor nests should these be discovered prior to or during the decommissioning phase. If there are active nests near the decommissioning areas, these should be reported to the EO and should be monitored until the birds have finished nesting and the fledglings left the nest.
Residual Impacts: Disturbance during the decommissioning phase is an unavoidable consequence, but will have low residual impact with implementation of the mitigations. The sensitivity of the affected habitat is however low and the overall residual impact on avifaunal habitat loss remains low.

8.3.4 Comparative Assessment of Access Road Alternatives

Although the existing access road (i.e. Access Road Alternative 1) runs adjacent to the dry bed of the Vlermuisleegte River which is in a potentially sensitive area, the use of the existing road must be weighed up against the likely avifaunal habitat loss and disturbance generated by the construction and the use of the alternative access routes, which require the construction of new roads. As the existing road is currently used to access the project site and is a large road that would require minimal additional work, this is considered to be the preferred alternative from an avifaunal perspective. Access Road Alternative 2 is considered generally undesirable from an avifaunal perspective as it would impact the Vlermuisleegte River corridor which has been identified as an important area for avifauna in the area. Access Road Alternative 3 is also considered undesirable as it traverses several areas with high *V. erioloba* density and which are of high avifaunal value due to the their structural diversity and possible presence of raptor nesting sites. Access Alternative 4 to the west is considered potentially acceptable as it is relatively short and does not traverse a large extent of high value habitat.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Avifauna	» Adjacent to the dry bed of the Vlermuisleegte River which is in a potentially sensitive area. » Require minimal additional work. » Minimal habitat loss and disturbance. » **Preferred**.	» Impact on the Vlermuisleegte River corridor which has been identified as an important area for avifauna. » Located within an area considered to be of low and medium sensitivity. » Not preferred.	» Longest access road alternative. » Traverses several areas with high *V. erioloba* density and which are of high avifaunal value. » Possible presence of raptor nesting sites. » Not preferred.	» Short access road alternative and does not traverse a large extent of high value habitat. » Located within a low sensitive area. » Acceptable.

8.3.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of avifauna impacts associated with Hyperion Solar Development 2 will be medium to low. From the outcomes of the avifaunal studies undertaken, it is concluded that the PV facility can be developed and impacts on avifauna can be managed to acceptable levels by taking the following into consideration:

- » The bed of the Vlermuisleegte River should be considered to be a no-go area for infrastructure apart from where there are already existing access roads through this area which can be used for access.
- » Post-construction monitoring with the aid of video surveillance should be considered, as this will contribute towards understanding bird interactions with solar panels.
- » All construction vehicles should adhere to a low speed limit (40km/h on site) to avoid collisions with susceptible species such nocturnal and crepuscular species (e.g. nightjars, thick-knees and owls) which sometimes forage or rest along roads.
- » The perimeter fence around the facility should be designed with potential impacts on ground-dwelling avifauna in mind. Double-fence designs where the inner electric fence is positioned within one (1) metre of the outer mesh fence may result in medium-sized non-passerine species colliding with either fence when trapped between these (Visser, 2016). Single-fence designs, whereby the electrical fencing component is attached to the inside of the mesh fence, are considered preferable as ground-dwelling birds cannot be trapped between these components.

8.4. Assessment of Impacts on Watercourses

The impacts on watercourses (including rivers, pans and wetlands) associated with the development is expected to be of low significance. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** for more details).

8.4.1 Results of the Watercourses Impact Assessment

The area surrounding the identified watercourses within the study area is mainly natural and untransformed. The Vlermuisleegte River was noted to have been historically cultivated. Trampling and grazing by livestock was identified within almost all the watercourses. Sand mining and various informal roads were the only identified anthropogenic activities occurring within the local catchment of these watercourses. Several areas of sensitivity have been identified within and surrounding the investigation area[30] (refer to **Figure 8.4** and **Figure 8.5**):

- » *Very High Sensitivity (No-go Area):* The Vlermuisleegte River is considered to be largely natural according to the Present Ecological State (PES) 1999[31], and is classified as moderately modified (Class C) according to the National Freshwater Ecosystem Priority Area (NFEPA) database. Due to agricultural activities within the floodplain associated with the river, the natural indigenous riparian vegetation has been impacted. Analysis of digital satellite imagery indicates however that some natural riparian vegetation remains within the area east of the river. The Vlermuisleegte River is considered to be a no-go area for all infrastructure except for Access Road Alternative 1, as this road has an existing impact on the Vlermuisleegte River.

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[30] To identify all watercourses that may potentially be impacted by the proposed development as a whole, a 500m "zone of investigation" around the development area and all associated project activities was investigated by the watercourse specialist.

[31] The most recent database (i.e. DWS 2014 database) did not assess the Vlermuisleegte River and therefore the PES stated in the 1999 database was used.

A perched depression wetland has been identified within the northern portion of the project site, situated within the Vlermuisleegte River. This depression is considered to be in a natural or good ecological condition (Class B). Due to the lack of habitat diversity and moderately low hydro-functionality, this depression is not considered to be of significant ecological importance on a landscape scale. However, since it forms part of the larger Vlermuisleegte River, it does potentially aid in retaining water during rainfall events (albeit limited). The depression wetland should be regarded as a no-go area for all infrastructure.

Ten (10) pan wetlands were identified scattered within the investigation area associated with access road Alternative 3, the closest of which is located approximately 45m from the proposed route location (Pan 8). Furthermore, a pan wetland (Pan 11) was identified within the investigation area associated with Access Road Alternative 4, although this system is located approximately 245m from the proposed route. The pans are considered to be mostly natural with no significant impacts to their hydrological or geomorphological properties. Some disturbance to the vegetation was evident primarily due to the trampling and grazing of livestock within and surrounding the pans. This has caused a slight change in ecosystem processes within the pans. No edge effects relating to anthropogenic activities were apparent at the time of the assessment. These pans are of some importance on a landscape scale, primarily due to the provisioning of habitat (albeit seasonally) by the pans.

» *High Sensitivity Area:* A 32m buffer has been applied to the extent of all watercourses identified within the project site and along the access road alternatives (i.e. pans and the Vlermuisleegte River). The 32m buffer represents the 32m regulated area associated with a watercourse as stipulated by the NEMA EIA Regulations of 2014 (as amended). No infrastructure should be placed in these areas of high sensitivity.

» *Medium Sensitivity:* A 100m buffer has been applied to the Vlermuisleegte River and a 500m buffer has been applied to the depression wetland. This buffer represent the GN509 regulated area of the watercourses. Development may take place within these areas but should be avoided if possible, to avoid triggering Section 21 (c) & (i) water uses.

» *Low Sensitivity:* The remaining areas within the project site and along the access roads are considered to be of low sensitivity from a watercourse conservation point of view.

No watercourses were identified to be associated with the development area; however, the eastern portion of the investigation area associated with the development area is bisected by the Vlermuisleegte River which drains in a south-eastern to north-western direction. This river is traversed by the proposed Access Road Alternative 1.

8.4.2 Description of the Impacts to Watercourses

Negative impacts to watercourses are expected to occur with the development of Hyperion Solar Development 2. The following impacts are assessed in detail in section 8.4.3:

Construction:

» Altered topography/geomorphology of the river, leading to altered runoff patterns and formation of preferential flow paths.

- Disturbance to the Vlermuisleegte river and its surrounding buffer area could lead to the proliferation of alien invasive vegetation species.
- Potential trampling by construction personnel within the Vlermuisleegte river beyond the construction footprint.
- Disturbance to the vegetation and soil associated with the Vlermuisleegte river and potentially increase in volume of sediment entering the river system.
- Disturbance to the natural buffer zone surrounding the pan wetland/s, including the vegetation and soil components.

Operation:

- Potential disturbance to the natural buffer zone surrounding the Vlermuisleegte River during maintenance activities, including disturbance to the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the river.
- Increased hardened surfaces in the vicinity of the river may potentially alter the pattern of runoff entering the river.
- Increased hardened surfaces in the vicinity of the pans may potentially alter the pattern of runoff entering the pans.
- Runoff from the road entering the river could be contaminated and could impact on the surface water quality of the river (if surface water is present).
- Runoff from the road can potentially create preferential flow paths in the river, thus causing erosion of the embankment of the river.

Due to the distance of the proposed surface infrastructure and the internal roads associated with the development area from the watercourses (the perched depression wetland and the Vlermuisleegte river), with the implementation of the recommended mitigation measures, a low to very low impact on the watercourses is expected to occur.

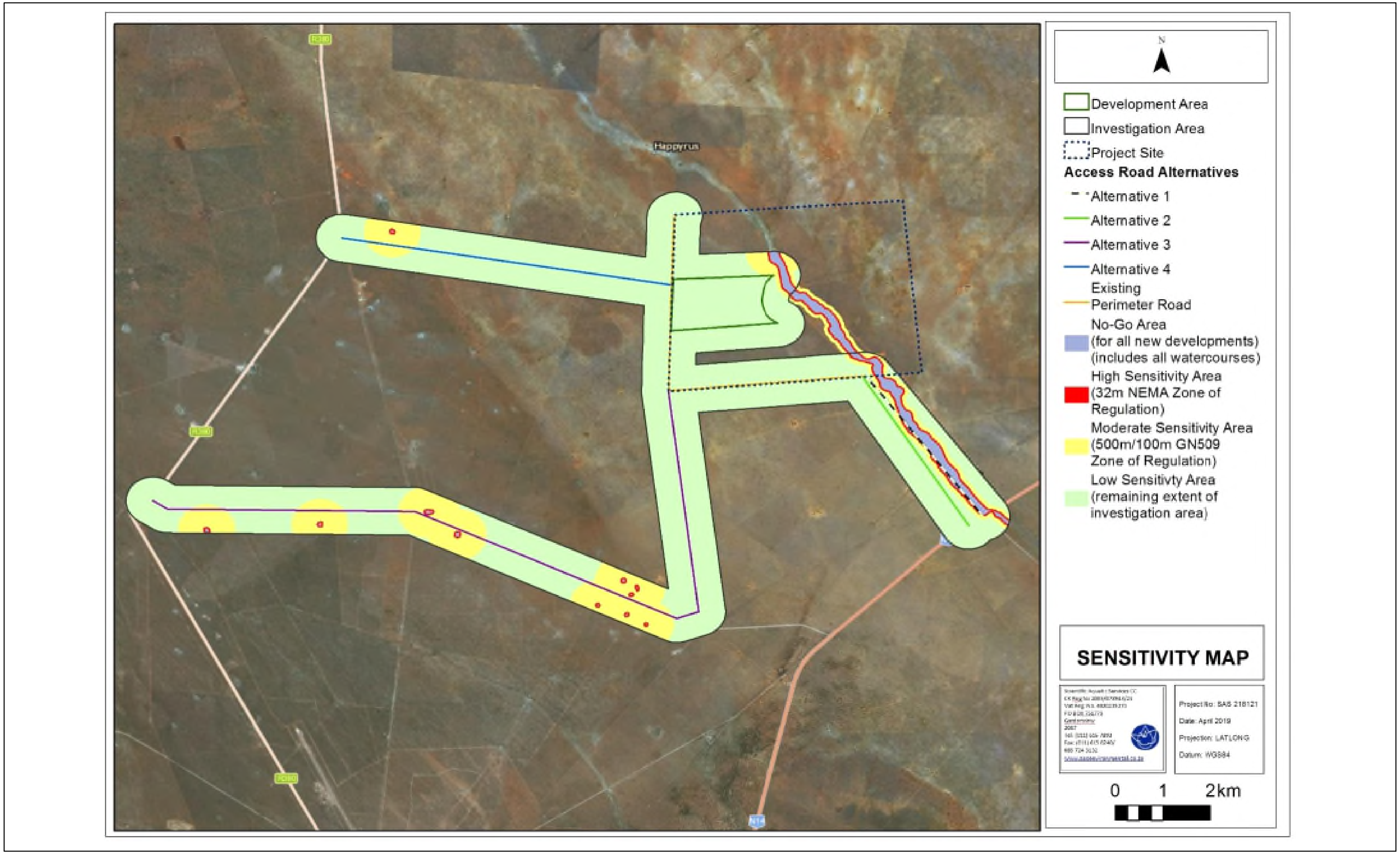

Figure 8.4: **Areas of sensitivity identified in accordance with the watercourses (No-go areas – only applicable to new developments) and their and 32m NEMA regulated area (High Sensitivity Area), their respective GN509 regulated areas (Moderate Sensitivity Area) and all other areas in which development could occur (Low Sensitivity Area).**

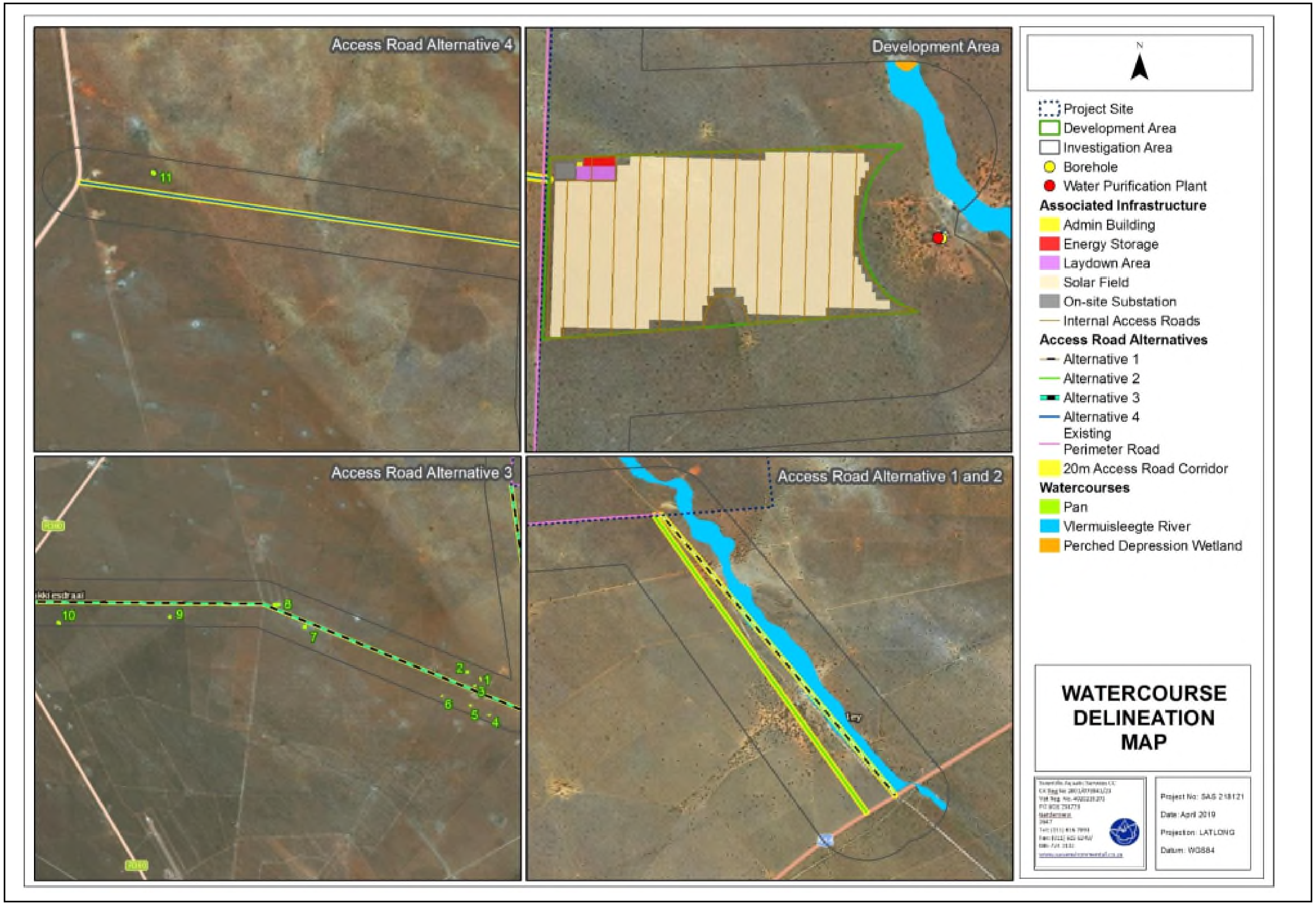

Figure 8.5: Conceptual presentations of the zones of regulation in terms of GN509 of 2016 in relation to the assessed watercourses associated with the development footprint and access road alternatives.

8.4.3 Impact tables summarising the significance of impacts on watercourses related to the PV facility and associated infrastructure during construction and operation (with and without mitigation)

Construction Phase Impacts

Nature: *Impacts associated with the upgrade of the existing T26 gravel road as part of the development of proposed access road Alternative 1.*

This will entail the following:

» Site preparation before construction activities surrounding the existing road. This will disturb the vegetation and soil associated with the Vlermuisleegte river and potentially increase the volume of sediment entering the river system.
» Disturbance to the Vlermuisleegte river and its surrounding buffer area could lead to the proliferation of alien invasive vegetation species.
» Potential trampling by construction personnel within the Vlermuisleegte river beyond the construction footprint.
» Altered topography/geomorphology of the river, leading to altered runoff patterns and formation of preferential flow paths.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Short term (1)	Short term (1)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Highly Probable (4)
Significance	**Medium (55)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Contractor laydown areas, and material storage facilities to remain outside of the Vlermuisleegte river and its 32m NEMA Zone of Regulation (ZoR).
» All vehicle re-fuelling is to take place outside of the Vlermuisleegte river and its 32m NEMA ZoR.
» All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
» Retain as much indigenous freshwater vegetation as possible.
» All vegetation removed as part of the road widening should be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility.
» During the construction of the Access Road Alternative 1, a buffer of no more than 5m on either side of the proposed road reserve within the Vlermuisleegte river may be impacted. This area must be cordoned off, and no vehicles or personnel are permitted outside of the authorised construction area.
» It should be feasible to utilise existing roads to gain access to the proposed access road construction area. No indiscriminate crossing of the river outside of the proposed crossing point may be permitted.
» The area of the river where no construction activities are proposed should be demarcated as a no-go area (for construction personnel and vehicles) with danger tape.
» Material to be used (gravel) as part of the widening of the road must be stockpiled outside the 32m NEMA ZoR of the river to prevent sedimentation of the river. These stockpiles may not exceed a height of 2m and should be protected from wind using tarpaulins.
» The road should be permeable to allow for drainage from the road surface. In this regard, suitable stormwater management should be implemented to allow for water to drain from the road without causing erosion.
» Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only and must not be mixed within the 32m NEMA ZoR of the Vlermuisleegte River.
» Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River occurs from excessive dust settling.

» After construction of the road, the area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring.
» It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction.
» All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species.

Residual:

There is a residual risk that a decrease in habitat provision by the Vlermuisleegte River may occur due to vegetation not being able to re-establish within and directly surrounding the construction footprint area.

Nature: *Impacts associated with construction of proposed access road Alternative 2.*

This proposed access road is located outside of the 100m ZoR of the Vlermuisleegte River in accordance with the National Water Act, 1998 (Act 36 of 1998). Thus, the proposed construction and operational activities of this access road alternative does not pose any legislative or freshwater conservation constraints. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River) were considered as a precautionary approach:

» Disturbance to the natural buffer zone surrounding the Vlermuisleegte River, including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the river.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (10)**	**Low (5)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» All vehicle re-fuelling is to take place outside of the Vlermuisleegte river and its 32m NEMA ZoR.
» All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
» Retain as much indigenous freshwater vegetation as possible.
» All vegetation removed as part of the road widening should be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility.
» It should be feasible to utilise existing roads to gain access to the proposed access road construction area. No indiscriminate driving within the 100m GN509 ZoR of the Vlermuisleegte River may be permitted.
» Material to be used (gravel) as part of the widening of the road must be stockpiled outside the 32m NEMA ZoR of the river to prevent sedimentation of the river. These stockpiles may not exceed a height of 2m and should be protected from wind using tarpaulins.
» The road should be permeable to allow for drainage from the road surface. In this regard, suitable stormwater management should be implemented to allow for water to drain from the road without causing erosion.
» Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only and must not be mixed within the 32m NEMA ZoR of the Vlermuisleegte River.
» Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River occurs from excessive dust settling.
» After construction of the road, the area surrounding the road must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring.
» It is highly recommended that an alien vegetation management plan be compiled during the planning phase

and implemented concurrently with the commencement of construction. » All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species.
Residual: There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River may occur due to vegetation not being able to re-establish within and surrounding the construction footprint area.

Nature: *Impacts associated with construction of proposed access road Alternative 3 and 4.*

The impact assessment of these two access road alternatives was undertaken in a combined fashion due to the distance of the access roads from the pan wetlands (the closest pan wetland to an access road is Pan Wetland 8, approximately 45m from access road Alternative 3).

Access Road Alternative 3:

Pan wetlands were identified within the investigation area associated with this road (the existing T25 gravel road) (Figure 1). Although it is not expected that this road would require significant construction activities (since it is already an existing wide, gravel road), the potential impacts of edge effects from the construction activities on the pan wetlands were assessed.

Figure 1: Photograph of the existing T25 gravel road. Several pan wetlands were identified within its 500m investigation area, the closest being approximately 45m from this road (Pan Wetland 8).

Access Road Alternative 4:

Only Pan wetland 11 was identified within the investigation area associated with this proposed access road alternative, approximately 245m north of the road. Although there is an existing gravel road (**Figure 2**), this road will need to be widened in order to provide one lane per direction and to accommodate construction vehicles and equipment.

The potential of edge effects that may occur on Pan 11 were considered:

» Disturbance to the natural buffer zone surrounding the pan wetland, including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of Pan 11.
» Construction activities may potentially cause dust, which could enter the pan wetland within the closest proximity to the road construction footprint.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (10)**	**Low (5)**

Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Contractor laydown areas, material storage facilities, and refuelling of construction activities must to remain outside the 32m NEMA ZoR of any of the pan wetlands.
- Contractor laydown areas, material storage facilities, and refuelling of construction activities must be planned to remain outside the 100m GN509 ZoR of the pan wetlands.
- All vehicle re-fuelling is to take place outside of the pan wetlands and its 32m NEMA ZoR.
- All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
- Retain as much indigenous freshwater vegetation as possible.
- Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River or pan occurs from excessive dust settling.
- It should be feasible to utilise existing roads to gain access to the proposed access road construction area.
- After construction of the road, the area surrounding the road must be revegetated with suitable indigenous vegetation (terrestrial vegetation) to prevent the establishment of alien vegetation species and their potential spread into the river.
- Material to be used (gravel) as part of the widening of the road must be stockpiled outside the 32m NEMA ZoR of the river to prevent sedimentation of the river. These stockpiles may not exceed a height of 2m and should be protected from wind using tarpaulins.
- Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only and must not be mixed within the 32m NEMA ZoR of the pan wetlands.
- After construction of the road, the area surrounding the road must be revegetated with suitable indigenous vegetation (terrestrial vegetation) to prevent the establishment of alien vegetation species and their potential spread into the pan wetlands.
- It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction.
- All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species.

Residual:

There is a residual risk that a decrease in habitat of the pan wetlands may occur due to vegetation not being able to re-establish within the construction footprint area. Constant usage of the proposed access road could potentially decrease the biodiversity (mainly faunal species) within the areas surrounding the pans.

Nature: *Impacts associated with construction of surface infrastructure and internal access roads associated with the PV development area*

Construction of the proposed surface infrastructure and internal access roads in the development area is proposed to be located outside of the 100m/500m GN509 ZoR of the Vlermuisleegte River and perched depression wetland. As these activities are located outside of the applicable GN509 ZoR of the watercourses in accordance with the National Water Act, 1998 (Act 36 of 1998), the proposed construction activities thereof do not pose any legislative or freshwater conservation constraints. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River and pan wetlands) were considered as a precautionary approach:

- Disturbance to the natural buffer zone surrounding the Vlermuisleegte River, including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the river.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)

Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (10)**	**Low (5)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Contractor laydown areas, material storage facilities, and refuelling of construction activities must be planned to remain outside the 100m GN509 ZoR of the river and pan.
» All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
» Retain as much indigenous freshwater vegetation as possible.
» Water imported to the construction site may not be allowed to drain into the Vlermuisleegte River or pan, and should be managed with appropriate stormwater management systems.
» Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only;
» All stockpiles created from excavated soils may not be higher than 2m and must be protected from wind erosion. These stockpiles should be levelled, or the soil be used as part of rehabilitation activities within the development area;
» It should be feasible to utilise existing roads to gain access to the construction area;
» After construction of the surface infrastructure, the surrounding area thereof must be revegetated with suitable indigenous vegetation (terrestrial vegetation) to prevent the establishment of alien vegetation species and their potential spread into the river.

Residual:

There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River and pan may occur due to vegetation not being able to re-establish within and surrounding the construction footprint area.

Operation Phase Impacts

Nature: *Impacts associated with the operation of proposed access road Alternative 1.*
This will entail the following:
» Runoff from the road (Access road Alternative 1) entering the river could be contaminated and could impact on the surface water quality of the river (if surface water is present).
» Runoff from the road can potentially create preferential flow paths in the river, thus causing erosion of the embankment of the river.

	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Highly Probable (4)	Probable (3)
Significance	**Medium (44)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Ensure that routine inspections and monitoring of the road are implemented. Monitoring should occur biannually (or as specified by the relevant engineer), and specifically after significant rainfall events.
» Regular inspection for alien and invasive vegetation along the road should occur, to limit their spread into the river;

» Stormwater runoff from the road into the river may not form preferential surface flow paths into the river. If this does occur, the areas should be rehabilitated (erosion gullies infilled) and revegetated to aid in dispersing the flow of water from the road into the river; » No unauthorised or indiscriminate movement of vehicles in the Vlermuisleegte River may be permitted during the visual inspection; » If repair activities to the road are required, the mitigation measures as per that of the construction phase must be implemented.
Residual: Constant usage of the road could potentially decrease the biodiversity (mainly faunal species) within and directly surrounding the portion of the river associated with the access road.

Nature: *Impacts associated with the operation of proposed access road Alternative 2.* This proposed access road is located outside of the 100m ZoR of the Vlermuisleegte River in accordance with the National Water Act, 1998 (Act 36 of 1998). Thus, the operational activities of this access road alternative do not pose any legislative or freshwater conservation constraints. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River) were considered as a precautionary approach: » Potential disturbance to the natural buffer zone surrounding the Vlermuisleegte River during maintenance activities, including disturbance to the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the river. » Increased hardened surfaces in the vicinity of the river may potentially alter the pattern of runoff entering the river.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (18)**	**Low (9)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Ensure that routine inspections and monitoring of the road are implemented; » Regular inspection of the area surrounding the road should occur to monitor the establishment of vegetation and prevent the establishment of alien and invasive vegetation species, and their potential spread into the river; » Stormwater runoff from the road should be monitored, so it does not result in erosion. Stormwater should be allowed to diffusely spread across the landscape. » No unauthorised or indiscriminate movement of vehicles in the Vlermuisleegte River may be permitted during the visual inspection; » If repair activities to the road are required, the mitigation measures as per that of the construction phase must be implemented.		
Residual: There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River may occur due to vegetation not being able to re-establish along the road. Constant usage of the road could potentially decrease the biodiversity (mainly faunal species) of the portion of the river associated with the access road.		

Nature: *Impacts associated with the operation of proposed access road Alternative 3 and 4.* The potential of edge effects to occur on the pan wetlands to these access road alternatives were considered: » Disturbance to the natural buffer zone surrounding the pan wetlands during maintenance activities, which can impact on the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of

the pans. » Increased hardened surfaces in the vicinity of the pans may potentially alter the pattern of runoff entering the pans.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (18)**	**Low (9)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Ensure that routine inspections and monitoring of the road are implemented; » Regular inspection for alien and invasive vegetation along the road should occur, to limit their spread into the pan wetlands; » Stormwater runoff from the road may not form preferential surface flow paths. If this does occur, the areas should be rehabilitated (erosion gullies infilled) and revegetated to aid in dispersing the flow of water from the road into the landscape; » No unauthorised or indiscriminate movement of vehicles in the pan wetlands may be permitted during the visual inspection; » If repair activities to the road are required, the mitigation measures as per that of the construction phase must be implemented.		
Residual: There is a residual risk that a decrease in habitat of the pan wetlands may occur due to vegetation not being able to re-establish within the road reserve. Constant usage of the proposed access road could potentially decrease the biodiversity (mainly faunal species) within the areas surrounding the pans.		

Nature: <u>*Impacts associated with the operation of proposed surface infrastructure and internal access roads.*</u> Operation of the proposed surface infrastructure and internal access roads in the PV development area, located outside of the 100m/500m GN509 ZoR of the Vlermuisleegte and perched depression wetland. As these activities are located outside of the applicable GN509 ZoR of the watercourses in accordance with the National Water Act, 1998 (Act 36 of 1998), the proposed operational activities thereof do not pose any legislative or freshwater conservation constraints. Nevertheless, the potential of edge effects to occur on the closest watercourse (i.e. the Vlermuisleegte River) were considered as a precautionary approach: » Disturbance to the natural buffer zone surrounding the Vlermuisleegte River during maintenance activities (such as cleaning of the PV panels), including the vegetation and soil components. This can impact on the habitat provisioning and biodiversity of the area surrounding the river. » Increased hardened surfaces in the vicinity of the river may potentially alter the pattern of runoff entering the river.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (18)**	**Low (9)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation: » Ensure that routine inspections and monitoring of the road are implemented; » Regular inspection of the area surrounding the surface infrastructure should occur to monitor the establishment of vegetation and prevent the establishment of alien and invasive vegetation species, and their potential spread into the river; » Stormwater runoff from the internal roads should be monitored, not to cause erosion and to be diffusely spread across the landscape; » No unauthorised or indiscriminate movement of vehicles in the Vlermuisleegte River or pan may be permitted during the visual inspection; » If repair activities to the road are required, the mitigation measures as per that of the construction phase must be implemented. » No water used as part of the solar panel cleaning activities may enter the river. It should be ensured that the water is collected in stormwater management systems within the development area. » Borehole water will be abstracted for use as part of the construction phase. As such it is considered imperative that a suitably qualified geohydrologist undertakes a yield test for the borehole to determine the sustainable yield that can be abstracted as well as the required rest periods to ensure no impacts on other users.
Residual: There is a residual risk that a decrease in habitat provision of the Vlermuisleegte River or pan may occur due to vegetation not being able to re-establish within the area surrounding the development area.

Nature: *Impacts associated with the construction and operation of the water purification plant* Construction and operation of the proposed water purification plant located approximately 175m west of the Vlermuisleegte River and outside of the 100m GN509 ZoR is in accordance with the National Water Act, 1998 (Act 36 of 1998). The construction and operational activities of this water purification plant do not pose any freshwater conservation constraints. Due to the distance of this purification plant from the river, the construction and operation thereof are of such low impact significance that no significant quantum of risk is expected to occur on the river. Nevertheless, the following potential indirect impacts were considered as a precautionary approach: » Increased disturbance within the surrounding natural area surrounding the river, may potentially lead to the proliferation of alien and invasive species establishment and spread into the river.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (10)**	**Low (5)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Water stored prior to purification/after purification should be in a sealed container which must be regularly inspected for leaks; » Regular inspection of the area surrounding the water purification plant should occur to monitor the establishment of vegetation and prevent the establishment of alien and invasive vegetation species, and their potential spread into the river; » Stormwater runoff from water purification plant should be monitored, not to cause erosion and to be diffusely spread across the landscape; » No untreated water may enter the river. If water is spilt, it should be ensured that the water is collected in stormwater management systems within the development area. » In terms of the definition of a water resource (which includes a watercourse, surface water, estuary or aquifer), any		

taking and storing of water needs to be regulated by Section 21(a) and (b) of the National Water Act, 1998 (Act No. 36 of 1998). A Water Use License may therefore be required. » The borehole should be monitored, and a data log kept for daily abstraction rates to ensure that abstraction is sustainable and does not impact surrounding water users. A geohydrologist should undertake annual audits to ensure compliance with authorised abstraction volume.
Residual: There is a risk that a decrease in habitat provisioning of the river may occur due to vegetation not being able to re-establish within the construction footprint area surrounding the water purification plant.

8.4.4 Comparative Assessment of Access Road Alternatives

Access road Alternative 1 was determined to have an impact of medium significance to the Vlermuisleegte River during the construction phase, with the application of the recommended mitigation measures. This is due to it traversing the Vlermuisleegte River which will result in disturbance to the vegetation and geomorphological components of the river during the construction phase. During the operational phase, if the recommended mitigation measures are implemented, the impacts significance would be Low. As for all other proposed access road alternatives, their construction and operation would have an impact of low significance (with the implementation of the recommended mitigation measures) to the watercourses (various identified pan wetlands). This is predominantly attributed to their distance from the identified watercourses.

It is the opinion of the freshwater ecologist that Access Road Alternative 4 should be selected, as from a freshwater conservation perspective, it is likely to pose the least impact to any watercourses during both its construction and operation.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Watercourses	» Directly traverses the Vlermuisleegte River. » Least Preferred but acceptable.	» Entails the construction of a new road. » Disturbance to the surrounding natural environment. » Not preferred.	» Does not traversing any watercourses. » Close proximity to the pan wetlands (albeit determined to be of low impact significance). » Not preferred.	» No other watercourses located within close proximity except for Pan Wetland 11. » **Preferred**.

8.4.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of watercourse impacts associated with Hyperion Solar Development 2 will be low. From the outcomes of the watercourse studies undertaken, it is concluded that the PV facility can be developed and impacts on watercourses can be managed to acceptable levels by taking the following into consideration:

» The access road should be permeable to allow for drainage from the road surface. In this regard, suitable stormwater management should be implemented to allow for water to drain from the road without causing erosion.

- Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River or pans occurs from excessive dust settling.
- An alien vegetation management plan should be compiled during the planning phase and implemented concurrently with the commencement of construction. Regular inspection for alien and invasive vegetation along the road should occur, to limit their spread into the river.
- Stormwater runoff from the road should be monitored, so it does not result in erosion. Stormwater should be allowed to diffusely spread across the landscape.
- In terms of the definition of a water resource (which includes a watercourse, surface water, estuary or aquifer), any taking and storing of water needs to be regulated by Section 21(a) and (b) of the National Water Act, 1998 (Act No. 36 of 1998). A Water Use License may therefore be required.
- It is considered imperative that a suitably qualified geohydrologist undertakes a yield test for the borehole to determine the sustainable yield that can be abstracted as well as the required rest periods to ensure no impacts on other users. The borehole should also be monitored, and a data log kept for daily abstraction rates to ensure that abstraction is sustainable and does not impact surrounding water users. A geohydrologist should undertake annual audits to ensure compliance with authorised abstraction volume.

8.5. Assessment of Impacts on Land Use, Soil and Agricultural Potential

The impact of Hyperion Solar Development 2 and associated infrastructure on the soils, land use, land capability and agricultural potential has been assessed as low (after mitigation), depending on the impact being considered. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G** – Soils Impact Assessment for more details).

8.5.1 Results of the Land Use, Soil and Agricultural Potential Study

The development area as well as Access Road Alternative 1 and 2 are located within one land type, i.e. Land Type Ah9. The eastern sections of Access Road Alternative 3 and 4 are located within land type Ah9, while the western sections of these two alternatives fall within land type Ag110. The homogeneity of soil properties of the development area correlates very well with the dominant soil forms of land type Ah9.

The development area and the access road alternatives are located within an area that has no potential for arable agriculture. While the deep apedal soil profiles are ideal for arable agriculture in the wetter eastern regions of South Africa, the erratic rainfall patterns and prolonged droughts experienced in the study area will result in dryland crop production failure. Irrigated agriculture is a possibility in the region, provided that there is a stable, licensed supply of irrigation water and the necessary irrigation infrastructure. There are no irrigation activities present within the development area or along the access road alternatives.

The grazing capacity of the veld in the development area and along the access road alternatives is 21 to 30ha per large animal unit or large stock unit (LSU). This indicates that the development area can accommodate 6 to 9 head of cattle for grazing purposes. Cattle farming is a viable long-term land use of the site provided that the current crippling drought conditions ceases and as long as the field quality is maintained by never exceeding the grazing capacity. Post-project land use should aim to re-establish the livestock farming potential of the land.

The land capability of the areas located within the project site can be classified as low-very low and low-moderate. Considering the soil forms present within the development area as well as the good grazing quality of the veld, the development area can be classified as having a low-moderate land capability (Class 7).

Overall, the project site has low sensitivity to the proposed development. The deep red and yellow-brown apedal soil profiles have no physical limitations to crop production but land capability of the area is severely impeded by the dry, semi-arid climate. Although the site is suitable for livestock production, the grazing capacity is also limited by the low rainfall of the area. The development of a renewable energy project such as Hyperion Solar Development 2 will have very little to no negative effect on the agricultural economy of the region.

8.5.2 Description of Land Use, Soil and Agricultural Potential Impacts

The undertaking of the specific activities required for the development of Hyperion Solar Development 2 will disrupt the natural soil horizon distribution and will subsequently impact on the current soil hydrological properties and functionality of the soils present within the project site proposed for the development. The following impacts on soils have been identified and assessed for the construction phase:

» Soil erosion is possible due to vegetation clearance. The impacts of soil erosion are both direct and indirect. The direct impacts are the reduction in soil quality which results from the loss of nutrient-rich upper layers of the soil and the reduced water-holding capacity of severely eroded soils. The off-site indirect impacts of soil erosion include the disruption of riparian ecosystems and sedimentation.

» Soil chemical pollution due to the storage of hazardous chemicals, concrete mixing, broken PV panels, temporary sanitary facilities and potential oil and fuel spillages from vehicles. This impact will be localised within the site boundary.

» In areas of permanent changes such as roads and the erection of infrastructure and topsoil stockpiles, the current land capability and land use will be lost permanently. This impact will however be localised within the site boundary.

All infrastructure and activities required for the operational phase will be established during the construction phase. Once construction has ceased, a number of impacts remain during the operational phase. During the operation phase the impacts related to loss of land use and land capability will stay the same. Areas under permanent buildings, substations, transformers and other covered surfaces are no longer susceptible to erosion, but hard surfaces will increase run-off during rain storms onto bare soil surfaces.

Soil chemical pollution during the operation phase will be minimal. Possible sources are oil that needs to be replaced and oil and fuel spillage from maintenance vehicles. This impact will be localised within the project site boundary.

Although wind erosion may have an impact before revegetation on adjacent areas, the loss of soil as a resource will be restricted to the actual footprint of Hyperion Solar Development 2. The only impact that may have effects beyond the development footprint is erosion which may cause the sedimentation of the adjacent wetlands.

8.5.3 Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)

Nature: Increased risk of soil erosion due to construction and operation of the solar PV facility

The construction of the PV facility, access road, water purification plant, camp site and laydown area will require the clearing and levelling of a limited area of land. The following construction activities will result in the bare soil surfaces that will be at risk of erosion:

- vegetation removal during site clearing;
- creating impenetrable surfaces during the construction phase that will increase run-off onto bare soil surfaces; and
- leaving soil surfaces uncovered during the rainy season during the construction phase.

During the operation phase the impenetrable surfaces such as paved areas and compacted roads stay intact, however, the impact of increased run-off persists on surrounding areas.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- Land clearance must only be undertaken immediately prior to construction activities.
- Unnecessary land clearance must be avoided.
- Soil stockpiles must be dampened with dust suppressant or equivalent.
- Soil stockpiles must be located to ensure that they are located away from any waterway or preferential water flow path in the landscape, to minimise soil erosion from these.
- Geo-textiles or similar measures must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away.
- A Stormwater Management Plan (SWMP) should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.
- Where discharge of rainwater on roads will be channelled directly into the natural environment, the application of diffuse flow measures must be included in the design.
- Revegetate cleared areas as soon as possible after construction activities.

Residual:

The residual impact from the construction and operation of Hyperion Solar Development 2, access road, and auxiliary buildings on the susceptibility to erosion will be negligible.

Nature: Chemical pollution due to construction and operation of the PV facility

The following construction activities can result in the chemical pollution of the soil:

- Hydro-carbon spills by machinery and vehicles during earthworks and the mechanical removal of vegetation during site clearing.
- Spills from vehicles transporting workers, equipment and construction material to and from the construction site.
- The accidental spills from temporary chemical toilets used by construction workers.
- The generation of domestic waste by construction and operational workers.
- Spills from fuel storage tanks during construction.
- Polluted water from wash bays and workshops during the construction phase.
- Accidental spills of other hazardous chemicals used and stored on site.

» Pollution from concrete mixing and broken PV panels. The operation of the PV facility can result in the chemical pollution of the soil: » Spills from vehicles transporting workers and equipment to and from the operation site. » The generation of domestic waste by operational workers. » Accidental spills of other hazardous chemicals used and stored on site.		
	Without mitigation	**With mitigation**
Extent	High (3)	Low (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (36)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
Mitigation: » High level maintenance must be undertaken on all vehicles and construction machinery to prevent hydrocarbon spills; » Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on; » Site surface water and wash water must be contained and treated before reuse or discharge from site; » Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material; » Spill kits must be available on site throughout the construction and operation phase; » Waste disposal at the construction site must be avoided by separating, trucking out and recycling of waste; » Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and » Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols as outlined in the EMPr. Contaminated soils must be disposed of to a registered hazardous waste landfill site.		
Residual: The residual impact from the construction and operation of the proposed project will be low to negligible.		

Nature: *Loss of land capability as a result of the development* The land capability of the project site where soil layers are changed and construction of infrastructure is done, will be lost. The impact remains present through the operational phase. The following activities can result in the loss of land capability within the project development footprint: » The removal of vegetation during site clearing; » Earthworks which destroy the natural layers of the soil profiles; and » The construction of access roads and photovoltaic power plant (frame structures and installation of modules onto frames) and infrastructure which will cover soil surfaces.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Definite (4)	Probable (4)
Significance	**Medium (36)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No

Can impacts be mitigated?	Yes
Mitigation: » Keep the project footprint as small as possible; and » Avoid areas with wetland land capability.	
Residual: The residual impact from the construction and operation of Hyperion Solar Development 2 and supporting infrastructure will be of low significance..	

8.5.4 Comparative Assessment of Access Road Alternatives

From a soils, land use, land capability and agricultural potential perspective, the following should be considered:

» The avoidance of areas with high arable agricultural potential as this is a scarce natural resource in South Africa.
» Areas with wetland land capability where surface disturbance of the hydromorphic soil forms will result in disabling the functionality of the wetland areas.
» The minimisation of the project surface footprint as this is directly proportional to the extent of the impact.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Landuse, Soil and Agricultural Potential	» Soil already affected by traffic. » Impacts on soil and land capability will only be for the widening of the existing road. » **Preferred**.	» Acceptable.	» Longest access road alternative. » Larger area of in situ soil profiles that will be disturbed. » Area will affected by soil compaction. » Least preferred.	» Acceptable.

8.5.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of Hyperion Solar Development 2 can be reduced to low. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on soils can be managed to acceptable levels by taking the following into consideration:

» Land clearance must only be undertaken immediately prior to construction activities.
» Geo-textiles or similar measures must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away.
» Where discharge of rainwater on roads will be channelled directly into the natural environment, the application of diffuse flow measures must be included in the design.
» The project footprint must be kept as small as possible.
» The Stormwater Management Plan (SWMP) should be developed and should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion.

8.6. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of Hyperion Solar Development 2. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H**).

8.6.1 Results of the Visual Impact Assessment

The affected landscape has a semi-natural rural character. However, there is evidence that this character is being eroded by additional solar energy developments in the vicinity of the proposed project. Whilst there are a significant number of additional projects proposed in the area, it seems unlikely the authorised projects will change the overall character of the landscape as experienced by the majority of receptors. This is because of the relatively flat topography that allows limited elevated views, the vegetation that will provide a large degree of screening and the fact that they are likely to be set back from major roads. Mining is the largest industrial activity in the area. All major mining activities are a significant distance from the proposed development area and are unlikely to have a major influence on the character of the landscape surrounding the project site.

Several sensitive receptors have been identified and includes:

» Roads in the vicinity including the N14, the R308 and a local road;
» Homesteads in the vicinity; and
» The Kathu Airport.

» <u>Views from roads:</u>
The project may be visible from the N14 as it is located approximately 6.5km from the road. The Zones of Theoretical Visibility (ZTV) analysis indicates that the project could potentially be seen over approximately 12.6km length of the road. Due to the relatively flat topography, the proposed array is likely to be seen as a narrow dark band in the landscape that at this distance and is unlikely to be obvious. It is also likely that vegetation between the road and the array is likely to at least break views of the development.

The project may also be visible to the R380 which at its closest is approximately 6.4km to the west of the proposed array. As with views from the N14, the proposed array will be viewed over flat topography and through natural vegetation. The ZTV analysis indicates that views from this road may be possible over approximately 0.9km of the road and at a distance of approximately 7.6km. Given the topography, screening provided by vegetation and the distance, it is highly unlikely that the array will be visible from the R380.

The ZTV analysis indicates that views may be possible of the proposed array from approximately 7.6km of a minor road that runs to the south and south west of the site at a minimum distance of approximately 7.3km. Due to the flat topography, the likelihood that at least a degree of screening will be provided by vegetation and the distance involved, it seems highly unlikely that the proposed array will be obvious from this road. At the distances involved, the taller structures associated with the on-site substation are highly unlikely to be obvious.

» <u>Views from homesteads:</u>
There are fourteen groups of buildings within the Approximate Limit of Visibility of which eight fall within the ZTV. The closest homestead is approximately 500m from the edge of the development. This

homestead is inhabited by the landowner who is in agreement with the project proceeding. In order to ensure that views from the homestead are not totally compromised, a buffer of 500m has been allowed for in development planning. The buildings are orientated in a manner that focuses outlook towards the south and away from the proposed development.

The on-site substation is located approximately 2km from this homestead on the opposite side (western) of the project. It is possible that the taller elements associated with the substation may be visible from the homestead, however, they will not be highly obvious and it is likely that existing vegetation will help to soften the view.

There is a homestead approximately 2.6km to the north of the proposed array. From Google Earth, the main house is orientated east to west with relatively dense trees on its southern side. It is therefore unlikely that it will be possible to see the proposed project from the house. Views of Hyperion Solar Development 2 may be possible from the surrounding area; however, it is likely that existing vegetation will at least partly screen the development. The on-site substation is located approximately 2.2km from this homestead. It is possible that the taller elements associated with the substation may be visible; however, they will not be highly obvious, and it is likely that existing vegetation will help to soften the view.

There is also a group of buildings approximately 2.6km to the southeast of the proposed array. It includes a single homestead with other farm buildings. These buildings are also surrounded by trees which are likely to provide a degree of screening. Any visual impact is likely to be part mitigated by distance as well as screening that is provided by existing natural vegetation. The on-site substation is located approximately 4.5km from this group of buildings. It is unlikely that the taller elements associated with the substation will be obvious at this distance.

The remaining five groups of buildings are in excess of 3.5km from the proposed array. It is possible that glimpses of the development may be possible from these, however, distance and intervening natural vegetation are likely to largely screen views of the proposed development.

Access road alternatives have the potential to impact visually on homesteads. Alternative 1 and 2 pass close to homesteads to the south east of the proposed project. It is possible that owners of the homesteads could favour this as it is likely to result in an upgraded access road that they might use. It will also mean that there will be an increased volume of traffic visible to the homesteads. This however is likely to be largely during the construction phase.

» Kathu Airport:
Kathu Airport is located approximately 10.9km from the proposed PV array. Largely due to distance and vegetation, the proposed array is highly unlikely to be visible from the airport. It is likely to be visible from planes on approach and exit from the airport. However, there are other solar facilities some of which are closer to the airport that will also be visible.

» Lighting Impacts:
Security and operational lighting at night could make the development obvious to receptors.

» Glare:
There are three areas where glare may be a concern for stakeholders including:
* The Kathu aerodrome;
* The un-surfaced road and the R308 to the west of the project; and

* The N14 to the south of the project.

Kathu aerodrome is located approximately10.9km to the south west of the proposed project. Due to the location of the facility relative to the airport it would only be possible for reflected light from the array to affect pilots on the northern flight path into the aerodrome. The northern end of the runway is located approximately 7km further south than the proposed project. If the array is fixed and the PV panels are aligned facing north, areas furthest south that reflected light from the panels might affect would have to be approximately 270° from the project. At this bearing an aircraft would be approximately 7km from the end of the runway. At this angle, the pilot's peripheral vision only would be affected. Whilst a plane may be on the final approach at this distance, it is likely to be relatively high and above any low-level reflected light from the array. At a recommended approach path of 3° an aircraft would be flying at a height in excess of 350m.

Given the distance and given that there is only potential for a pilot to see reflected light from the array in his / her peripheral vision on approach and will not affect the straight ahead view or the view of instruments, it can be concluded that the proposed facility is highly unlikely to have any significant effect on the airport.

From reference to the ZTV, the project could be visible intermittently over a section of the N14. This section of road however to the south or the proposed project which makes it impossible for glare from the project to affect it. Because glare is reflected light from an inclined panel, it will generally affect areas above the level of the panel surface and slightly to the north east or north west of the project

As the un-surfaced local road that runs to approximately 8km to the south west and the R308 that runs in excess of 12km from the proposed project are highly unlikely to be affected due to distance as well as the fact that there is significant natural vegetation between the roads and the proposed development which will effectively screen views and therefore will also screen reflected light from the PV panels.

8.6.2 Visual Assessment

Visual impacts will occur during the construction and operation phases of Hyperion Solar Development. The following impacts are assessed in detail in section 8.6.3:

» The general change in character of the landscape due to the proposed development.
» Visual impacts on views from roads including the N14, the R308 and local roads.
» Visual impacts on local homesteads.
» The impact of lighting.
» Glint and glare from the PV panels which could impact negatively on the flight path into Kathu Airport

The visibility of the proposed project is likely to be limited, and it is therefore unlikely to have a major influence on the character of the landscape as experienced by the majority of people. Overall, the significance of the visual impacts of Hyperion Solar Development 2 is considered to be low with the implementation of mitigation measures.

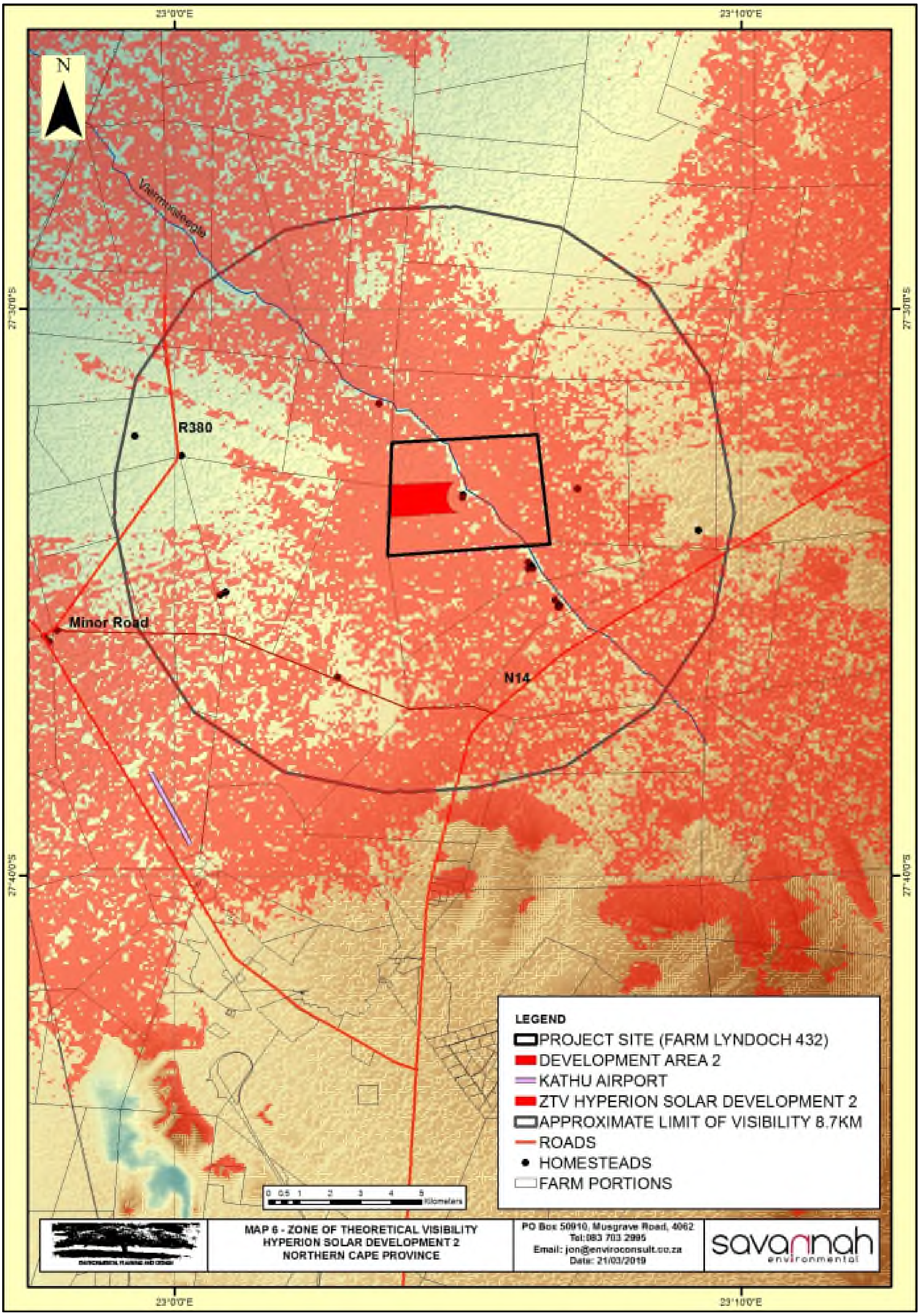

Figure 8.6: **A map illustrating the zone of theoretical visibility (ZTV) and the typical views towards Hyperion Solar Development 2.**

8.6.3 Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)

The impacts assessed below apply to the development area and the 20m access roads corridors assessed for Hyperion Solar Development 2.

Nature: Impact on General Landscape Character

Loss of natural vegetation and industrialisation of the landscape caused by the proposed project. The issue relates to the further degradation / industrialisation of the general rural landscape character.

The development area is located within an area that is perceived as being a semi-natural rural landscape. It is however being developed rapidly with other similar solar projects. However, the initial review indicates that whilst glimpses of these projects may be possible, the perception of a semi-natural landscape is likely to remain. The proposed development is likely to have limited impact due to the general limited visibility. The proposed development is not likely to significantly change this perception.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	**Low (21)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss
Can impacts be mitigated?	Yes.	

Mitigation:

Planning:

» Plan development levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain and augment natural vegetation on all sides of the proposed project.
» Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

» Maintain and augment natural vegetation around the proposed project. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on views from roads including the N14, the R308 and local roads* The issue relates to the industrialisation of the rural landscape due to views of the project from roads. Possible receptors include travellers on the N14, the R308 and a local road that runs to the south and south west between the N14 and the R308. The affected sections of all roads are in excess of 6.5km from the proposed project. Due to the flat topography, the distance involved and the natural vegetation which is likely to provide a degree of screening, it is unlikely that the project will be obvious from these roads. The proposed development is therefore likely to have limited impact due to the general limited visibility. The proposed development is not likely to significantly change this perception.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small (0)
Probability	Probable (3)	Improbable (2)
Significance	**Low (21)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss
Can impacts be mitigated?	Yes.	
Mitigation: Planning: » Plan development levels to minimise earthworks to ensure that levels are not elevated; » Plan to maintain the height of structures as low as possible; » Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development; » Retain and augment natural vegetation on all sides of the proposed project. » Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary. Operation: » Reinstate any areas of vegetation that have been disturbed during construction; » Remove all temporary works; » Monitor rehabilitated areas post-construction and implement remedial actions;		

» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area. » Maintain and augment natural vegetation around the proposed project. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impact on views from local homesteads* The issue relates to the industrialisation of the rural landscape due to views of the project from homesteads. There is one homestead approximately 500m from the proposed development. However, this is inhabited by the affected landowner and his family. It has been confirmed that he is in agreement with the proposed development. A 500m buffer has also been allowed by the developer to ensure that whilst the development may be obvious, it doesn't completely impose a new aesthetic on the homestead's surroundings. As this homestead belongs to the owner of the property on which the project is proposed, it is not considered in the assessment below. There is a homestead approximately 2.6km to the north of the proposed array. It is unlikely that the development will be highly obvious from the house due to existing trees around the building and its orientation. Views of the array may be possible from the surrounding area. However, it is likely that existing vegetation will at least part screen the development. There is also a group of buildings approximately 2.6km to the southeast of the proposed array. The buildings are also surrounded by trees which are likely to provide a degree of screening. Any visual impact is also likely to be part mitigated by distance as well as screening that is likely to be provided by existing natural vegetation. The remaining five groups of buildings are in excess of 3.5km from the proposed array. It is possible that glimpses of the development may be possible from these; however, distance and intervening natural vegetation is likely to largely screen views.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to minor (1)	Small (0)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	The proposed development can be dismantled and removed at the end of the operational phase. There will therefore be no irreplaceable loss. However, given the likely long term nature of the project, it is possible that a proportion of stakeholders will view the loss of view as irreplaceable.	No irreplaceable loss
Can impacts be mitigated?	Yes.	
Mitigation:		

Planning: » Plan development levels to minimise earthworks to ensure that levels are not elevated; » Plan to maintain the height of structures as low as possible; » Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development; » Retain and augment natural vegetation on all sides of the proposed project. » Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary. Operation: » Reinstate any areas of vegetation that have been disturbed during construction; » Remove all temporary works; » Monitor rehabilitated areas post-construction and implement remedial actions; » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area. » Maintain and augment natural vegetation around the proposed project. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Glint and glare impacts associated with the flight path into Kathu Airport* Kathu Airport is located approximately 10.9km to the south west of the proposed project. It is possible but given the distance unlikely that reflected light from the array could be visible from the northern flight path particularly during early mornings during summer months. This however is unlikely and it will not affect the straight ahead pilot's view or the view of instruments.		
	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Small (0)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (16)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Yes.	
Mitigation: Operation: If glare proves to be problematic, the only mitigation possible would be adjustment of the angle of repose of the panels. Due to distance, a minor adjustment in the angle is likely to be all that is needed.		
Residual Impacts: There are no residual risks.		

Nature: *Light pollution and making the project obvious within a relatively dark night time landscape* Security and operational lighting could make the project visible to receptors at night. This will be seen in the context of other projects as well as lighting associated with mining and settlement. Currently the only lighting in the immediate

vicinity of the project is associated with homesteads and is relatively low level. It should be noted that from observations made on site, the majority of the closest projects that is to the south west and within the ALV of Hyperion Solar Development 2 (Kalahari Solar Power Project) is relatively dark at night. Only the turbine house of this development is lit with relatively low key lighting.

Figure 1: View of Kalahari Solar Power Project at night from the Kathu Airport

The facility may be lit by security lights to a level sufficient to ensure that security cameras can operate at night. This is likely to result in the array being obvious at night from surrounding areas. Lighting from passing traffic on the N14 is also obvious. There is potential therefore for the project to extend the influence of lighting into an area that would otherwise be relatively dark at night.

	Without mitigation	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Small to Minor (1)
Probability	Definite (5)	Improbable (2)
Significance	**Medium (50)**	**Low (21)**
Status (positive or negative)	The appearance of a large lit area may be accepted by most people because it is so close to the N14, major mining operations as well as Kathu, all of which are well lit. It is likely however that some people will see the expansion of lighting as a **negative** impact.	If the lights are generally not visible then the occasional light is unlikely to be seen as negative. **Neutral**
Reversibility	High	High
Irreplaceable loss of resources?	It would be possible to change the lighting / camera system so	No irreplaceable loss

	the impact cannot be seen as an irreplaceable loss.	
Can impacts be mitigated?	Yes.	

Mitigation:

» Use low key lighting around buildings and operational areas that is triggered only when people are present.
» Plan to utilise infra-red security systems or motion sensor triggered security lighting;
» Ensure that lighting is focused on the development with no light spillage outside the site; and
» Keep lighting low, no tall mast lighting should be used.

Residual Impacts:

No residual risk has been identified.

Nature: *Impacts on the natural character of the landscape due to the access road alternatives*

Loss of natural vegetation due to access road construction eroding the natural character of the landscape.

	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Small to minor (1)	Small (0)	Minor to low (3)	Minor (2)	Minor to low (3)	Minor (2)	Minor to low (3)	Minor (2)
Probability	Improbable (2)	Improbable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Probable (3)
Significance	**Low (14)**	**Low (12)**	**Low (27)**	**Low (24)**	**Low (27)**	**Low (24)**	**Low (27)**	**Low (24)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	High	High	High	High	High	High	High	High
Irreplaceable loss of resources?	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Yes.							

Mitigation:

Planning:

» Plan levels to minimise earthworks;
» Plan alignment to avoid as many trees as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation on either side of the road;
» Plan to replace lost vegetation.

Operation:

» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.

» Maintain and augment natural vegetation around the proposed project. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

Nature: *Impacts on the natural character of the landscape due to the access road alternatives*
Loss of natural vegetation due to access road construction eroding the natural character of the landscape.

	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)	Site and immediate surroundings (2)
Duration	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)	Long term (4)
Magnitude	Minor to low (3)	Minor to low (3)	Minor to low (3)	Minor (2)	Small (0)	Small (0)	Small (0)	Small (0)
Probability	Probable (3)	Probable (3)	Probable (3)	Probable (3)	Very improbable (1)	Very improbable (1)	Very improbable (1)	Very improbable (1)
Significance	Low (27)	Low (27)	Low (27)	Low (24)	Low (6)	Low (6)	Low (6)	Low (6)
Status (positive or negative)	Negative	Negative	Negative	Negative	Neutral	Neutral	Neutral	Neutral
Reversibility	High	High	High	High	High	High	High	High
Irreplaceable loss of resources?	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss	No irreplaceable loss
Can impacts be mitigated?	Yes.				Not necessary.			

Mitigation:
Planning:
» Plan levels to minimise earthworks;
» Plan alignment to avoid as many trees as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation on either side of the road;
» Plan to replace lost vegetation particularly between the proposed alignment and existing homesteads.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area.
» Maintain and augment natural vegetation around the road alignment, particularly between the road and existing

homesteads. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the site; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: The residual risk relates to loss of natural vegetation cover being obvious on decommissioning of the proposed project. It is therefore critical that effective rehabilitation is undertaken.

8.6.4 Comparative Assessment of Access Road Alternatives

The proposed alternative access road alternatives are likely to cause relatively low levels of visual impact. The main issue issues relate to proximity to homesteads which could result in traffic being obvious to residents as well as the loss of vegetation which could have negative influence in terms of character change. Access Road Alternative 1 being an upgrade of an existing road is likely to cause the least overall impact on existing natural vegetation and therefore the least impact on the overall landscape character. However, Alternative 1 and 2 being aligned closest to existing homesteads are likely to have the greatest impact on residents. All alternatives are acceptable from a visual impact perspective.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Visual	» Least impact on the overall landscape character. » Closely aligned to existing homesteads. » Acceptable.	» Closely aligned to existing homesteads. » Acceptable	» Acceptable	» Acceptable

8.6.5 Implications for Project Implementation

The visibility of the proposed project is likely to be limited, and it is therefore unlikely to have a major influence on the character of the landscape as experienced by the majority of people. Overall, the significance of the visual impacts is expected to be low with the implementation of mitigation measures by the developer, contractors, and operational staff. From the outcomes of the Visual Impact Assessment undertaken, it is concluded that the PV facility can be developed and visual impacts can be managed to acceptable levels by taking the following into consideration:

» Retain/re-establish and maintain natural vegetation immediately adjacent to the development footprint/servitude.
» Maintain the general appearance of the infrastructure.
» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas.

8.7. Assessment of Impacts on Heritage Resources

Negative impacts on heritage resources may occur due to loss of archaeological and palaeontological resources during construction activities of Hyperion Solar Development 2. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix I**).

8.7.1 *Results of the Heritage Impact Assessment (including archaeology and palaeontology)*

Palaeontology:

The basement rocks in the region are of lava with an outcrop occurring on the project site in the Vlermuisleegte River. Although the SAHRIS Palaeosensitivity Map indicates the area to be of moderate to high sensitivity, based on the specialists' experience from other projects, suggests that the area should be regarded as of generally low sensitivity with the possibility of small pockets of high sensitivity occurring in places. The main concern is likely to be the potential occurrence of mammalian remains in solution hollows in the calcrete or associated with old pan or *vlei* deposits along drainage lines. A buffer of 50m from the Vlermuisleegte is recommended in order to avoid chance finds of such fossil localities. A far larger buffer has already been incorporated into the project design to protect other types of heritage resources which means that significant palaeontological impacts are unlikely to occur. No palaeontological resources were identified during the field survey. Overall, a field rating of GP B is applied to palaeontology.

Archaeology:

The red sand covering much of the project site is sterile of archaeological materials with one exception, a light scatter of artefacts with a few gravel clasts approximately 70m to the east of the Vlermuisleegte River in the centre of the project site. Other areas where stone artefacts were identified, were areas which also comprised of gravel. These areas include a low gravel hill approximately 1km to the south of the proposed development area and along the banks of the Vlermuisleegte River. The Vlermuisleegte River and immediate surrounds should be considered as a no-go area as it is likely that the area close to the Vlermuisleegte River may consist of gravel that contains the artefacts which are closer to the surface, and are regarded as sensitive. A buffer of approximately 120m from the edge of the Vlermuisleegte is recommended to protect all areas considered to be potentially sensitive at the surface.

The most interesting artefact identified during the survey was located in an open test excavation (apparently a search for diamonds) on the north-eastern bank of the Vlermuisleegte River. A standing section of approximately 1m high had artefacts present in it. One of these was a broken bifacial point of the sort commonly referred to as a 'Still Bay point' after the location where such artefacts were first described. The Still Bay period is part of the MSA and dates to between 77 and 70 000 years ago (Lombard *et al.* 2012).

Archaeology was also recorded along the current access road, which runs alongside the Vlermuisleegte River (i.e. Access Alternative 1). The artefact density was strongly variable, but wherever there was gravel present, there were also artefacts. In some places it was evident that gravel had been imported to surface the road. This gravel, too, contained artefacts. A number of excavations alongside the road were present and examined for archaeology. The artefacts seemed to be from the MSA with ESA and LSA types absent. This is in contrast to the archaeology in and around Kathu town to the south which is strongly dominated by the ESA. Overall, a field rating of GP A is applied to archaeology on this project site.

Graves:

Several graves were identified within the project site. This included as informal farm workers' graveyard and five 'stone-packed' graves present of which only one had a 'headstone' which was made from a piece of corrugated iron. A sheet of flat metal dated 1973 was found in the grass and had once been part of one of the graves. This was the only date associated with the five graves. A single formal grave was identified adjacent to the Vlermuisleegte River. It's headstone indicated the date of death as being 8 October 1928. To the east of the Vlermuisleegte River, a collection of stone was located in a sandy area on the upper part of the bank. No other stone were present in the vicinity and the collection is clearly anthropogenic. No graves protected under the NHRA are known from the project site.

Built Environment:
There were no buildings located within the development area for Hyperion Solar Development 2. Several buildings are present within the project site and along Access Road Alternative 1 and 2. According to the landowner, the oldest structures on the farm date to the 1940s. An examination of them showed that they were fairly generic disused farm structures and not of any significance. The presence of a rondavel is somewhat unusual but still of no obvious significance. The main house within the project site was originally an older building but it has been completely renovated and is now essentially modern. Two farm houses and some associated outbuildings is located close to Access Road Alternatives 1 and 2. These all appear to date no earlier than the mid-20th century and none carry any heritage significance. The house located at Feature 1195 and one close to Feature 2003 are both older than 60 years as testified by their presence on the 1957 aerial photograph (Job 391, strip 9, photograph 2030).

Overall, the structures on and near the project site all have low cultural significance for their architectural and historical values.

The overall impact significance of the proposed development on palaeontology is likely to be low. No heritage resources of significance have been identified within the development footprint for Hyperion Solar Development 2 except for a concentration of stone artefacts in gravel on a very small raised gravel area. (refer to Feature 1223 in **Figure 8.6**). This feature is considered to be of low signification. Three features have been identified within the 20m access road corridor for Alternative 1. These include:

» Site1202 - An exposure of solid calcrete considered to be of no heritage significance.
» Site1203 - Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte River. Construction within this area is deemed acceptable.
» Site 1204 - Stone artefacts in gravel on and beneath current access road along the south-western bank of the Vlermuisleegte River. Construction within this area is deemed acceptable. An excavation alongside the road goes directly into dense gravel.

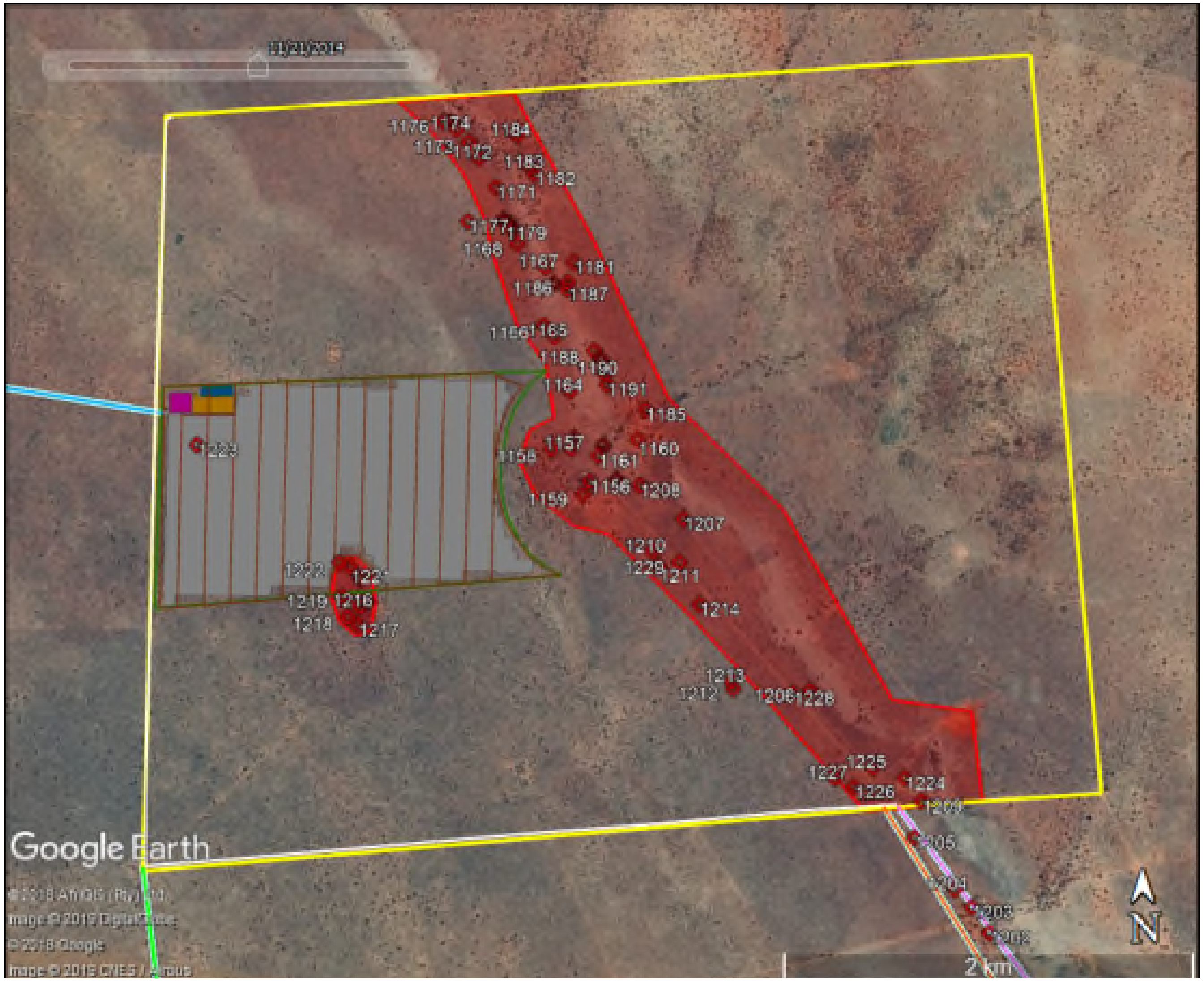

Figure 8.6: **Heritage resources within the vicinity of Hyperion Solar Development 2.**

8.7.2 Description of the Heritage Impacts

Potential impacts to palaeontological resources would occur during the construction phase only and would be direct impacts. The spatial extent of impacts would be limited to the local area but the chances of impacts occurring are deemed to be very limited. There are no fatal flaws in terms of palaeontology and the significance of potential impacts before mitigation is considered to be low. With the implementation of mitigation, which would involve protecting and reporting any chance finds, the significance would remain low.

Potential impacts to archaeological resources would occur during the construction phase only and would be in the form of direct impacts. The spatial extent of impacts would generally be limited to the local area but it should be considered that all archaeology in the Kathu region has the potential to add value to the Grade I Kathu Complex. Impacts of some sort are highly probable due to the widespread distribution of archaeology within the gravels of the area but in areas with deeper sand the chances are greatly diminished. There are no fatal flaws in terms of archaeology. The significance of potential impacts to archaeological resources are low with the implementation of mitigation measures.

Potential impacts to unmarked graves would occur during the construction phase only and would be in the form of direct impacts. The spatial extent of impacts would be very limited. Because graves are so rarely encountered in the local landscape, the probability of graves being impacted within the development area is deemed to be very low. There are no fatal flaws in terms of graves since, although they are important, their locations cannot be predicted and they can only be dealt with on a case by case basis if discovered during construction. Because of the very low probability of impacts occurring, the significance of potential impacts is considered to be low with the implementation of mitigation measures.

Extensive, deep excavations are unlikely to be required for the development of a solar energy facility. Significant negative impacts on local fossil heritage are therefore unlikely to result from the proposed development.

8.7.3 Impact tables summarising the significance of impacts on heritage related to the PV facility and associated infrastructure during construction and operation (with and without mitigation)

Nature: *Impacts on archaeological resources due to the construction of Hyperion Solar Development 2* Direct destruction of archaeological materials during construction activities of the PV facility.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (56)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes.	
Mitigation: Test excavations and sampling of artefacts and also protection and reporting of chance finds for further actions as needed. Geotechnical investigations can inform on where gravel is likely to be intersected during development and mitigation work should focus on such areas.		

Residual Impacts:
It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.

Nature: *Impacts on archaeological resources due to the construction of Hyperion Solar Development 2* Direct destruction of archaeological materials during construction activities of the PV facility.								
	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)	Moderate (6)	Minor (2)
Probability	Highly probable (4)	Improbable (2)	Probable (3)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)	Improbable (2)
Significance	**Medium (56)**	**Low (16)**	**Medium (42)**	**Low (16)**	**Low (28)**	**Low (16)**	**Low (28)**	**Low (16)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes.							
Mitigation: Test excavations and sampling of artefacts and also protection and reporting of chance finds for further actions as needed. Geotechnical investigations can inform on where gravel is likely to be intersected during development and mitigation work should focus on such areas.								
Residual Impacts: It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.								

Nature: *Impacts on archaeological resources due to the perimeter road* Direct destruction of archaeological materials during construction activities.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Improbable (2)	Improbable (2)
Significance	**Low (28)**	**Low (16)**

Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes.	
Mitigation: Protection and reporting of chance finds for further actions as needed.		
Residual Impacts: It is not possible to locate every single stone artefact and there is a possibility that artefacts may be lost during the development process. Of concern would be the loss of denser patches of archaeology but this cannot yet be determined because the vast majority of material lies deeply buried. Successful sampling of the archaeology on site would greatly reduce the residual impacts.		

The tables below is applicable to the PV facility and associated infrastructure, including all access road alternatives under consideration.

Nature: *Impacts on palaeontological resources* Direct destruction of fossil materials during construction activities.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Low (4)	Minor (2)
Probability	Improbable (2)	Very improbable (1)
Significance	**Low (22)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes.	
Mitigation: Implementation of a chance find procedure. Chance finds to be protected *in situ* and reported. Further actions can then be taken if deemed necessary.		
Residual Impacts: It is not possible to locate every single fossil and there is always a possibility that fossil materials will be lost during the development process. These are generally likely to be isolated examples with low significance		

Nature: *Impacts on graves* Direct destruction of graves during construction activities.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate (6)	Minor (2)
Probability	Very improbable (1)	Very improbable (1)
Significance	**Low (12)**	**Low (8)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Irreversible
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes.	
Mitigation: *In situ* protection and reporting of any graves discovered during construction work so that they can be recorded and removed to safety.		

Residual Impacts:
There may still be graves that are never identified and preserved or rescued. However, for preserved or rescued graves there would be almost zero residual impact.

8.7.4 Comparative Assessment of Access Road Alternatives

From a palaeontological perspective, no access road alternative is preferred since Alternative 1 is already a disturbed alignment and the other three alternatives may not reach beneath the surficial sand and underlying gravels. From an archaeological perspective, the impacts associated with Alternative 1 and 2 are of medium significance and mitigation will involve test excavations and sampling of the archaeology. Access Road Alternatives 3 and 4 are both likely to be over deeper sand, and the probability of impacts occurring is far lower with the significance before and after mitigation being low.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Archaeology	» Impacts will be of medium significance without the implementation of mitigation. » Fair chance of intersecting artefact-bearing gravel. » Area already disturbed. » **Preferred**.	» Impacts will be of medium significance without the implementation of mitigation. » Fair chance of intersecting artefact-bearing gravel. » Least preferred	» Impacts will be of low significance without the implementation of mitigation. » Acceptable.	» Impacts will be of low significance without the implementation of mitigation. » Acceptable.
Palaeontology	» Acceptable	» Acceptable	» Acceptable	» Acceptable

8.7.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts on heritage resources as a result of the development of Hyperion Solar Development 2 will be low. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on heritage can be managed to acceptable levels by taking the following into consideration:

» A buffer of approximately 120m from the edge of the Vlermuisleegte is recommended to protect all areas considered to be potentially sensitive at the surface. Should any solar facility infrastructure (including solar panels, access roads, buildings) be planned within this buffer, the environmental control officer (ECO) should be alerted to the greater possibility of fossil remains here.
» Once geotechnical work has been done on the site an archaeologist should be appointed to conduct test excavations and sampling of the archaeology in areas where *in situ* gravel will be intersected by foundations, cable trenches and/or access roads (Alternative 1 and 2). This work should aim primarily to understand the distribution of archaeology on the landscape, although if any dense archaeology is encountered it may be necessary to expand excavations.
» A chance find procedure must be developed and implemented in the event that archaeological or palaeontological resources are found. This should be included in the EMPr.

- If any fossils, archaeological material or human burials are uncovered during the course of development then work in the immediate area should be halted. The find would need to be reported to the heritage authorities and may require inspection by an archaeologist or palaeontologist. Such heritage is the property of the State and may require excavation and curation in an approved institution

8.8. Assessment of Social Impacts

Impacts on the social environment are expected during both the construction and operation phases. Potential social impacts and the relative significance of the impacts associated with the development of Hyperion Solar Development 2 are summarised below (refer to **Appendix J**).

8.8.1 Results of the Social Impact Assessment

Traditionally, the construction phase of a PV solar development is associated with the majority of social impacts. Many of the social impacts are unavoidable and will take place to some extent, but can be managed through the careful planning and implementation of appropriate mitigation measures. A number of potential positive and negative social impacts have been identified for the project. An assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as "fatal flaws".

Based on the social impact assessment, the following general conclusions and findings can be made:

- The potential negative social impacts associated with the construction phase are typical of construction-related projects and not just focussed on the construction of solar PV projects (these relate to an influx of non-local workforce and jobseekers, intrusion and disturbance impacts (i.e. noise and dust, possible wear and tear on roads and safety and security risks), and could be reduced with the implementation of the mitigation measures proposed. The significance of such impacts on the local communities can therefore be mitigated.
- The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during the operation phase.
- The proposed project could assist the local economy in creating entrepreneurial growth and opportunities, especially if local business is involved in the provision of general material, goods and services during the construction and operational phases. This positive impact is likely to be compounded by the cumulative impact associated with the development of several other solar facilities within the surrounding area, and as a result of the project's location within an area which is characterised by high levels of solar irradiation and which is therefore well-suited to the development of commercial solar energy facilities.
- The proposed development represents an investment in infrastructure for the generation of non-polluting, renewable energy, which, when compared to energy generated as a result of burning polluting fossil fuels, represents a positive social benefit for society as a whole.
- It should be noted that the expected benefits associated with the project, which include generation of electricity from renewable sources and local economic and social development, are likely to outweigh the perceived impacts associated with the project.

8.8.2 Description of Social Impacts

The following positive and negative impacts have been identified and assessed for Hyperion Solar Development 2.

Positive social impacts associated with the construction phase of Hyperion Solar Development 2:
» Direct and indirect employment opportunities and skills development
» Socio-economic stimulation

Negative social impacts associated with the construction phase of Hyperion Solar Development 2:
» Influx of construction workers and change in population
» Increase in crime
» Increased risk of HIV infections
» Hazard exposure
» Impacts on daily living and movement patterns
» Disruption to social and community infrastructure
» Nuisance impacts (noise and dust)
» Transformation of the sense of place

Positive social impacts associated with the operation phase of Hyperion Solar Development 2:
» Direct and indirect employment opportunities and skills development
» Socio-economic stimulation

Negative social impacts associated with the operation phase of Hyperion Solar Development 2:
» Transformation of the sense of place impacts

8.8.3 Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)

Construction Phase Impacts

Nature: *Nuisance impacts (noise and dust) associated with the PV facility*
Site-specific activities such as site clearance and the deliveries of materials, equipment, plant and the transportation of the workforce along unsealed access roads will generate the most dust and noise. Dust that accumulates on foliage and grasses that is used for grazing may result in that foliage and those grasses becoming unpalatable for livestock and/or game. This may in turn have an effect on farming activities within the vicinity of the project site and along the access road over the construction period. This impact will negatively impact sensitive receptors situated within or in close proximity to the project site, and could also potentially impact surrounding land users. The impact of noise and dust on surrounding land users and local farmsteads can be reduced through the application of appropriate mitigation measures.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Minor to Low (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (30)**	**Low (25)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes

Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Wet gravel roads on a regular basis or alternatively use biodegradable dust suppressants.
» Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues.
» Appoint a community liaison officer to deal with complaints and grievances from the public.

Residual Impacts:

» Dust may settle on vegetation discouraging livestock and game from browsing in the area affected by dust.

Nature: *Nuisance impacts (noise and dust*

Annoyance dust and noise as a result of traffic and construction activities of the access road.

	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6))	Low (4)	Low (4)	Minor to Low (3)
Probability	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)	Highly probable (4)
Significance	**Medium (36)**	**Low (28)**	**Medium (36)**	**Low (28)**	**Medium (36)**	**Low (28)**	**Low (28)**	**Low (24)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Irreplaceable loss of resources?	No	No	No	No	No	No	No	No
Can impacts be mitigated?	Yes.							

Mitigation:

» Apply appropriate dust suppressant to gravel roads on a regular basis.
» Ensure that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
» Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues.
» Appoint a community liaison officer to deal with complaints and grievances from the public.

Residual Impacts:

Once construction ceases there should be minimal residual impact associated with announce, dust and noise

Nature: *Increase in crime*

It is often opportunistic crimes such as stock theft, the abuse of alcohol and relationship related crimes that are associated with construction activities. With this in mind it would be pertinent for the developers to ensure that processes are put in place through which any suspected criminal activities associated with the project can be easily communicated and swiftly addressed.

	Without mitigation	**With mitigation**

Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Minor to Low (3)
Probability	Highly probable (4)	Probable (3)
Significance	**Low (28)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Ensure that construction workers are clearly identifiable. All workers should carry identification cards and wear identifiable clothing.
- Fence off construction site and control access to these sites.
- Appoint an independent security company to monitor the site.
- Appoint a community liaison officer.
- Encourage local people to report any suspicious activity associated with the construction site to the community liaison officer.
- A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC Contractor, and sub-contractors remain responsible and accountable, and to facilitate the identification and implementation of additional mitigation measures if required.
- Prevent loitering within the vicinity of the construction camp as well as construction sites by recruiting off site in visa an offsite recruiting office/agent, whatever is most appropriate.

Residual Impacts:

- If crime levels do rise in the area it may take some time before they are restored to the previous low level.
- Depending on the crimes committed victims may suffer long-term effects as a result of their experience.

Nature: *Increased risk of HIV infections*

With an HIV prevalence rate of 23.2% amongst antenatal women in 2013, the John Taolo Gaetsewe District Municipality had a relatively moderate HIV prevalence rate. This placed the district as the 15th lowest districts of the 52 districts across the country. The fact that sexually transmitted diseases tend to be spread by construction and transport workers, together with the high prevalence of HIV across the rest of South Africa, opens the area to a high risk of HIV infections (Singh & Malaviya, 1994; Ramjee & Gouws, 2002; Meintjes, Bowen, & Root, 2007; World Bank Group, 2016; Bowen, Dorrington, Distiller, Lake, & Besesar, 2008; Bowen P. , Govender, Edwards, & Cattell, 2016; Kikwasi & Lukwale, 2017; Bowen P. , Govender, Edwards, & Lake, 2018).

This risk is likely to be at its highest during the construction phase of the project as the construction workforce increases and material and equipment is delivered to site and is likely to subside during the operational phase.

	Without mitigation	**With mitigation**
Extent	Regional (4)	Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate to High (7)	Moderate (6)
Probability	Highly probable (4)	Probable (3)
Significance	**High (60)**	**Medium (42)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	

Mitigation:

- Ensure that an onsite HIV and AIDS policy is in place and that construction workers are expose to a health and HIV/AIDS awareness educational programme within the first month of construction.

» Provide voluntary and free counselling, free testing and condom distribution services to the workforce.
Residual Impacts: » The area currently has a relatively low HIV prevalence rate and any increase in this rate would have serious consequences that could last over an extended period. » People contracting HIV and their families will suffer life changing consequences.

Nature: *Influx of construction workers and change in population* During construction the workforce is likely to peak at approximately 500 workers of which 60% will be low skilled, 25% semi-skilled and 15% skilled. It is possible that the influx of construction workers could have an impact on the family structures and social networks of local communities. This is particularly relevant in situations where workers are accommodated amongst local communities and/or where they frequent the same recreational facilities as local communities. These risks may be associated with: » Alcohol and/or drug use » Relationship formation and/or the disruption of existing relationships » Prostitution » Pregnancies, and the » Spreading of sexually transmitted diseases.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Low to Minor (3)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Communicate the limitation of opportunities created by the project through Community leaders and Ward Councillors to prevent an influx of job seekers. » Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work. » Draw up a recruitment policy in conjunction with the Community Leaders and Ward Councillors of the area and ensure compliance with this policy.		
Residual Impacts: » There is the risk that some workers remain in the area in the hope of finding employment with other projects planned for the region. This risk is, however, reduced as most workers will be recruited locally.		

Nature: *Impacts associated with the exposure to hazards during the construction of the PV facility* The use of heavy equipment and vehicles and an increase in vehicle traffic within the vicinity of all construction sites will result in an increased risk to the personal safety of people and animals. Of particular concern are increased hazards faced by pedestrians, cyclists and motorists with emphasis on vulnerable groups such as children and the elderly. Excavation work and trenches also pose a hazard to the safety of people, particularly children and animals, who may fall into these works and who may have difficulty in getting out. There will also be an increased risk of fires brought about through construction workers lighting fires for cooking and for warmth during cold periods.		
	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)

Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Low to Minor (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Ensure all construction equipment and vehicles are properly maintained at all times.
- Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly.
- No open fires are allowed on the site;
- A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC Contractor, and sub-contractors remain responsible and accountable, and to facilitate the identification and implementation of additional mitigation measures if required.
- Where necessary training should be provided on the implementation of the grievance mechanism to ensure that those who are most likely to be affected by the project are suitably knowledgeable on how to raise concerns and have these addressed.
- Compile and implement a Fire Management and Emergency Preparedness.
- Follow the recommendations in the Traffic Management Plan.

Residual Impacts:

- With an increased risk of hazard exposure there is the possibility that people may be injured or killed which will place a burden on their families.

Nature: *Impacts associated with the exposure to hazards during the construction of the access road*

Exposure to hazards associated with construction activities and the delivery of heavy machinery and equipment to site.

	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (1)	Short-term (1)	Short-term (1)	Short-term (1)	Short-term (1)	Short-term (1)	Short-term (1)	Short-term (1)
Magnitude	Moderate /High (7)	Moderate (6)	Moderate /High (7)	Moderate (6)	Moderate /High (7)	Moderate (6)	Low (5)	Low (4)
Probability	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)
Significance	**Medium (45)**	**Medium (40)**	**Medium (45)**	**Medium (40)**	**Medium (45)**	**Medium (40)**	**Medium (35)**	**Low (30)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Irreplaceable loss of resources?	No	No	No	No	No	No	No	No
Can impacts be mitigated?	Yes.							
Mitigation:								

» Ensure all construction equipment and vehicles are properly maintained at all times.
» Ensure that operators and drivers are properly trained and make them aware, through regular toolbox talks, of any risk they may pose to the community. Place specific emphasis on the vulnerable sector of the population such as children and the elderly.
» Ensure that fires lit by construction staff are only ignited in designated areas and that the appropriate safety precautions, such as not lighting fires in strong wilds and completely extinguishing fires before leaving them unattended, are strictly adhered to.
» Make staff aware of the dangers of fire during regular tool box talks.
» A grievance mechanism must be prepared and communicated to surrounding landowners and local communities, to ensure that the project proponent, EPC contractor, and sub-contractors remain responsible and accountable and to facilitate the identification and implementation of additional mitigation measures if required.
» Where necessary training should be provided on the implementation of the grievance mechanism to ensure that those who are most likely to be affected by the project are suitably equipped in the mechanism of raising concerns and having these addressed.
» Compile and implement a Fire Management and Emergency Preparedness Response Plan.

Residual Impacts:
Where existing roads are upgraded, as in the case of Alternative 1 and the section along the existing T25 gravel road in respect of Alternative 3, there could be a beneficial impact associated with the upgrade and the application of mitigation measures. This, however, will depend on dust and noise suppression mitigation measures being strictly and consistently adhered to. In respect of new sections of road needing to be constructed in respect of Alternatives 2, 3 and 4, even where mitigation measures are successfully and consistently applied the opening of the area will result in access associated with dust and noise that was previously non-existent.

Nature: *Impacts on daily living and movement patterns – PV Facility*
Disruptions to daily living patterns are likely to be minimal and restricted to the construction phase of the project. This impact will be mainly associated with the site and the main access roads. These disruptions are only likely to be associated with the delivery of materials and machinery to site and the transportation of workers to and from site.

	Without mitigation	**With mitigation**
Extent	Regional (2)	Regional (2)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Low to Minor (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (28)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
» Follow the recommendations in the Traffic Management Plan.
» Ensure that, at all times, people have access to their properties as well as to social facilities.
» All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues.
» Heavy vehicles should be inspected regularly to ensure their road safety worthiness.
» Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work).
» The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged due to construction activities.

Residual Impacts:
» It is unlikely that any disruption of community patterns will persist after construction.

Nature: *Impacts on daily living and movement patterns – Access Road* Disruption of daily living patterns due to construction activities and deliveries of machinery and heavy equipment to site.								
	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)	Short-term (2)
Magnitude	Moderate (7)	Moderate (6)	Moderate (7)	Moderate (6)	Moderate (7)	Moderate (6)	Low (5)	Low (4)
Probability	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)	Highly probable (4)	Probable (3)
Significance	**Medium (40)**	**Low (27)**	**Medium (40)**	**Low (27)**	**Medium (40)**	**Low (27)**	**Medium (32)**	**Low (21)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Irreplaceable loss of resources?	No	No	No	No	No	No	No	No
Can impacts be mitigated?	Yes.							
Mitigation: » Ensure that, at all times, people have access to their properties as well as to social facilities. » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. » Heavy vehicles should be inspected regularly to ensure their road safety worthiness. » The developer and EPC Contractor must ensure that the roads utilised for construction activities are either maintained in the present condition or upgraded if damaged due to construction activities.								
Residual Impacts: As long as adequate site clean-up is undertaken there should be no residual impacts.								

Nature: *Disruption to social and community infrastructure* With the workforce associated with the construction phase peaking at approximately 500 workers, it is unlikely that in isolation the project will have any significant effect on social and community infrastructure in the area.		
	Without mitigation	**With mitigation**
Extent	Regional (3)	Regional (3)
Duration	Short term (1)	Short term (1)
Magnitude	Low (4)	Minor to Low (3)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Medium (32)**	**Low (28)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Regularly monitor the effect that construction is having on infrastructure and immediately report any damage of		

infrastructure to the appropriate authority. » Ensure that where communities' access is obstructed that this access is swiftly restored to an acceptable state.
Residual Impacts: » If disrupted social and community infrastructure is not swiftly restored there is a risk that local communities may experience an extended loss in this respect.

Nature: *Direct and indirect employment opportunities and skills development* The project will lead to the creation of both direct and indirect job which will have a positive economic benefit within the region. In this regard there are approximately 500 direct jobs associated with the construction phase of the project and approximately 65 over the operational phase. During the construction phase approximately 60% of these direct job opportunities will be for low and non-skilled workers with ~25% going to semi-skilled and ~15% to skilled workers. It is anticipates that the majority of the general labour force will as far as possible be sourced from the local labour pool. Where relevant skills are unavailable from the local labour pool, these would need to be sought elsewhere. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.		
	Without enhancement	**With enhancement**
Extent	Regional (3)	Regional (3)
Duration	Short term (1)	Short term (1)
Magnitude	Minor to Low (3)	Low (4)
Probability	Definite (5)	Definite (5)
Significance	**Medium (35)**	**Medium (40)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement: » Wherever feasible, local residents should be recruited to fill semi- and unskilled jobs. » Women should be given equal employment opportunities and encouraged to apply for positions. » A skills transfer plan should be put in place at an early stage and workers should be given the opportunity to develop skills which they can use to secure jobs elsewhere post-construction. » A procurement policy promoting the use of local business should, where possible, be put in place and applied throughout the construction phase. » As far as possible local contractors that are compliant with Broad-Based Black Economic Empowerment (B-BBEE) criteria should be used.		
Residual Impacts: » Job creation and skills development may help in addressing poverty and low living standards in the region and improve skills and experience in the local area.		

Nature: *Socio-economic stimulation* Apart from the increase in job creation, the project is also likely to stimulate the local economy and again this is likely to be most significant at a cumulative level. At the project level there will be an economic contribution attached to Hyperion Solar Development 2. This contribution will be in the form of disposable salaries and the purchases of services and supplies from the local communities in and around the region.		
	Without enhancement	**With enhancement**
Extent	Regional (2)	Regional (2)
Duration	Short term (1)	Short term (1)
Magnitude	Moderate (6)	Moderate to High (7)
Probability	Definite (5)	Definite (5)
Significance	**Medium (45)**	**Medium (50)**

Status (positive or negative)	Positive	Positive
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

- A procurement policy promoting the use of local business should, where possible, be put in place to be applied throughout the construction phase.
- A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g. construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable.

Residual Impacts:

- The project could assist in upgrading the skills of local community members and growth in local business.

Solar Energy Facility Operation Phase Impacts

Nature: *Transformation and the sense of place – PV Facility*

Within a social context a sense of place includes a wide range of criteria, all or some of which add meaning to a particular area for individuals and groups. These criteria may include the vista, geography, urban layout, flora and fauna, community, history and fragrance of a place amongst many others and are interpreted uniquely on an individual basis. Some individuals may embrace changes to the sense of place that others may reject and for some it may merely be a change in the demographics of an area that leaves them feeling threatened, vulnerable and insecure. Groups and group membership can help to reinforce the sense of place of an area and can also serve to reinforce fears and suspicions associated with pending changes to the sense of place. A sense of place has much to do with unique individual perceptions attached to the location and is subjective by nature.

Photovoltaic facilities are highly visible due to their large size, highly reflective surfaces and geometry. Consequently, local communities perceive these facilities as having a negative impact on the landscape and as such limiting their quality of life (Chiabrando, Fabrizio, & Garnero, 2011) as a result of the transforming of the sense of place of the area.

	Without mitigation	**With mitigation**
Extent	Regional (4)	Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low to Moderate (5)
Probability	Definite (5)	Definite (5)
Significance	**High (70)**	**High (65)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Apply the mitigation measures recommended in the Visual Impact Assessment Report.
- Communicate the benefits associated with renewable energy to the broader community.
- Ensure that all affected land owners and tourist associations are regularly consulted.
- A Grievance Mechanism should be put in place and all grievances should be dealt with in a transparent manner.
- The mitigation measures recommended in the Visual and Heritage and Palaeontology Impact Assessments should be followed.

Residual Impacts:

- Once the project has been decommissioned it will take some time and effort to restore the area's original sense of place.

Nature: *Transformation and the sense of place – Access Road* Transformation of the sense of place due to the construction and use of the road over the operational phase of the project which is likely to result in a change along the road corridor associated with: » Announce, dust and noise » Hazard exposure and » Disruption in daily living patterns.								
	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)	Local (1)
Duration	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)	Moderate (6)	Low (4)
Probability	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)
Significance	**Medium (55)**	**Medium (45)**	**Medium (55)**	**Medium (45)**	**Medium (55)**	**Medium (45)**	**Medium (55)**	**Medium (45)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse	Difficult to reverse
Irreplaceable loss of resources?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes.							
Mitigation: » Apply appropriate dust suppressant to gravel roads on a regular basis. » Ensure all vehicles are roadworthy and drivers are qualified and made aware of the potential noise and dust issues. » Ensure that, at all times, people have access to their properties as well as to social facilities. » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues. » Apply the mitigation measures suggested in the Visual Impact Assessment Report. » A Grievance Mechanism should be put in place and all grievances should be dealt with in a transparent manner. » Appoint a community liaison officer to deal with complaints and grievances from the public.								
Residual Impacts: As long as adequate site clean-up is undertaken there should be no residual impacts.								

Nature: *Direct and indirect employment opportunities and skills development* During the operational phase ~40% of the job opportunities will be for low and unskilled workers. Many of the beneficiaries are likely to be historically disadvantaged members of the co During the operational phase ~70% of the job opportunities will be for low and unskilled workers. Many of the beneficiaries are likely to be historically disadvantaged members of the community and the project will provide opportunities to develop skills amongst these people. None of the employment opportunities will be permanently stationed onsite.		
	Without enhancement	**With enhancement**
Extent	Regional (2)	Regional (2)
Duration	Long term (4)	Long term (4)
Magnitude	Minor to Low (3)	Low (4)

Probability	Definite (5)	Definite (5)
Significance	**Medium (45)**	**Medium (50)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

» Implement a training and skills development programme for locals;
» Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme.
» The recruitment selection process should seek to promote gender equality and the employment of women wherever possible.

Residual Impacts:

» Job creation and skills development may help in addressing poverty and low living standards in the region.

Nature: *Socio-economic stimulation*

Socio-economic stimulation will be based on the use of local goods and services will include, but is not limited to, the provision of construction materials and equipment, and workforce essentials such as catering services, trade clothing, safety equipment, ablution, accommodation, transportation and other goods. Projects which form part of the DoE's REIPPP Programme are required as part of their bidding requirements to contribute towards local economic development (LED) and social upliftment initiatives within the area in which they are proposed. In addition, they are required to spend a percentage of their revenue on socio-economic and enterprise development, as well as allocate ownership shares to local communities that benefit previously disadvantaged communities around the project. A portion of the dividends generated by each development also needs to be invested into LED projects and programmes. The proposed development therefore has the potential to contribute positively towards socio-economic development and improvements within the local area.

	Without enhancement	**With enhancement**
Extent	Regional (4)	Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Low to Moderate (5)	Moderate (6)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**High (70)**
Status (positive or negative)	Positive	Positive
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Enhancement:

» Ensure that the procurement policy supports local enterprises.
» Establish a social responsibility programme either in line with the REIPPP BID guidelines or equivalent.
» Work closely with the appropriate municipal structures with regard to establishing a social responsibility programme.
» Ensure that any trusts or funds are strictly managed in respect of outcomes and funds.

Residual Impacts:

» The project could assist in upgrading the skills of local community members and in strengthening the national grid.

8.8.4 Comparative Assessment of Access Road Alternatives

From a social perspective, Access Road Alternative 4 is considered most favourable compared to all other alternatives due to farming and residential activities along Access Road Alternatives 1, 2 and 3. In addition, with respect to Alternative 3, the danger posed by the intersection with the access road and the unsealed gravel road T25 has also been considered. Notwithstanding this, however, the specialist has also considered the findings of the Soil, Land Use, Land Capacity and Agricultural Potential Assessment as well as the Heritage Impact Assessment and concludes that Access Road Alternative 1 is also considered acceptable.

Notwithstanding the fact that a clear social preference has emerged in respect of the various access road alternatives, this is not compelling in that the impacts along all access road alternatives can be mitigated to acceptable levels. Consequently, the social preference can be overridden by either technical and/or biodiversity requirements if these requirements are compelling.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Social	» Farming activities along the road corridor, however, preferred from an agricultural potential and heritage perspective. » Acceptable.	» Farming activities along the road corridor. » Least preferred.	» Farming activities along the road corridor and junction with T25 unsealed gravel road. » Least preferred.	» Only obvious activities are quarrying activities in the vicinity of the junction with the R380. » **Preferred.**

8.8.5 Implications for Project Implementation

The significance of the positive impacts associated with the socio-economic aspects that will be affected by Hyperion Solar Development 2 ranges from medium to high with the implementation of the enhancement measures recommended. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and social impacts can be managed to acceptable levels. Enhancement measures include:

- » A local employment policy should be adopted to maximise opportunities made available to the local labour force.
- » Labour should be sourced from the local labour pool, and only if the necessary skills are unavailable, should labour be sourced from (in order of preference) the Local Municipality, District Municipality, Northern Cape Province, South Africa, or elsewhere.
- » A database of local companies, specifically Historically Disadvantaged Individuals (HDIs) which qualify as potential service providers (e.g. construction companies, security companies, catering companies, waste collection companies, transportation companies etc.) should be created and companies listed thereon should be invited to bid for project-related work where applicable.
- » Vocational training programmes should be established to promote the development of skills.
- » A Community Needs Assessment (CAN) must be conducted to ensure that the LED and social upliftment programmes proposed by the project are meaningful.

The significance of the negative impacts associated with the social aspects that will be affected by Hyperion Solar Development 2 ranges from low to medium to high with the implementation of the recommended mitigation measures. The mitigation measures include:

- » Develop and implement a local procurement policy which prioritises "locals first" to prevent the movement of people into the area in search of work.

- » Engage with local community representatives prior to construction to facilitate the adoption of the locals first procurement policy.
- » Appoint a Community Liaison Officer (CLO) to assist with the procurement of local labour.
- » Implement a method of communication whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.
- » The appointed EPC Contractor must appoint a security company to ensure appropriate security procedures and measures are implemented.
- » All vehicles must be road worthy and drivers must be qualified, obey traffic rules, follow speed limits and be made aware of the potential road safety issues.
- » Dust suppression measures must be implemented for heavy vehicles such as wetting of gravel roads on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.

8.9. Assessment of Impacts on Traffic

Potential traffic impacts and the relative significance of the impacts associated with the development of Hyperion Solar Development 2 are summarised below (refer to **Appendix I** of the EMPr).

8.9.1 Results of the Traffic Impact Assessment

The number of heavy vehicles per 7MW installation is estimated to range between 200 and 300 trips depending on the site conditions and requirements. For the 75MW, the total trips can therefore be estimated to be between 2 000 and 3 000 heavy vehicle trips, which will generally be made over a 12-month construction period. Choosing the worst-case scenario of 3 000 heavy vehicles over a 12-month period travelling on an average of 22 working days per month, the resulting daily number of vehicle trips is 12.

Considering that the number of vehicle trips during peak hour traffic in a rural environment can roughly be estimated at around 20-40% of the average daily traffic, the resulting vehicle trips for the construction phase are approximately 3-5 trips. The impact on general traffic on the N14 is therefore deemed nominal.

If the panels are imported instead of manufactured within South Africa, the respective shipping company will be able to indicate how the panels can be packed (for example using 2MW packages and 40ft containers). These can then be stored at the port and repacked onto flatbed trucks. During operation, it is assumed that approximately five full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network.

The use of borehole water for the cleaning of the PV panels are considered. Should borehole water not be available or suitable, the following assumptions have been made to estimate the resulting trips generated from transporting water to the site:

- » 5 000 litre water bowsers to be used for transporting the water.
- » Approximately 5 litres of water needed per panel.
- » Total number of trips is therefore approximately 28 vehicles.
- » Panels will be cleaned four times a year.

It is expected that these trips will not have a significant impact on external traffic. However, to limit the impact, it is recommended to schedule these trips outside of peak traffic periods.

Several options can be considered for the transportation of infrastructure to the development area. These include:

» *National Route to Site for Imported Components:*
There are two viable options for the port of entry for imported components - the Port of Saldanha in the Western Cape and the Port of Ngqura in Port Elizabeth. The preferred route from the preferred point of entry and an alternative route is shown in green in **Figure 8.7**. The preferred route is approximately 948km in length and will start at the Port of Ngqura, heading north on the N10 passing Middelburg, Hanover, De Aar, Britstown, Prieska, Griekwastad, Postmasburg en route to the N14 at Kathu. From the N14 at Kathu, the vehicles will travel on gravel roads leading to the proposed site.

An alternative route, shown in light blue in the **Figure 8.7**, is 967km in length and follows the same route as the preferred route up to Middelburg, where it connects to the N9 towards Kimberley, passing the towns of Colesberg, Phillippolis, Fauresmith and Koffiefontein. From Kimberley. Vehicles will follow the R31 past Barkly West, turning onto the R31 at Danielskuil. The vehicles will turn left onto the N14 at Kuruman and access the gravel roads leading to the proposed site. It is critical to ensure that the abnormal load vehicle will be able to move safely and without obstruction along the preferred route.

» *Route for Components manufactured locally:*
It is anticipated that elements manufactured within South Africa will be transported to the site from the Cape Town, Johannesburg and Pinetown/Durban areas. It is also assumed that the transformer, which will be transported with an abnormal load vehicle, will be transported from the Johannesburg area and therefore it needs to be verified that the route from the manufacturer to the site does not have any load limitations for abnormal vehicles. At this stage, only a high-level assessment can be undertaken as no information of the exact location of the manufacturer is known and all road structures (such as bridges and culverts) need to be confirmed for their load bearing by SANRAL or the respective Roads Authority.

» *Route from Cape Town:*
Components, such as PV panels, manufactured in Cape Town will be transported to site via road as shown in **Figure 8.8**. Haulage vehicles will travel via the R27, R399 and N7 to site, passing Veldrift, Piketberg, Vanrhynsdorp, Calvinia, Kenhardt and Keimoes en route to the site. Haulage vehicles will mainly travel on national and provincial roads and the total distance to the proposed site is approximately 1 020km.

» *Route from Johannesburg:*
It is assumed that the inverter and support structure will be manufactured in the Johannesburg area and transported to site via road. The travel distance is around 570km and no road limitations are expected on this route for normal loads vehicles as it will mainly follow national and provincial roads. The route is shown in **Figure 8.9**.

» *Route from Pinetown/Durban:*
If the PV panels are manufactured in South Africa, they could possibly be manufactured in the Pinetown area, close to Durban and transported to site via road. These elements are normal loads and no road limitations are expected along the routes, which is shown in **Figure 8.10**. Haulage vehicles will mainly travel on national and provincial roads and the total distance to the proposed site is

approximately
1 000km.

Figure 8.7: Preferred and alternative route from Port of Ngqura.

Figure 8.8: Route from Cape Town.

Figure 8.9: Route from Johannesburg.

Figure 8.10: Route from Pinetown/Durban

8.9.2 Description of Traffic Impacts

The following impacts have been identified and assessed for Hyperion Solar Development 2.

Impacts associated with the construction phase of Hyperion Solar Development 2:

» The construction traffic would also lead to noise and dust pollution.
» This phase also includes the construction of roads, excavations, trenching for electrical cables and other ancillary construction works that will temporarily generate the most traffic.

Impacts associated with the operation phase of Hyperion Solar Development 2:

» During operation, it is expected that staff and security will periodically visit the facility. It is assumed that approximately five (5) full-time employees will be stationed on site. The traffic generated during this phase will be minimal and will not have an impact on the surrounding road network. The traffic generated during this phase will be minimal and will have not have any impact on the surrounding road network.

The significance of the transport impact without mitigation measures during the construction phase can be considered as medium. However, considering that this is temporary and short term in nature, the impact can be mitigated to an acceptable level.

8.9.3 *Impact tables summarising the significance of impacts on traffic during the construction and operation phases (with and without mitigation)*

Nature: Congestion as a result of the transport of equipment, material and staff to site		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Very Short (1)	Very Short (1)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (36)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Stagger component delivery to site. » Reduce the construction period. » The use of mobile batch plants and quarries in close proximity to the site. » Staff and general trips should occur outside of peak traffic periods. » Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.		
Residual Impacts: None are anticipated.		

Nature: Traffic on roads will generate dust. Air quality will be affected by dust pollution		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Very Short (1)	Very Short (1)
Magnitude	Low to Moderate (5)	Minor (1)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (32)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Dust Suppression of gravel roads during the construction phase, as required. » Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.		
Residual Impacts: None are anticipated.		

Nature: Traffic on roads will generate noise. Noise pollution due to increased traffic.		
	Without mitigation	**With mitigation**
Extent	Local (2)	Local (1)
Duration	Very Short (1)	Very Short (1)
Magnitude	Low to Moderate (5)	Minor (1)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (32)**	**Low (6)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

- Stagger component delivery to site.
- Reduce the construction period as far as possible.
- The use of mobile batch plants and quarries in close proximity to the site.
- Staff and general trips should occur outside of peak traffic periods.

Residual Impacts:

None are anticipated.

Nature: The upgrading of existing gravel roads/pathways and the construction of new gravel roads will generate construction traffic, which in turn would generate dust and noise pollution.								
	Alternative 1		**Alternative 2**		**Alternative 3**		**Alternative 4**	
	Without mitigation	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)	Local (2)
Duration	Short term (1)	Short term (1)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)	Moderate (5)	Low (3)	Moderate (6)	Moderate (5)	Moderate (5)	Low (3)
Probability	Definite (5)	Improbable (2)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)	Definite (5)
Significance	**Low (25)**	**Low (10)**	**High (60)**	**Medium (50)**	**High (65)**	**High (60)**	**High (60)**	**Medium (50)**
Status (positive or negative)	Negative	Negative	Negative	Negative	Negative	Negative	Negative	Negative
Reversibility	Reversible	Reversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible	Irreversible
Irreplaceable loss of resources?	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Can impacts be mitigated?	Yes. Dust and noise pollution can be mitigated. The damage to the environment caused by the construction of the new road cannot be mitigated.							

Mitigation:

- Stagger component delivery to site.
- Dust suppression.
- Reduce the construction period.
- The use of mobile batch plants and quarries in close proximity to the site.

» Staff and general trips should occur outside of peak traffic periods
Residual Impacts:
» The construction of new roads and upgrading of pathways will have a permanent, irreversible impact on the environment.

8.9.4 Comparative Assessment of Alternatives

All access road alternatives are considered acceptable. Alternative 1 is deemed the preferred access road alternative as it is an existing gravel road and is shorter than the other alternatives, i.e. less expensive to upgrade and maintain. Alternative 2 is not a preferred option as this would require the construction of a new road. Furthermore, the access of Alternative 2/N14 would be too close to the existing T26/N14 access (<300m spacing). Short access spacings and staggered access spacings on high order roads, such as the N14, poses a safety risk to drivers. Access alternatives off the R380, such as Alternative 3 and Alternative 4, are not preferred as the R380 navigates through the town of Kathu, thus construction traffic would be required to travel through the town.

Aspect	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Traffic	» Existing farm road. » Less expensive to upgrade and maintain. » **Preferred**.	» New road i.e. more expensive to upgrade and maintain. » Acceptable.	» New road and upgrading of 10km of T25. » Longer than other alternatives i.e. more expensive to upgrade and maintain. » Existing gravel pathway. » Acceptable.	» New road i.e. more expensive to upgrade and maintain. » Existing gravel pathway. » Acceptable.

8.9.5 Implications for Project Implementation

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts on traffic as a result of the development of Hyperion Solar Development 2 will be low with the implementation of mitigation. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on traffic can be managed to acceptable levels by taking the following into consideration:

» Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.
» Dust suppression of gravel roads should be undertaken during the construction phase, as required.
» Delivery of components to the site should be staggered.

8.10. Impacts Related to the Storage and Handling of Dangerous Goods

During the construction and operation phase, Hyperion Solar Development 2 will store materials which may be considered to be a dangerous good.

"Dangerous goods" is defined under the Listing Notices of the EIA Regulations (2014) that deal with the storage, or storage and handling, of dangerous goods. "Dangerous goods" are defined as:

"Goods containing any of the substances as contemplated in South African National Standard No. 10234, supplement 2008 1.00: designated "List of classification and labelling of chemicals in accordance with the Globally Harmonized Systems (GHS)" published by Standards South Africa, and where the presence of such goods, regardless of quantity, in a blend or mixture, causes such blend or mixture to have one or more of the characteristics listed in the Hazard Statements in section 4.2.3, namely physical hazards, health hazards or environmental hazards".

The above definition makes specific reference to SANS 10234. South Africa has implemented the Globally Harmonized System of Classification and Labelling of Chemicals by issuing this national standard. The dangerous goods likely to be stored or handled on site would mainly include grease, fuels and batteries (housed within fully self-contained specially adapted shipping type containers).

8.10.1. Description of the Impacts associated with the Storage and Handling of Dangerous Goods

The construction and operation of the Hyperion Solar Development 2 requires the storage of dangerous goods, including fuels for everyday construction, operation and maintenance.

The facilities or infrastructure for storage and handling of a dangerous good will be located in containers with a combined capacity up to 30m³ (cubic metres). These dangerous goods will be stored on-site in appropriate storage vessels within bunded areas/ on impervious surfaces. The storage and handling of dangerous goods has the potential to result in soil and/or water contamination should any spillages/leakages occur. This is considered to be the most significant risk, other than a direct risk to personnel on site, which is an occupational health and safety issue and is considered in line with the Occupational Health and Safety Act. While not all materials to be stored on site are considered to be hazardous (or have a hazard rating), materials such as fuel and oils are flammable and also have the potential to cause fires, explosions, damage to infrastructure, as well as injuries of staff.

The proposed project will require the construction of facilities or infrastructures for the storage of the dangerous goods. The construction phase will require the handling and storage of materials including hydraulic oil, fuel, cement below 30m³.

8.10.2. Impact tables summarising the significance of the storage and handling of dangerous goods (with and without mitigation measures)

Nature of impact: Soil and water contamination due to the handling and storage of dangerous goods during the construction and operation phases.		
	Without mitigation	**With mitigation**
Extent	Local (5)	Local (5)
Duration	Short-term (2)	Short-term (1)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (45)**	**Low (20)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible

Irreplaceable loss of resources	No	No
Can impacts be mitigated	Yes	

Mitigation

» Any spillages of dangerous substances must be contained as soon as possible, and remedial and clean-up actions initiated immediately.
» Regular inspections of the permanent bunded areas for storage of dangerous goods must be undertaken throughout the life cycle of the project.
» Appropriate spill kits must be available on site.
» Maintenance vehicles must have access to spill kits.
» An emergency spill response plan must be developed for implementation during the construction and the operational phase. Personnel should be suitably trained to attend to any spills that may occur.
» A fire management plan must be developed for implementation during the construction and the operational phase Personnel must be suitably trained to manage any fires which may occur on site.
» Flammable substances must be stored in enclosed containers away from heat, sparks, open flames, or oxidizing materials.
» Develop a monitoring and leak detection procedure for monitoring of the chemical spillages.

Residual Impacts

If spillages occur and are not cleaned up, contamination can result in impacts which remain after decommissioning of the project

8.11. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing Hyperion Solar Development 2. Should this alternative be selected, there would be no environmental impacts on the site due to the construction and operation activities of a PV facility.

a) Land use and agriculture

The potential of the project site for arable agriculture is very limited. While the deep apedal soil profiles are ideal for arable agriculture in the wetter eastern regions of South Africa, the erratic rainfall patterns and prolonged droughts experienced in the study area will result in dryland crop production failure. The very low rainfall in the area indicates that the only means of cultivation would be by irrigation; however remote sensing imagery of the area shows no signs of any agricultural infrastructure and none of irrigation. Cattle grazing is considered to be a viable long-term land use for the project site. The grazing capacity of the veld in the development area and along the access roads is 21 to 30 ha per large animal unit or large stock unit (LSU) (ARC-ISCW, 2004) and is considered to be very low. This indicates that Hyperion Solar Development 2 can accommodate 6 to 9 head of cattle for grazing purposes.

The proposed development of Hyperion Solar Development 2 would allow the on-going current grazing activities to continue on areas of the project site that will not house PV facility infrastructure. The development footprint of Hyperion Solar Development 2 is ~11.3% of the total extent of the project site and is located within areas of low agricultural potential. Therefore the current land-use will be retained, while also generating renewable energy from the solar resource available for the area. The impact on agricultural activities as a result of the project is, therefore, expected to be low.

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current grazing activities, losing out on the opportunity to generate renewable energy from solar energy as additive thereto (i.e. current grazing activities would continue). Therefore, from a land-use perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of a viable and compatible land use for the project site which allows the current land-use activities to continue.

In addition, the landowner would obtain an income from the facility (as the project owner will pay an amount to the landowner in accordance with the lease agreement for the use of the land). This would contribute towards the financial stability of the landowner which could in turn contribute to the financial viability of the farming practices on the project site. The implementation of the 'do nothing' alternative would retain the current land-use, fore-going the opportunity to generate renewable energy from the solar resource and supplementing of the income of the landowner.

The 'do nothing' alternative would result in a lost opportunity for the landowner (in terms of implementing a compatible alternative land use option, while still retaining the current land use, as well as a loss in long-term revenue) and the country (in terms of renewable energy). From this perspective the no-go alternative is not preferred when considering land use and agricultural potential of the project site.

b) Socio-economic impact

Social: The impacts of pursuing the no-go alternative are both positive and negative as follows:

- The benefits would be that there is no disruption from an influx of additional jobseekers into the Kathu area, nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
- Negative impacts would be associated with an opportunity lost in terms of job creation, skills development and associated economic business opportunities for the local economy, as well as a loss of the opportunity to generate energy from a renewable resource without creating detrimental effects on the environment.

Foregoing the proposed development would not necessarily compromise the development of renewable energy facilities in South Africa. However, the socio-economic benefits for local communities at this location and within the surrounding area would be forfeited.

Therefore, from a socio-economic perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of socio-economic benefits, when considering the current socio-economic conditions of the area.

New Business: Some of the positive spin off effects that are to ensue from the project expenditure will be localised in the communities located near the site, such as the town of Kathu. The local services sector and specifically the trade, transportation, catering and accommodation, renting services, personal services and business services are expected to benefit the most from the project activities during the construction phase. New business sales that will be stimulated as a result of the establishment of the PV facility, albeit for a temporary period, will be lost with the implementation of the 'do nothing' alternative. Therefore from a business perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of new business opportunities.

The project will lead to the creation of both direct and indirect job which will have a positive economic benefit within the region. In this regard there are approximately 500 direct jobs associated with the construction phase of the project and approximately 65 over the operational phase. During the construction phase approximately 60% of these direct job opportunities will be for low and non-skilled workers with ~25% going to semi-skilled and ~15% to skilled workers. It is anticipates that the majority of the general labour force will as far as possible be sourced from the local labour pool. Where relevant skills are unavailable from the local labour pool, these would need to be sought elsewhere. The injection of income into the area in the form of wages will represent an opportunity for the local economy and businesses in the area.

Employment: Approximately 500 full time equivalent jobs will be created during the construction phase. Of those employment opportunities likely to be generated, approximately 60% will accrue to low skilled workers, 25% to semi-skilled workers, and 15% to skilled workers. The development of Hyperion Solar Development 2 within the Gamagara Local Municipality will aid in a reduction of the unemployment rate, however if the facility is not developed then the unemployment rate will not be positively influenced by the proposed development. The upliftment and socio-economic benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative. Therefore, from an employment perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of employment opportunities.

Skills development: The establishment of Hyperion Solar Development 2 will offer numerous opportunities for skills transfer and development. This is relevant for both on-site activities and manufacturing activities. Various PV facilities are proposed to be developed in the area and in the Northern Cape Province, which means that the transfer of skills from foreign experts to the local engineers and construction workers will take place, similar to what has taken place where PV facilities have been constructed and operated within the Province and the rest of the country. The skills training and transfer benefits for individuals within local communities would be forfeited with the implementation of the 'do nothing' alternative.

Municipal goals: The implementation of Hyperion Solar Development 2 would contribute towards addressing the Gamagara Local Municipality's key issue regarding high levels of poverty and unemployment, skills shortage, and inequalities, through the creation of employment opportunities, the provision of skills training opportunities, and local economic growth, including growth in personal income levels of those community members who would be employed on the project.

The no-go alternative will therefore result in the above economic benefits not being realised and a subsequent loss of income and opportunities to local people. From this perspective the no-go alternative is not preferred.

c) Regional scale impact

At a broader scale, the benefits of additional capacity to the electricity grid and those associated with the introduction of renewable energy would not be realised. The Northern Cape has an ample solar resource. Although Hyperion Solar Development 2 is only proposed to contribute a contracted capacity of up to75MW to the grid capacity, this would assist in meeting the electricity demand throughout the country and would also assist in meeting the government's goal for renewable energy and the energy mix. The generation of electricity from renewable energy resources offers a range of potential socio-economic and environmental benefits for South Africa. These benefits include:

» Increased energy security;
» Resource saving (i.e. fossil fuels and water);

- » Exploitation of South Africa's significant renewable energy resource;
- » Pollution reduction;
- » Climate friendly development;
- » Support for international agreements;
- » Employment creation;
- » Acceptability to society; and
- » Support to a new industry sector.

At present, South Africa is some way off from fully exploiting the diverse gains from renewable energy and from achieving a considerable market share in the renewable energy industry. South Africa's electricity supply remains heavily dominated by coal-based power generation.

The current promulgated Integrated Resource Plan (IRP) 2010 includes 17.8GW of renewables, 9.6GW of nuclear, 6.25GW of coal, and approximately 8.9GW of other generation sources such as hydro, and gas. Based on the Draft IRP 2018 there is currently 1 474MW of installed PV capacity, while an additional 814MW has been committed between 2020 and 2022, and an additional 5 670MW capacity has been allocated between 2025 and 2030. This plan is however yet to be finalised and promulgated but it is unlikely that the contribution of renewable energy to the electricity generation mix will be reduced in the final plan. The IRP essentially drives the assortment of energy to be implemented for South Africa which is known as the energy mix of the country, considering various generation technologies.

d) Conclusion

The 'do-nothing' alternative will do little to influence the renewable energy targets set by government due to competition in the sector, and the number of renewable energy projects being bid to the Department of Energy. However, as the project site experiences ample solar resource are available, not developing Hyperion Solar Development 2 would see such an opportunity being lost. As current land use activities can continue on the project site once the project is operational, the loss of the land to this project during the operation phase (~11.3% of the larger project site) is not considered significant. In addition, the Northern Cape Province will not directly benefit from additional generated power being evacuated into the National grid. Therefore, from a regional perspective, the 'do-nothing' alternative is not preferred as there is a perceived loss of benefits for the regional area.

From the specialist studies undertaken, no environmental fatal flaws were identified to be associated with Hyperion Solar Development 2. All impacts associated with the project can be mitigated to acceptable levels. If the PV facility is not developed the following positive impacts will not be realised:

- » Job creation from the construction and operation phases.
- » Economic benefit to participating landowners due to the revenue that will be gained from leasing the land to the developer.
- » Meeting of energy generation mix in a most economic and rapid manner.
- » Provision of clean, renewable energy in an area where it is optimally available.

As detailed above, the 'do-nothing' alternative will result in a number of lost opportunities. The 'do nothing' alternative is therefore not preferred for the development of Hyperion Solar Development 2.

CHAPTER 9. ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 8, a PV facility may have effects (positive and negative) on natural resources, the social environment and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with Hyperion Solar Development 2 largely in isolation (from other similar developments).

The DoE, under the REIPPP Programme, released in 2011 a request for proposals (RFP) to contribute towards Government's renewable energy target and to stimulate the industry in South Africa. The REIPPP Programme has been rolled out in bid windows (rounds) over the past 7 years, in which developers submit planned renewable energy projects for evaluation and selection. The bid selection process considers a number of qualification and evaluation criteria. The proposed tariff, as well as socio-economic development contributions by the project and the bidder are the main basis for selection after the qualification criteria have been met.

As a result of the REIPPP Programme, there has been a substantial increase in interest in PV facility developments in South Africa (largely in the Northern Cape and North West Provinces), with a number of PV facilities selected as Preferred Bidder projects and 45 PV facilities currently operational (Energyblog, 2018[32]). It is, therefore, important to follow a precautionary approach in accordance with NEMA to ensure that the potential for cumulative impacts[33] are considered and avoided where possible.

This chapter assesses the potential for the impacts associated with the project to become more significant when considered in combination with the other known or proposed PV facility projects within the area.

9.1 Approach taken to Assess Cumulative Impacts

The cumulative impacts that have the potential to be compounded through the development of the PV facility and its associated infrastructure in proximity to other similar developments include impacts such as those listed below. The role of the cumulative assessment is to test if such impacts are relevant to Hyperion Solar Development 2 within the project site being considered for the development:

» Unacceptable loss of threatened or protected vegetation types, habitat or species through clearing, resulting in an impact on the conservation status of such flora, fauna or ecological functioning;
» Unacceptable risk to watercourses through disturbance associated with construction activities and increased runoff and erosion during the operation phase;

[32] https://www.energy.org.za/data-and-tools
[33] Cumulative impacts in relation to an activity are defined in the Environmental Impact Assessment Regulations (Government Notice R326) as the past, current and reasonably foreseeable future impact of an activity, considered together with the impact of activities associated with that activity, that in itself may not be significant, but may become significant when added to existing and reasonably foreseeable impacts eventuating from similar or diverse activities.

- Unacceptable risk to avifauna through habitat loss, displacement and collision with facility infrastructure;
- Unacceptable loss of high agricultural potential areas presenting a risk to food security and increased soil erosion;
- Unacceptable loss of heritage resources;
- Complete or whole-scale change in sense of place and character of an area and unacceptable visual intrusion;
- Unacceptable impact to socio-economic factors and components; and
- Unacceptable risk and degradation due to traffic related impacts.

It is important to explore the potential for cumulative impacts as this will lead to a better understanding of these impacts and the potential for mitigation that may be required. The scale at which the cumulative impacts are assessed is important. For example, the significance of the cumulative impact on the regional or national economy will be influenced by PV facility developments throughout South Africa, while the significance of the cumulative impact on visual amenity may only be influenced by PV facility developments that are in closer proximity to each other. For practical purposes a sub-regional scale of 30km has been selected for this cumulative impact evaluation.

Figure 9.1 indicates the location of Hyperion Solar Development 2 in relation to all other known and viable (i.e. projects with a valid Environmental Authorisation) PV facilities located within a radius of 30km from the project site. These projects were identified using the Department of Environmental Affairs Renewable Energy Database and current knowledge of projects being proposed in the area. In the case of Hyperion Solar Development 2, there are twenty-four (24) solar energy facilities (PV and CSP) located within a 30km radius of the project site (refer to **Figure 9.1** and **Table 9.1**), all at various stages of development. At the time of writing this final EIA Report four facilities are operational, seventeen facilities had been authorised, and three facilities are still in process of obtaining Environmental Authorisation[34]. The potential for cumulative impacts is summarised in the sections which follow and has been considered within the specialist studies (refer to **Appendices D – J**).

[34] Applications for Environmental authorisation for numerous PV facilities have been undertaken within the area, however some of these applications have lapsed and are no longer considered to be valid and are therefore not considered as part of the cumulative impact assessment.

Table 9.1: Solar energy facilities located within the broader area (within a 30km radius) of the Hyperion Solar Development 2 project site

Project Name	DEA Reference Number(s)	Location	Approximate distance from Hyperion Solar Development 2	Project Status
Hyperion Solar Development 1 (PV) (1 x 75MW project)	14/12/16/3/3/2/1109	Remaining Extent of the Farm Lyndoch 432	Within the project site	EIA in process
Hyperion Solar Development 3 (PV) (1 x 75MW project)	14/12/16/3/3/2/1111	Remaining Extent of the Farm Lyndoch 432	Within the project site	EIA in process
Hyperion Solar Development 4 (PV) (1 x 75MW project)	14/12/16/3/3/2/1112	Remaining Extent of the Farm Lyndoch 432	Within the project site	EIA in process
Kalahari Solar Power Project (CSP) (1 x 100MW project)	12/12/20/1994/1	Remaining Extent of the Farm Kathu 465	~9.3km south west	Preferred Bidder (operational)
Kalahari Solar Power Project (CSP) (1 x 150MW project)	12/12/20/1994/2	Remaining Extent of the Farm Kathu 465	~9.3km south west	Approved
Kalahari Solar Power Project (CSP) (1 x 150MW project)	12/12/20/1994/3	Remaining Extent of the Farm Kathu 465	~9.3km south west	Approved
Bestwood Solar Farm (PV)	12/12/20/1906	Remaining Extent of the Farm Bestwood 459	~14km south	Approved
Boitshoko Solar Power Plant (PV) (1 x 115MW project)	14/12/16/3/3/2/935	Remaining Extent of Portion 1 of the Farm Lime Bank 471	~15.4km south west	Approved
Sishen Solar Farm (PV) (1 x 75MW project)	12/12/20/1860	Portion 6 of the Farm Wincanton 472	~15.8km west	Preferred Bidder (operational)
Kathu SEF (PV) (1 x 75MW project)	12/12/20/1858/1	Portion 4 of the Farm Wincanton 472	~15.8km west	Preferred Bidder (operational)
Kathu SEF (PV) (1 x 25MW project)	12/12/20/1858/2	Portion 4 of the Farm Wincanton 472	~15.8km west	Approved
Shirley Solar Park (PV) (1 x 75MW project)	14/12/16/3/3/2/616	Portion 1 of the Farm Shirley 367	~17.9km north west	Approved
Adams Solar Power Generation Plant (PV) (1 x 19MW project)	12/12/20/2566	Remaining Extent of the Farm Adams 328	~22km north	Approved
Adams PV SEF (PV) (1 x 75MW project)	12/12/20/2567	Remaining Extent of the Farm Adams 328	~22km north	Preferred Bidder (operational)
AEP Kathu Solar PV Energy Facility (PV) (1 x 75MW project)	14/12/16/3/3/2/911	Remaining Extent of the Farm Legoko 460	~22.4km south	Approved

Project Name	DEA Reference Number(s)	Location	Approximate distance from Hyperion Solar Development 2	Project Status
AEP Legoko PV Solar Facility (PV) (1 x 75MW)	14/12/16/3/3/2/819	Portion 2 of the Farm Legoko 460	~22.4km south	Approved
Roma Energy Mount Roper Solar Plant (PV) (1 x 10MW project)	14/12/16/3/3/1/474	Portion 4 of the Farm Whitebank 379	~25km north east	Approved
Whitebank Solar Plant (PV) (1 x 10MW project)	14/12/16/3/3/1/475	Portion 4 of the Farm Whitebank 379	~25km north east	Approved
Mogobe PV SEF (1 x 75MW project)	14/12/16/3/3/2/820	Portion 1 of the Farm Legoko 460	~25km south	Approved
Roma Energy Mount Ropers Solar Plant (PV) (1 x 5MW project)	14/12/16/3/3/1/1753	Remaining Extent of the Farm Mount Roper 321	~25.7km north east	Approved
Perth – Kuruman Solar Farm (PV) (1 x 75MW project)	14/12/16/3/3/2/761	Remaining Extent of the Farm Pert 276	~30km north	Approved
Perth – Hotazel Solar Farm (PV) (1 x 75MW project)	14/12/16/3/3/2/762	Remaining Extent of the Farm Pert 276	~30km north	Approved
Kagiso Solar Power Plant (PV) (1 x 115MW project)	14/12/16/3/3/2/934	Remaining Extent of the Farm Pert 276	~30km north	Approved
Tshepo Solar Power Plant (PV) (1 x 115MW project)	14/12/16/3/3/2/936	Remaining Extent of Farm 275	~30km north	Approved

It should be noted that not all the PV facilities presently under consideration by various solar energy developers will be built for operation. Not all proposed developments will be granted the relevant permits by the relevant authorities (DEA, DOE, NERSA and Eskom) due to the following reasons:

» There may be limitations to the capacity of the existing or future Eskom grid;
» Not all applications will receive a positive environmental authorisation;
» There are stringent requirements to be met by applicants in terms of the REIPPP Programme and a highly competitive process that only selects the most competitive projects;
» Not all proposed PV facilities will be able to reduce the associated negative impacts to acceptable levels or be able to mitigate the impacts to acceptable levels (fatally flawed);
» Not all proposed facilities will eventually be granted a generation license by NERSA and sign a Power Purchase Agreement with Eskom; and
» Not all developers will be successful in securing financial support to advance their projects further.

As there is therefore a level of uncertainty as to whether all the above-mentioned PV facilities will be implemented, this results in it being difficult to quantitatively assess the potential cumulative impacts. The cumulative impacts of other known PV facilities in the broader area and Hyperion Solar Development 2 are therefore qualitatively assessed in this Chapter. This assessment is based on information which is currently available. The following potential impacts are considered:

- Cumulative Impacts on Ecological Processes
- Cumulative Impacts on Avifauna
- Cumulative Impacts on Watercourses
- Cumulative Impacts on Heritage Resources
- Cumulative Visual Impacts
- Cumulative Socio-economic Impacts
- Cumulative Impacts on Traffic

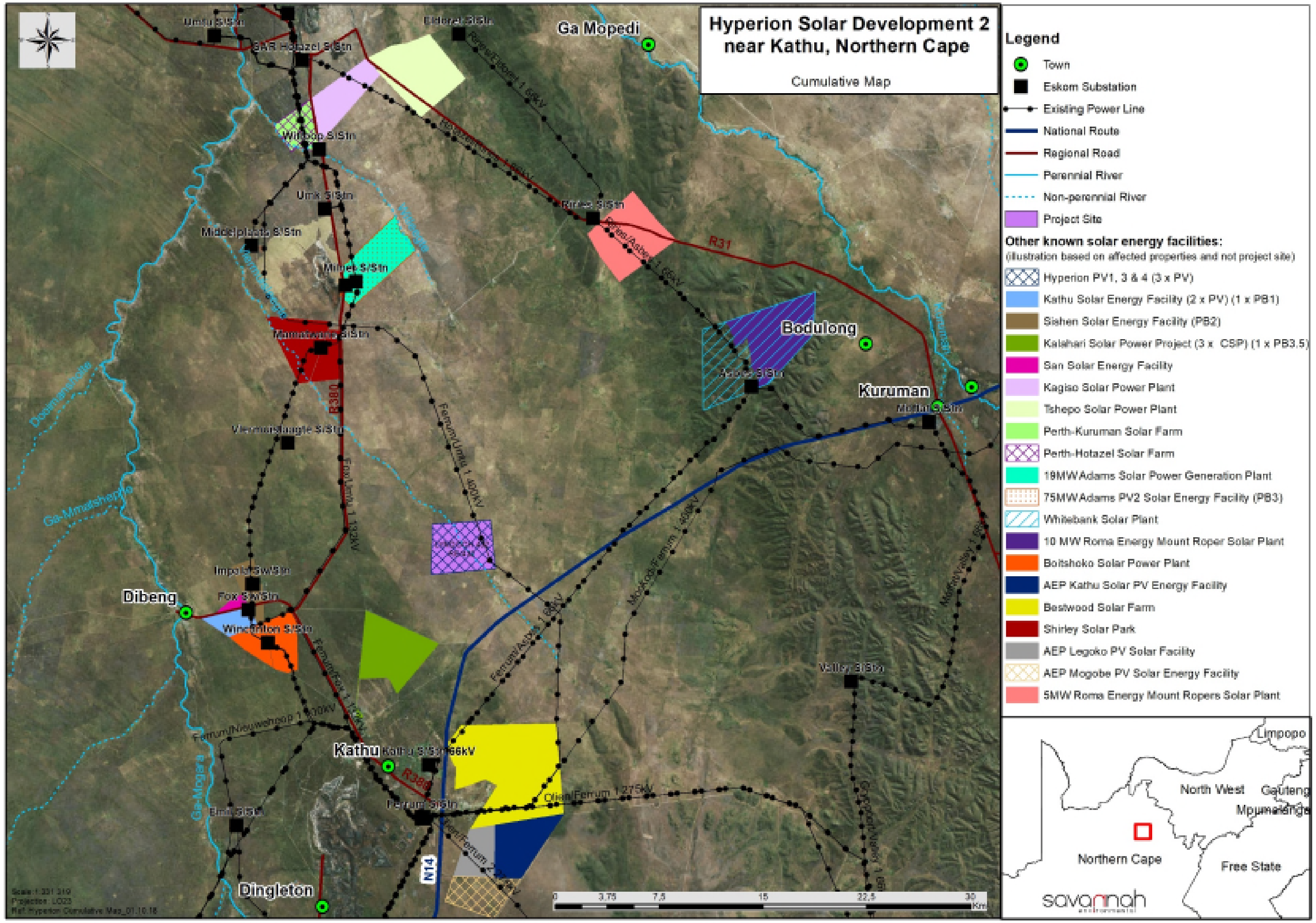

Figure 9.1: **Identified solar energy projects located within a 30km radius of the Hyperion Solar Development 2 project site that are considered as part of the cumulative impact assessment for the Hyperion Solar Development 2 project.**

9.2 Cumulative Impacts on Ecological Processes

Cumulative impacts associated with Hyperion Solar Development 2 and the proposed associated infrastructure have been identified by the ecological specialist (refer to **Appendix D**). Cumulative impacts in the area are a potential concern due to the proliferation of proposed solar energy development in the wider Kathu area. There are several existing solar projects including the already constructed 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 projects 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 also 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.

The cumulative impact on protected tree species is a potential concern given the relatively high numbers of trees that would be affected. However, both *V. 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. The actual 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. Therefore, until such time as the development footprint of Hyperion Solar Development 2 exceeds 500ha, an offset is not recommended. That is not to definite that an offset is 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.

The contribution of Hyperion Solar Development 2 to cumulative impacts is considered to be low and acceptable, with no unacceptable loss or risk expected. The ecological cumulative impact associated with Hyperion Solar Development 2 and other solar energy projects in the area will be of a medium significance.

Nature: *Reduced ability to meet conservation obligations & targets due to cumulative habitat loss* The development of Hyperion Solar Development 2 will potentially 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 (positive or negative)	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 on which Hyperion Solar Development 2 is proposed.
- » 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.

Nature: Negative impact on broad-scale ecological processes

Development of the PV 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	Minor to Low (3)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	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 Impacts:

The presence of the facility will represent an obstacle for some fauna which would contribute to fragmentation in the area.

9.3 Cumulative Impacts on Avifauna

Cumulative impacts from an avifauna perspective include exacerbated displacement and loss of habitat (refer to **Appendix E**). Hyperion Solar Development 2 would potentially contribute approximately 180ha of additional habitat loss and fragmentation in the area. The significance of this impact is likely to be of a local nature only. The cumulative impact is assessed in context of the extent of the current project site, other developments in the area as well as general habitat loss and transformation resulting from agriculture and other activities (i.e. mining) in the area.

The cumulative avifauna impacts, considering the development of Hyperion Solar Development 2 and the PV facilities within the surrounding area will be of a medium significance and acceptable, with no unacceptable loss or risk expected.

Nature: *Cumulative habitat loss and fragmentation* Impact on avifaunal habitats, migration routes and nesting areas due to cumulative loss and fragmentation of habitat, as well collisions and electrocutions along the grid connection.		
	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 (4)	Low to Moderate (5)
Probability	Improbable (2)	Probable (3)
Significance	**Low (18)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	To some degree, but the majority of the long-term impact results from the presence of the facility and other developments in the area which cannot be well mitigated.	
Mitigation: » Minimise the development footprint of each facility as far as possible. A cover of indigenous grasses should be encouraged and maintained within the facility. This prevents the invasion of weeds and is the easiest to manage in the long-term. Furthermore, the grasses can be maintained low through livestock (sheep) grazing which is being successfully used at existing PV facilities. This will assist in maintaining natural vegetative cover which may support avifaunal population, as opposed to complete clearing of all vegetation which is undesirable. » Ensure that suitable ecological corridors within the broader area are identified and maintained, whereby ecological connectivity between areas of higher conservation value are preserved. » The facility should be fenced off in a manner which allows small fauna to pass through the facility, but that does not result in ground-dwelling avifauna (e.g. bustards, korhaan, thick-knees, coursers) being trapped and electrocuted along the boundary fences (Venter, 2016). In practical terms this means that the facility should be fenced-off to include only the developed areas and should include as little undeveloped ground or natural veld as possible. Single-fence designs (with the electrical fencing attached to the inside) as opposed to double-fence designs are preferred so as to avoid ground-dwelling birds becoming entrapped in the space between the two fences. In addition, there should be no electrified ground-strands present within 30cm of the ground, while the electrified strands should also be located on the inside of the fence and not the outside. Images of suitable fencing types from existing PV facilities are available on request.		

9.4 Cumulative Impacts on Watercourses

The proposed Hyperion Solar Development 2 will contribute to the cumulative impacts on the natural environment in the vicinity of the proposed project as the existing solar energy facilities within a 30km radius of the project site and other anthropogenic activities would (refer to **Appendix F**).

Since no surface infrastructure associated with the development area is located within any of the identified watercourses and if either Access Road Alternatives 2, 3 or 4 are to be implemented, the significance of the cumulative impacts of the proposed project would be regarded to be of low significance. With the implementation of mitigation measures, impacts from the proposed Hyperion Solar Development 2 construction activities will not exceed the boundaries of the development and investigation area and the cumulative impact on the larger catchment can, therefore, be considered very low/limited. The cumulative impacts on watercourses associated with Hyperion Solar Development 2 have been assessed to be acceptable, with no unacceptable loss or risk expected.

Nature: *Cumulative impacts on watercourses*

Other activities within the vicinity of the proposed Hyperion Solar Development 2 include an existing solar energy facility (approximately 9.3km south west of the project site), natural and untransformed areas, road crossings and bridges, as well as urban areas.

Aspects pertaining to the cumulative impacts include:

» Site clearing, compaction and disturbance of soils in the vicinity of watercourses;
» Changes to biodiversity maintenance, streamflow regulation capabilities, sediment balance etc. of the watercourses; and
» Erosion, canalisation, increased runoff and sedimentation of the watercourses.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Low (2)	Low (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Very Improbable (1)
Significance	**Low (18)**	**Low (9)**
Status (positive or negative)	Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Contractor laydown areas, and material storage facilities to remain outside of the Vlermuisleegte river and pans and their 32m NEMA ZoR.
» All vehicle re-fuelling is to take place outside of the Vlermuisleegte river and pans and their 32m NEMA ZoR;
» All development footprint areas to remain as small as possible and vegetation clearing to be limited to what is essential.
» Retain as much indigenous freshwater vegetation as possible.
» All vegetation removed should be transported from the construction site (may not be stockpiled) and disposed of at a registered waste disposal facility.
» Material to be used (gravel) as part of the widening of roads must be stockpiled outside the 32m NEMA ZoR of the river to prevent sedimentation of the river. These stockpiles may not exceed a height of 2m and should be protected from wind using tarpaulins.

» Roads should be permeable to allow for drainage from the road surface. In this regard, suitable stormwater management should be implemented to allow for water to drain from the road without causing erosion. » Any concrete or mixing of materials as part of the construction activities should be done within a designated batching area only and must not be mixed within the 32m NEMA ZoR of the Vlermuisleegte River and pans in the area. » Regular spraying of non-potable water or through the use of chemical dust suppressants to reduce dust must be considered mandatory to ensure no smothering of vegetation within the Vlermuisleegte River and/or pans in the area occurs from excessive dust settling. » After construction of roads, the area surrounding the roads must be revegetated with suitable indigenous vegetation to prevent the establishment of alien vegetation species and to prevent erosion from occurring. » It is highly recommended that an alien vegetation management plan be compiled during the planning phase and implemented concurrently with the commencement of construction. » All alien and invasive vegetation should be removed. Any vegetation removed should be taken to a registered landfill site to prevent the proliferation of alien and invasive species.

9.5 Cumulative Impacts on Land Use, Soil and Agricultural Potential

Cumulative impacts from a soils perspective are related to an increase in the loss of agricultural land used for livestock farming, as well as an increased risk of erosion (refer to **Appendix G**). These impacts can be reduced by keeping the footprints of the solar energy facilities minimised where possible and strictly following soil management measures pertaining to erosion control and management and monitoring of any possible soil pollution sources such as vehicles traversing over the sites.

Currently, twenty-four (24) projects are authorised within 30km from the Hyperion Solar Development 2 project site. Three PV projects and one CSP project are currently in operation. Such a large number of projects will change the dominant current land use of the area from livestock farming to electricity generation. In addition to this, cumulative impacts will be associated with an increased risk for soil erosion when vegetation is removed and possible pollution of soil resources. The contribution of the Hyperion Solar Development 2 to cumulative impacts is considered to be low due to the limited footprint of the facility and the limited land capability. The cumulative impacts on soils have been assessed to be acceptable, with no unacceptable loss or risk expected.

The significance of the cumulative soil impacts considering all projects in the area will be medium.

Nature: *Cumulative impact on livestock farming* The main cumulative impact expected to occur with the development of Hyperion Solar Development and the other solar energy facilities within the area is a decrease in land capability for livestock farming.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Regional (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Minor to Low (3)
Probability	Highly Probable (4)	Highly probable (4)
Significance	**Low (28)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:
» The only mitigation measures for this impact is to keep the footprints of all solar energy facilities as small as possible and within areas of low-moderate land capability.

Nature: Cumulative impact associated with soil erosion Increase in areas susceptible to soil erosion as a result of Hyperion Solar Development 2 and other solar energy facilities within a 30km radius.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local to Regional (2)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Minor to Low (3)
Probability	Probable (3)	Highly Probable (4)
Significance	**Low (24)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No
Mitigation: Each of the projects should adhere to the highest standards for soil erosion prevention and management such as: » Land clearance must only be undertaken immediately prior to construction activities; » Unnecessary land clearance must be avoided; » Soil stockpiles must be dampened with dust suppressant or equivalent; » Soil stockpiles must be located away from any waterway or preferential water flow path in the landscape, to minimise soil erosion from these; » Geo-textiles or similar measures must be used to stabilise soil stockpiles and uncovered soil surfaces during the construction phase and to serve as a sediment trap to contain as much soil as possible that might erode away; » The Storm water Management Plan (SWMP) for each facility should provide for a drainage system sufficiently designed to prevent water run-off from the solar panels to cause soil erosion; » Where discharge of rainwater on roads will be channelled directly into the natural environment, the application of diffuse flow measures must be included in the design of each facility; and » Revegetate cleared areas as soon as possible after construction activities.		

Nature: Cumulative impact associated with the increased risk of soil pollution Increase in soil pollution as a result of Hyperion Solar Development 2 and other solar energy facilities within a 30km radius.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (1)	Local to Regional (2)
Duration	Short-term (2)	Permanent (5)
Magnitude	Low (4)	Minor to Low(3)
Probability	Improbable (2)	Probable (3)
Significance	**Low (14)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:
Each of the projects should adhere to the highest standards for soil erosion prevention and management such as: » High level maintenance must be undertaken on all vehicles and construction machinery to prevent hydrocarbon spills at each site; » Impermeable and bunded surfaces must be used for storage tanks and to park vehicles on; » Site surface water and wash water must be contained and treated before reuse or discharge from each site; » Spills of fuel and lubricants from vehicles and equipment must be contained using a drip tray with plastic sheeting filled with adsorbent material; » Waste disposal at the construction site must be avoided by separating, trucking out and recycling of waste; » Potentially contaminating fluids and other wastes must be contained in containers stored on hard surface levels in bunded locations; and » Accidental spillage of potentially contaminating liquids and solids must be cleaned up immediately by trained staff with the correct equipment and protocols as outlined in the EMPr.

9.6 Cumulative Impacts on Heritage (including archaeology and palaeontology)

The Hyperion Solar Development 2 will likely result in minimal impacts to heritage resources (refer to **Appendix I).** The most significant impact will be associated with impacts to archaeological resources. Given that the site seems to be dominated by MSA archaeology rather than ESA, as occurs more frequently closer to Kathu (and within the Grade 1 archaeological landscape), the opportunity to explore the archaeology can be considered as a positive cumulative impact of medium significance for regional archaeology. It is therefore unlikely that the proposed Hyperion Solar Development 2 project will result in unacceptable risk, unacceptable loss, whole-scale changes to the sense of place or unacceptable increase in impact.

The heritage cumulative impacts associated with Hyperion Solar Development 2 will be of a medium significance and is acceptable, with no unacceptable loss or risk expected.

Nature: *Cumulative heritage impacts* The focus is on archaeological resources which have the greatest potential for significant impacts and which can be physically disturbed or destroyed during construction activities.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (3)	Low (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
Status (positive or negative)	Negative	Positive
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: No mitigation required.		

9.7 Cumulative Visual Impacts

The Kathu Bushveld includes woody vegetation that extends above head height. This taller vegetation may not be very dense but the cumulative screening effect over distance is considered to be significant (refer to **Appendix H**). Vegetation is therefore likely to at least visually break the horizontal dark line of solar panels. The cumulative impact on general landscape character, impacts on views from roads and from local homesteads due to renewable energy projects in the area is considered to be of medium significance. The contribution of the proposed project to these cumulative impacts is assessed as low. This is generally due to distance of the project from receptors and the VAC of the landscape. The cumulative visual impacts associated with Hyperion Solar Development 2 have been assessed to be acceptable, with no unacceptable loss or risk expected.

The possible cumulative effect of glare on Kathu Airport and the cumulative contribution of the proposed project are both considered to be of low significance. This is largely due to the relatively effective mitigation measures that might be employed.

Nature: *Potential cumulative visual impact on landscape character*

The proposed project could extend the general influence of development and specifically solar projects into a relatively natural rural area. The project is one of four proposed projects on the same property. Whilst there are twenty one similar projects within 30km of the proposed project, four are located within the approximate limit of visibility of the project and may be visible to a stakeholder at the same time. These projects could combine visually to create the impression of a concentration of development.

Other projects could also combine to create this impression but the subject project will not add to this impression. Whilst projects that are seen in isolation surrounded by relatively natural areas will also create the impression of industrialisation as a stakeholder moves through the area, they are unlikely to create the impression that solar development is the main landcover, in other words, they will appear as industrial elements within a general naturalistic landscape.

The proposed project is also unlikely to be obvious from any public areas or routes. Its contribution to the cumulative visual impact of solar projects is therefore likely to be limited.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Site and surroundings (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to Minor (1)	Moderate (6)
Probability	Improbable (2)	Probable (3)
Significance	**Low (14)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Planning:

- Plan development levels to minimise earthworks to ensure that levels are not elevated;
- Plan to maintain the height of structures as low as possible;
- Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
- Retain and augment natural vegetation on all sides of the proposed project.

» Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary. Operation: » Reinstate any areas of vegetation that have been disturbed during construction; » Remove all temporary works; » Monitor rehabilitated areas post-construction and implement remedial actions; » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area; » Maintain and augment natural vegetation around the proposed project. Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the sites; » Rehabilitate and monitor areas post-decommissioning and implement remedial actions.
Residual Impacts: Residual impacts relate to the loss of indigenous vegetation as well as the failure to remove development and infrastructure on decommissioning.

Nature: *Potential cumulative visual impact on views from roads including the N14, the R308 and local roads* The proposed project is very unlikely to have any significant impact on the N14, the R308 or local roads. A detailed visual analysis of other solar projects (other than Hyperion 1, 3 and 4) in the area has not been undertaken due to limited information available on these projects, however given the location of other projects in closer proximity to roads, it seems possible that other solar projects in the area could have a significant impact.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and surroundings (2)	Regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Small to Minor (1)	Moderate to low (5)
Probability	Improbable (2)	Probable (3)
Significance	**Low (14)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Planning: » Plan development levels to minimise earthworks to ensure that levels are not elevated; » Plan to maintain the height of structures as low as possible; » Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development; » Retain and augment natural vegetation on all sides of the proposed project. » Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary. Operation: » Reinstate any areas of vegetation that have been disturbed during construction; » Remove all temporary works; » Monitor rehabilitated areas post-construction and implement remedial actions; » Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;		

» Maintain and augment natural vegetation around the proposed project.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
Residual impacts relate to the loss of indigenous vegetation as well as the failure to remove development and infrastructure on decommissioning.

Nature: *Potential cumulative visual impact on homesteads*
The proposed project may not be visible from existing homesteads but will be visible from areas surrounding homesteads. It is likely that other closer projects will be more visible to homesteads and will in fact help screen the proposed development. Whilst a detailed assessment of the impact of other projects (other than Hyperion 1, 3 and 4) has not been undertaken due to limited information available on these projects, from review of online mapping, it seems possible that other projects will impact negatively on homesteads in the region.

The cumulative impact is therefore also likely to be improbable with a low significance.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and immediate surroundings, (2)	Regional (3)
Duration	Long term (4)	Long-term (4)
Magnitude	Small to minor (1)	Moderate to low (5)
Probability	Probable (3)	Probable (3)
Significance	**Low (21)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:
Planning:
» Plan development levels to minimise earthworks to ensure that levels are not elevated;
» Plan to maintain the height of structures as low as possible;
» Minimise disturbance of the surrounding landscape and maintain existing vegetation around the development;
» Retain and augment natural vegetation on all sides of the proposed project.
» Ensure that the colour of the back face of panels looks black and paint support structures closest to receptors mid grey (southern-most row). If other projects are developed to the south, this mitigation measure is not necessary.

Operation:
» Reinstate any areas of vegetation that have been disturbed during construction;
» Remove all temporary works;
» Monitor rehabilitated areas post-construction and implement remedial actions;
» Minimise disturbance and maintain existing vegetation as far as is possible both within and surrounding the development area;
» Maintain and augment natural vegetation around the proposed project.

Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the site;
» Rehabilitate and monitor areas post-decommissioning and implement remedial actions.

Residual Impacts:
Residual impacts relate to the loss of indigenous vegetation as well as the failure to remove development and

infrastructure on decommissioning.

Nature: *Potential cumulative visual impact of glare affecting Kathu Aerodrome*

Whilst a detailed glare analysis of other solar projects in the area has not been undertaken due to limited information available on these projects, due to the number of projects in the area, the probability of glare being an issue will increase to probable and due to the spread of the possible projects the extent increases to "regional".

The proposed project is unlikely to add significantly to glare issues associated with solar PV development in the area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site and immediate surroundings, (2)	Regional (3)
Duration	Long term (4)	Long-term (4)
Magnitude	Minor (2)	Minor (2)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Should glare prove problematic, mitigation might include a slight adjustment to the angle of repose of solar panels.

Residual Impacts:

None anticipated.

Nature: *Night Time Lighting Impacts*

Currently lighting in the area is comprised of low level lighting around homesteads and another solar project (Kalahari Solar) as well as lighting on the N14 to the south. There is a risk that the proposed project will intensify lighting impacts in the area. If additional solar development does occur on other sites, it is highly possible that these developments could also extend lighting impacts. If appropriate mitigation measures are applied as recommended for the subject project then cumulative impacts are anticipated to be low.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Site (1)	Regional (3)
Duration	Long term (4)	Long term (4)
Magnitude	Small to minor (1)	Small to minor (1)
Probability	Improbable (2)	Improbable (3)
Significance	**Low (12)**	**Low (24)**
Status (positive or negative)	If the lights are generally not visible then the occasional light is unlikely to be seen as negative. Neutral	Neutral
Reversibility	High	High
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

» Use low key lighting around buildings and operational areas that is triggered only when people are present.

» Plan to utilise infra-red security systems or motion sensor triggered security lighting. » Ensure that lighting is focused on the development with no light spillage outside the site; and » Keep lighting low, no tall mast lighting should be used.
Residual Impacts: No residual risk has been identified.

9.8 Cumulative Social Impacts

The potential for social cumulative impacts to occur is likely. Potential cumulative social impacts identified for Hyperion Solar Development 2 include positive impacts on the economy, business development, and employment, as well as negative impacts such as the increased risk of HIV infections, change in the area's sense of place, increased pressure on public services, supplies and infrastructure (refer to **Appendix J**).

Hyperion Solar Development 2 and the establishment of other PV facilities within the area has the potential to result in significant positive cumulative impacts, specifically with regards to the creation of a number of socio-economic opportunities for the region, which in turn, can result in positive social benefits. The positive cumulative impacts include the creation of employment, skills development and training opportunities, and downstream business opportunities. The cumulative benefits to the local, regional, and national economy through employment and procurement of services are more considerable than that of Hyperion Solar Development 2 alone.

In addition, the fact that the project is proposed within an area characterised by good levels of solar irradiation suitable for the development of commercial solar energy facilities implies that the surrounding area is likely to be subject to considerable future applications for PV facilities. Levels of unemployment, and the low level of earning potential may attract individuals to the area in search of better employment opportunities and higher standards of living.

While the development of a single PV facility may not result in a major influx of people into an area, the development of several projects at one time may have a cumulative impact on the in-migration and movement of people. The influx of construction workers is likely to place pressure on accommodation and the need for both service delivery and supplies.

It is well documented on both an international and local basis that the construction industry carries a high level of HIV which can be spread amongst the local communities, particularly through the spread of prostitution that follows the availability of disposable income (Meintjes, Bowen, & Root, 2007; Bowen, Dorrington, Distiller, Lake, & Besesar, 2008; Wasie, et al., 2015; Bowen P. , Govender, Edwards, & Cattell, 2016; Kikwasi & Lukwale, 2017; Bowen P. , Govender, Edwards, & Lake, 2018). It is also well documented on both an international and local level that HIV is also spread by truck drivers (Singh & Malaviya, 1994; Ramjee & Gouws, 2002; Strauss, et al., 2018). It is likely that there will be an increase in truck drivers in the area as equipment and material is delivered to the various construction sites.

It is very difficult to control an influx of people into an area, especially in a country where unemployment rates are high. It is therefore important that the project proponent implement and maintain strict adherence with a local employment policy in order to reduce the potential of such an impact occurring, as well as to be able to communicate the process for employment so that people know how and where to apply. The cumulative social impacts associated with Hyperion Solar Development 2 have been assessed to be acceptable, with no unacceptable loss or risk expected.

Nature: *Increased risks of HIV*
With an HIV prevalence rate of 17.5%, the Northern Cape Province is the province with the lowest HIV prevalence rates as assessed in 2013 compared to all other provinces across the country. With the influx of labour, particularly following the construction of the various renewable energy projects within the region, the risk of HIV infections in the area is likely

to rise significantly. With the area being extremely poor and the associated disposable income that will follow the construction workers and truck drivers to the area will heighten the risk of the spread of HIV infections across what is a relatively isolated region.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (4)	Regional (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	High (8)
Probability	Probable(3)	Highly probable(4)
Significance	**Medium (42)**	**High (64)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	
Mitigation: Mitigation can only be implemented at a regional level and will need to be driven on a provincial and municipal basis. In this sense the following mitigation measures would need to be considered: » Ensure that all companies coming into the area have and are implementing an effective HIV/AIDS policy. » Introduce HIV/AIDS awareness programmes to schools and youth institutions. » Carefully monitor and report on the HIV status of citizens in the region. » Be proactive in dealing with any increase in the HIV prevalence rate in the area.		
Residual Impact: An increase in the HIV prevalence rate that will last well beyond the construction period and will have dire consequences for local communities.		

Nature: *Increase in crime* It is possible that due to increased construction activities in the area the perception may be created that there is an associated increase in job opportunities. This may result in job seekers descend on the region in the hope of gaining employment. These activities across the area may also attracted entrepreneurs to set up small businesses aimed at servicing the growing population. All this activity could also attract opportunists who may take advantage of the emerging situation which may lead to an increase in crime in the area. . In 2018 Kuruman had a total of 3 760 crimes reported with Kathu having a total of 2 634 reported crimes. The issue of crime associated with construction sites is of growing concern across the country and needs serious attention to prevent it from getting out of hand. Consequently the increase in crime associated with developments in the area becomes a risk on a cumulative basis.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (2)	Regional (5)
Duration	Short-term (1)	Long term (4)
Magnitude	Minor to low (3)	Moderate (6)
Probability	Probable(3)	Highly probable(4)
Significance	**Low (18)**	**High (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Yes	Yes
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Mitigation can only be implemented at a regional level and will need to be driven on a provincial and municipal basis. In this sense the following mitigation measures would need to be considered:		

» Encourage contractors and local people to report any suspicious activity associated with crime to the appropriate authorities. » Ensure that the local municipalities, police, security companies, and policing forums are alerted to the increased construction activities in the region and the risk it posse in respect of crime. » Prevent loitering within the vicinity of the construction camp as well as construction sites. » Manage the growth of informal settlements that may arise as a response to growing job opportunities by promptly alerting the appropriate authorities. » Set up a community forum consisting of contractors, local and national government officials and

Nature: Cumulative impact on the area's sense of place

With the number of PV facilities, substations and transmission lines in the vicinity the sense of place of the area is transforming from what had more of a rural farming aura to take on more of an industrial character. The project, considered along with the various other projects in the area, is likely to accelerate this transformation thus changing the sense of place of the region. Some of the concerns associated with this change to the environment relate to glare and aircraft interference, particularly considering the proximity of Sishen Airport; the visual impact both static and dynamic along the N14 and R380 and land use transformation from farming to industrial. As this change will be associated with the clustering of several projects in the area it will need to be considered on a cumulative basis.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (4)	Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Moderate (5)	High (8)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**High (80)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	

Mitigation:

Mitigation can only be implemented at a regional level and will need to be driven on a provincial and municipal basis. In this sense the following mitigation measures would need to be considered:

» Consider undertaking a cumulative impact assessment to evaluate the changes taking place across the area on a broader scale.
» Form a regional work group tasked with addressing the effect of changes to the sense of place of the region.
» Establish grievance mechanisms to deal with complaints associated with changes to the area.
» Enlighten the public about the need and benefits of renewable energy.
» Engage with tourism businesses and authorities in the region to identify any areas of cooperation that may exist.

Nature: Cumulative impact associated with the disruption of public services, supplies and infrastructure

With the proliferation of renewable energy facilities in the area, it is likely that the local municipality will find it difficult to keep up with service delivery. The influx of construction workers is likely to place pressure on accommodation and the need for both service delivery and supplies. On this basis, market demands could inflate costs that may have a negative effect on local communities, particularly the poor, who may be forced to pay higher prices for essential supplies resulting in an escalation of the cost of living in the area. Social services such as medical and educational facilities could also be placed under pressure due to increased demand. Although this may reach its peak during the construction phases, it should be mitigated to some extent by the fact that the construction of the various project will be spread across different timelines, with some project commencing while other reach completion. Where numerous projects are entering into construction phase simultaneously, the project companies should engage to align efforts.

Employing local people across the various projects and project phases may also assist in reducing the stress placed on services, supplies and infrastructure in the area. During the operational phases it is likely that these demands will continue as operational staff take up more long-term residency in the area and are supported by service and maintenance personnel who may spend some time on site on a contractual basis. An influx of temporary maintenance and service workers is likely to last over the operational phase of the projects but is likely to settle within the medium term as the economy adjusts and the municipal authorities are able to respond to this growth.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (2)	Regional (4)
Duration	Short-term (1)	Long-term (4)
Magnitude	Minor to Low (3)	Moderate to High (7)
Probability	Highly probable (4)	Highly probable (4)
Significance	**Low (24)**	**High (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: Mitigation can only be implemented at a regional level and will need to be driven on a provincial and municipal basis. In this sense the following mitigation measures would need to be considered: » Engage with the municipal authorities to ensure that they are aware of the expansion planned for the area and the possible consequences of this expansion; » Ensure that local labour is recruited in respect of these developments in the area.		

Nature: *Cumulative impact associated with economic development within the area* The proliferation of renewable energy facilities within the region is likely to result in significant and positive cumulative impacts in the area in terms of both direct and indirect job creation, skills development, training opportunities, and the creation of business opportunities for local businesses.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Regional (4)	Regional (5)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low to Moderate (5)	Moderate to High (7)
Probability	Definite (5)	Definite (5)
Significance	**High (65)**	**High (80)**
Status (positive or negative)	Positive	Positive
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Enhancement: Mitigation can only be implemented at a regional level and will need to be driven on a provincial and municipal basis. In this sense the following mitigation measures would need to be considered: » Implement a training and skills development programme for locals; » Ensure that the procurement policy supports local enterprises; » Establish a social responsibility programme in line with the REIPPP; » Work closely with the appropriate municipal structures in regard to establishing a social responsibility programme; » Ensure that any trusts or funds are strictly managed in respect of outcomes and funds allocated.		

9.9 Cumulative Traffic Impacts

To assess the cumulative traffic impact, it was assumed that all renewable energy projects within 50km currently proposed and authorised, would be constructed at the same time. This is considered a precautionary approach as in reality; these projects would be subject to a highly competitive bidding process. Only a handful of projects would be selected to enter into a power purchase agreement with Eskom, and construction is likely to be staggered depending on project-specific issues.

The construction and decommissioning phases are the only significant traffic generators for renewable energy projects. The duration of these phases is short term (i.e. the impact of the generated traffic on the surrounding road network is temporary and renewable energy facilities, when operational, do not add any significant traffic to the road network). Even if all renewable energy projects within the area are constructed at the same time, the roads authority will consider all applications for abnormal loads and work with all project companies to ensure that loads on the public roads are staggered and staged to ensure that the impact will be acceptable.

Nature: Traffic generated by the proposed development and the associated noise and dust pollution.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Regional (5)
Duration	Short-term (1)	Medium-term (3)
Magnitude	Moderate (6)	High (8)
Probability	Highly probable (4)	Definite (5)
Significance	**Medium (36)**	**High (80)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation: » Use of preferred access (A1) will reduce traffic impact on Kathu. » Stagger component delivery to site. » Dust suppression. » Reduce the construction period. » The use of mobile batch plants and quarries in close proximity to the site. » Staff and general trips should occur outside of peak traffic periods.		

9.10 Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of Hyperion Solar Development 2 throughout all phases of the project life cycle and within all areas of study considered as part of this final EIA Report. The main aim for the assessment of cumulative impacts considering Hyperion Solar Development 2 is to test and determine whether the development will be acceptable within the landscape proposed for the development, and whether the loss, from an environmental and social perspective, will be acceptable without whole-scale change.

The assessment of the cumulative impacts was undertaken through the consideration of the Hyperion Solar Development 2 impacts in isolation and compared to the cumulative impacts of Hyperion Solar Development 2 and other solar energy facilities within a 30km radius from the proposed project site.

The significance of the cumulative impacts associated with the development of Hyperion Solar Development 2 ranges from low to high, depending on the impacts being considered. A summary of the cumulative impacts are included in **Table 9.2** below.

Table 9.2: Summary of the cumulative impact significance for Hyperion Solar Development 2 within the project site

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Ecology	Low	Medium to Low (depending on the impact being considered)
Avifauna	Low	Medium
Watercourses	Low	Low
Soil, Land use and Agricultural Potential	Low	Medium
Heritage (archaeology and palaeontology)	Medium	Medium
Visual	Low	Medium to Low (depending on the impact being considered)
Socio-Economic	Negative - Low to High (depending on the impact being considered) Positive - High	High (positive and negative)
Traffic	Medium	High

The following can be concluded regarding the cumulative impacts of Hyperion Solar Development 2:

» **Ecological processes:** Cumulative impacts associated with Hyperion Solar Development 2 on ecological processes includes a reduced ability to meet conservation obligations and targets, impacts on Broad-Scale Ecological Processes due to the clearing of vegetation and impacts to fauna and flora. The cumulative impact will be of a medium to low significance depending on the impact being considered. No impacts of a high significance were identified. The contribution of Hyperion Solar Development 2 to cumulative impacts is considered to be low. As the development footprint of Hyperion Solar Development 2 does not exceeds 500ha, an offset is not recommended nor is one required by DAFF. The most significant impact is associated with the loss of habitat and the implications of this for ecological functioning and landscape connectivity in the area. There will be no unacceptable loss of threatened or protected vegetation types, habitats or species due to the development of the Hyperion Solar Development 2 and other PV facilities within the surrounding area.

» **Avifauna:** Cumulative impacts associated with Hyperion Solar Development 2 from an avifauna perspective includes habitat loss and transformation resulting from agriculture and other activities in the area. The significance of the cumulative impact associated with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding areas is expected to be of medium significance. The contribution of Hyperion Solar Development 2 to cumulative impacts is considered to be low. The cumulative impacts can be mitigated to some extent and are not considered to pose an unacceptable risk or impact to the development of Hyperion Solar Development 2.

- **Watercourses:** Cumulative impacts associated with Hyperion Solar Development 2 on watercourses includes erosion, canalisation, increased runoff and sedimentation of the watercourses. The significance of the cumulative impact associated with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding areas is considered to be of low significance. The cumulative impacts can be mitigated and are not considered to pose an unacceptable risk or impact to the development of Hyperion Solar Development 2.
- **Land Use, Soils and Agricultural Potential:** Cumulative impacts on land-use, soil and agricultural potential have been identified and assessed which relates to a decrease in land capability for livestock farming, soil erosion and the increased risk of soil pollution. The significance of the cumulative impact will be medium with the development of Hyperion Solar Development 2 and other solar PV energy facilities within the surrounding area. The contribution of Hyperion Solar Development 2 to cumulative impacts is considered to be low. There will be no unacceptable loss of land capability for livestock farming due to the development of Hyperion Solar Development 2 and other solar PV energy facilities within the surrounding areas. This is largely due to the fact that farming activities can continue on the areas of the properties not affected by the solar developments.
- **Heritage (including archaeology and palaeontology):** Hyperion Solar Development 2 will likely result in minimal cumulative impacts to heritage resources. The most significant impact will be associated with impacts to archaeological resources. The significance of the cumulative impact will be of medium significance. There will be no unacceptable loss of heritage resources associated with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding areas.
- **Visual:** The cumulative impact on general landscape character, impacts on views from roads and from local homesteads due to renewable energy projects in the area is considered to be of medium significance. There will be no unacceptable impact on the visual quality of the landscape associated with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding area.
- **Socio-economic:** Several positive and negative social cumulative impacts have been identified and assessed for Hyperion Solar Development 2. The positive impact relates to employment opportunities, business opportunities and skills development. Positive impacts will be enhanced with the development of numerous developments in the area. The significance of the impacts will be high with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding area. The negative impact relates to a large-scale in-migration of people, an increased risk of HIV, pressure on service delivery, supplies and infrastructure, as well as the impact to the sense of place. The significance of the impacts will be high with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding area. There will be no unacceptable risk or impacts to the social aspects and characteristics of the town of Kathu with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding area.
- **Traffic:** The cumulative assessment followed a precautionary approach which considered a scenario where all solar energy facilities within a 50km radius would be constructed at the same time. Cumulative traffic impacts is considered to be of high significance. The impact of the generated traffic on the surrounding road network is temporary and renewable energy facilities, when operational, do not add any significant traffic to the road network. There will be no unacceptable impact on traffic associated with the development of Hyperion Solar Development 2 and other PV facilities within the surrounding area.

Based on the specialist cumulative assessment and findings, the development of Hyperion Solar Development 2 and its contribution to the overall impact of all solar energy facilities to be developed within a 30km radius, it can be concluded that Hyperion Solar Development 2 cumulative impacts will be of a low to moderate to high significance, depending on the impact being considered. There are however no impacts or risks identified to be considered as unacceptable with the development of Hyperion Solar Development 2 and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change is expected.

CHAPTER 10. CONCLUSIONS AND RECOMMENDATIONS

Cyraguard (Pty) Ltd (a subsidiary of Building Energy South Africa (Pty) Ltd), is proposing the construction of a photovoltaic (PV) solar energy facility on a site near Kathu in the Northern Cape Province. Hyperion Solar Development 2 comprises a solar energy generation facility and associated infrastructure and is intended to form part of the Department of Energy's (DoE's) Renewable Energy Independent Power Producer Procurement (REIPPP) Programme. Hyperion Solar Development 2 will be designed to have a contracted capacity of up to 75MW, and will make use of photovoltaic (PV) solar technology.

The portion of the Remaining Extent of Farm Lyndoch 432 was identified and assessed as the project site for the development of Hyperion Solar Development 2. The 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 (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
» On-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and distribution power transformers.
» A 132kV on-site substation up to 1ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
» A new 132kV power line between the on-site substation and the national grid[35].
» 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 up to 1ha in extent.
» Internal access roads, perimeter road and fencing around the development area.
» Main access road to the development area. Four alternatives are currently being considered in this regard:
  * Alternative 1: 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
  * 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.
  * 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

[35] The construction of the 132kV overhead power line will be assessed as part of a separate Basic Assessment process which will consider feasible alternatives for the power line route.

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 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 to be considered within the EIA process.

Hyperion Solar Development 2 (Pty) Ltd has confirmed that the project site is suitable for a solar PV energy development from a technical perspective due to the available solar resources, access to the electricity grid, current land use, land availability and site-specific characteristics including accessibility. The aim of the EIA process was to confirm the feasibility of the site from an environmental perspective. A summary of the recommendations and conclusions for the proposed project as determined through the EIA process is provided in this Chapter.

10.1 Evaluation of Hyperion Solar Development 2

The preceding chapters of this report together with the specialist studies contained within **Appendices D-J** provide a detailed assessment of the potential impacts that may result from the development of Hyperion Solar Development 2. This chapter concludes the environmental assessment of the PV facility and associated infrastructure by providing a summary of the results and conclusions of the assessment of the development area and access road alternatives proposed for Hyperion Solar Development 2. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP, and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of highly sensitive features within the project site by the development footprint and the undertaking of monitoring, as specified by the specialists.

The potential environmental impacts associated with Hyperion Solar Development 2 identified and assessed through the EIA process include:

» Impacts on ecology, flora and fauna.
» Impacts on avifauna.
» Impacts on watercourses.
» Impacts on heritage resources, including archaeology and palaeontology.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative socio- economic impacts.
» Traffic impacts.

10.1.1 Impacts on Ecology

The Ecological Impact Assessment assessed the impact of Hyperion Solar Development 2 on the sensitive ecological features present within the project site for the life-cycle of the project. The assessment identified impacts within the construction and operation phases of the project.

During the construction phase, the impacts expected to occur include impacts on vegetation and listed protected plant species and faunal impacts. The significance of the construction phase impacts ranges from medium to low, following the implementation of the mitigation measures recommended by the specialist. No impacts of a high significance were identified prior to the implementation of mitigation.

During the operation phase, the anticipated impacts include faunal impacts, an increased erosion risk and potential for increased alien plant invasion. The significance of the impacts for the operation phase are low, following the implementation of the mitigation measures recommended by the specialist. No impacts of high significance were identified for the project prior to the implementation of mitigation.

The loss of protected tree species is an unavoidable impact associated with the project. Given that the site is not considered to be exceptional in terms of the size or density of trees present, it is the opinion of the specialist that 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 Hyperion Solar Development 2. This is supported by DAFF following their evaluation of the project site. DAFF has however advised that Hyperion Solar Development 2 may be subjected to an offsite mitigation condition such as greening.

From the findings of the Ecological Impact Assessment (**Appendix D**) it can be concluded that no impacts of high ecological significance were identified which would hinder the development of Hyperion Solar Development 2 and its associated infrastructure within the proposed development area. The proposed development is considered to be appropriate and acceptable from an ecological perspective at the proposed location, and will not result in detrimental impacts to ecosystems and habitat features present within the project site and within the surrounding properties. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from an ecological perspective is Alternative 1. Access Road Alternative 2 and 4 are also considered to be acceptable.

10.1.2 Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**) assessed the impact of Hyperion Solar Development 2 on the sensitive ecological features present within the project site for the life-cycle of the project. The assessment identified impacts within the construction and operation phases of the project.

Conclusions of this study are based on the findings of two site visits undertaken in August 2018 and January 2019 (i.e. wet and dry season site visits), ecological and biodiversity information available in the literature and various spatial databases with mapping based on the satellite imagery of the site as well as personal knowledge of the site obtained during the site visits. The avifauna impacts identified to be associated with Hyperion Solar Development 2 will be negative and local in extent. The duration of the impacts will be short to long-term, for the lifetime of the PV facility.

During the construction phase of Hyperion Solar Development 2 and the access road alternatives, a loss of habitat and disturbance due to clearance of vegetation is expected to occur. The significance of these impacts can be reduced to medium with the implementation of the recommended mitigation measures.

Impacts associated with the operation phase of Hyperion Solar Development 2 include collision with PV panels and entrapment on fences. The significance of the impacts will be low with the implementation of mitigation measures.

From the results of the avifauna assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from an avifaunal perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from an avifauna perspective is Alternative 1. Access Road Alternative 4 is also considered to be acceptable.

10.1.3 Impacts on Watercourses

The Watercourse Impact Assessment (**Appendix F**) assessed the impact of Hyperion Solar Development 2 on watercourses present within the project site and within a 500m radius from the project site for the life-cycle of the project. The area surrounding the identified watercourses is mainly natural, untransformed areas; however, the river was noted to have been historically cultivated. Trampling and grazing of livestock was identified within almost all the watercourses. Sand mining and various informal roads were the only identified anthropogenic activities occurring within the local catchment of these watercourses. The assessment identified impacts within the construction and operation phases of the project. No direct impacts will occur.

During the construction phase of Hyperion Solar Development 2 and the access road alternatives, the impacts expected to occur will include the disturbance of vegetation and soil, increase of alien invasive species, increased hardened surfaces and altered runoff patterns. The significance of these impacts can be reduced to medium to low with the implementation of the recommended mitigation measures.

Impacts associated with the operation phase of Hyperion Solar Development 2 include decreased surface water quality, erosion, increased hardened surfaces and altered runoff patterns. The significance of the impacts will be medium to low with the implementation of mitigation measures.

From the results of the Watercourses Impact Assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a watercourse perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from a watercourse perspective is Alternative 4. Notwithstanding the fact that a clear preference has emerged in respect of the various access road alternatives, this is not compelling in that the impacts along all access road alternatives can be mitigated to acceptable levels. Consequently, the preference can be overridden by either technical and/or biodiversity requirements if these requirements are compelling. Access Road Alternative 1 is considered to be acceptable with the implementation of mitigation.

10.1.4 Impacts on Land Use, Soil and Agricultural Potential

The proposed Hyperion Solar Development 2 project infrastructure is located within an area that has no potential for arable agriculture. The construction and operation of a PV facility on the project site is considered acceptable from a soils perspective as it will supplement and stabilise the landowner's income in an area where farming is susceptible to prolonged droughts.

Impacts have been identified for both the construction and operation phases for Hyperion Solar Development 2 (**Appendix G**). The impacts associated with land use, soil and agricultural potential include an increased risk of soil erosion, potential chemical pollution and loss of land capability. The significance of the impacts is low with the implementation of the mitigation measures recommended by the specialist.

From the results of the Land Use, Soil and Agricultural Potential assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from a soils perspective is Alternative 1. Access Road Alternative 2 and 4 are also considered to be acceptable.

10.1.5 Visual Impacts

The Visual Impact Assessment (**Appendix H**) identified negative impacts on visual receptors during the undertaking of construction activities and the operation phase of Hyperion Solar Development 2.

During the construction phase the undertaking of construction activities will impact on sensitive visual receptors in close proximity to Hyperion Solar Development 2. The construction phase will result in a noticeable increase in heavy vehicles utilising the roads which may cause a visual nuisance to other road users and landowners in the area. The construction phase visual impacts will be of short duration and have a low significance following the implementation of the recommended mitigation measures.

Visual impacts expected to occur during the operation phase includes impact on sensitive visual receptors, lighting impacts, visual impact of the ancillary infrastructure, and a visual impact on the sense of place in the region. The significance of the visual impacts is of low significance with the implementation of the recommended mitigation measures. The specialist has indicated support for the development of Hyperion Solar Development 2 from a visual perspective provided that recommended mitigation measures are implemented. The access road alternatives are likely to cause relatively low levels of visual impact and therefore all alternatives are considered acceptable.

10.1.6 Impacts on Heritage Resources

The Heritage Impact Assessment (**Appendix I**) identified impacts associated with the construction and operation of Hyperion Solar Development 2. The impact on heritage resources include the archaeology and palaeontology of the project site. Impacts to palaeontology and archaeology may occur during the construction phase, but these can be mitigated and/or managed. No sites of high significance have been identified within the project site. Impacts to graves could occur but the possibility thereof is extremely small. The landscape is characterised by mining and energy developments / infrastructure and will be able to absorb the proposed development. There are no fatal flaws in terms of heritage.

Due to the very low probability of impacts occurring, the significance of potential impacts is considered to be low with the implementation of mitigation measures. The specialist has therefore indicated support for the development of Hyperion Solar Development 2 from a heritage perspective. The nominated preferred access road alternative from an archaeological perspective is Alternative 1. Access Road Alternative 3 and 4 are also considered to be acceptable. From a palaeontological perspective, all access road alternatives are considered to be acceptable.

10.1.7 Social Impacts

The Social Impact Assessment (**Appendix J**) identified positive and negative impacts which are expected to occur during the construction and operation phases of Hyperion Solar Development 2. The assessment identified that the expected benefits associated with the project, which include local economic and social development, is likely to outweigh the perceived impacts associated with the project.

Traditionally, the construction phase of a PV solar development is associated with the majority of social impacts. Many of the social impacts are unavoidable and will take place to some extent, but can be managed through the careful planning and implementation of appropriate mitigation measures. A number of potential positive and negative social impacts have been identified for the project, however an assessment of the potential social impacts indicated that there are no perceived negative impacts that are sufficiently significant to allow them to be classified as fatal flaws.

During the construction phase the positive impacts expected to occur include direct and indirect employment opportunities and skills development and socio-economic stimulation. The significance of these impacts are medium with the implementation of the recommended enhancement measures. The negative social impacts expected to occur during the construction phase includes an influx of construction workers and change in population, increase in crime, increased risk of HIV infections, impacts on daily living and moving patterns, nuisance impacts (i.e. noise and dust), hazard exposure and disruption to social and community infrastructure and visual impacts. The significance of the negative construction phase impacts will be medium to low with the implementation of the recommended mitigation measures.

During the operation phase the positive impacts expected to occur includes direct and indirect employment opportunities and skills development and a contribution to Local Economic Development (LED) and social upliftment. The significance of the positive operation impacts will be medium to high with the implementation of the recommended enhancement measures. The negative impacts expected during the operation phase includes a visual and sense of place. The significance of the negative operation impacts will be high with the implementation of the recommended mitigation measures.

From the results of the social impact assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a social perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from a social perspective is Alternative 4. Notwithstanding the fact that a clear social preference has emerged in respect of the various access road alternatives, this is not compelling in that the impacts along all access road alternatives can be mitigated to acceptable levels. Consequently, the social preference can be overridden by either technical and/or biodiversity requirements if these requirements are compelling.

10.1.8 Traffic Impacts

The Traffic Impact Assessment Report (**Appendix I of the EMPr**) considered the impacts that the development of Hyperion Solar Development 2 will have on the road network within the surrounding area.

During the construction phase imported elements associated with the development of Hyperion Solar Development 2 will be shipped to and transported from the nearest and most practical port. It is estimated that the total number of heavy vehicle trips would vary between 2000 and 3000 during the construction phase. The impact of this on the road network is considered to be low with the implementation of mitigation measures.

During operation, it is assumed that approximately five full-time employees will be stationed on site and hence vehicle trips generated are low and will have a negligible impact on the external road network. The significance of the traffic impacts during the operation phase will be low with the implementation of the recommended mitigation measures.

From the results of the traffic impact assessment, it can be concluded that no fatal-flaws will be associated with the development of Hyperion Solar Development 2 from a traffic perspective. The specialist has therefore indicated that the development may be authorised, constructed and operated, subject to the implementation of the recommended mitigation measures. The nominated preferred access road alternative from a traffic perspective is Alternative 1. Access Road Alternative 2, 3 and 4 are also considered to be acceptable.

10.1.9 Assessment of Cumulative Impacts

Cumulative impacts and benefits on various environmental and social receptors will occur to varying degrees with the development of several renewable energy facilities in South Africa. The degree of significance of these cumulative impacts is difficult to predict without detailed studies based on more comprehensive data/information on each of the receptors and the site-specific developments. The alignment of renewable energy developments with South Africa's National Integrated Response Plan (IRP) and the global drive to move away from the use of non-renewable energy resources and to reduce greenhouse gas emissions is undoubtedly positive. The economic benefits of renewable energy developments at a local, regional and national level have the potential to be significant.

Within a 30km radius of the Hyperion Solar Development 2 project site, there are twenty four (24) solar energy facilities (PV and CSP) which were considered as part of the cumulative impact assessment. The cumulative impacts associated with Hyperion Solar Development 2 have been assessed to be acceptable, with no unacceptable loss or risk expected (refer to **Table 10.1** and Chapter 9).

Table 10.1: Summary of the cumulative impact significance for Hyperion Solar Development 2

Specialist assessment	Overall significance of impact of the proposed project considered in isolation	Cumulative significance of impact of the project and other projects in the area
Ecology	Low	Medium to Low (depending on the impact being considered)
Avifauna	Low	Medium
Watercourses	Low	Low
Soil, Land use and Agricultural Potential	Low	Medium
Heritage (archaeology and palaeontology)	Medium	Medium
Visual	Low	Medium to Low (depending on the impact being considered)
Socio-Economic	Negative - Low to High (depending on the impact being considered) Positive - High	High (positive and negative)
Traffic	Medium	High

Based on the specialists' cumulative assessments and findings regarding the development of Hyperion Solar Development 2 and its contribution to the overall impact of all solar energy facilities (PV and CSP) to be developed within a 30km radius, it can be concluded that Hyperion Solar Development 2 cumulative impacts are expected to be both positive and negative and will be of a low to high significance, depending on the impact under consideration. There are however no impacts or risks identified to be considered as unacceptable with the development of Hyperion Solar Development 2 and other solar energy facilities within the surrounding area. In addition, no impacts which will result in whole-scale change are expected.

10.2. Environmental Sensitivity Mapping

From the specialist investigations undertaken for Hyperion Solar Development 2, the following sensitive areas/environmental features have been identified and demarcated within the project site (refer to **Figures 10.1 to 10.3** and **Appendix N**):

» **Ecology** – The main sensitive feature of the project site is the Vlermuisleegte River which is unsuitable for development and is therefore considered to be a no-go area for all project components apart from Access Road Alternative 1 which marginally infringes this area. The majority of the area east of the Vlermuisleegte River has a moderate to high *V. erioloba* density and is considered to be of 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. All of these areas are avoided by the project development area.

  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. The majority of the development area falls within this area of low ecological sensitivity.

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. The solar field infringes on the northern portion of this ridge. This is considered to be acceptable from an ecological perspective. A small section of the north eastern corner of the development area infringes on a section of the medium sensitive area consisting of *V. erioloba* trees. No infrastructure is proposed within this area and it is therefore avoided by the development footprint.

The majority of the access road alternative corridors is located within areas of low ecological sensitivity. Sections of Alternative 2 and 4 traverse areas with a high density of V. erioloba trees. Access Road Alternative 1 and 2, as well as small sections of Alternative 3 and 4 are also located within an ESA. Approximately 1.5km of Access Road Alternative 3 falls within a CBA2.

» **Bird Habitat and Sensitive Areas** – The project site supports three main avifaunal microhabitats, i.e. the *Tarchonanthus camphoratus* scrub, *V. erioloba* woodland, and the open grassland associated with the Vlermuisleegte River. These three habitats have different sensitivities, due to the subtle differences in the avifaunal assemblages that they support. The majority of the project site to the west of the Vlermuisleegte River consists of *Tarchonanthus camphoratus* scrub which is considered to be of medium sensitivity. It is host to the typical avifauna of the Kalahari bioregion. This area experienced a devastating fire in 2009, which destroyed many of the large *V. erioloba* trees as now only found to the east of the Vlermuisleegte River. The development area and footprint is restricted to this microhabitat.

The *V. erioloba* woodland to the east of the Vlermuisleegte is considered to be of high ecological sensitivity with respect to avifauna, as it supports large *V. erioloba* trees interspersed with patches of *Acacia mellifera* and *Terminalia sericea*, which contribute towards higher habitat heterogeneity and a wider array of nesting sites, resulting in an overall greater diversity of avifauna. Data obtained from the current field study is insufficient to conclusively demonstrate differences in avifaunal assemblages between the *V. erioloba* woodland to the east, and the *Tarchonanthus* scrub to the west of the Vlermuisleegte River. However, indications from the site visit undertaken in January 2019 suggest that it is likely to be more diverse and this is a reasonable assumption as there is a known relationship between habitat heterogeneity and species richness (Harrison et al., 1997). The area to the east of the Vlermuisleegte is therefore considered to be of high ecological sensitivity and largely unsuitable for development.

The open grassland that occupies the bed of the dry Vlermuisleegte River is considered to be of very high sensitivity, as this is a restricted habitat that has elements similar to that of pans. These areas are very sensitive due to their high use and specialised avifauna that is usually associated with these features. The Vlermuisleegte River may therefore support a very different assemblage of birds compared to the scrub and woodland habitat and may even support red-listed species under favourable conditions, such as Burchell's Courser and Ludwig's Bustard. No additional development or transformation within this area is recommended. The continued use of the current access road (i.e. T26 gravel road) is considered acceptable provided that no large raptor nests of species of concern are found in the trees near the road.

The majority of the access road alternative corridors is located within areas of medium avifauna sensitivity. Sections of Alternative 2, 3 and 4 traverse areas with a high density of *V. erioloba* trees which are of high avifaunal value due to the their structural diversity and possible presence of raptor nesting sites.

- **Watercourses** – The Vlermuisleegte River is considered to be largely natural according to the Present Ecological State (PES) 1999[36], and is classified as moderately modified (Class C) according to the National Freshwater Ecosystem Priority Area (NFEPA) database. Due to agricultural activities within the floodplain associated with the river, the natural indigenous riparian vegetation has been impacted. Analysis of digital satellite imagery indicates however that some natural riparian vegetation remains within the area east of the river. The Vlermuisleegte River is considered to be of very high sensitivity and a no-go area for all infrastructure except for Access Road Alternative 1, as this road has an existing impact on the Vlermuisleegte River. The development footprint for Hyperion Solar Development 2 avoids the Vlermuisleegte River.

  A perched depression wetland has been identified within the northern portion of the project site, situated within the Vlermuisleegte River. Due to the lack of habitat diversity and moderately low hydro-functionality, this depression is not considered to be of significant ecological importance on a landscape scale. However, since it forms part of the larger Vlermuisleegte River, it does potentially aid in retaining water during rainfall events (albeit limited). The depression wetland should be regarded as a no-go area for all infrastructure.

  Ten (10) pan wetlands were identified scattered within the investigation area associated with access road Alternative 3, the closest of which is located approximately 45m from the proposed route location (Pan 8). Furthermore, a pan wetland (Pan 11) was identified within the investigation area associated with Access Road Alternative 4, although this system is located approximately 245m from the proposed route. The pans are considered to be mostly natural with no significant impacts to their hydrological or geomorphological properties. These pans are of some importance on a landscape scale, primarily due to the provisioning of habitat (albeit seasonally) by the pans and should be considered an area of high sensitivity. No pan wetlands were identified within the 20m access road alternatives corridors.

  A 100m buffer has been applied to the Vlermuisleegte River and a 500m buffer has been applied to the depression wetland. These buffers represent the GN509 regulated area of the watercourses. Development may take place within these areas but should be avoided if possible, to avoid triggering Section 21 (c) & (i) water uses. Although a small section of the north eastern corner of the development area infringes on the 500m buffer, the buffer is avoided by the development footprint.

- **Heritage -** The majority of the project site is considered to be sterile of archaeological materials except for a light scatter of artefacts with a few gravel clasts approximately 70m to the east of the Vlermuisleegte River (Site 1185). Other areas where stone artefacts were identified were areas which also comprised of gravel. The southern boundary of the development area traverse the centre of the low gravel hill. This area is considered to be of a high heritage sensitivity and is avoided by the

[36] The most recent database (i.e. DWS 2014 database) did not assess the Vlermuisleegte River and therefore the PES stated in the 1999 database was used.

development footprint. The Vlermuisleegte River and immediate surrounds should be considered as a no-go area as it is likely that the area close to the Vlermuisleegte River may consist of gravel that contains the artefacts which are closer to the surface, and are regarded as sensitive. A buffer of approximately 120m from the edge of the Vlermuisleegte is recommended to protect all areas considered to be potentially sensitive at the surface. The development area and footprint is located outside of the 120m buffer.

Site 1223 fall within the north western corner of the solar field. This site is considered to be of low signification. Three (3) heritage sites were identified within the 20m access road corridor for Alternative 1. These include Site 1202, 1203 and 1204. Construction within these areas is deemed acceptable.

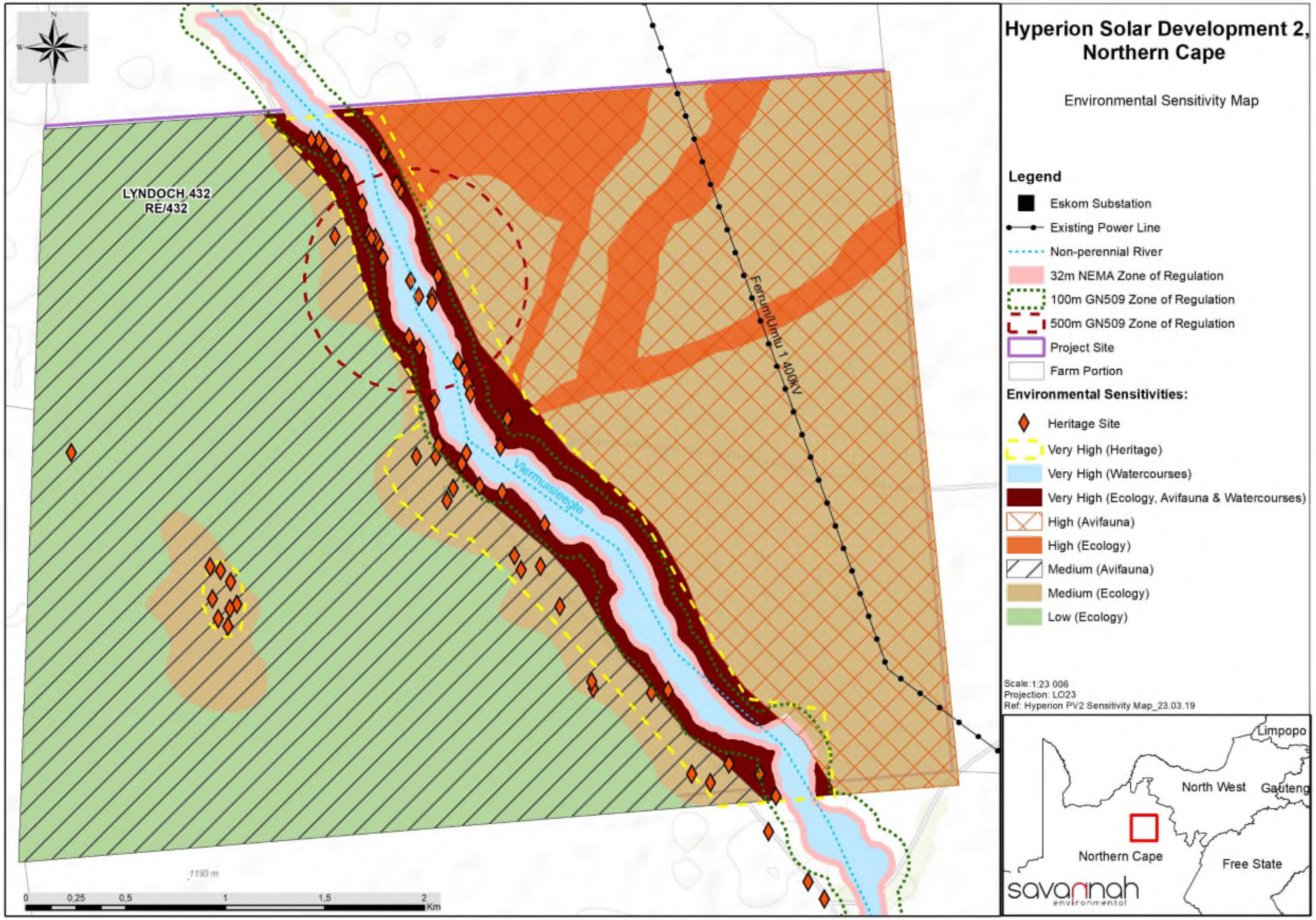

Figure 10.1: Environmental sensitivity map of the project site considered for Hyperion Solar Development 2.

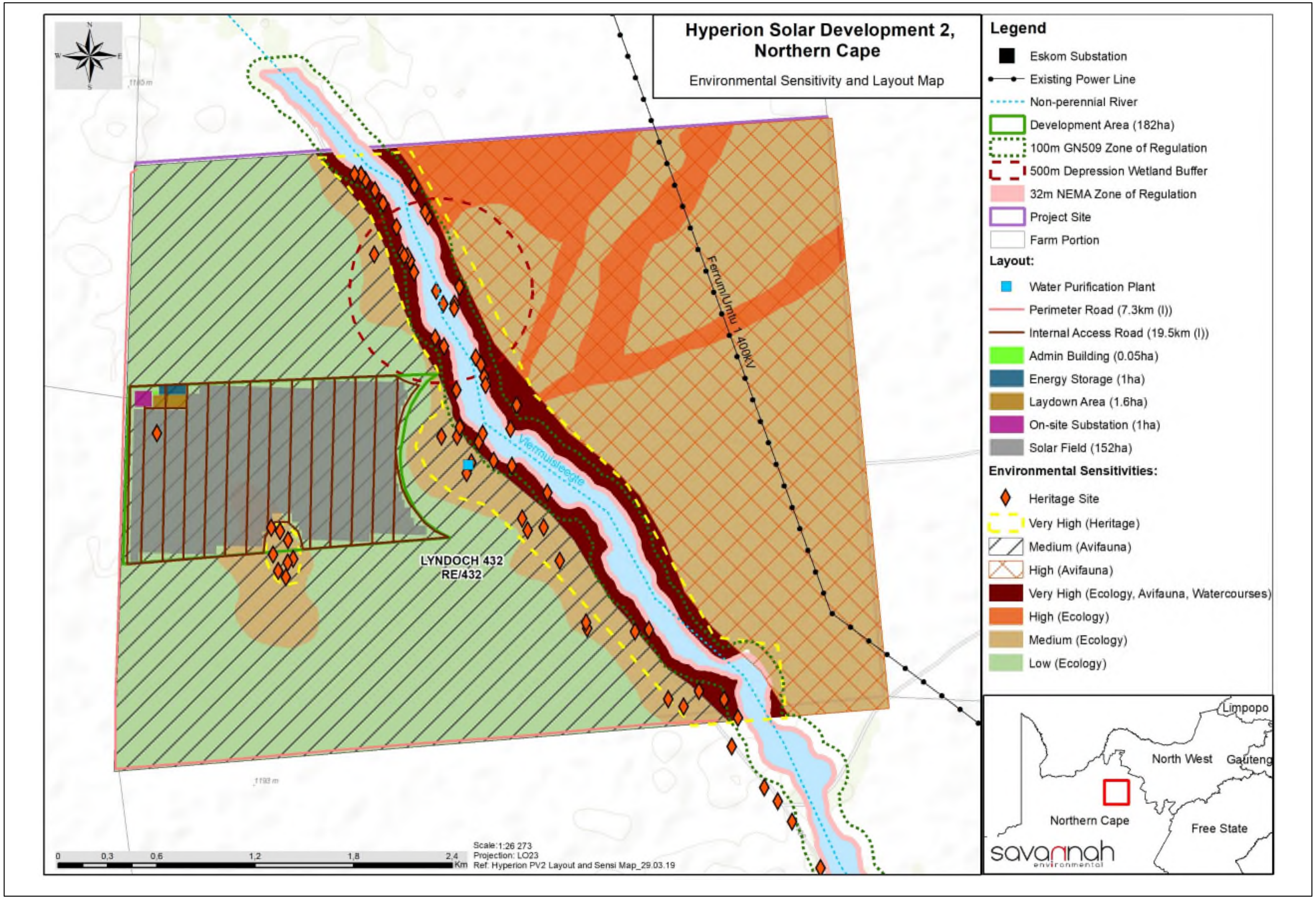

Figure 10.2: Environmental sensitivity map of the project site overlain by the layout assessed for Hyperion Solar Development 2.

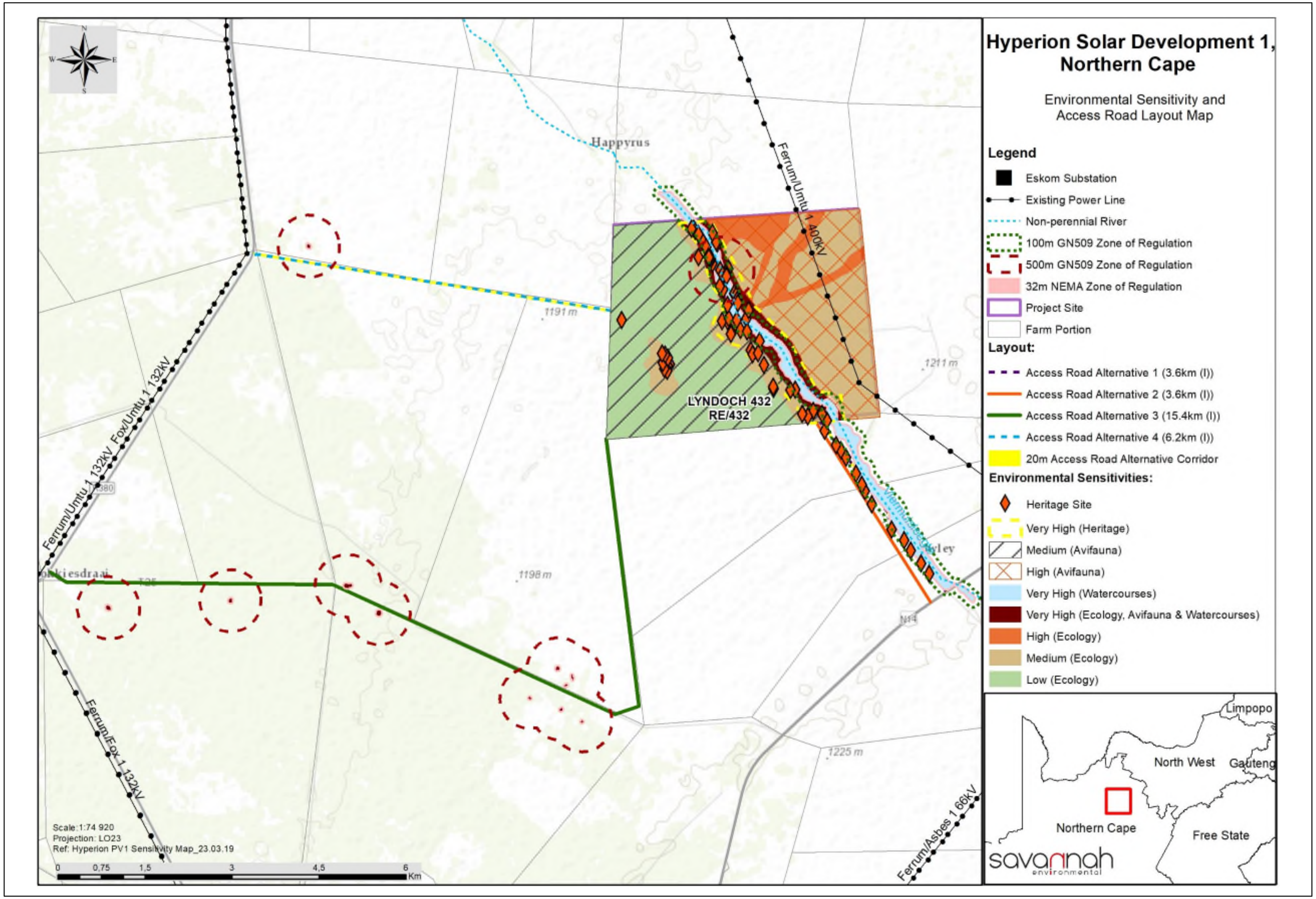

Figure 10.3: Environmental sensitivity map of the project site and access road corridors assessed for Hyperion Solar Development 2.

10.3. Assessment of Alternatives and the Identification of the Preferred Alternatives

As part of the EIA process undertaken for Hyperion Solar Development 2, four (4) access road alternatives have been identified and comparatively assessed for the development. The assessment of the alternatives and the acceptability of the alternatives for implementation as part of Hyperion Solar Development 2 was considered by the specialists for the project and was assessed comparatively as part of the impact assessment chapter (Chapter 8) of this final EIA Report. These access road alternatives include:

» Alternative 1: 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
» 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.
» 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 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 to be considered within the EIA process.

A 20m corridor has been assessed for each access road alternative. The table below (**Table 10.2**) provides the results of the comparative assessment undertaken for the access road alternatives from an environmental perspective, and identifies the preferred alternative from an environmental acceptability perspective.

Table 10.2: Results of the comparative assessment undertaken and the identification of the preferred alternative from an environmental perspective.

Specialist field	Access Road Alternative 1	Access Road Alternative 2	Access Road Alternative 3	Access Road Alternative 4
Ecology	**Preferred**	Acceptable	Least Preferred	Acceptable
Avifauna	**Preferred**	Not preferred.	Not preferred.	Acceptable
Watercourses	Least preferred but acceptable	Not preferred.	Not preferred.	**Preferred**
Land use, soil and agricultural potential	**Preferred**	Acceptable	Least Preferred	Acceptable
Heritage - Palaeontology	Acceptable	Acceptable	Acceptable	Acceptable
Heritage - Archaeology	**Preferred**	Least Preferred	Acceptable	Acceptable
Visual	Acceptable	Acceptable	Acceptable	Acceptable
Social	Acceptable	Least Preferred	Least Preferred	**Preferred**
Traffic	**Preferred**	Acceptable	Acceptable	Acceptable

Although Access Road Alternative 4 is the preferred alternative from a watercourse and social perspective, it has been indicated by the water and social specialists all impacts along all access road alternatives can be mitigated to acceptable levels. Consequently, the social and watercourse preference can be overridden by either technical and/or biodiversity requirements if these requirements are compelling.

Considering the results of the comparative assessment presented above, Access Road Alternative 1 is preferred from the majority of the specialist studies undertaken. Access Road Alternative 4 is the second preferred alternative. Access Road Alternative 1 and 4 are therefore assigned as part of the preferred development footprint for Hyperion Solar Development 2 (refer to **Figure 10.4**).

10.4. Environmental Costs of the PV Facility versus Benefits of the PV Facility

Environmental costs (including those to the natural environment, economic and social environment) can be anticipated at a local and site-specific level, and are considered acceptable provided the mitigation measures as outlined in the EIA Report and the EMPr are implemented and adhered to. No fatal flaws have been identified. These environmental costs could include:

» *A loss of biodiversity, flora and fauna due to the clearing of land for the construction and utilisation of land for the PV facility* - The cost of loss of biodiversity is considered to be limited due to the placement of infrastructure within an area considered to be of a low to medium sensitivity.
» *Visual impacts associated with the PV Facility* - The development of Hyperion Solar Development 2 may have a visual impact within (but not restricted to) an 8.7km radius of the PV facility. Impacts will be of a low significance with the implementation of the recommended mitigation measures.
» *Change in land-use and loss of land available for agricultural activities within the development footprint* - The cost in this regard is expected to be limited due to the low agricultural potential of the property and the fact that current grazing activities can continue on the remainder of the property during construction and operation.

Benefits of Hyperion Solar Development 2 include the following:
» The project will result in important economic benefits at the local (specifically Kathu) and regional scale through job creation, income and other associated downstream economic development. These will persist during the pre-construction, construction, operation and decommissioning phases of the project.
» The project contributes towards the Provincial and Local goals for the development of renewable energy as outlined in the respective IDPs.
» The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy development.
» The development will supplement and stabilise the landowner’s income in an area where farming is susceptible to prolonged droughts.
» The water requirement for a PV facility is negligible compared to the levels of water used by coal-based technologies. This generation technology is therefore supported in dry climatic areas.
» South Africa’s per capita greenhouse gas emissions are amongst the highest in the world due to the reliance on fossil fuels. Hyperion Solar Development 2 will contribute to achieving goals for implementation of renewable energy and sustaining a ‘green’ economy within South Africa.

The benefits of Hyperion Solar Development 2 are expected to occur at a national, regional and local level. As the costs to the environment at a site-specific level have been largely limited through the appropriate placement of infrastructure on the project site within areas considered to be acceptable for the proposed development, and impacts can be reduced through the implementation of recommended mitigation measures, the benefits of the project are expected to outweigh the environmental costs of the PV facility.

10.5. Overall Conclusion (Impact Statement)

The construction and operation of a PV facility with a contracted capacity of up 75MW on a project site located near Kathu in the Gamagara Local Municipality, and the greater John Taolo Gaetsewe District Municipality has been proposed by Hyperion Solar Development 2 (Pty) Ltd. A technically viable project site and development footprint was proposed by the developer and assessed as part of the EIA process. The environmental assessment of the development footprint within the project site was undertaken by independent specialists and their findings have informed the results of this final EIA Report.

The specialist findings have indicated that there are no identified environmental fatal flaws associated with the implementation of Hyperion Solar Development 2 within the project site. The developer has proposed a technically viable and suitable layout for the project and associated infrastructure which has been assessed as part of the independent specialist studies. Through this assessment the preferred development footprint from an environmental perspective has been identified, and assigned as part of the layout map for the Hyperion Solar Development 2. This layout avoids all identified areas of very high and high environmental sensitivity and therefore minimises impacts as far as possible. The layout from an environmental perspective identified through this EIA process is therefore considered as the most appropriate alternative to form part of the development footprint for the Hyperion Solar Development 2 and are considered to be acceptable within all fields of specialist study undertaken for the project. All impacts associated with the preferred layout can be mitigated to acceptable levels or enhanced through the implementation of the recommended mitigation or enhancement measures. The layout map (including the details of the project) is included as **Figure 10.4** and is considered to be the preferred layout for Hyperion Solar Development 2.

Through the assessment of the development of Hyperion Solar Development 2 within the project site it can be concluded that the development of the PV facility is environmentally acceptable (subject to the implementation of the recommended mitigation measures).

10.6. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer which avoids all identified highly sensitive environmental features within the project site, as well as the potential to further minimise the impacts to acceptable levels through mitigation, it is the reasoned opinion of the EAP that the development of Hyperion Solar Development 2 is acceptable within the landscape and can reasonably be authorised (**Figure 10.4**).

The following infrastructure would be included within an authorisation issued for the project:

» Arrays of PV panels (static or tracking PV system) with a contracted capacity of up to 75MW.

- Mounting structures to support the PV panels (utilising either fixed-tilt / static, single-axis tracking, or double-axis tracking systems).
- On-site inverters (to convert the power from Direct Current (DC) to Alternating Current (AC)), and distribution power transformers.
- A 132kV on-site substation up to 1ha in extent to facilitate the connection between the solar energy facility and the Eskom electricity grid.
- 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 up to 1ha in extent.
- Internal access roads, perimeter road and fencing around the development area.
- Main access road to the development area utilising Access Road Alternative 1.

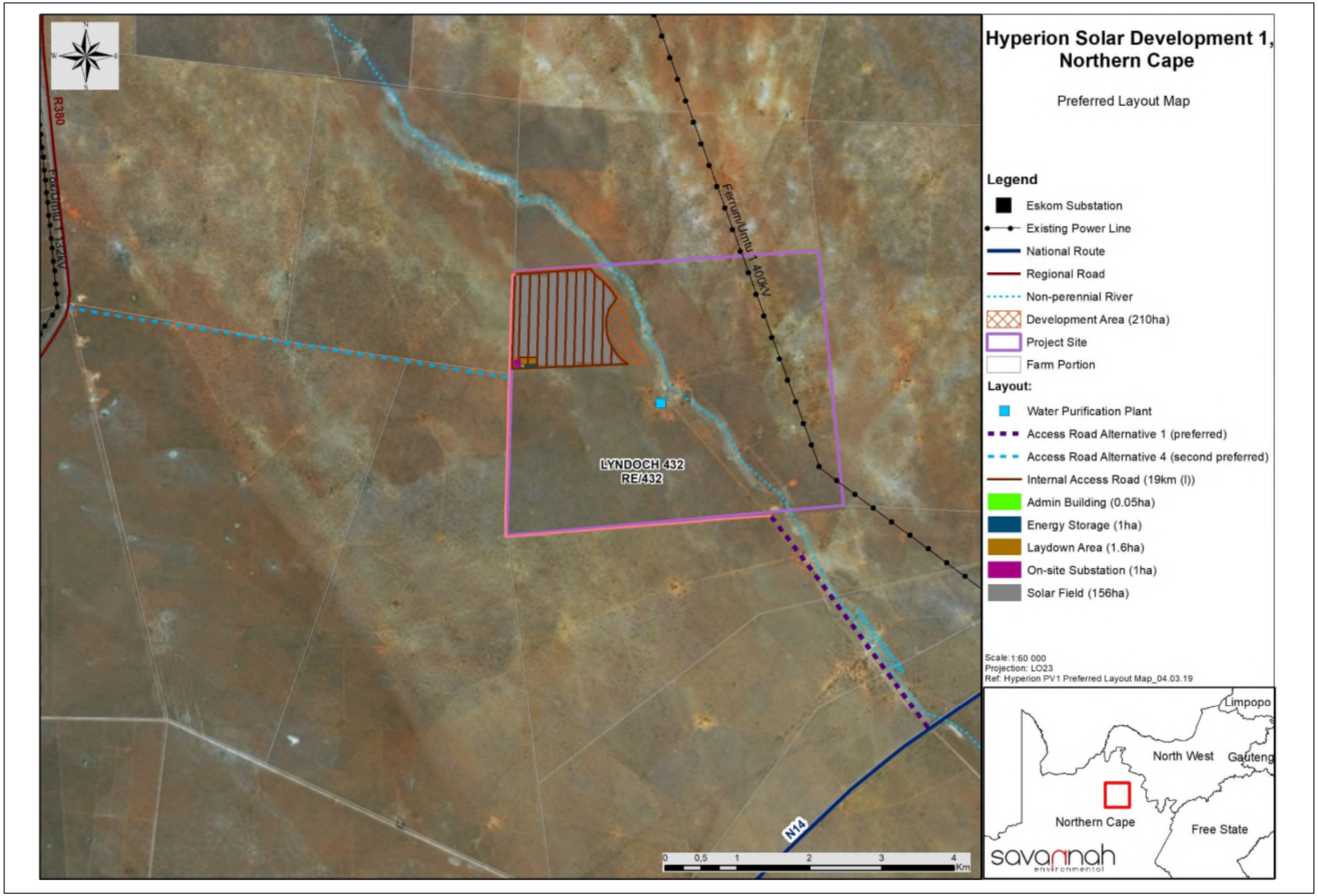

Figure 10.4: Final preferred layout map of the preferred development footprint for Hyperion Solar Development 2, as was assessed as part of the EIA process (A3 map included in Appendix N)

The following key conditions would be required to be included within an authorisation issued Hyperion Solar Development 2:

- All mitigation measures detailed within this final EIA Report, as well as the specialist reports contained within **Appendices D to J**, are to be implemented.
- The EMPr as contained within **Appendix K** of this final EIA Report should form part of the contract with the Contractors appointed to construct and maintain the PV facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of Hyperion Solar Development 2 is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Following the final design of Hyperion Solar Development 2, a final layout must be submitted to DEA for review and approval prior to commencing with construction. No development is permitted within the identified no-go, very high and high sensitivity areas as detailed in **Figure 10.1.**
- A pre-construction walk-through of the final development footprint for species of conservation concern that would be affected and that can be translocated as well as comply with the Northern Cape Nature Conservation Act and DENC/DAFF permit conditions, must be undertaken prior to the commencement of the construction phase.
- Should the project be selected as a preferred bidder in the Department of Energy's REIPPP Programme, the need for an offsite mitigation must be determined, and should be feasible and implementable by both the developer and the DAFF. The Ecological Impact Assessment (refer to **Appendix D**) includes guidelines for the implementation of such an offsite mitigation.
- Before construction commences individuals of listed species within the development footprint that would be affected, must be counted and marked and translocated, where deemed necessary by the ecologist conducting the pre-construction walk-through survey. Permits from the relevant provincial authorities, i.e. the Northern Cape Department of Environment and Nature Conservation (DENC), must be obtained before the individuals are disturbed.
- 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.
- The project footprint must be kept as small as possible.
- The bed of the Vlermuisleegte River should be considered to be a no-go area for infrastructure apart from where there are already existing access roads through this area which can be used for access.
- Post-construction monitoring with the aid of video surveillance should be considered, as this will contribute towards understanding bird interactions with solar panels.
- An alien vegetation management plan should be compiled during the planning phase and implemented concurrently with the commencement of construction. Regular inspection for alien and invasive vegetation along the road should occur, to limit their spread into the river.
- Once geotechnical work has been done on the site an archaeologist should be appointed to conduct test excavations and sampling of the archaeology in areas where in situ gravel will be intersected by foundations, cable trenches and/or access roads (Alternative 1 and 2). This work should aim primarily to understand the distribution of archaeology on the landscape, although if any dense archaeology is encountered it may be necessary to expand excavations.
- A chance find procedure must be developed and implemented in the event that archaeological or palaeontological resources are found. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately.

CHAPTER 11. REFERENCES

Council for Scientific and Industrial Research (CSIR). 2018. Statistics of utility-scale solar PV, wind and CSP in South Africa in 2017.

National Energy Regulator of South Africa (NERSA). 2017. Monitoring Renewable Energy Performance of Power Plants – Progress in the first half of 2017. Issue 10.

Ecological Impact Assessment

Alexander, G. & Marais, J. 2007. A Guide to the Reptiles of Southern Africa. Struik Nature, Cape Town.

Bates, M.F., Branch, W.R., Bauer, A.M., Burger, M., Marais, J., Alexander, G.J. & de Villiers, M. S. 2014. Atlas and Red List of the Reptiles of South Africa, Lesotho and Swaziland. Strelitzia 32. SANBI, Pretoria.

Branch W.R. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town.

Du Preez, L. & Carruthers, V. 2009. A Complete Guide to the Frogs of Southern Africa. Struik Nature., Cape Town.

EWT & SANBI, 2016. Red List of Mammals of South Africa, Lesotho and Swaziland. EWT, Johannesburg.

Marais, J. 2004. Complete Guide to the Snakes of Southern Africa. Struik Nature, Cape Town.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Minter LR, Burger M, Harrison JA, Braack HH, Bishop PJ & Kloepfer D (eds). 2004. Atlas and Red Data book of the frogs of South Africa, Lesotho and Swaziland. SI/MAB Series no. 9. Smithsonian Institution, Washington, D.C.

Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Oosthuysen, E. & Holness, S. 2016. Northern Cape Critical Biodiversity Areas (CBA) Map. Northern Cape Department of Environment and Nature Conservation & Nelson Mandela Metropolitan University. Available at SANBI BGIS http://bgis.sanbi.org/.

Skinner, J.D. & Chimimba, C.T. 2005. The mammals of the Southern African Subregion. Cambridge University Press, Cambridge.

Avifauna Impact Assessment

DeVault, T.L., Seamans, T.W., Schmidt, J.A., Belant, J.L., & Blackwell, B.F. 2014. Bird use of solar photovoltaic installations at US airports: Implications for aviation safety. Landscape and Urban Planning 122: 122–128.

Harrison, J.A., Allan, D.G., Underhill, L.G., Herremans, M., Tree, A.J., Parker, V. & Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol. 1 & 2. BirdLife South Africa, Johannesburg.

Hockey, P.A.R., Dean, W.R.J. & Ryan, P.G. (eds). 2005. Roberts Birds of Southern Africa, 7th edition. The Trustees of the John Voelcker Bird Book Fund, Cape Town.

Jenkins, A.R., Ralston-Paton, S. & Smit-Robinson, H.A. 2017. Birds and solar energy. Guidelines for assessing and monitoring the impact of solar power generating facilities on birds in southern Africa. Birdlife South Africa, Johannesburg.

Jenkins, A.R., Shaw, J.M., Smallie, J.J., Gibbons, B., Visagie, R. & Ryan, P.G. 2011. Estimating the impacts of power line collisions on Ludwig's Bustards Neotis ludwigii. Bird Conservation International 21: 303–310.

Jenkins, A.R., Smallie, J.J. & Diamond, M. 2010. Avian collisions with power lines: a global review of causes and mitigation with a South African perspective. Bird Conservation International 20: 263-278.

Kagan, R.A., Verner, T.C., Trail, P.W. & Espinoza, E.O. 2014. Avian mortality at solar energy facilities in southern California: a preliminary analysis. Unpublished report National Fish & Wildlife Forensics Laboratory, USA.

Lehman, R.N., Kennedy, P.L. & Savidge, J.A. 2007. The state of the art in raptor electrocution research: A global review. Biological Conservation 136: 159-174.

Marnewick, M.D., Retief, E.F., Theron, N.T., Wright, D.R. & Anderson, T.A. 2015. Important Bird and Biodiversity Areas of South Africa. Birdlife South Africa, Johannesburg.

Martin, G.R. & Shaw, J.M. 2010. Bird collisions with power lines: Failing to see the way ahead? Biological Conservation 143: 2695-2702.

Moore-O'Leary, K.A., Hernandez, R.R., Johnston, D.S., Abella, S.R., Tanner, K.E., Swanson, A.C., Kreitler, J., Lovich, J.E. 2017. Sustainability of utility-scale solar energy - critical ecological concepts. Frontiers in Ecology and the Environment 15: 385-394.

Mucina L. & Rutherford M.C. (eds) 2006. The Vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Oosthuysen, E. & Holness, S. 2016. Northern Cape Critical Biodiversity Areas (CBA) Map. Northern Cape Department of Environment and Nature Conservation & Nelson Mandela Metropolitan University. Available at SANBI BGIS http://bgis.sanbi.org/.

Rudman, J., Gauché, P., & Esler, K.J. 2017. Direct environmental impacts of solar power in two arid biomes: An initial investigation. South African Journal of Science 113(11/12), Art. #2017-0113, 13 pages. http://dx.doi.org/10.17159/sajs.2017/20170113

Shaw, J.M. 2013. Power line collisions in the Karoo: conserving Ludwig's Bustard. Unpublished PhD thesis, University of Cape Town, Cape Town.

Smith, J.A., & Dwyer, J.F. 2016. Avian interactions with renewable energy infrastructure: an update. Condor 118: 411-423.

Southern African Bird Atlas Project 2 (SABAP2). http://sabap2.adu.org.za Accessed: August 2018.

Taylor, M.R., Peacock, F. & Wanless, R.W. (eds) 2015. The 2015 Eskom Red Data Book of Birds of South Africa, Lesotho and Swaziland. Birdlife South Africa, Johannesburg.

Taylor, P.B., Navarro, R.A., Wren-Sargent, M., Harrison, J.A. & Kieswetter, S.L. (eds) 1999. TOTAL CWAC Report: Coordinated Waterbird Counts in South Africa, 1992-1997. Avian Demography Unit, University of Cape Town, Cape Town.

Visser, E. 2016. The impact of South Africa's largest photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Unpublished MSc thesis, University of Cape Town, Cape Town.

Visser, E., Perold, V., Ralston-Paton, S., Cardenal, A.C., & Ryan, P.G. 2018. Assessing the impacts of a utility-scale photovoltaic solar energy facility on birds in the Northern Cape, South Africa. Renewable Energy 133: 1285-1294.

Walston, L.J, Rollins, K.E, LaGory, K.E., Smith, K.P. & Meyers, S.A. 2016. A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States. Renewable Energy 92: 405-414.

Young, D.J., Harrison, J.A., Navarro, R.A., Anderson, M.A. & Colahan, B.D. 2003. Big birds on farms: Mazda CAR report 1993-2001. Avian Demography Unit, Cape Town.

Watercourse Impact Assessment

Department of Water Affairs and Forestry. 1999. IER (Floodplains): Determining the Ecological Importance and Sensitivity (EIS) and the Ecological Management Class (EMC). DWA, Pretoria, RSA.

DWA, South Africa Version 1.0 of Resource Directed Measures for Protection of Water Resources, 1999. [Appendix W3].

Department of Water Affairs and Forestry. 2007. Manual for the assessment of a Wetland Index of Habitat Integrity for South African floodplain and channelled valley bottom wetland types.

Department of Water Affairs and Forestry (2005). A practical field procedure of identification and delineation of wetlands and riparian areas. DWA, Pretoria.

DWAF 2005. A practical field procedure of identification and delineation of wetlands and riparian areas. DWA, Pretoria, RSA.

Job, N. 2009. Application of the Department of Water Affairs and Forestry (DWAF) wetland delineation method to wetland soils of the Western Cape.

Job, N., Snaddon, K., Day, K., Nel, J, Smith-Adoa, L. en Kotze, I. 2008. C.A.P.E. Fine-scale Biodiversity Planning Project: Aquatic Ecosystems of the Sandveld – Saldanha Planning Domain.

Kirkwood, D., Pence, G.Q., & von Hase, A. 2010. Western Cape Biodiversity Framework: Critical Biodiversity Areas and Ecological Support Areas of the Western Cape. A C.A.P.E. Land-use planning project. Unpublished Project Report.

Kotze D.C., Marneweck G.C., Batchelor A.L., Lindley D.S. and Collins N.B. 2008. WET-EcoServices: A technique for rapidly assessing ecosystem services supplied by wetlands. WRC Report No. TT 339/08. Water Research Commission, Pretoria, RSA.

Macfarlane D.M., Kotze D.C., Ellery W.N., Walters D., Koopman V., Goodman P. and Goge C. 2009. WET-Health: A technique for rapidly assessing wetland health. WRC Report No. TT 340/09. Water Research Commission, Pretoria, RSA.

Nel, JL, Driver, A., Strydom W.F., Maherry, A., Petersen, C., Hill, L., Roux, D.J, Nienaber, S., Van Deventer, H., Swartz, E. & Smith-Adao, L.B. 2011a. Atlas of Freshwater Ecosystem Priority Areas in South Africa: Maps to support sustainable development of water resources. Water Research Commission Report No. TT 500/11, Water Research Commission, Pretoria, RSA.

Ollis, DJ; Snaddon, CD; Job, NM & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. SANBI Biodiversity Series 22. South African Biodiversity Institute, Pretoria, RSA.

Rountree, M.W. and Kotze, D.C. 2013. Appendix A3: Ecological Importance and Sensitivity Assessment. In: Rountree, M. W., Malan, H.L., and Weston, B.C. Eds. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). WRC Report No. 1788/1/12. Pretoria.
Scientific Aquatic Services (SAS) 2017. Freshwater Scoping Assessment as part of the Environmental Assessment and Authorisation Process for the proposed Boulders Wind Farm, Vredenburg, Western Cape Province. (Report reference SAS217144).

The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org.

Heritage Impact Assessment

Almond, J. 2018. Kathu Hyperion Solar Project near Kathu, Northern Cape: palaeontological heritage desktop input. Unpublished report prepared for ASHA Consulting (Pty) Ltd. Cape Town: Natura Viva cc.

Anonymous. (1975). 1-million-year find at Sishen. Diamond Fields Advertiser, 13 Aug 1975

Beaumont, P.B. (1990). Kathu Townlands 1. In: Beaumont, P.B. & Morris, D. (eds) Guide to archaeological sites in the Northern Cape. Kimberley: McGregor Museum. 96–97.

Beaumont, P.B. (2004). Kathu Pan and Kathu Townlands / Uitkoms. In: Morris, D. & Beaumont, P.B. (eds) Archaeology in the Northern Cape: Some Key Sites. Kimberley: McGregor Museum. 50-53.

Beaumont, P. (2006). Phase 1 heritage impact assessment report on erf 1439, remainder of erf 2974, remainder of portion 1 of farm Uitkoms 463, and farms Kathu 465 and Sims 462 at and near Kathu in the Northern Cape Province. Unpublished report prepared for MEG Environmental Impact Studies. Kimberley: McGregor Museum.

Beaumont, P. (2007). Supplementary archaeological impact assessment report on sites near or on the farm Hartnolls 458, Kgalagadi District Municipality, Northern Cape Province. Unpublished report prepared for MEG Environmental Impact Studies. Kimberley: McGregor Museum.

Beaumont, P.B. (2008a). Phase 1 Archaeological Impact Assessment Report on Portion 459/49 of the Farm Bestwood 459 at Kathu, Kgalagadi District Municipality, Northern Cape Province. Unpublished report prepared for MEG Environmental Impact Studies. Kimberley: McGregor Museum.

Beaumont, P.B. (2008b). Phase 1 heritage impact assessment report on portion 463/8 of the farm Uitkoms 463, near Kathu, Kgalagadi District Municipality, Northern Cape Province. Unpublished report prepared for MEG Environmental Impact Studies. Kimberley: McGregor Museum.

Chazan, M., Wilkins, J., Morris, D. & Berna, F. (2012). Bestwood 1: a newly discovered Earlier Stone Age living surface near Kathu, Northern Cape Province, South Africa. Antiquity 86: 331.

De Jong, R.C. (2008). Heritage impact assessment report: proposed residential development and associated infrastructure on a 200 ha portion of the farm Bestwood 429 RD at Kathu, Northern Cape Province. Unpublished report prepared for Rock Environmetal Consulting (Pty) Ltd. Queenswood, Pretoria: Cultmatrix.

Dreyer, C. (2006). First phase archaeological and cultural heritage impact assessment of the proposed residential developments at the farm Hartnolls 458, Kathu, Northern Cape. Unpublished report prepared for MDA Environmental Consultants. Brandhof: Cobus Dreyer.

Dreyer, C. (2008). First phase archaeological and cultural heritage assessment of the proposed residential developments at a portion of the remainder of the Farm Bestwood 459RD, Kathu, Northern Cape. Unpublished report prepared for Rock Environmental Consulting (Pty) Ltd. Brandhof: Cobus Dreyer.

Dreyer, C. (2010). First phase archaeological & cultural heritage assessment of the proposed iron ore mining developments on Portion 2 of the farm Demaneng 546, Kuruman, Northern Cape. Unpublished report. Brandhof: Cobus Dreyer.

Dreyer, C. (2013). First phase archaeological & heritage assessment of the Vaal-Gamagara Water Pipeline Project, Northern Cape Revisit to the Kathu Pan archaeological site. Unpublished report prepared for MDA Environmental and Development Consultants. Brandhof: Cobus Dreyer.

Gaigher, S. (2013). Heritage impact assessment report environmental impact assessment phase proposed establishment of the San Solar Energy Facility located north of Kathu on a Portion of the Farm Wincanton 472, Northern Cape Province. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Louis Trichardt: G&A Heritage.

Heritage Western Cape. (2012). A short guide to and policy statement on grading. Version 6, 30th May 2012.

Humphreys, A.J.B. (1976). Note on the Southern Limits of Iron Age Settlement in the Northern Cape. South African Archaeological Bulletin 31: 54-57.

Klein, R.G. (1988). The Archaeological Significance of Animal Bones from Acheulean Sites in Southern Africa. The African Archaeological Review 6: 3-25.

Klein, R.G. (2000). The Earlier Stone Age of southern Africa. South African Archaeological Bulletin 55: 107-122.

Lombard, M., Wadley, L. Deacon, J., Wurz, S., Parsons, I., Mohapi, M., Swart, J. & Mitchell, P. 2012. South African and Lesotho Stone Age sequence updated (i). South African Archaeological Bulletin 195: 123-144.

Morris, D. (2014). Rectification and/or regularisation of activities relating to the Bestwood Township development near Kathu, Northern Cape: Phase 1 archaeological impact assessment. Unpublished report prepared for Jeffares & Green (Pty) Ltd. Kimberley: McGregor Museum.

Orton, J. 2015. Kathu Solar Project power line: pre-construction inspection of pans. Unpublished letter to Savannah Environmental (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Orton, J. & Walker, S. 2015. Archaeological survey for the proposed Kalahari Solar Project, Kuruman Magisterial District, Northern Cape. Unpublished report prepared for Savannah Environmental (Pty) Ltd. Muizenberg: ASHA Consulting (Pty) Ltd.

Porat, N., Chazan, M., Grün, R., Aubert, M., Eisenmann, V., Horwitz, L.K. (2010). New radiometric ages for the Fauresmith industry from Kathu Pan, southern Africa: implications for the Earlier to Middle Stone Age transition. Journal of Archaeological Science 37: 269–283.

SAHRA. 2007. Minimum Standards: archaeological and palaeontological components of impact assessment reports. Document produced by the South African Heritage Resources Agency, May 2007.

Saker, H. & Aldridge, J. (1971). The origins of the Langeberg Rebellion. Journal of African History 12: 299-317.

Van Schalkwyk, J. (2010). Archaeological impact survey report for the proposed Kalahari Solar Park Development ON THE farm Kathu 465, Northern Cape Province. Unpublished report prepared for Cultmatrix. Monument Park: J. van Schalkwyk.

Van Schalkwyk, J. (2012). Heritage impact assessment for the proposed estate development on the farm Kalahari Golf and Jag Landgoed 775, Kathu, Northern Cape Province. Unpublished report prepared for MEG Omgewingsimpakstudies. Monument Park: J. van Schalkwyk.

Van Zinderen Bakker, E.M. (1995). Archaeology and Palynology, South African Archaeological Bulletin 50: 98-105.

Walker, S., Chazan, M., Lukich, V. & Morris, D. (2013). A second Phase 2 archaeological data recovery at the site of Kathu Townlands for Erf 5116: Kathu, Northern Cape Province. Unpublished report prepared for PZK Beleggings 3000 CC. Kimberley: McGregor Museum.

Walker, S.J.H., Lukich, V., Chazan, M. (2014). Kathu Townlands: a high density Earlier Stone Age locality in the interior of South Africa. PLoS ONE 9(7): e103436. doi:10.1371/journal.pone.0103436.

Wilkins, J. (2013). Technological change in the early Middle Pleistocene: the onset of the Middle Stone Age at Kathu Pan 1, Northern Cape, South Africa. Unpublished PhD thesis. University of Toronto.

Wilkins, J. & Chazan, M. (2012). Blade production ~500 thousand years ago at Kathu Pan 1, South Africa: support for a multiple origins hypothesis for early Middle Pleistocene blade technologies. Journal of Archaeological Science 39: 1883-1900.

Wilkins, J., Schoville, B.J., Brown, K.S. & Chazan, M. (2012). Evidence for Early Hafted Hunting Technology. Science 338: 942-946.

Visual Impact Assessment

Guidelines for involving visual and aesthetic specialists in EIA processes.

Author; Bernard Oberhozer. Published by the Provincial Government of the Western Cape: Department of Environmental Affairs and Development Planning, 2005.

Guidelines for landscape and visual impact assessment (third edition), authors; the Landscape Institute and Institute of Environmental Assessment and Management, published by E & FN Spon, 2013.

Methods of environmental impact assessment, edited by; Peter Morris and RikiTherivel, Oxford Brookes University, UCL Press, 2000.

The vegetation of South Africa, Lesotho and Swaziland (Strelitziaseries; no. 19), Mucina, L. & Rutherford, M.C. (eds.), 2006, South African National Biodiversity Institute, Pretoria.

Mosaic Land Cover. SANBI, 2009.

Consortium of Spatial Information web site, http://www.cgiar-csi.org/

Social Impact Assessment

ASHA Consulting (Pty) Ltd. (2019). Heritage Impact Assessment: Proposed Hyperion Solar Development 2, Lyndoch 432/Rem, Kuruman Magisterial District, Northern Cape. Lakeside: ASHA Consulting (Pty) Ltd.

Bowen, P., Dorrington, R., Distiller, G., Lake, H., & Besesar, S. (2008). HIV/AIDS in the South African construction industry: an empirical study. Construction Management and Economics, 26(8) , 827-839.

Bowen, P., Govender, G., Edwards, P., & Cattell, K. (2016). An explanatory model of attitudinal fear of HIV/AIDS testing in the construction industry. Engineering, Construction and Architectural Management, 23(1) , 92-112.

Bowen, P., Govender, R., Edwards, P., & Lake, A. (2018). HIV infection in the South African construction industry. Psychology, Health & Medicine: 23(5), 612-618.

Carlislea, J. E., Kaneb, S. L., Solan, D., & Joed, J. C. (2014). Support for solar energy: Examining sense of place and utility-scale development in California. Energy Research & Social Science, Volume 3, September, 124-130.

Chiabrando, R., Fabrizio, E., & Garnero, G. (2011). On the applicability of the visual impact assessment OAISPP tool to photovoltaic plants. Renewable and Sustainable Energy Reviews, Volume 15, Issue 1, 8454-850.

Creamer Media's Engineering News. (2019, March 20). Criminals hinder South African building projects.

Creamer Media's Engineering News.

Department of Energy Republic of South Africa. (2018). Draft Integrated Resource Plan, 2018 for public comments. Pretoria: Department of Energy Republic of South Africa.

Department of Environmental Affairs and Tourism. (2004). South African National Climate Change Response Strategy, September 2004. Pretoria: Department of Environmental Affairs and Tourism.

Environmental Planning and Design. (2019). Hyperion Solar Development 2, Landscape & Visual Impact Assessment Report. Westville: Environmental Planning and Design.

Fourie, D., Kritzinger-van Niekerk, L., & Nel, M. (2015). An overview of the renewable energy independent power producers procurement programme (REIPPPP) . Centurian: Department of Energy IPP Office .

Government Gazette No. 41445. (2018). Notice 114, page 92-96. Pretoria: Government Printing Works.

Independent Power Producer Office. (2018a). Independent Power Producers Procurement Programme. An Overview. Centurion: Independent Power Producers Office.

Independent Power Producers Procurement Office. (2018b). Provincial Report Volume 1: Northern Cape Overview. Centurion: Independent Power Producers Procurement Office.

Intergovernmental Panel on Climate Chang (Approved SPM – copyedit pending). (6 October 2018). Global Warming of 1.5 °C an IPCC special report on the impacts of global warming of 1.5 °C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate chan . Intergovernmental Panel on Climate Chang.

Kikwasi, G. J., & Lukwale, S. R. (2017). HIV/AIDS and Construction Workers: Knowledge, Risk Sexual Behaviours and Attitude. Global Journal of Health Science 10(1):37.

Letter to the Minister of Finance the Honourable Tito Mboweni. (2019, March 18). Construction Industry up in Flames: Urgent Action Required. South African Forum of Civil Engineering Contractors (SAFCEC), pp. 1-5.
Meintjes, I., Bowen, P., & Root, D. (2007). HIV/AIDS in the South African construction industry: Understanding the HIV/AIDS discourse for a sector-specific responce. Construction Managment and Economics, 25(3), 255-266.

Monteiro, A., & Prinsloo, L. (2019). Builders plead for help as crime hampers projects worth R25.5bn . Port Elizabeth: Daily Dispatch.

National Department of Health. (2015). The National Antenatal Sentinel HIV prevalence Survey, South Africa, 2013. Pretoria: National Department of Health.
Northern Cape Province. (2014). Northern Cape Province Twenty Year Review 2014. Kimberly: Northern Cape Province.

Ramjee, G., & Gouws, E. (2002). Prevalence of HIV Among Truck Drivers Visiting Sex Workers in KwaZulu-Natal, South Africa. Sexually Transmitted Diseases: Volume 29 - Issue 1, 44-49.

Rycroft, M. (2015). Renewable energy development zones (REDZ) . Energize RE: Renewable Energy Supplement - June, 15-17.

Sager, M. (2014). Renewable Energy Vision 2030– South Africa. World Wide Fund for Nature (formerly World Wildlife Fund), South Africa.

Singh, Y. N., & Malaviya, A. N. (1994). Long distance truck drivers in India: HIV infection and their possible role in disseminating HIV into rural areas. International Journal of STD & AIDS 5(2|), 137-138.

Smit, D. (2011). Alternative sources of energy for South Africa in various shades of green. Retrieved from University of Pretoria Features Innovation: https://www.up.ac.za/media/shared/Legacy/sitefiles/file/44/1026/2163/8121/alternativesourcesofenergyforsouthafricainvariousshadesofgreen.pdf

South African Government. (2003). White Paper on Renewable Energy. Pretoria: Government Printing Works.

South African Government. (2008). National Energy Act. No 34 of 2008. Pretoria: Government Printing Works.

South African Government. (2010a). Integrated Resource Plan 2010-2030. Pretoria: Government Printing Works.

South African Government. (2010b). New Growth Path Framework. Pretoria: Government Printing Works.

South African Government. (2012). National Infrastructure Plan. Pretoria: Government Printing Works.

Statistics South Africa. (2011). Census 2011 Municipal Fact Sheet. Pretoria: Statistics South Africa.

Statistics South Africa. (2018). Mid-year population estimates 2018. Pretoria: Statistics South Africa.

Statistics South Africa. (2019). Quarterly Labour Force Survey: Quarter 4: 2018. Pretoria: Statistics South Africa.

Strauss, M., George, G., Lansdell, E., Mantell, J. E., Govender, K., Romo, M., . . . Kelvin, E. A. (2018). HIV testing preferences among long distance truck drivers in Kenya: a discrete choice experiment. AIDS Care. 30(1), 72-80.

Sütterlin, B., & Siegrist, M. (2017). Public acceptance of renewable energy technologies from an abstract versus concrete perspective and the positive imagery of solar power. Energy Policy, Volume 106, July, 356-366.

TerraAfrica Consult cc. (2019). Soil, Land Use, Land Capability and Agricultural Potential Assessment for the Proposed Hyperion Solar Development 2. TerraAfrica Consult cc.
The World Bank. (2009). Gender in Agriculture Sourcebook. Washington: The World Bank.

Vanclay, F. (2002). Conceptualising social impacts. Environmental Impact Assessment Review, 22, 183-211.

Vanclay, F., Esteves, A. M., Aucamp, I., & Franks, D. (2015). Social Impact Assessment: Guidance document. Fargo ND: International Association for Impact Assessment.

Visschers, V. H., & Siegrist, M. (2014). Find the differences and the similarities: Relating perceived benefits, perceived costs and protected values to acceptance of five energy technologies. Journal of Environmental Psychology, Volume 40, December, 117-130.

Wasie, B., Tiruneh, K., Gebeyehu, W., Desalegn, E., Tadesse, F., & Kiros, K. (2015). HIV prevalence, risk perception, and correlates of risky sexual practice among migrant workers in Northwest Ethiopia. Ethiopian Journal of Health Development Vol.29 No.2 , 90-98.

Wong, B. (2013). ocial Impact Assessment: The principles of the US and International Version, Criticisms and Social Impact Variables. Proceeding of the Global Conference on Business, Economics and Social Sciences 2013 (e-ISBN 978-967-12022-0-3) 25-26 June 2013 (pp. 137-147). Kuala Lumpur: Organized by: WorldResearchConference.com.

Wong, B. (2013). Social Impact Assessment: The principles of the US and International Version, Criticisms and Social Impact Variables. Proceeding of the Global Conference on Business, Economics and Social

Sciences 2013 (e-ISBN 978-967-12022-0-3) 25-26 June 2013 (pp. 137-147). Kuala Lumpur: Organized by: WorldResearchConference.com.

World Bank Group. (2016). Climate Change Action Plan 2016-2020. Washington: International Bank for Reconstruction and Development / The World Bank.

Traffic Impact Assessment

Google Earth Pro.

SANS 10280/NRS 041-1:2008 - Overhead Power Lines for Conditions Prevailing in South Africa.

Road Safety Act (Act No. 93 of 1996).

The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads.

Soils, Land Use and Agricultural Potential

The Soil Classification Working Group (2018). Soil Classification: A Natural and Anthropogenic System for South Africa. ARC-Institute for Soil, Climate and water, Pretoria.

Fey, M. (2010). Soils of South Africa. Cambridge. Cape Town.

Morgenthal, T.L., D.J. du Plessis, T.S. Newby and H.J.C. Smith (2005). Development and Refinement of a Grazing Capacity Map for South Africa. ARC-ISCW, Pretoria.