HARMONY JOEL SOLAR PV FACILITY

Free State Province

Environmental Impact Assessment Report

DESTEA Reference No.: EMS/11(i),12(ii)(a)(c),14,19, 24(ii), 1,15, 4(b) (i)(gg), 10(b) (i)(gg)(hh), 12(b)(i), 14(ii)(a)(b)(i)(hh)/22/16

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March 2023

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PROJECT DETAILS

DFFE Ref No.:	:	**DESTEA Ref Nr:** DESTEA Reference No.: EMS/11(i),12(ii)(a)(c),14,19, 24(ii), 1,15, 4(b) (i)(gg), 10(b) (i)(gg)(hh), 12(b)(i), 14(ii)(a)(b)(i)(hh)/22/16 **NEAS ref:** FSP/EIA/0000492/2022
Title	:	Environmental Impact Assessment Process: Harmony Joel Solar PV Facility, Free State Province
Authors	:	Savannah Environmental (Pty) Ltd Chantelle Geyer Karen Jodas Nicolene Venter Jo-Anne Thomas
Client	:	Freegold Harmony (Pty) Ltd
Report Revision	:	Draft for public review
Date	:	March 2023

When used as a reference this report should be cited as: Savannah Environmental (2023) EIA Report for the Harmony Joel Solar PV Facility, Free State Province.

PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

Freegold Harmony (Pty) Ltd (a subsidiary of Harmony Gold Mining Company Ltd) has appointed Savannah Environmental as the independent environmental consultant to undertake the Scoping and Environmental Impact Assessment (S&EIA) process for the Harmony Joel Solar PV Facility, Free State Province. The EIA process is being undertaken in accordance with the requirements of the 2014 EIA Regulations promulgated in terms of the National Environmental Management Act (No. 107 of 1998) (NEMA).

This EIA Report consists of ten chapters, as follows:

- **Chapter 1** provides background to the Harmony Joel Solar PV Facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of the Harmony Joel Solar PV Facility.
- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the Harmony Joel Solar PV Facility.
- **Chapter 5** outlines the approach to undertaking the Scoping/EIA process.
- **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
- **Chapter 7** provides an assessment of the potential issues associated with the Solar PV facility and associated infrastructure.
- **Chapter 8** presents the assessment of cumulative impacts of the Solar PV Facility.
- **Chapter 9** presents the conclusions and recommendations based on the findings of the EIA Report.
- **Chapter 10** provides references used to compile the EIA report.

The 30-day period for review is from **24 March 2023** to **26 April 2023**. The report is available for public review at (http://www.savannahsa.com/public-documents/energy-generation/). All comments received and recorded during the 30-day review and comment period will been included, considered, and addressed within the final EIA Report to be submitted to the Competent Authority for consideration.

Comments should be submitted in writing on or before 26 April 2023 to the contact person below.

Please submit your comments by **26 April 2023** to:
Nicolene Venter of **Savannah Environmental** PO Box 148, Sunninghill, 2157 Tel: 011-656-3237 Mobile: 060 978 8396 Fax: 086-684-0547 Email: publicprocess@savannahsa.com

Comments can be made as written submission via fax, post, or email

EXECUTIVE SUMMARY

Freegold Harmony (Pty) (a subsidiary of Harmony Gold Mining Company Ltd) is looking to supplement its energy supply by implementing photovoltaic (PV) generation at their Mine site, aiding their transition to a more sustainable and environmentally friendly energy mix at the existing Harmony Joel Mine. A solar PV facility with a generating capacity of 18MW is proposed in close proximity to the Harmony Joel mining operations. The site is located 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Joel Solar PV Facility, will comprise of several arrays of PV panels and associated infrastructure. The project site is located on Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but outside of the mining area (the project would not impact on mining activities).

A project site[1] considered to be technically suitable for the development of the solar PV facility, with an extent of approximately 1000ha, was identified by Freegold Harmony (Pty) Ltd. A development area[2] of ~220ha was demarcated within the project site for the construction and operation of the Harmony Joel Solar PV Facility and its associated infrastructure, and the full extent of this development area is assessed within this EIA Report. The development area allows an adequate footprint[3] (~47ha) for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities.

The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching substation to be connected to the existing Shafts 1 & 2 HJ Joel Mining Substation via a power line (located ~830m south west of the development footprint). The grid connection infrastructure is located within a 300m wide assessment corridor and traverses Portion 0 of the Farm Leeuwbult 580.

The relative location of the project site, development area and the grid connection corridor are indicated in **Figure 1.**

From a local perspective, the Mine site within the greater Virginia area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the availability of a grid connection, and the availability of land on which the development can take place.

As of 2019, the Industrial sector was the leading electricity consumer in South Africa, with up to 56 percent of the total consumption (Ratshomo 2019). Mining and quarrying accounted for 10% of the industrial

[1] The project site comprises the affected property for that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the EIA process, within which direct effects of the proposed project may occur. The project site is ~1000ha in extent.

[2] The development area is that identified area where the 18MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~220ha in extent.

[3] The development footprint is the defined area (47ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Joel Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

consumption (Chamber of Mines of South Africa, 2017). The successful development of the renewable energy project will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the Free State Province and South Africa. This will assist the Free State in creating green jobs and reducing greenhouse gas emissions, while reducing the energy demand on the Eskom national grid.

Table 1: Detailed description of the Harmony Joel Solar PV Facility project site

Province	**Free State Province**
District Municipality	Lejweleputswa District Municipality
Local Municipality	Matjhabeng Local Municipality
Ward Number (s)	Ward 6
Nearest town(s)	Theunissen (20km wouth west of the site)
Affected Properties:	Portion 0 of the Farm Leeuwbult 580

The Harmony Joel Solar PV Facility will have a contracted capacity of up to 18MW and will include specific infrastructure, namely:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation and switching substation, to be connected via an overhead power line to the Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint).

The overarching objective for the Harmony Joel Solar PV Facility is to maximise electricity production through exposure to the available solar resource, while minimising infrastructure, operational and maintenance costs, as well as potential social and environmental impacts. In order to meet these objectives, local level environmental and planning issues are assessed through the EIA process with the aid of site-specific specialist studies in order to delineate areas of sensitivity within the identified project site, and this serves to inform and optimise the design of the solar PV facility.

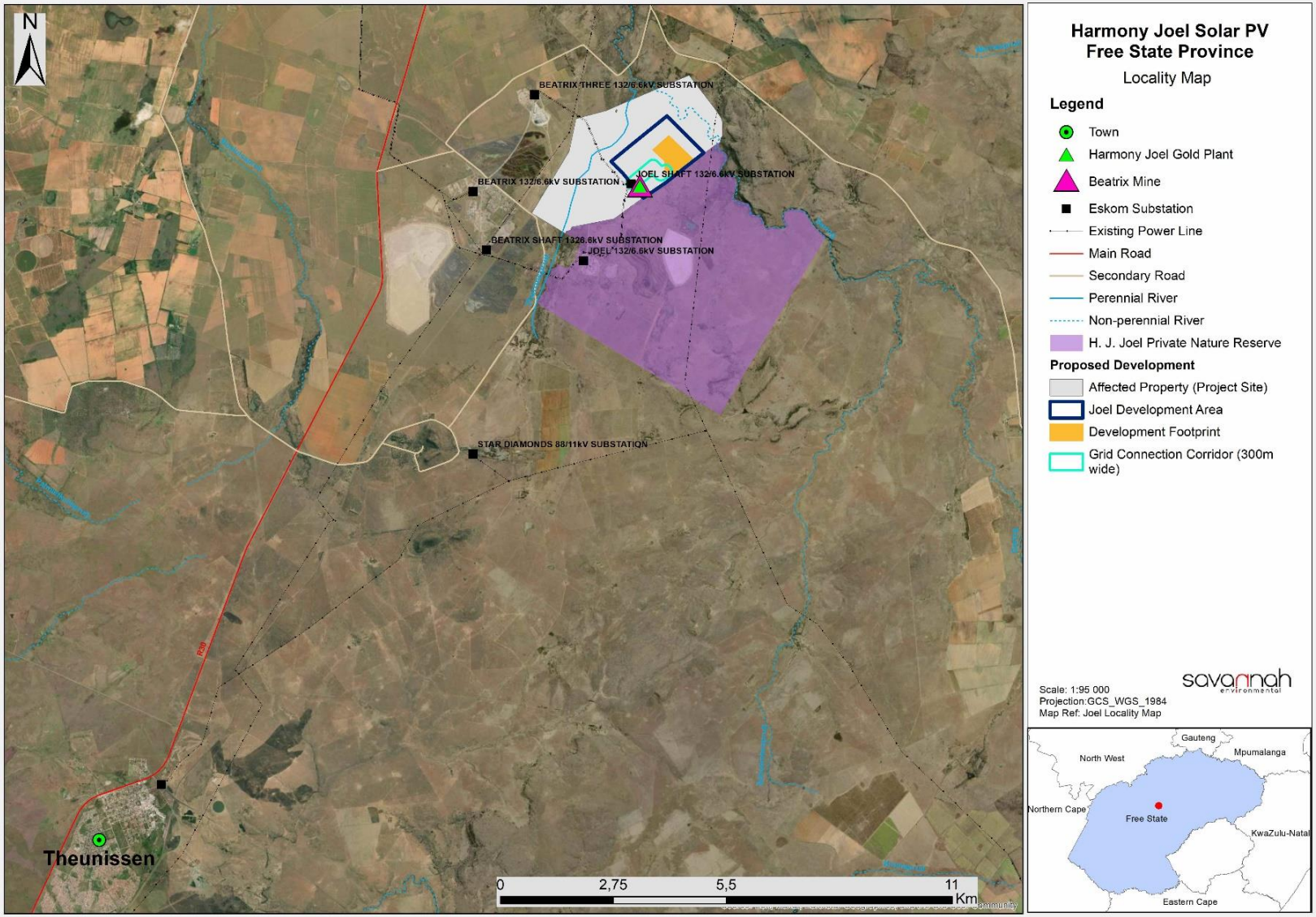

Figure 1: Locality map illustrating the location of the Harmony Joel Solar PV Facility project site and associated infrastructure (refer to **Appendix L**).

1. Environmental Permitting Requirements

The Harmony Joel Solar PV Facility and its associated infrastructure trigger the need for the following environmental permit:

» **An Environmental Authorisation (EA)** from the Free State Department of Small Business Development, Tourism and Environmental Affairs (DESTEA) in accordance with the requirements of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) and Environmental Impact Assessment (EIA) Regulations (GNR 326), 2014, as amended.

Savannah Environmental has been appointed as the Independent Environmental Assessment Practitioner (EAP) in accordance with NEMA and Regulations 21 to 24 of the 2014 EIA Regulations (GNR 326) to undertake the required S&EIA in support of the application for Environmental Authorisation (EA) and the public participation process for the project, in order to identify and assess all potential environmental impacts associated with the proposed Solar Energy Facility and recommend appropriate mitigation measures in an Environmental Management Programme (EMPr).

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be fore warned of potential environmental issues and allows for the resolution of issues reported on in the Scoping and EIA Reports as well as a dialogue with Interested and Affected Parties (I&APs). Comprehensive, independent environmental specialist studies are required in accordance with the EIA Regulations to provide the competent authority with sufficient information in order to make an informed decision. The EIA process being undertaken for the proposed general waste disposal site comprises two phases – i.e., Scoping and Impact Assessment - and involves the identification and assessment of environmental impacts through specialist studies, as well as public participation. The process followed in these two phases is as follows:

» The **Scoping Phase** includes the identification and description of potential impacts associated with the proposed project through a desktop study and consultation with interested and affected parties and key stakeholders. This phase considers the broader project area in order to identify and delineate any environmental fatal flaws, no-go or sensitive areas, as well as project alternatives in order to determine which should be assessed in more detail in the EIA Phase. Following the public review period of the Scoping Report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA Phase to the competent authority for acceptance and approval to continue with the EIA Phase of the process.

» The **EIA Phase** involves a detailed assessment of potentially significant positive and negative impacts (direct, indirect, and cumulative) identified in the Scoping Phase. This phase considers a proposed development footprint and includes detailed specialist investigations (including field surveys), consideration of feasible alternatives and public consultation. Recommendations of practical and achievable mitigation and management measures are included in an Environmental Management Programme (EMPr) considering all phases of the project. Following the public review period of the EIA Report and EMPr, this phase culminates in the submission of a Final EIA Report and EMPr to the competent authority for review and decision-making.

2. Evaluation of the Harmony Joel Solar PV Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-I** provide a detailed assessment of the potential impacts that may result from the development of the proposed Harmony Joel Solar PV Facility and associated grid connection corridor. This chapter concludes the environmental assessment by providing a summary of the results and conclusions of the assessment of the development area, and specifically the development footprint/facility layout. 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 sensitive features within the development footprint.

The potential environmental impacts associated with the Harmony Joel Solar PV Facility and associated grid connection corridor assessed through the EIA process include:

» Impacts on terrestrial ecology (including flora, fauna and wetlands)
» Impacts on avifauna.
» Impacts on soils and agricultural potential.
» Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative social impacts.

The development footprint, as assessed in the EIA Report is presented in **Figure 2**.

1.1. Impacts on Terrestrial Ecology (including flora, fauna and wetlands)

The site falls within the Central Free State Grassland (LC) and Highveld Alluvial vegetation types. The development will result in the loss of natural vegetation but which is considered to have only a moderate conservation value. The areas surrounding the site does contain fairly extensive natural areas, although mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation.

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that while the assessment and significance rating consider the full extent of the development area, the implementation of avoidance of sensitive areas as a mitigation strategy has been adopted. The northern and eastern portions of the development area (comprising of the Doring River and its tributaries including the Theronspruit river to the west) has been excluded entirely from the development footprint and the necessary mitigation implemented to ensure no indirect impacts affect the identified sensitive habitats.

The site for the proposed solar development is listed as being an Ecological Support Areas 1 & 2 (ESA1 and ESA2). This indicates that the area is not essential to meeting conservation targets, but forms part of the functioning of the Doring River adjacent to the site, and as a result does provide important functions in the support of this system.

The majority of this area has previously been transformed by urban development, mining operations and livestock grazing. Subsequently those portions of previous grazing have now re-established grassland, but which is of secondary establishment while portions of previous residential areas had also been rehabilitated but is evidently still quite degraded. Despite the largely transformed condition of the site, fairly large areas of remaining natural grassland are also still present, and these areas clearly have a moderate conservation value.

Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Joel Solar PV Facility project that cannot be reduced to a medium significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Mitigation measures must be implemented to mitigate any impacts.

1.2. Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix E**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact).

Three avifaunal habitat types were identified on the study site and surroundings, consisting of open grassland with bush clump mosaics, the Doring River system with riverine woodland, and transformed units (ranging from build-up land and mining infrastructure). The study site was also surrounded by slimes dams and the Doring River system, which provided additional habitat for waterbird and shorebird taxa. Approximately 162 bird species are expected to occur in the wider study area, of which 91 species were observed in the study area (during two independent surveys). The expected richness included four threatened or near threatened species, 15 southern African endemics and 19 near-endemic species. However, the occurrence of threatened and near threatened bird species was predicted to be low, although the natural broad-scale habitat units provided foraging habitat for the occasional occurrence of the vulnerable Lanner Falcon (*Falco biarmicus*) and endangered Secretarybird (*Sagittarius serpentarius*). Eleven southern African endemics and 13 near-endemic species were confirmed on the study site. In addition, a total of 50 collision-prone bird species have been recorded from the study area, of which 29 species were waterbird and shorebird taxa, and another 11 species were birds of prey.

The main impacts associated with the proposed PV solar facility included the following:

- The loss of habitat and subsequent displacement of bird species due to the ecological footprint required during construction.
- Direct interaction (collision trauma) by birds with the surface infrastructure (photovoltaic panels) caused by polarised light pollution and/or colliding with the panels (as they are mistaken for waterbodies).
- Collision with associated infrastructure (mainly overhead power lines).

The risk for risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana* and Egyptian Goose *Alopochen aegyptiacus*) colliding with the PV infrastructure remained eminent due to the presence of wetland-associated features and the nearby Doring River system (including the Theronspruit river to the west). Waterbird interactions with the PV infrastructure was predicted as persistent due to the spatial location of the proposed footprint site (surrounded by water features of which some sustain large numbers of birds). It is recommended that the proposed mitigation measures and monitoring protocols be implemented during the construction and operation phase of the

project (including the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds).

The most significant potential impact associated with the Solar PV development relates to habitat destruction and disturbance/displacement. The area currently experiences high levels of existing impacts such as highly modified areas used for mining and grazing as well as high levels of disturbance associated with the mining activities. The avifaunal community, even in the remnant patches of natural or near-natural vegetation scattered amongst the agricultural fields, is likely accustomed to the ongoing habitat disturbance and movement of large machinery. The solar PV facility is therefore unlikely to pose a significant negative impact on the avifaunal community of the receiving environment.

No fatal flaws were identified during the assessment of the PV Facility. It is recommended by the specialist that the proposed mitigation measures and monitoring protocols (additional with pre- and post-construction monitoring) be implemented during the construction and operational phase of the project.

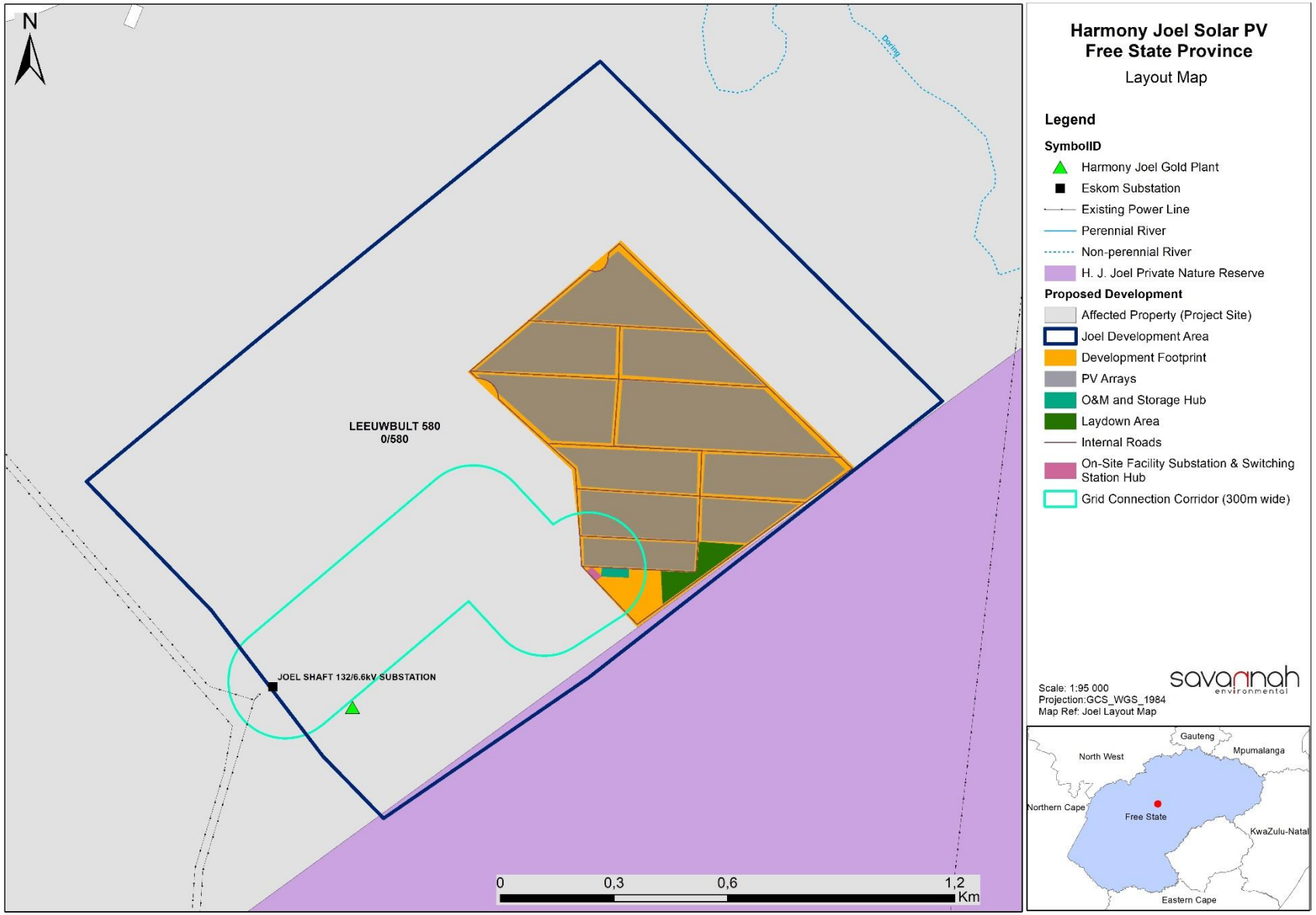

Figure 2: Development footprint (~47ha) and layout assessed within this EIA Report for the Harmony Joel Solar PV Facility

1.3. Impacts on Soils and Agricultural Potential

The Agricultural Agro-Ecosystem Assessment found that the area consists of four different natural soil forms, i.e. Glen horizon, Glenrosa, Sepane and Swartland. The areas with existing soil disturbance are classified as Technosols. The largest part of the total area assessed, has Low-Moderate land capability (143.79ha).

All soils are assigned Low sensitivity to the proposed development due to absence of any rainfed or irrigated crop production within the development footprint. There is also no irrigation infrastructure, such as centre pivots or drip irrigation, present within the project area. The grazing capacity (according to DALRRD, 2018), is 6ha/LSU, indicating that the proposed development area of 220ha has forage to feed 36 head of cattle.

It is anticipated that the construction and operation of the Harmony Joel Solar PV and associated grid connection corridor facility will have low impacts on soils and agricultural potential.

Considering that the infrastructure components, will be placed in close proximity to each other, the specialist can confirm that all reasonable measures have been taken to avoid or minimize fragmentation and disturbance of agricultural activities, provided that the mitigation measures provided in this report are implemented.

1.4. Impacts on Heritage Resources (archaeological and paleontological)

The Heritage Impact Assessment identified that all impacts associated with the development of the Harmony Joel Solar PV Facility will be of high and low significance before mitigation (depending on the impact considered), and can be mitigated to an acceptable level of impact (i.e., low significance). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented.

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. The results of the survey only identified two sites of scientific cultural value – JL2, graded IIIC and JL5 graded IIIB within the development area proposed for the Harmony Joel Solar PV Facility.

Based on the experience of the palaeontologist and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. No fossils were seen during the site survey and there were no rocky outcrops present.

The heritage specialists have no objection to the proposed development of the Harmony Joel Solar PV facility on condition that the respective no-go buffers be implemented around sites JL2 and JL5, and a Chance Finds Fossil Procedure be implemented for the duration of the construction phase of the project. From a heritage and paleontological perspective, the facility layout and grid line route are considered acceptable.

1.5. Visual Impacts

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. Land use activities within the broader region are predominantly described as maize farming, with some mining activity evident towards

the west (BEISA mine) of the proposed site. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use.

Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of rural homesteads and settlements.

Subject to the recommended mitigation measures being implemented, from a Landscape and Visual Impact perspective, it is the specialist's opinion that there is no reason why the proposed layout should not be authorised.

1.6. Social Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the Harmony Joel Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The site falls within existing mining development area and therefore falls within the Mine's social and economic processes and structures, with the socio-economic development and local economic development plans taking the PV facility into consideration. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. Harmony Joel Solar PV Facility and its associated grid connection is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

Based on the findings of the SIA the proposed establishment of the Harmony Joel Solar PV Facility is supported.

1.7. Assessment of Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Harmony Joel Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts considering the Harmony Joel Solar PV Facility 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 following conclusions can be drawn regarding the cumulative impacts associated with the project:

- The areas surrounding the site does still contain fairly extensive natural portions though mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation. The proposed solar development would therefore not result in a high cumulative impact though would certainly contribute toward the overall cumulative transformation of the area. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to avifauna with the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.

- There will be no unacceptable loss of land capability due to the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding areas, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of heritage resources associated with the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding areas. The cumulative impact is therefore acceptable.
- Change to the sense of place and character of the area is expected with the development of renewable energy facilities. However, the change is not considered to be significant.
- No unacceptable socio-economic impacts are expected to occur. The cumulative impact is therefore acceptable.

A summary of the cumulative impacts is included in **Table 1** below.

Table 1: Summary of the cumulative impact significance for the Harmony Joel Solar PV Facility

Specialist assessment	Cumulative significance of impact of the project and other projects in the area (without Mitigation)	Cumulative significance of impact of the project and other projects in the area (with Mitigation)
Ecology	Medium	High
Avifauna	Low to Medium (depending on the impact being considered)	Medium
Land use, soil and agricultural potential	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)
Heritage (archaeology and palaeontology)	Low	Low
Visual	Medium	Medium
Socio-Economic	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)

Based on the specialist cumulative assessment and findings, the development of the Harmony Joel Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Harmony Joel Solar PV Facility cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to ecological impacts due to the extent of development encroachment on natural areas[4]. It was concluded that the development of the 18MW Harmony Joel Solar PV Facility will not contribute significantly toward the cumulative impacts in this area due to the proposed location being adjacent to an active mining site. The cumulative impact attributed to this facility is therefore acceptable.

2. Environmental Costs of the Solar PV Facility and its associated grid connection versus Benefits of the Solar 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:

[4] The assumption is that all of the other projects are not located on transformed land.

- 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 has been minimised/avoided through the implementation of recommendations provided by the specialist. The 500m regulated buffer around the Doring River is avoided by the PV facility. The CBA2 are avoided by the PV facility. The resulting impact is considered to be acceptable.
- Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable without any impact of high significance.
- Heritage impacts associated with the PV facility. The heritage resources are avoided by the optimised layout, and two features has a 30m (for JL2) and 50m (for JL5) no-go buffer respectively which is required to be adhered to. Mitigation measures that have been recommended will reduce the anticipated impacts.
- Loss of land for agriculture. The development will remove areas available for agricultural activities. However, based on the low sensitivity of the soils within the development footprint of the PV Facility, this will not be significant.
- Visual impacts associated with the PV facility. It is envisaged that the structures where visible from shorter distances, and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence. General mitigations have been recommended to minimise the impact.
- Impacts on the social environment. Socio-economic impacts include impacts on the sense of place and the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project. The project is for use by the Mine, with any excess electricity to be wheeled to the national grid, primarily to reduce the reliance on Eskom as an energy provider.

Benefits of the Harmony Joel Solar PV Facility include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development. These will persist during all stages of the project.
- The project provides an opportunity for a new land use on the affected properties which is considered as a more efficient use of the land and provides an opportunity for financial benefits to the current land use.
- Reliable and cost-effective energy, sourced and generated through private or internal arrangements eliminates the possibility of unexpected power outages and unreliable grid power from government-owned entities such as Eskom. The additional energy supply helps reduce the burden on such entities and reduces the need for energy management alternatives such as load shedding.
- In terms of value creation through sustainability it is estimated that the Harmony Gold suite of solar PV projects (of which the Harmony Joel Solar PV Facility is one) will offset the liabilities of anticipated costs pending Scope 2 carbon taxes, against the backdrop of deregulation of the energy sector in South Africa, represents a big step forward for mining and private power industries in South Africa.
- The construction of the solar energy plants will be a watershed moment for Harmony, as not only will these transactions help deliver on the Mine's environmental and social obligations and undertakings, but they will also de-risk the business and deliver many socio-economic benefits, including ensuring that investors and other stakeholders continue to derive value and positive returns in a global climate of energy uncertainty.
- The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy.

» The water requirement for a solar 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. The Harmony Joel Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Harmony Joel Solar PV Facility 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility.

3. Overall Conclusion (Impact Statement)

The preferred activity was determined by Freegold Harmony (Pty) Ltd to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding sensitive areas identified.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the EIA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen by Harmony Gold, who intend to use the power for their Harmony Joel operations, as well as from a policy perspective at a local, provincial and National level. The project development footprint is located outside of any protected area and outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this EIA process.

From a biodiversity perspective, the site is not located within a protected area. Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Joel Solar PV facility that cannot be reduced to a moderate or low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Identified avifauna sensitivities were identified and avoided by the development footprint, and the layout proposed ensures that the heritage resource is avoided and recommended buffers are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

The Social Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

As detailed in the cost-benefit analysis, the benefits of the Harmony Joel Solar PV facility 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Harmony Joel Solar PV facility based on the current layout as provided by the Applicant will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

4. Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development site, the avoidance of the sensitive environmental features within the project development area, 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 Harmony Joel Solar PV facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the Applicant (**Figure 2**) is considered to be appropriate from an environmental perspective, with micro-siting of panels and roads required to ensure that the layout avoids all identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

18MW Solar PV facility: Harmony Joel Solar PV facility located within the project site located on the Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but outside of the mining area. The grid connection infrastructure is located within a 300m wide assessment corridor and traverses Portion 0 of the Farm Leeuwbult 580.

The following key conditions would be required to be included within an authorisation issued for the Harmony Joel Solar PV Facility:

- All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to I** are to be implemented.
- The EMPr as contained within **Appendix J** of this EIA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Harmony Joel Solar PV facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Exclude all areas of Very High Sensitivity from the PV facility development footprint.

- Following the final design of the Harmony Joel Solar PV facility, a revised layout must be submitted for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 3.**
- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- 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 national and provincial authorities, must be obtained before the individuals are disturbed.
- A detailed site-specific eradication and management programme for alien invasive plants must be developed and implemented.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.
- Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
- Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DESTEA.

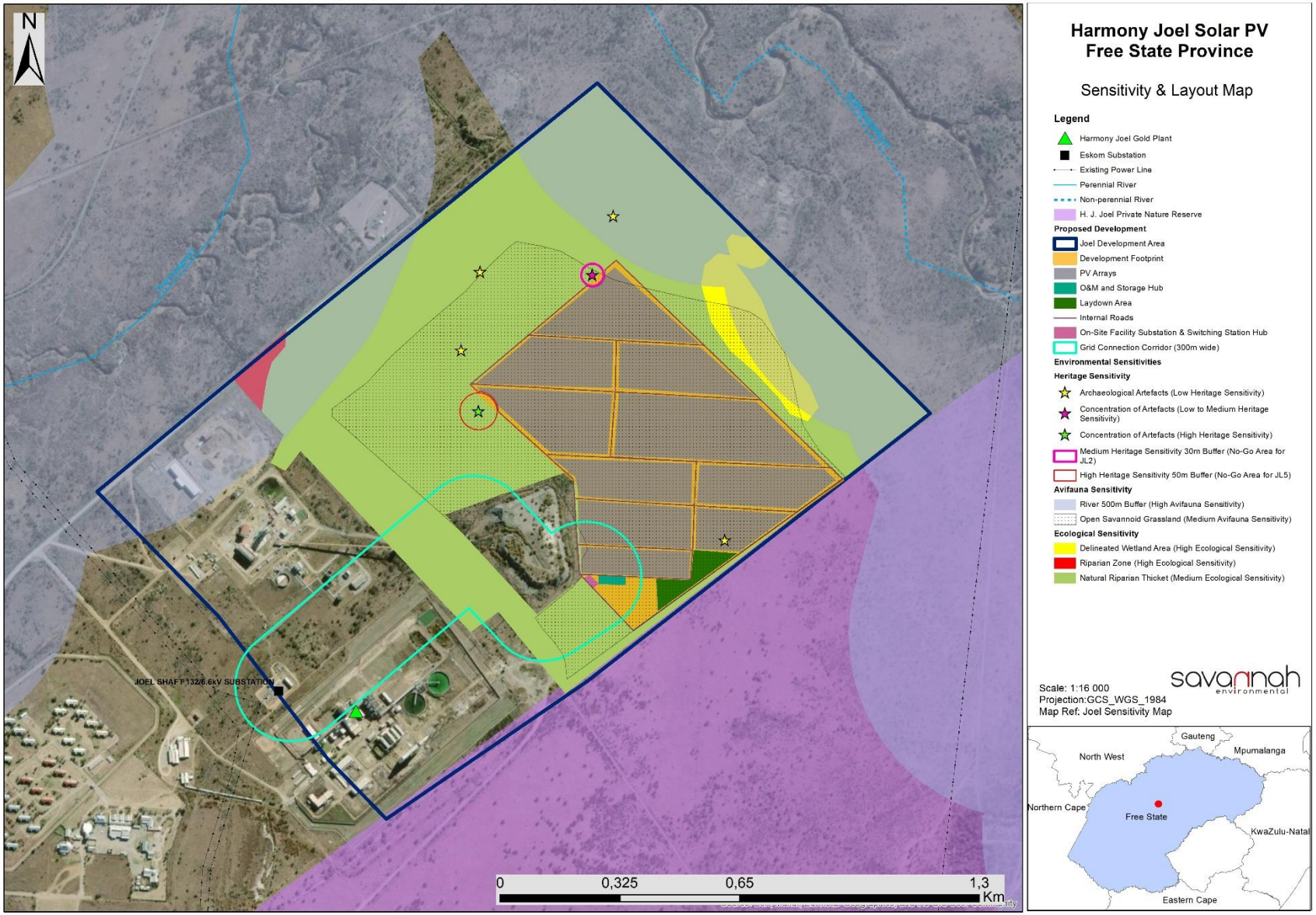

Figure 3: Environmental sensitivity and layout map from the results of the impact assessment of the Harmony Joel Solar PV Facility.

DEFINITIONS AND TERMINOLOGY[5]

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.

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.

Commercial Operation date: The date after which all testing and commissioning has been completed and is the initiation date to which the seller can start producing electricity for sale (i.e. when the project has been substantially completed).

Commissioning: Commissioning commences once construction is completed.

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.

Development area: The development area is that identified area (located within the project site) where the Harmony Joel Solar PV Facility is planned to be located. The development area is still to be determined.

Development footprint: The development footprint is the defined area (located within the development area) where the PV array and other associated infrastructure for the Harmony Joel Solar PV Facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

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.

[5] Where relevant, definitions are aligned with those definitions as per the EIA Regulations (2014, as amended).

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.

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.

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

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

Project site: The project site is the area with an extent of 1000ha, within which the Harmony Joel Solar PV Facility development footprint will be located.

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).

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.

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CHAPTER 1: INTRODUCTION

Freegold Harmony (Pty) (a subsidiary of Harmony Gold Mining Company Ltd) is looking to supplement its energy supply by implementing photovoltaic (PV) generation at their Mine site, aiding their transition to a more sustainable and environmentally friendly energy mix at the existing Harmony Joel Mine. A solar PV facility with a generating capacity of 18MW is proposed in close proximity to the Harmony Joel mining operations. The site is located 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Joel Solar PV Facility, will comprise of several arrays of PV panels and associated infrastructure. The project site is located on Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but outside of the mining area (the project would not impact on mining activities).

A project site[6] considered to be technically suitable for the development of the solar PV facility, with an extent of approximately 1000ha, was identified by Freegold Harmony (Pty) Ltd. A development area[7] of ~220ha was demarcated within the project site for the construction and operation of the Harmony Joel Solar PV Facility and its associated infrastructure, and the full extent of this development area is assessed within this EIA Report. The development area allows an adequate footprint[8] (~47ha) for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities.

The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching substation to be connected to the existing Shafts 1 & 2 HJ Joel Mining Substation via a power line (located ~830m south west of the development footprint). The grid connection infrastructure is located within a 300m wide assessment corridor and traverses Portion 0 of the Farm Leeuwbult 580.

The relative location of the project site, development area and the grid connection corridor are indicated in **Figure 1.1**.

From a local perspective, the Mine site within the greater Virginia area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the availability of a grid connection, and the availability of land on which the development can take place.

As of 2019, the Industrial sector was the leading electricity consumer in South Africa, with up to 56 percent of the total consumption (Ratshomo 2019). Mining and quarrying accounted for 10% of the industrial

[6] The project site comprises the affected property for that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the EIA process, within which direct effects of the proposed project may occur. The project site is ~1000ha in extent.

[7] The development area is that identified area where the 18MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~220ha in extent.

[8] The development footprint is the defined area (47ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Joel Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

consumption (Chamber of Mines of South Africa, 2017). The successful development of the renewable energy project will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the Free State Province and South Africa. This will assist the Free State in creating green jobs and reducing greenhouse gas emissions, while reducing the energy demand on the Eskom national grid.

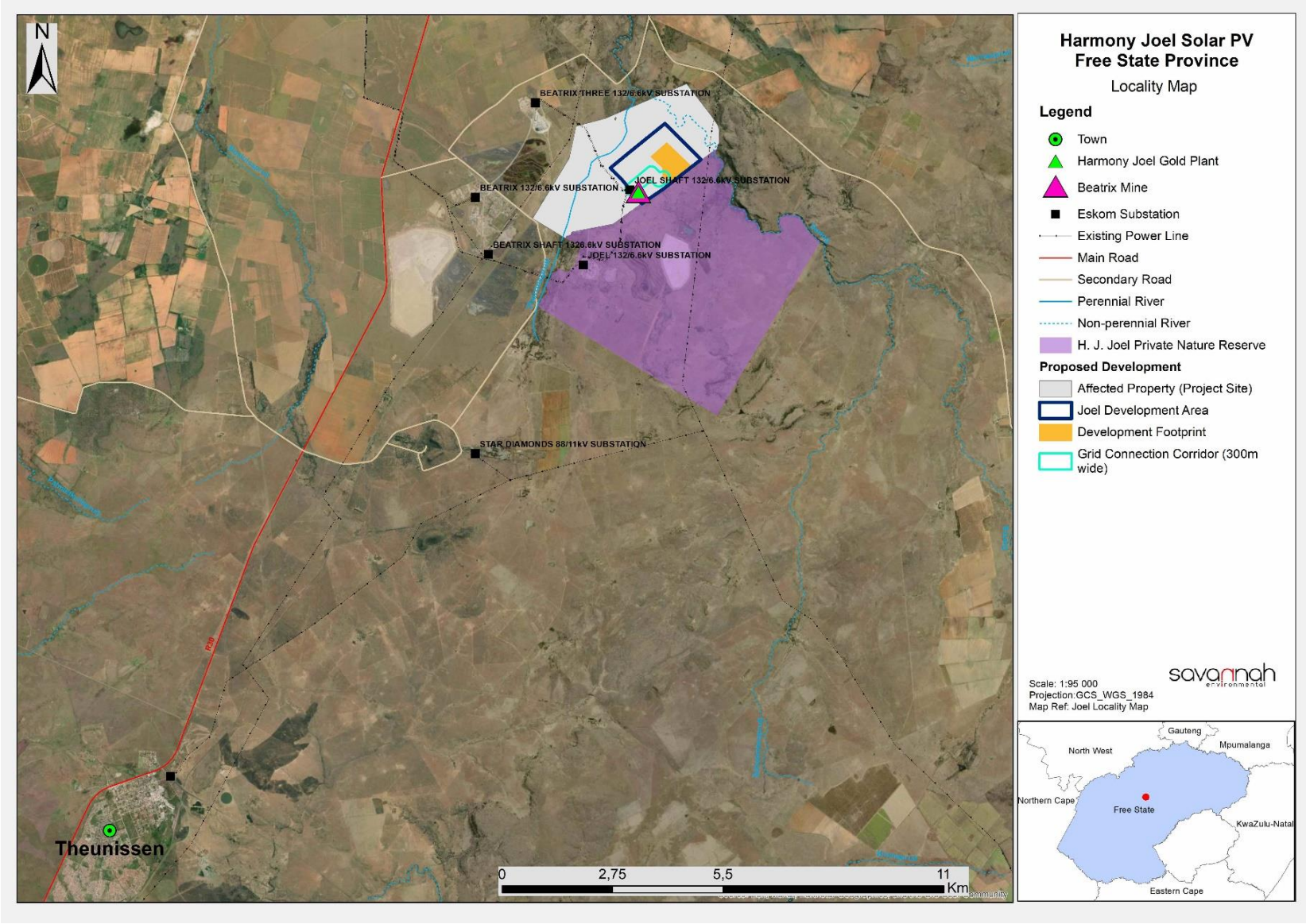


Figure 1.1: Locality map illustrating the location of the Harmony Joel Solar PV Facility project site and associated infrastructure (refer to **Appendix L**).

1.1 Project Overview

The construction of a dedicated solar PV facility at the Harmony Joel Mine is proposed in order to reduce the Mine's consumption of grid-supplied power by using solar power. This would provide cost savings to the Mine and allow the mining operation to operate efficiently with uninterrupted power supply, while reducing the demand on the national grid. The Applicant, Freegold Harmony (Pty) Ltd will fund and own the PV plant which will generate energy for on-site consumption by the mining operations.

The project site has been identified by the Applicant as a technically feasible site which has the potential for the development of a solar PV facility. A development area[9] of approximately ~220ha has been identified within the project site for the development of the Harmony Joel Solar PV Facility. The full extent of the development area has been considered within this EIA Report with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning.

During the Scoping Phase, the full extent of the project site was considered by the specialist assessments, with the aim of determining the suitability from an environmental and social perspective and identifying areas that should be avoided in development planning. Based on the specialist assessments undertaken during the Scoping Phase, areas of environmental sensitivity were identified within the project site. In order to avoid these areas of potential sensitivity and to ensure that potential detrimental environmental impacts are minimised as far as possible, the developer identified a suitable development footprint[10] (~47ha in extent) within the project site where the PV arrays and other associated infrastructure for the Harmony Joel Solar PV Facility is planned to be constructed. Since the project site assessed during the Scoping Phase is larger than the area required for the development footprint, it provides the opportunity for the optimal placement of the infrastructure, ensuring avoidance of major identified environmental sensitivities. An overview of the project development site is provided in **Table 1.1**

Table 1.1: Detailed description of the project site

Province	**Free State Province**
District Municipality	Lejweleputswa District Municipality
Local Municipality	Matjhabeng Local Municipality
Ward Number (s)	Ward 6
Nearest town(s)	Theunissen (20km wouth west of the site)
Farm Portion, Name and Number associated with the PV Facility and grid connection	Portion 0 of the Farm Leeuwbult 580
SG 21 Digit Code (s)	Portion 0 of the Farm Leeuwbult 580 (F03300000000058000000)
Current zoning	Mining
Current land use	Grazing (mainly cattle)
Site Extent (Study Area)	~1000ha
PV Development Area	~220ha
PV Development Footprint	~47ha

[9] The development area is that identified area where the 18MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~220ha in extent.

[10] The development footprint is the defined area (47ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Joel Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

Site Coordinates (project site)		Latitude:	Longitude:
	Northern point	28° 14'53.46"S	26°50'00.40"E
	Eastern point	28° 15'05.94"S	26°50'16.52"E
	Southern point	28° 15'23.27"S	26°49'47.38"E
	Western point	28° 15'24.31"S	26°49'19.86"E
	Centre point	28° 15'16.60"S;	26°49'43.69"E

The Harmony Joel Solar PV Facility will have a contracted capacity of up to 18MW and will include specific infrastructure, namely:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation and switching substation, to be connected via an overhead power line to the Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint).

The overarching objective for the Harmony Joel Solar PV Facility is to maximise electricity production through exposure to the available solar resource, while minimising infrastructure, operational and maintenance costs, as well as potential social and environmental impacts. In order to meet these objectives, local level environmental and planning issues are assessed through the EIA process with the aid of site-specific specialist studies in order to delineate areas of sensitivity within the identified project site, and this serves to inform and optimise the design of the solar PV facility.

1.2 Requirement for an Environmental Impact Assessment Process

Section 24 of South Africa's National Environmental Management Act (No. 107 of 1998) (NEMA) pertains to Environmental Authorisations (EA), 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 (CA). The 2014 Environmental Impact Assessment (EIA) Regulations, as amended (GNR 326) published under the 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 an EA from the Competent Authority.

Various aspects of the Harmony Joel Solar PV Facility are listed as activities that may have a detrimental impact on the environment. The primary listed activity triggered by Harmony Joel Solar PV Facility is Activity 15 of Listing Notice 2 (GN R325) which relates to the development of facilities or infrastructure that requires the clearance of an area of 20ha or more of indigenous vegetation[11]. The Harmony Joel Solar PV Facility will have a footprint of approximately 47ha.

[11] "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.

The Harmony Joel Solar PV Facility requires Environmental Authorisation subject to the completion of a full Scoping and Environmental Impact Assessment (S&EIA), as prescribed in Regulations 21 to 24 of the 2014 (amended in 2017) EIA Regulations (GNR 326). The generated electricity will be for own use by the Harmony Joel Mining Plant, with any excess electricity to be wheeled to the national grid. As such, the project does not relate to the Integrated Resource Plan for Electricity (IRP) 2010 – 2030, and the Free State Department of Small Business Development, Tourism and Environmental Affairs (DESTEA) has been identified as the relevant Competent Authority for the application for environmental authorisation.

1.3 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report

This EIA Report has been prepared in accordance with the requirements of the EIA Regulations published on 08 December 2014 (as amended on 07 April 2017) promulgated in terms of Chapter 5 of the National Environmental Management Act (Act No 107 of 1998). This chapter of the EIA Report includes the following information required in terms of EIA Regulations, Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(a) the details of (i) the EAP who prepared the report and (ii) the expertise of the EAP including a curriculum vitae.	The details of the EAP and the expertise of the EAP have been included in **Section 1.5**. The Curriculum vitae of the Savannah Environmental team have been included as **Appendix A**.
3(1)(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 and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The location of the Harmony Joel Solar PV facility has been included as **Figure 1.1**. The details of the affected properties, including the property names and numbers, as well as the SG-codes are included in **Table 1.1**.
3(1)(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; or (ii) on land where the property has not been defined, the coordinates within which the activity is to be undertaken.	A locality map illustrating the location of the Harmony Joel Solar PV Facility has been included in **Figure 1.1**. The centre point co-ordinates of the project site are included in **Table 1.1**.

This EIA Report consists of ten chapters, which include the following:

- **Chapter 1** provides background to the Harmony Joel Solar PV Facility project and the environmental impact assessment.
- **Chapter 2** provides a project description of the Harmony Joel Solar PV Facility.
- **Chapter 3** outlines strategic regulatory and legal context for energy planning in South Africa and specifically relating to the project.
- **Chapter 4** describes the need for, and alternatives considered for the Harmony Joel Solar PV Facility.
- **Chapter 5** outlines the approach to undertaking the Scoping/EIA process.

» **Chapter 6** describes the existing biophysical and social environment within and surrounding the study and development area.
» **Chapter 7** provides an assessment of the potential issues associated with the Solar PV facility and associated infrastructure.
» **Chapter 8** presents the assessment of cumulative impacts of the Solar PV Facility.
» **Chapter 9** presents the conclusions and recommendations based on the findings of the EIA Report.
» **Chapter 10** provides references used to compile the EIA report.

1.4 Overview of this Environmental Impact Assessment (EIA) Process

An EIA is an effective planning and decision-making tool for the project developer as it allows for the identification and management of potential environmental impacts. It provides the opportunity for the developer to be forewarned of potential environmental issues and allows for the resolution of the issues reported on in the Scoping and EIA reports as well as dialogue with interested and affected parties (I&APs).

The EIA process comprises of two (2) phases (i.e., Scoping and Impact Assessment) (refer to **Figure 1.2**) and involves the identification and assessment of potential environmental impacts through the undertaking of independent specialist studies, as well as public participation. The process followed in these two phases is as follows:

» The **Scoping Phase** includes the identification of potential issues associated with the project through a desktop study (considering existing information), and consultation with interested and affected parties and key stakeholders. This phase considers the project site to identify and delineate any environmental fatal flaws, no-go and / or sensitive areas. Following a public review period of the Scoping report, this phase culminates in the submission of a final Scoping Report and Plan of Study for the EIA to the Competent Authority for consideration and acceptance. The Scoping Report was accepted, and the Plan of Study for the EIA Phase approved by DESTEA.

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

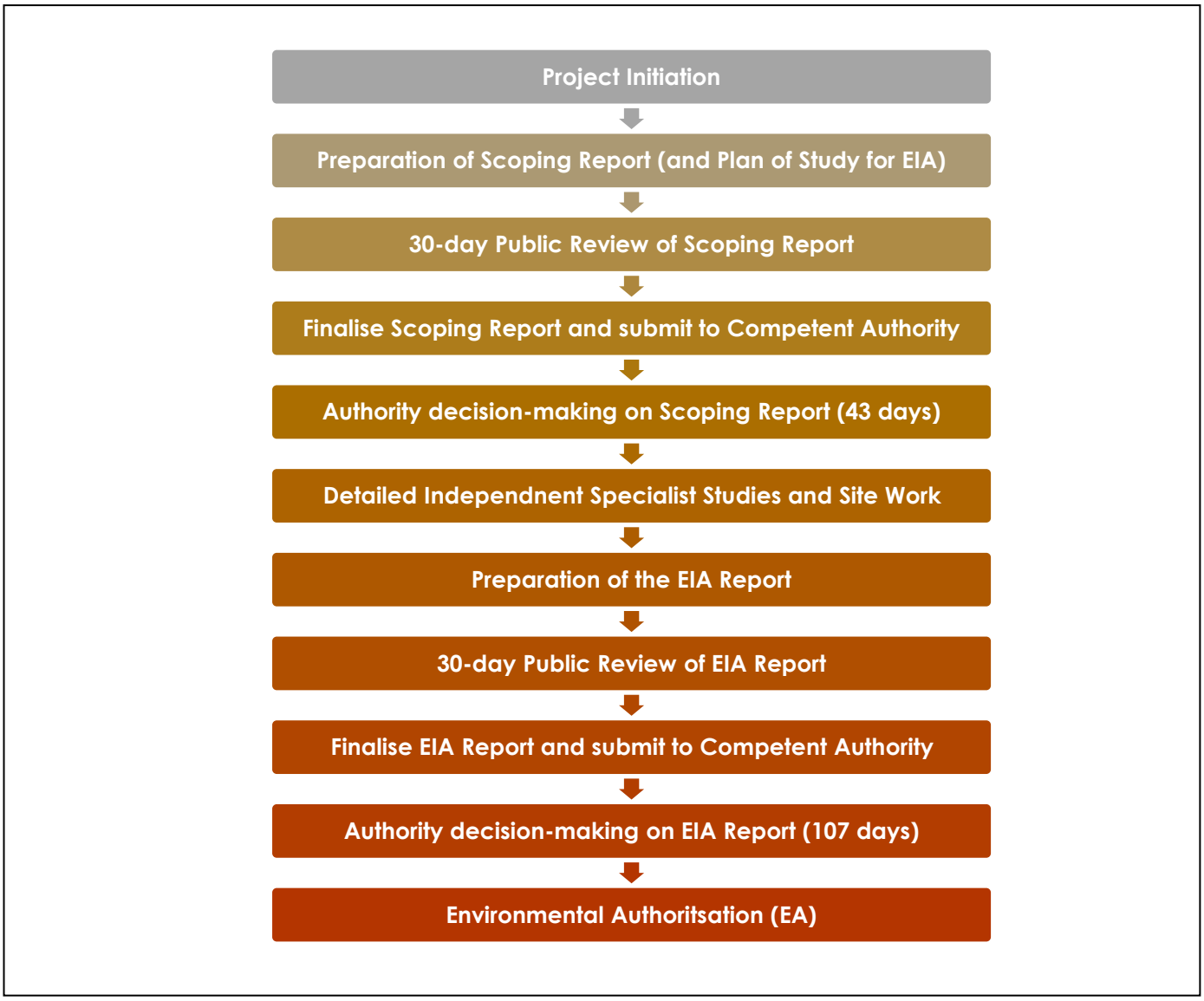


Figure 1.2: Regulated timeframe of an EIA Process

1.5 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 consultant responsible for managing the Application for EA and supporting Scoping and Environmental Impact Assessment (S&EIA) process; inclusive of comprehensive, independent specialist studies. The application for EA and S&EIA process will be 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 specialists are subsidiaries 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 facility.

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 since 2006, for a wide variety of projects throughout South Africa, including those associated with electricity generation and infrastructure development.

The Savannah Environmental team for this project includes:

- **Chantelle Geyer** is the junior EAP on this project and the GIS Practitioner, she holds a BSc degree in Environmental Science, and a BSc Honours degree in Environmental Geology degree from the North-West University, South Africa. She is an Environmental Consultant and specialises in basic assessments, environmental impact assessments, GIS-mapping, public participation administration, and environmental management programmes.
- **Karen Jodas** is the project manager for the Harmony Gold projects. She holds a Master of Science Degree and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP) and a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA). 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 25 years. She has successfully managed and undertaken EIA processes for infrastructure development projects throughout South Africa. Responsibilities for environmental studies include project management (including client and authority liaison and management of specialist teams); review and manipulation of data; identification and assessment of potential negative environmental impacts and benefits; review of specialist studies; and the identification of mitigation measures.
- **Nicolene Venter**, is a Board Member of IAPSA (International Association for Public Participation South Africa). She holds a Higher Secretarial Diploma and has over 21 years of experience in public participation, stakeholder engagement, awareness creation processes and facilitation of various meetings (focus group, public meetings, workshops, etc.). She is responsible for project management of public participation processes for a wide range of environmental projects across South Africa and neighbouring countries.
- **Jo-Anne Thomas** is a registered EAP with the Environmental Assessment Practitioners Association of South Africa (EAPASA - 2019/726) and is registered as a Professional Natural Scientist with the South African Council for Natural Scientific Professions (SACNASP). She provides technical input for projects in the environmental management field, specialising in Strategic Environmental Advice, Environmental Impact Assessment studies, environmental auditing and monitoring, environmental permitting, public participation, Environmental Management Plans and Programmes, environmental policy, strategy and guideline formulation, and integrated environmental management. Her key focus is on integration of the specialist environmental studies and findings into larger engineering-based projects, strategic assessment, and providing practical and achievable environmental management solutions and mitigation measures.

Curricula vitae (CVs) detailing Savannah Environmental team's expertise and relevant experience are provided in **Appendix A**.

1.6 Details of the Independent Specialist Team

In order to adequately identify and assess potential impacts associated with the project, a number of specialists have been appointed as part of the project team and have provided specialist input into this EIA Report (refer to **Table 1.2**). CVs detailing the independent specialists' expertise and relevant experience are provided in **Appendix A**.

Table 1.2: Independent Specialists that contributed to the EIA

Company	Specialist Area of Expertise	Specialist Name
DPR Ecologists & Environmental Services	Ecology and Wetlands	Darius Van Rensburg
Pachnoda Consulting	Avifauna	Lukas Niemand
Terra Africa Environmental Consultants	Soils and Agricultural Potential	Marinè Pienaar
CTS Heritage	Heritage and Palaeontology	Jenna Lavin
Eco Thunder Consulting	Visual	Brogan Geldenhuys
Eco Thunder Consulting	Social environment	Marti Le Roux

CHAPTER 2: PROJECT DESCRIPTION

This Chapter provides an overview of the Harmony Joel Solar PV Facility and associated infrastructure and details the project scope which includes the planning/design, construction, operation, and decommissioning activities required for the development.

2.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of the EIA regulations, 2014, as amended - Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Reports:

Requirement	Relevant Section
3(1)(b) the location of the activity including: (i) the 21-digit Surveyor General code of each cadastral land parcel, (ii) where available the physical address and farm name and (iii) where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties.	The location of the proposed project is detailed in Chapter 1, **Table 1.1**, as well as in **Section 2.2.1**. The project site is located on Portion 0 of the Farm Leeuwbult 580.
3(1)(c) a plan which locates the proposed activity or activities applied for at an appropriate scale.	A locality map is provided in **Chapter 1 Figure 1.1**
3(1)(d)(ii) a description of the scope of the proposed activity, including a description of the activities to be undertaken including associated structures and infrastructure	A description of the activities to be undertaken with the development of the project is included in **Table 2.1** and **Table 2.2**. A description of the associated infrastructure is included in **Section 2.4**. Activities to be undertaken during the various project development phases is included in **Section 2.6**.

2.2. Nature and Extent of the Harmony Joel Solar PV Facility

Freegold Harmony (Pty) Ltd is looking to supplement its energy supply by implementing solar photovoltaic (PV) generation, aiding their transition to a more sustainable and environmentally friendly energy mix.

2.2.1 Overview of the Project Site and Planned Infrastructure

The site is located 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen within the Masilonyana Local Municipality and the Lejweleputswa District Municipality, in the Free State Province.

The project site is located on Portion 0 of the Farm Leeuwbult 580 (refer to **Figure 2.1**), which is owned by the Mine but outside of the mining area (the project would not impact on mining activities).

The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching substation to be connected via a power line to the existing Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint). The grid connection

infrastructure is located within an assessment corridor of 300m wide and traverses Portion 0 of the Farm Leeuwbult 580.

A technically feasible project site, with an extent of 1000ha has been identified by Freegold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~220ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities. A development footprint of ~47ha has been identified within the project site and assessed for the construction of the facility and its associated infrastructure. The optimal position for the PV facility was determined taking into consideration the environmental sensitivities identified through the Scoping Study. The PV infrastructure has been appropriately placed to optimise the energy generating potential of the solar resource while also minimising impacts on environmental sensitivities.

2.2.2 Components of the Harmony Joel Solar PV Facility

The project site is proposed to accommodate both the PV facility as well as most of the associated infrastructure which is required for such a facility and will include:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation and switching substation, to be connected via an overhead power line to the Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint).

A summary of the details and dimensions of the planned infrastructure associated with the project is provided in **Table 2.1.** The details and dimensions of the facility development footprint were assessed as part of the independent specialist studies undertaken as part of the EIA process. **Figure 2.1** illustrates the development footprint of the Harmony Joel Solar PV Facility assessed as part of this EIA report.

Table 2.1 provides the details of the Harmony Joel Solar PV facility, including the main infrastructure components and services that will be required during the project life cycle.

Table 2.1: Details the Harmony Joel Solar PV Facility and associated infrastructure

Component	Description / Dimensions
Contracted capacity of the facility	18MW
Total extent of the Affected Properties, also referred to as the project site[12]	~1000ha
Total extent of the PV Development Area[13]	~220ha
Total extent of the PV Development Footprint[14]	~47ha
Technology	» Monofacial or Bifacial PV panels, mounted on either fixed-tilt, or single-axis tracking systems
PV panels	» Height: ~5.m from ground level (installed).
Facility Substation	» On-site facility substation located on the Portion 0 of the Farm Leeuwbult 580 » Approximately 2ha in extent.
Switching Substation	» Switching substation located within Portion 0 of the Farm Leeuwbult 580 » Approximately 2ha in extent
Grid Connection	» A 300m wide grid connection corridor within which the grid connection infrastructure will be constructed and operated. » Corridor traverses Portion 0 of the Farm Leeuwbult 580 » Cabling connecting PV array to facility substation
Site and internal access	» The site is accessible via the R30 and an unnamed mine access road. » Wherever possible, existing access roads will be utilised to access the project site and development area. Internal roads of up to 6m in width will be required to access the PV panels and the on-site substation.
Other infrastructure	» Laydown areas » Operations and Maintenance buildings » Control centre » Warehouse/ workshop

[12] The project site is that identified area within which the development area and development footprint are located. It is the broader geographic area assessed as part of the EIA process, within which indirect and direct effects of the project may occur. The project site is ~1000ha in extent.

[13] The development area is that identified area where the 18MW PV facility is planned to be located. This area has been selected as a practicable option for the facility, considering technical preference and constraints. The development area is ~220ha in extent.

[14] The development footprint is the defined area (located within the development area) where the PV panel array and other associated infrastructure for the Harmony Joel Solar PV facility is planned to be constructed. This is the actual footprint of the facility, and the area which would be disturbed.

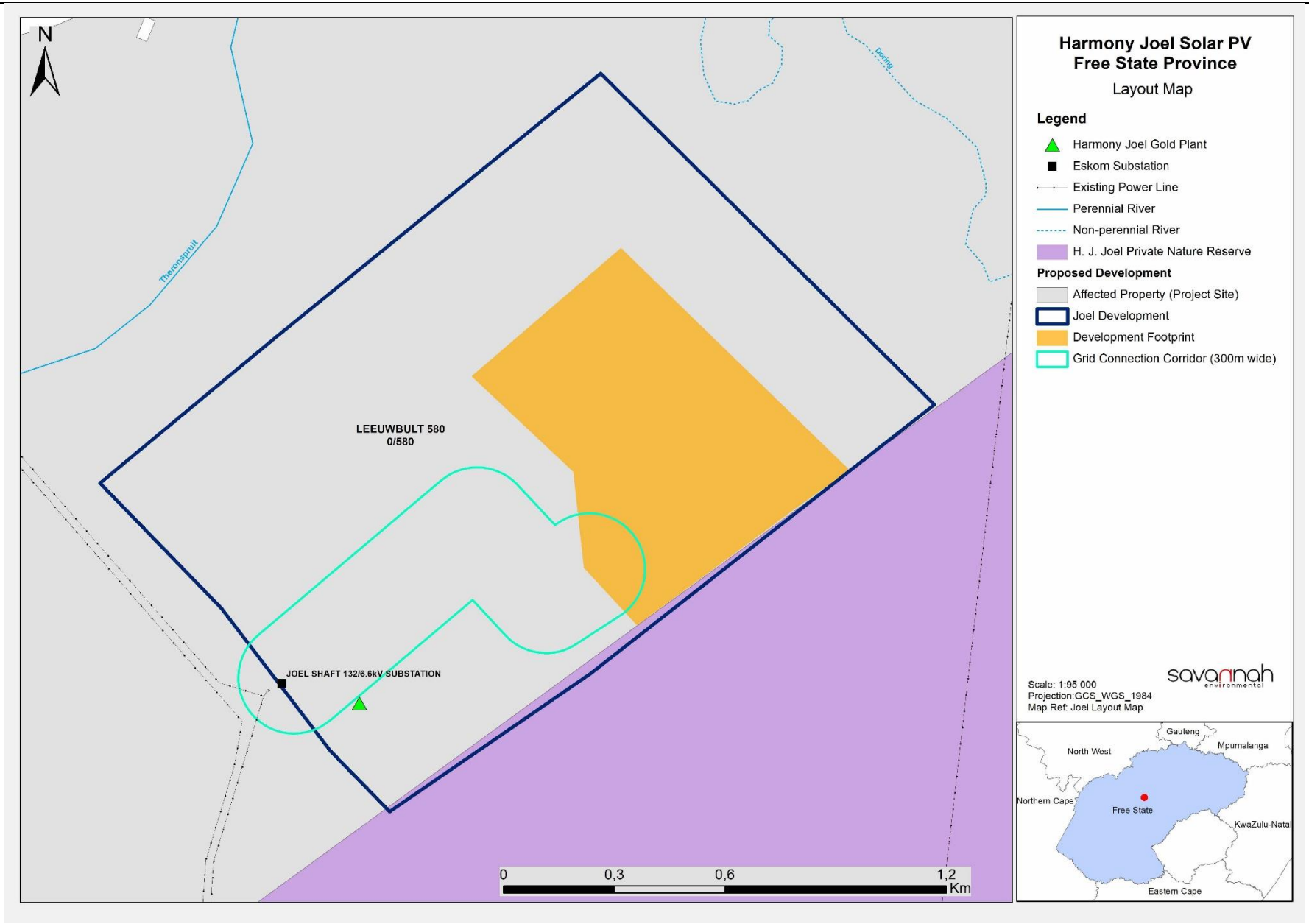


Figure 2.1: Development footprint (~47ha) assessed within this EIA Report for the Harmony Joel Solar PV Facility (refer to **Appendix L**).

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

Solar PV energy facilities 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 placing them into a higher state of energy to create electricity.

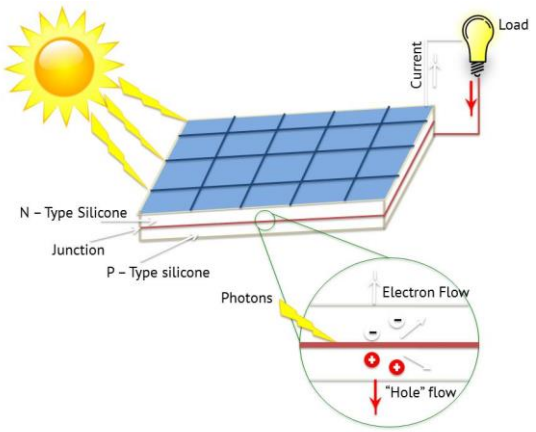


Figure 2.2: Diagram illustrating the Photovoltaic Effect (Source: Centre for Sustainable Energy)

The Photovoltaic Effect is achieved through the use of the following components:

Photovoltaic 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 2.3**). The PV cell is positively charged on one side and negatively charged on the other side and electrical conductors are attached to either side to form a circuit. This circuit then captures the released electrons in the form of an electric current (direct current). An inverter must be used to convert direct current (DC[15]) to alternating current (AC[16]). The electricity is then stepped up to a higher voltage via a transformer before being evacuated into the national grid via a power line.

[15] 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).

[16] 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).

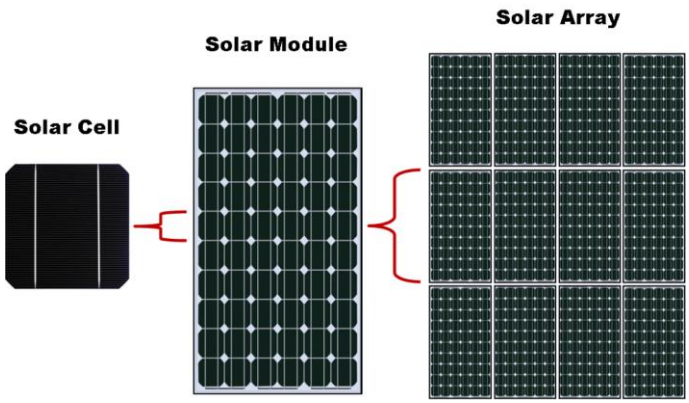


Figure 2.3: Overview of a PV cell, module and array / panel (Source: pveducation.com)

Bifacial Solar Panel Technology

Freegold Harmony (Pty) Ltd is considering the use of bifacial tracking technology. Bifacial ("two-faced") modules produce solar power from both sides of the panel. Traditional solar panels capture sunlight on one light-absorbing side. The light energy that cannot be captured is simply reflected away. Bifacial solar panels have solar cells on both sides, which enables the panels to absorb light from the back and the front (refer to **Figure 2.4**). In general, more power can be generated from bifacial modules for the same area, without having to increase the development footprint.

The optimum tilt for a bifacial module has to be designed so as to capture a big fraction of the reflected irradiation. Use of trackers is recommended so the modules can track the sun's movement across the sky, enabling them to stay directed to receive the maximum possible sunlight to generate power.

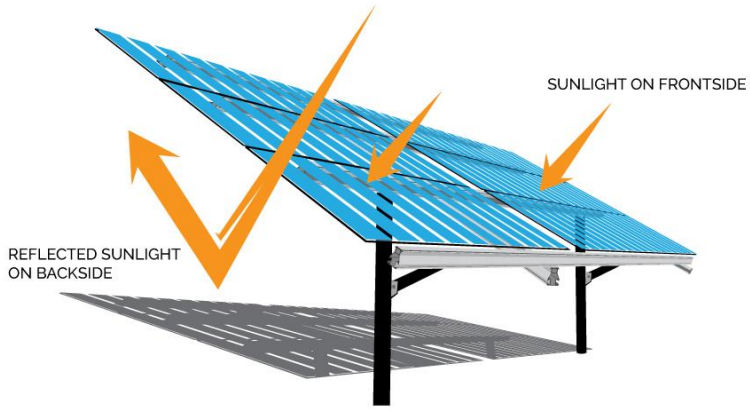


Figure 2.4: Diagram showing how bifacial Solar PV panels work (Source: https://sinovoltaics.com/learning-center/solar-cells/bifacial-solar-modules/)

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 2.5**). 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.

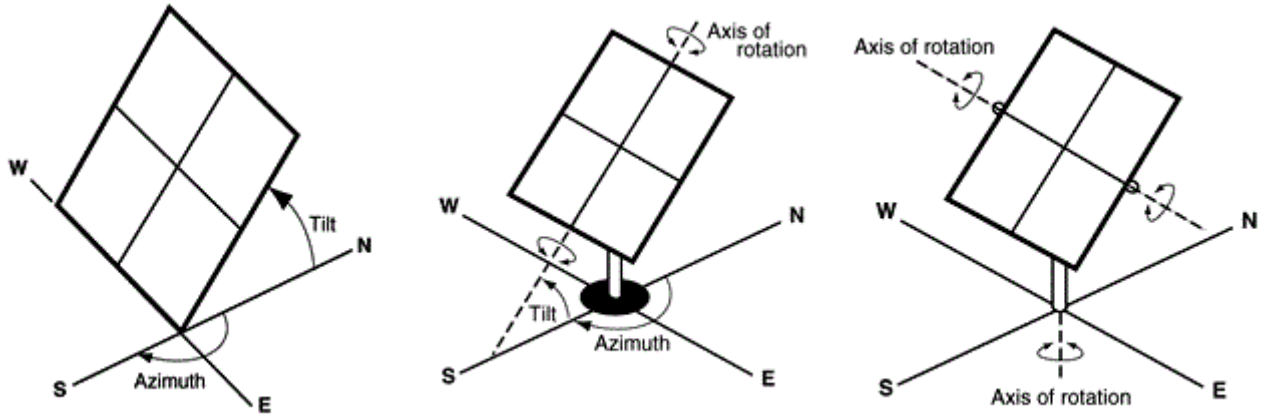


Figure 2.5: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

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

2.4 Activities during the Project Development Stages

In order to construct Harmony Joel Solar PV Facility and its associated infrastructure, a series of activities will need to be undertaken during the design, pre-construction, construction, operation, and decommissioning phases which are discussed in more detail below.

2.4.1 Design and Pre-Construction Phase

Pre-Construction Phase	
Requirements	» Planning and design of facility
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to accommodate the required equipment. » Preparation of the site (e.g., laydown area). » Mobilisation of construction equipment.
Conduct surveys prior to construction	» Including, but not limited to a detailed geotechnical survey, site survey and confirmation of the infrastructure micro-siting footprint, survey of the security booth, O&M building, workshop, storage and site office areas to determine and confirm the locations of all associated infrastructure.

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 and/or associated infrastructure. While an objective of the Engineering, Procurement and Construction (EPC) contractor, who will be responsible for the overall construction phase 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 will take place. This report therefore describes the project in terms of the best available knowledge at the time. The final facility design will be required to be approved by the DESTEA.

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, on-site facility substation and the facility'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 development area. The purpose is to design earthworks and foundations for structures and to execute earthwork repairs necessitated due to changes in the subsurface environment.

2.4.2 Construction Phase

The construction phase will entail a series of activities including:

Construction Phase	
Requirements	» Project requires an Environmental Authorisation from the DESTEA » Construction expected to be 6 to 12 months in duration. » The construction phase involves installation of the solar PV panels and the structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue for most of the construction phase. » Create direct construction employment opportunities. Approximately 100-120 employment opportunities will be created. » No on-site labour camps. Employees to be accommodated in the nearby towns such as Theunissen and Virginia and transported to and from site on a daily basis. » Overnight on-site worker presence would be limited to security staff. » Waste removal and sanitation will be undertaken by a suitably qualified sub-contractor. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. » Electricity required for construction activities will be provided by the mine. Where low voltage connections are possible, these will be utilised. » Water required for the construction phase will be supplied by the mine or municipality in addition, and where the mine cannot supply water it will be obtained via the Municipality. Should water availability at the time of construction be limited, water will be transported to site via water tanks. Water will be used for sanitation and potable water on site as well as construction works.
Activities to be undertaken	
Conduct surveys prior to construction	» Including, but not limited to a geotechnical survey, site survey and confirmation of the panel micro-siting footprint, and survey of the on-site collector substation site to determine and confirm the locations of all associated infrastructure.
Establishment of access roads to the Site	» Internal access roads within the site will be established at the commencement of construction. » Existing access roads will be utilised, where possible, to minimise impact. It is unlikely that access roads will need to be upgraded as part of the proposed development. » Access roads to be established for construction and/or maintenance activities within the development footprint. » Internal service road alignment will be up to 6m wide. Location is to be determined by the final micro-siting or positioning of the PV panels.

Undertake site preparation	» Including the clearance of vegetation at the footprint of PV panel supports, establishment of the laydown areas, the establishment of internal access roads and excavations for foundations. » Stripping of topsoil to be stockpiled, for use during rehabilitation. » Vegetation clearance to be undertaken in a systematic manner to reduce the risk of exposed ground being subjected erosion. » Include search and rescue of floral species of concern (where required) and the identification and excavation of any sites of cultural/heritage value (where required).
Establishment of laydown areas and batching plant on site	» A laydown area for the storage of PV panels components and civil engineering construction equipment. » The laydown will also accommodate building materials and equipment associated with the construction of buildings. » No borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas.
Construct foundation	» Excavations to be undertaken mechanically. » For PV array installation vertical support posts will be driven into the ground. » Depending on geological conditions, the use of alternative foundations may be considered (e.g., screw pile, helical pile, micropyle or drilled post/piles).
Transport of components and equipment to and within the site	» The components for the solar PV facility and onsite substation will be transported to site by road. Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site. » Some of the components (i.e., substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) 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. » Components for the establishment of the substation (including transformers) and the associated infrastructures to be transported to site. » Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site.
Erect PV Panels and Construct Substation, Invertors	» For array installation, typically vertical support posts are driven into the ground. Depending on the results of the geotechnical study a different foundation method, such as screw pile, helical pile, micro-pile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV arrays would be mounted. Brackets attach the PV modules to the tables. » Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. » While cables are being laid and combiner boxes are being installed, the PV tables are erected. » Wire harnesses connect the PV modules to the electrical collection systems. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site substation.
Connection of PV panels to the substation	» PV arrays to be connected to the on-site substation via underground electrical cables. » Excavation of trenches is required for the installation of the cables. Trenches will be up to 1.5m deep.

	» Underground cables are planned to follow the internal access roads, as far as possible. » Onsite substation to be connected via underground cables.
Establishment of ancillary infrastructure	» Site offices and maintenance buildings, including workshop areas for maintenance and storage will be required. » Establishment will require the clearing of vegetation, levelling, and the excavation of foundations prior to construction.
Connect substation to the power grid	» A new 132kV power line will run from the onsite substation and the switching substation and tie into the Shafts 1 & 2 HJ Joel Mining Substation
Undertake site rehabilitation	» Commence with rehabilitation efforts once construction completed in an area, and all construction equipment is removed. » On commissioning, access points to the site not required during the operation phase will be closed and prepared for rehabilitation.

Procurement and employment

The development, procurement, installation, maintenance, and management of renewable energy facilities have significant potential for job creation and skills development in South Africa. The construction phase will create temporary employment opportunities and the operation phase will create limited full-time employment opportunities. At its peak, the construction is likely to result in the creation of approximately 100 - 120 employment opportunities. Of those employment opportunities available, approximately 60% will comprise opportunities for low skilled workers, 25% for semi-skilled workers, and 15% for skilled workers. Skills developed through experience in the construction of the facility will be retained by the community members involved.

Establishment of an Access Road to the Study Area and Internal Access Roads within the Development Area

The road network surrounding the site comprises of the R30 to the western side of the development site, there are also various unnamed roads. The project site can be readily accessed via the main roads and unnamed Mine access roads. The site will be accessed via existing access points, therefore access spacing restrictions are not envisaged. At all access points, it is recommended that vegetation within the road reserve be kept clear to maintain visibility.

Undertake Site Preparation

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

Services Required

» *Waste* - waste will be minimised, re-used, and recycled as far as practically possible. Where re-use and recycling is not possible. The management of waste generated during construction will be integrated with the Mine's existing waste management procedures. Waste containers, including containers for hazardous waste, will be located at easily accessible locations on site when construction activities are undertaken. Excess waste material will be removed once the construction phase is complete and will be disposed of at registered landfill site/waste facility. handling, storage and disposal of the hazardous waste components, i.e. oils and other lubricants, will be done in accordance with the relevant legislation.
» *Sanitation* – during the construction phase, mobile chemical toilets or a conservancy tank will be placed within the development area for use by contractors.
» *Electricity supply* - electricity required for construction activities will be provided by the Mine. Where low voltage connections are possible, these will be utilised.

» *Water supply* – water required for the construction phase will be supplied by the mine or municipality. In addition, and where the mine cannot supply water, it will be obtained via the Municipality. Should water availability at the time of construction be limited, water will be transported to site via water tanks. Water will be used for sanitation and potable water on site as well as construction works.

Transport of Components and Equipment to Site

The components for the solar PV facility and onsite substation will be transported to site by road. Transportation will take place via appropriate National and Provincial roads, and the dedicated access/haul road to the site. Some of the components (i.e., substation transformer) may be defined as abnormal loads in terms of the Road Traffic Act (Act No. 29 of 1989) 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

A laydown area for the storage of PV panels components and civil engineering construction equipment. The laydown will also accommodate building materials and equipment associated with the construction of buildings. No borrow pits will be required. Infilling or depositing materials will be sourced from licenced borrow pits within the surrounding areas. A temporary concrete batching plant of 50m x 50m in extent to facilitate the concrete requirements for foundations, if required.

Erect PV Cells and Construct On-Site Facility Substation and Invertors

The construction phase involves installation of the solar PV panels, including the entire necessary structural and electrical infrastructure to make the plant operational. In addition, preparation of the soil and improvement of the access roads would continue for most of the construction phase. For array installation, typically vertical support posts are driven into the ground. Depending on the results of the Geotechnical Report, a different foundation method, such as screw pile, helical pile, micro-pile or drilled post/pile could be used. The posts will hold the support structures (tables) on which PV arrays would be mounted. Brackets attach the PV modules to the tables. Trenches are dug for the underground AC and DC cabling and the foundations of the inverter enclosures and transformers are prepared. While cables are being laid and combiner boxes are being installed, the PV tables are erected. Wire harnesses connect the PV modules to the electrical collection systems. Underground cables and overhead circuits connect the Power Conversion Stations (PCS) to the on-site AC electrical infrastructure and ultimately the project's on-site facility substation.

Figure 2.6: Frame structural details

The construction of an on-site facility substation would require a survey of the site, site clearing and levelling, construction of access road/s (where required), construction of a level terrace and foundations, assembly, erection, installation and connection of equipment, rehabilitation of any disturbed areas and protection of erosion sensitive areas.

Establishment of Ancillary Infrastructure

Ancillary infrastructure will include cabling for the connection to the Eskom national grid, workshops and maintenance buildings, storage and laydown areas, gatehouse, security offices, and other storage areas under roof. The establishment of these facilities/buildings will require the localised clearing of vegetation and levelling of the development footprint and the excavation of foundations prior to construction.

Undertake Site Remediation

Once construction is completed and all construction equipment is removed, the site must be rehabilitated where practical and reasonable. On full commissioning of the solar PV facility, any access points to the site which are not required during the operation phase must be closed and rehabilitated.

7MW RustMo1 Solar Farm near Rustenburg - Operational

Figure 2.7: Photographs of the construction and operation phases of a solar facility similar to the Harmony Joel Solar PV Facility
(Source: https://medium.com/@solar.dao/how-to-build-pv-solar-plant-6c9f6a01020f; https://www.shutterstock.com/video/clip-1028794-workers-mounting-panels-on-solar-power-plant-construction; https://www.esi-africa.com/renewable-energy/kenya-construction-solar-farm-gets-green-light/)

2.4.3 Operation Phase

The Harmony Joel Solar PV Facility is expected to be operational for up to 25 years. The facility will, under normal operating conditions, operate continuously, 7 days a week.

Operation Phase	
Requirements	» Duration will be up to 25 years. » Requirements for security and maintenance of the project. » Employment opportunities relating mainly to operation activities and maintenance. » Employment opportunities will be available during the operation of the solar facility.
Activities to be undertaken	
Operation and Maintenance	» Full time security, maintenance, and control room staff. » All PV panels will be operational except under circumstances of mechanical breakdown, inclement weather conditions, or maintenance activities. » Solar PV to be subject to periodic maintenance and inspection. » It is anticipated that the PV panels will be washed twice a year during operation using clean water with no cleaning products, or non-hazardous biodegradable cleaning products. » Disposal of waste products (e.g., oil) in accordance with relevant waste management legislation. » Areas which were disturbed during the construction phase to be utilised, should a laydown area be required during operation.

Key elements of the Operation and Maintenance plan include monitoring and reporting the performance of the project, conducting preventative and corrective maintenance, receiving visitors, and maintaining security of the project.

Water will be required for the operation phase. The water required will be sourced directly from the Mine.

Other services required for the operation phase include refuse material disposal and sanitation and will follow the same protocols which are currently in place for the Mine.

2.4.4 Decommissioning Phase

Depending on the continued economic viability of the Harmony Joel Solar PV Facility following the 25-year operation period, the solar PV 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 disassembled and replaced with new, more efficient technology/infrastructure available at that time. However, if the decision is made to decommission the solar PV facility, the following activities will form part of the project scope.

Decommissioning Phase	
Requirements	» Decommissioning of the Harmony Joel Solar PV Facility infrastructure at the end of its economic life. » Potential for repowering of the facility, depending on the condition of the facility at the time. » Expected lifespan of approximately 25 years (with maintenance) before decommissioning is required. » Decommissioning activities to comply with the legislation relevant at the time. » It is expected that the areas of the project site affected by the solar facility infrastructure (development footprint) will revert back to its original land-use (i.e., grazing) once the Harmony Joel facility has reached the end of its economic life and all infrastructure has been decommissioned.
Activities to be undertaken	
Site preparation	» Confirming the integrity of site access to the site to accommodate the required decommissioning equipment. » Preparation of the site (e.g., laydown areas and construction platform). » Mobilisation of construction equipment.
Disassemble and remove PV panels	» Components to be reused, recycled, or disposed of in accordance with regulatory requirements. » 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. » Concrete will be removed to a depth as defined by an agricultural specialist and the area rehabilitated. » Cables will be excavated and removed, as may be required

Site Preparation

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

Disassemble and Remove Existing Components

When the solar PV facility is ultimately decommissioned, the equipment to be removed will depend on the proposed land use for the site at that time. At this time, all above ground facilities that are not intended for future use at the site will be removed. Underground equipment (e.g. foundation, wiring) will be removed, and the surface restored. 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 plant would be deconstructed and recycled or disposed of in accordance with regulatory requirements. The site will be rehabilitated and returned to a beneficial land use.

CHAPTER 3: POLICY AND LEGISLATIVE CONTEXT

This Chapter provides an overview of the policy and legislative context within which the development of the solar PV facility is proposed. It identifies environmental legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable or have bearing on the proposed activity, and which are required to be considered in the assessment process.

3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter of the EIA Report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
3(1)(e) a description of the policy and legislative context within which the development is proposed and how the proposed development complies with and responds to the legislation and policy context.	Chapter 3 provides an overview of the policy and legislative context which is considered to be associated with the development of the solar energy facility. The regulatory and planning context has been considered at national, provincial, and local levels. A description of the policy and legislative context within which Harmony Joel Solar PV Facility is proposed is included in **Sections 3.3, 3.4, 3.5** and **3.6.**

3.2 Strategic Electricity Planning in South Africa

The need to expand electricity generation capacity in South Africa is based on national policy and informed by on-going strategic planning undertaken by the Department of Mineral Resources and Energy (DMRE). The hierarchy of policy and planning documentation that support the development of renewable energy projects such as a solar energy facility is illustrated in **Figure 3.1**. These policies are discussed in more detail in the following sections, along with the provincial and local policies or plans that have relevance to the development of Harmony Joel Solar PV Facility. Even though the facility is proposed for the use by the mine, it is still important to demonstrate how this proposed project fits within this policy framework.

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels. As solar energy developments are a multi-sectoral issue (encompassing economic, spatial, biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process of a solar energy project and the related statutory environmental assessment process.

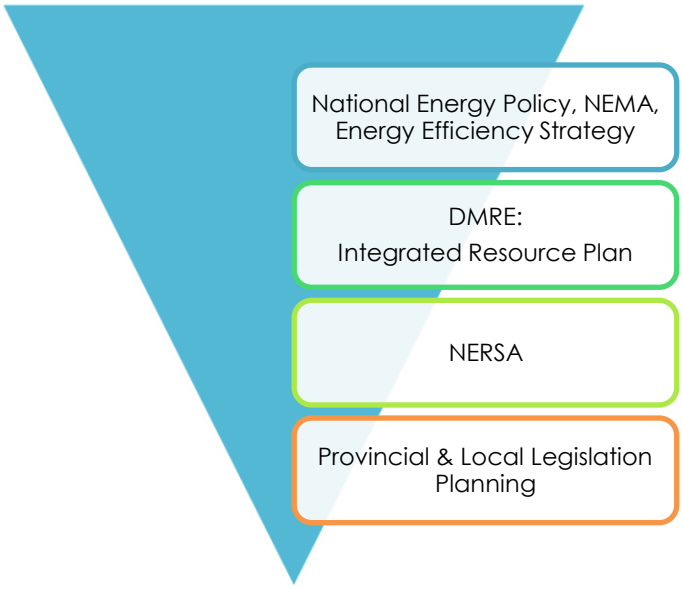


Figure 3.1: Hierarchy of electricity and planning documents

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

- **Department of Mineral Resources and Energy (DMRE):** This Department is responsible for policy relating to all energy forms and for compiling and approving the Integrated Resource Plan (IRP) for electricity. Furthermore, the Department is also responsible for granting approvals for the use of land which is contrary to the objects of the Mineral and Petroleum Resource Development Act (Act No. 28 of 2002) (MPRDA) in terms of Section 53 of the Act. Therefore, in terms of the Act, approval from the Minister is required to ensure that proposed activities do not sterilise mineral resources that may occur within the project site and development area.
- **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 Forestry, Fisheries, and the Environment (DFFE):** This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations, 2014 (GN R326) as amended.
- **The 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):** This Agency is responsible for the regulation and maintenance of all national road routes.
- **Department of Water and Sanitation (DWS):** This Department is responsible for effective and efficient water resources management to ensure sustainable economic and social development. This Department is also responsible for evaluating and issuing licenses pertaining to water use (i.e. Water Use Licenses (WUL) and General Authorisation).
- **The Department of Agriculture, Land Reform, and Rural Development (DALRRD):** This Department is the custodian of South Africa's agricultural resources and is primarily responsible for the formulation and implementation of policies governing the agriculture sector. Furthermore, the Department is also responsible for issuing permits for the disturbance or destruction of protected tree species listed under Section 15 (1) of the National Forest Act (No. 84 of 1998) (NFA).

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

- **Provincial Government of the Free State –** Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA): is the Competent Authority for the EIA process for the project and is responsible for issuing of biodiversity and conservation-related permits.
- **Free State Department:** Police, Roads and Transport: This Department provides effective co-ordination of crime prevention initiatives, provincial police oversight, traffic management and road safety towards a more secure environment.
- **Free State Heritage Resources Authority (FSPHRA):** This Department identifies, conserves and manages heritage resources throughout the Free State Province, as well as comments on heritage related issues within the Province.

At the **Local Level,** the local and district municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Free State Province, both the local and district municipalities play a role. The local municipality includes the Masilonyana Local Municipality, which forms part of the Lejweleputswa District Municipality. In terms of the Municipal Systems Act (No. 32 of 2000), it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control.

3.3 Policy and Planning Considerations on International, National, Provincial and Local Levels

3.3.1 Policy and planning on an International Level

South Africa has committed to various international policies which relate to environmental concerns, specifically that of climate change and global warming. **Table 3.1** below provides a summary of the international policies and plans that South Africa has made commitments towards, and how the proposed development of the Harmony Joel Solar PV facility aligns with the thinking or commitments of these agreements. The Harmony Joel Solar PV Facility is considered to be aligned with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 3.1: International policies and plans relevant to the Harmony Joel Solar PV Facility

Relevant policy	Relevance to the Harmony Joel Solar PV Facility
United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)	The Conference of the Parties (COP), established by Article 7 of the UNFCCC, 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. The Conference of the Parties (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. 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 Paris Agreement set out that every 5 years countries must set out increasingly ambitious climate action. This meant that, by 2020, countries needed to submit or update their plans for reducing emissions, known as nationally determined contributions (NDCs). The COP26 summit held on 2021 brought parties together to accelerate action towards the goals of the Paris Agreement and the UN Framework Convention on Climate Change. On 13 November 2021, COP26 concluded in Glasgow with all countries agreeing the

Relevant policy	Relevance to the Harmony Joel Solar PV Facility
	Glasgow Climate Pact to keep 1.5˚C alive and finalise the outstanding elements of the Paris Agreement. 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. The policy provides support for the Harmony Joel Solar PV Facility which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
The Equator Principles IV (October 2020)	The Equator Principles (EPs) IV constitute a financial industry benchmark used for determining, assessing, and managing project's 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 (such as the Harmony Joel Solar PV Facility and apply globally to all industry sectors. 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 Harmony Joel Solar PV Facility. 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 IFC Performance Standards on Environmental and Social Sustainability, and Environmental Health and Safety (EHS) Guidelines. The Harmony Joel Solar PV Facility is currently being assessed in accordance with the requirements of the 2014 EIA Regulations, as amended (GN R326), published in terms of Section 24(5) of the National Environmental Management Act (No. 107 of 1998) (NEMA), which is South Africa's national legislation providing for the authorisation of certain controlled activities. Through this assessment, all potential social and environmental risks are identified and assessed, and appropriate mitigation measures proposed.
International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012)	The International Finance Corporation's (IFC) Performance Standards (PSs) on Environmental and Social Sustainability were developed by the IFC and were last updated on 1 January 2012. Performance Standard 1 requires that a process of environmental and social assessment be conducted, and an Environmental and Social Management System (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. The above-mentioned standard is the overarching standard to which all the other standards relate. Performance Standards 2 through to 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, the standards 2 and 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.

Relevant policy	Relevance to the Harmony Joel Solar PV Facility
	Given the nature of the Harmony Joel Solar PV Facility, it is anticipated (at this stage of the process) that Performance Standards 1, 2, 3, 4, 6, and 8 may be applicable to the project.
International Just Energy Transition Partnership (2021)	The governments of South Africa, France, Germany, the United Kingdom, and the United States of America, along with the European Union, have announced a new ambitious, long-term Just Energy Transition Partnership to support South Africa's decarbonisation efforts. The Partnership aims to accelerate the decarbonisation of South Africa's economy, with a focus on the electricity system, to help it achieve the ambitious goals set out in its updated Nationally Determined Contribution emissions goals.

3.3.2 Policy and planning on a National Level

The South African government a commitment in August 2011 to support the development of renewable energy capacity.

A brief review of the most relevant national policies is provided below in **Table 3.2**. The development of Harmony Joel Solar PV Facility is considered to align with the aims of these policies, even where contributions to achieving the goals therein are only minor.

Table 3.2: Relevant national legislation and policies for Harmony Joel Solar PV Facility

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
Constitution of the Republic of South Africa, 1996	Section 24 of the Constitution pertains specifically to the environment. It 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. The Constitution outlines the need to promote social and economic development. Section 24 of the Constitution therefore requires that development be conducted in such a manner that it does not infringe on an individual's environmental rights, health, or well-being. This is especially significant for previously disadvantaged individuals who are most at risk to environmental impacts. The undertaking of an EIA process for the proposed project in terms of the requirements of the EIA Regulations, 2014 (as amended) aims to minimise any impacts on the natural and social environment.
National Environmental Management Act (No. 107 of 1998) (NEMA)	This piece of legislation is South Africa's key piece of environmental legislation and sets the framework for environmental management in South Africa. NEMA is founded on the principle that everyone has the right to an environment that is not harmful to their health or well-being as contained within the Bill of Rights. The national environmental management principles state that the social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment. The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
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.
White Paper on the Energy Policy of the Republic of South Africa (1998)	The White Paper on Energy Policy places emphasis on the expansion of energy supply options to enhance South Africa's energy security. This can be achieved through increased use of RE and encouraging new entries into the generation market. The policy states that the advantages of Renewable Energy include: » minimal environmental impacts during operation in comparison with traditional supply technologies, » generally lower running costs, and high labour intensities. Disadvantages include: » higher capital costs in some cases, » lower energy densities, » and lower levels of availability, depending on specific conditions, especially with sun and wind-based systems. Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.
White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)	The White Paper on Renewable Energy Policy Supplements Government's predominant policy on energy as set out in the White Paper on the Energy Policy of the Republic of South Africa (DME, 1998). The policy recognises the potential of RE and aims to create the necessary conditions for the development and commercial implementation of Renewable Energy technologies. The White Paper on Renewable Energy sets out Government's vision, policy principles, strategic goals, and objectives for promoting and implementing Renewable Energy in South Africa. The country relies heavily on coal to meet its energy needs due to its abundant, and accessible and affordable coal resources. However, massive Renewable Energy resources that can be sustainable alternatives to fossil fuels, have so far remained largely untapped. The development of additional renewable energy projects will promote the use of the abundant South African renewable energy resources and contribute to long-term energy security and diversification of the energy mix.
The Electricity Regulation Act (No. of 2006)	The Electricity Regulation Act (ERA) (No. 04 of 2006) as amended by the Electricity Regulation Act (No. 28 of 2007), replaced the Electricity Act (No. 41 of 1987), as

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
	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 National Energy Regulator (NERSA) as the 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, trading, and import and export of electricity is regulated. Schedule 2 of the Electricity Regulation Act provides for exemptions from the obligation in the Act to apply for (and hold) a licence from NERSA. In terms of this schedule, the threshold for distributed generation was raised to 100MW in August 2021. Project developers are exempted from applying for a license but are required to register with NERSA and comply with the relevant grid code(s).
National Development Plan 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. 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. In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, 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 will look 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. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Harmony Joel Solar PV Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
Integrated Energy Plan (IEP), 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.

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
	» 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.

Integrated Resource Plan for Electricity (IRP) 2010-2030	**The Integrated Resource Plan (IRP) for Electricity is a subset of the IEP and constitutes South Africa's National electricity plan. The IRP is an electricity infrastructure development plan based on least-cost electricity supply and demand balance, taking into account security of supply and the environment. 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 promulgated IRP 2010–2030 identified the preferred generation technology required to meet expected demand growth up to 2030. It incorporated government objectives such as affordable electricity, reduced greenhouse gas (GHG) emissions, reduced water consumption, diversified electricity generation sources, localisation and regional development.** **Following the promulgation of the IRP 2010–2030, implementation followed in line with Ministerial Determinations issued under Section 34 of the Electricity Regulation Act (Act No. 4 of 2006). The Ministerial Determinations give effect to planned infrastructure by facilitating the procurement of the required electricity capacity.** **According to the IPP Procurement Programme overview report (2021), as at 31 March 2021,a total of 6 422MW has been procured under the REIPPP Programme from 112 IPPs in seven bid rounds, with 5 078MW being currently operational and made available to the grid. IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants.** **Under the Eskom Build Programme, 1 332MW has been procured from the Ingula Pumped Storage Project, 1 588MW and 800MW from the Medupi and Kusile power stations and 100MW from the Sere Wind Farm.** **Provision has been made for the following new capacity by 2030:** » **1 500MW of coal** » **2 500MW of hydro** » **6 000MW of solar PV** » **14 400MW of wind** » **1 860MW of nuclear** » **2 088MW of storage** » **3 000MW of gas/diesel** » **4 000MW from other distributed generation, co-generation, biomass and landfill technologies** **Of relevance to the proposed project is the provision for distributed generation capacity for own use. Therefore, the development of the Harmony Joel Solar PV Facility is supported by the IRP 2019.**
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 terms 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.
National Development Plan 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. In terms of the Energy Sectors 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. In formulating its vision for the energy sector, the NDP took the IRP 2010 as its point of departure. Therefore, 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 will look 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. The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Harmony Joel Solar PV Facility supports the NDP through the development of energy-generating infrastructure which will not lead to the generation of GHGs and will result in economic development and growth of the area surrounding the development area.
National Climate Change Response Policy, 2011	The Conference of the Parties (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 is open for signature and subject to ratification, acceptance or approval by States and regional economic integration organisations that are Parties to the Convention from 22 April 2016 to 21 April 2017. Thereafter, this Agreement shall be open for accession from the day following the date on which it is closed for signature. The agreement can only be sanctioned once it has been ratified by 55 countries, representing at least 55% of emissions. 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 was promulgated on 04 November 2016, thirty days after the date on which at least 55 Parties to the Convention, which account for at least 55% of the total global greenhouse gas emissions have deposited their instruments of ratification, acceptance, approval, or accession with the Depositary. 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. The policy provides support for Harmony Joel Solar PV Facility, which will contribute to managing climate change impacts, supporting the emergency response capacity, as well as assist in reducing GHG emissions in a sustainable manner.
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. Harmony Joel Solar PV Facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.
National Climate Change Response Strategy for South Africa, 2004	The need for a national climate change policy for South Africa was identified as an urgent requirement during the preparations for the ratification of the UNFCCC in 1997. A process to develop such a policy was thus instituted under the auspices of the National Committee for Climate Change (NCCC), a non-statutory stakeholder body set up in 1994 to advise the Minister on climate change issues and chaired by the then Department of Environmental Affairs and Tourism (DEAT). It was determined that a national climate change response strategy will promote integration between the programmes of the various government departments involved to maximise the benefits to the country as a whole, while minimising negative impacts. Further, as climate change response actions can potentially act as a significant factor in boosting sustainable economic and social development, a national strategy specifically designed to bring this about is clearly in the national interest, supporting the major objectives of the government, including poverty alleviation and the creation of jobs. A number of principles and factors guided the conception of the strategy and are required to be implemented. These are: » Ensuring that the strategy is consistent with national priorities, including poverty alleviation, access to basic amenities including infrastructure development, job creation, rural development, foreign investment, human resource development and improved health, leading to sustainable economic growth. » Ensuring alignment with the need to consistently use locally available resources. » Ensuring compliance with international obligations. » Recognizing that climate change is a cross cutting issue that demands integration across the work programmes of other departments and stakeholders, and across many sectors of industry, business, and the community. » Focussing on those areas that promote sustainable development. » Promoting programmes that will build capacity, raise awareness, and improve education in climate change issues. » Encouraging programmes that will harness existing national technological competencies. » Reviewing the strategy constantly in the light of national priorities and international trends. » Recognizing that South Africa's emissions will continue to increase as development is realised.

	The strategy was devised through an integrated approach and considers policies and programmes of other government departments and the fact that South Africa is a developing country. This will ensure that the principles of sustainable development are adequately served and do not conflict with existing development policies.
Strategic Integrated Projects (SIPs)	The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across 18 Strategic Integrated Projects (SIPs) which have 5 core functions, including to unlock opportunity, transform the economic landscape, create new jobs, strengthen the delivery of basic services, and support the integration of African economies. » SIP 8 of the energy SIPs supports the development of RE projects as follows: *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) and supports bio-fuel production facilities.* » SIP 20: Energy (gazetted in GG 43547 on 24 July 2020). Includes 3 sub-projects; a. Emergency/Risk Mitigation Power Purchase Procurement Programme (2000MW): National b. Small IPP Power Purchase Procurement Programme (100MW): National c. Embedded Generation Investment Programme (EGIP)-400MW: National The Embedded Generation Investment Programme (EGIP) forms part of the Energy Strategic Integrated Project No. 20c. The development of Harmony Joel Solar PV Facility is aligned with SIP20c and is classified as a Strategic Integrated Project (SIP) and is to be managed within the requirements as set out in the Infrastructure Development Act (Act No. 23 of 2014) and its amendments. The project, together with any associated Infrastructure such as but not limited to access roads, substations and overhead power lines, is regarded as a SIP to be expedited in terms of Schedule 2 (Section 17(2)) of the Infrastructure Development Act (Act No. 23 of 2014).
National Protected Area Expansion Strategy (2010)	The National Protected Area Expansion Strategy 2010 (NPAES) areas were identified through a systematic biodiversity planning process. They present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES and were designed with strong emphasis on climate change resilience and requirements for protecting freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine scale planning which may identify a range of different priority sites based on local requirements, constraints, and opportunities (NPAES, 2010). According to the NPAES, there are no areas within the study area that have been identified as priority areas for inclusion in future protected areas. The study area is therefore outside the NPAES focus area.
National Biodiversity Economy Strategy (NBES) (March 2016)	The biodiversity economy of South Africa encompasses the businesses and economic activities that either directly depend on biodiversity for their core business or that contribute to conservation of biodiversity through their activities. The commercial wildlife and the bioprospecting industries of South Africa provide cornerstones for the biodiversity economy and are the focus of this strategy. Both the wildlife and bioprospecting sub-sectors of the biodiversity economy have already demonstrated the potential for significant future development and growth. In the study commissioned on the situational analysis of the biodiversity economy, the

contribution of the biodiversity economy to the national economy can be measured in terms of Gross Domestic Product (GDP), with the wildlife and bioprospecting industries contributing approximately R3 billion to GDP in 2013. Growth in the wildlife and bioprospecting industries can make a significant impact on the national economy, while contributing to national imperatives such as job creation, rural development, and conservation of our natural resources.

The Wildlife Industry value chain is centred on game and wildlife farming/ranching activities that relate to the stocking, trading, breeding, and hunting of game, and all the services and goods required to support this value chain. The key drivers of this value chain include domestic hunters, international hunters, and a growing retail market demand for wildlife products such as game meat and taxidermy products. This sector is therefore characterised by an interesting combination of agriculture, eco-tourism, and conservation characteristics.

Over the period 2008-2013, the total Wildlife Industry market grew by more than 14% per year. This growth comprised an average annual growth exceeding 6% in domestic hunting, a decrease in international hunting, and an exponential growth in live auction sales. It is considered likely that the consolidated Wildlife Industry has the potential to experience a weighted average annual growth rate of between 4 %-14 % per year up to 2030.

In order for the wildlife and bioprospecting sub-sectors of the biodiversity economy to achieve its full potential, a strategic partnership between the state, private sector and communities is required. To this end, a National Biodiversity Economy Strategy (NBES) is required to guide the sustainable growth of the wildlife and bioprospecting industries and to provide a basis for addressing constraints to growth, ensuring sustainability, identifying clear stakeholder's responsibilities, and monitoring progress of the Enabling Actions.

The Vision of NBES is to optimise the total economic benefits of the wildlife and bioprospecting industries through its sustainable use, in line with the Vision of the Department of Environmental Affairs. The purpose of NBES is to provide a 14-year national coordination, leadership and guidance to the development and growth of the biodiversity economy.

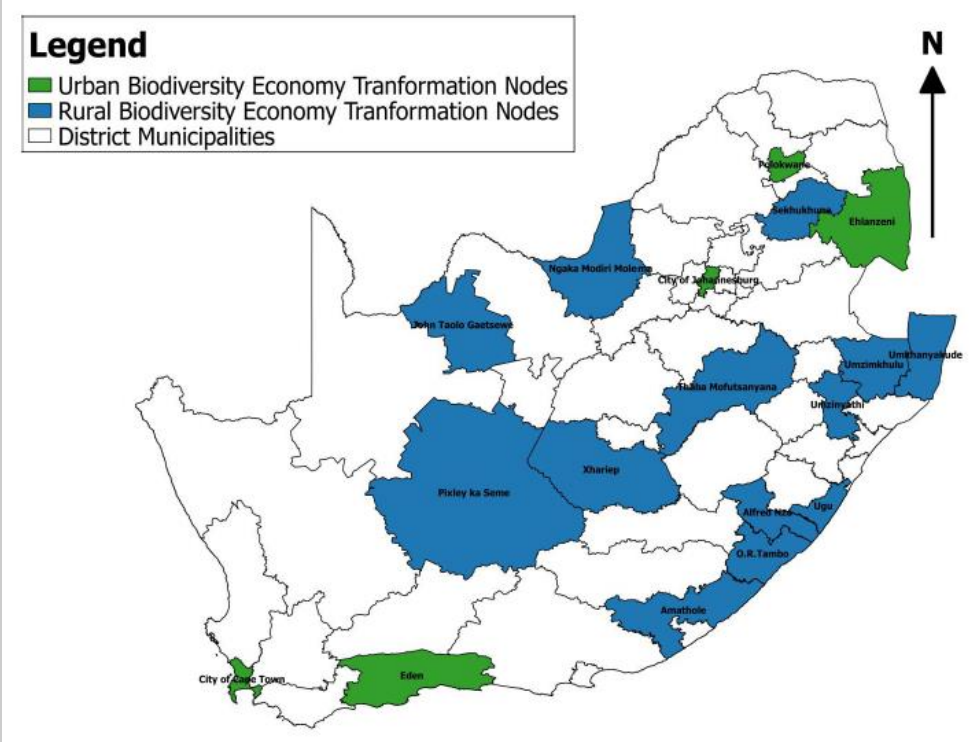
NBES has set an industry growth goal stating that by 2030, the South African biodiversity economy will achieve an average annualised GDP growth rate of 10% per annum. This envisioned growth curve extends into the year 2030 and is aligned to the efforts of the country's National Development Plan, Vision 2030. The NBES seeks to contribute to the transformation of the biodiversity economy in South Africa through inclusive economic opportunities, reflected by a sector which is equitable - equitable access to resources, equitable and fair processes, and procedures and equitable in distribution of resources (i.e., business, human, financial, indigenous species, land, water) in the market.

To address these transformation NBES imperatives, NBES has the principles of:

- Conservation of biodiversity and ecological infrastructure
- Sustainable use of indigenous resources
- Fair and equitable beneficiation
- Socio-economic sustainability

» Incentive driven compliance to regulation
» Ethical practices
» Improving quality and standards of products.

The NBES provides the opportunity to redistribute South Africa's indigenous biological/ genetic resources in an equitable manner, across various income categories and settlement areas of the country. The NBES has prioritised nodes in the country for biodiversity economy transformation, referred to as BET nodes. NBES prioritises 18 BET nodes, 13 rural and 5 urban districts across the nine provinces of the country, with communities having been prioritised for development of small and medium size enterprises and community-based initiatives which sustainably use of indigenous biological and/or genetic resources. The municipality within which the project is proposed is not identified as a priority area.



3.3.3 Policy and planning at a Provincial Level

A brief review of the most relevant provincial policies is provided below in **Table 3.3**. The proposed development is considered to align with the aims of these policies, even if contributions to achieving the goals therein are only minor.

Table 3.3: Relevant provincial legislation and policies for Harmony Joel Solar PV Facility

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
Free State Provincial Growth and Development Strategy (FSGDS) (2013 - 2030)	The overarching goal of the Free State Growth and Development Strategy (FSGDS) is to align the provincial and national policies and programmes and to guide development in terms of effective and efficient management and governance to achieve growth and development. The strategy is a living document that uses the latest business planning and evaluation tools in order to maximise the effect of all spending.

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
	Based on the social and economic development challenges of the Province, the Strategy identifies a few primary objectives, including stimulating economic development and developing and enhancing the infrastructure for economic growth and social development, poverty alleviation through human and social development, ensuring a safe and secure environment for all and the promotion of effective and efficient governance and administration. The development of the solar facility supports the overall objective of stimulating economic development and infrastructure investment towards growth and social development, by contributing to the energy mix, supply and infrastructure of the province. The development of the facility will also contribute (albeit limited) to the alleviation of poverty through the creation of direct and indirect employment opportunities and well as skills development.
Free State Provincial Growth and Development Strategy (FSGDS), Revised October 2013	The revised FSGDS refers to specific imperatives which sets the tone and pace for shared growth and development in the Province. These include: » The need to effectively use scarce resources within the Province, while addressing the real causes of development challenges. » The need to accelerate service delivery based on a common provincial development agenda as the basis for provincial strategic direction. » The need to identify investment opportunities and provide an environment of certainty critical for private-sector investment. » The need to promote intergovernmental coordination between the three spheres of government. » The need to facilitate facilitates the implementation of the People's Contract within the Province. » The need to provide a common vision as the basis for common action amongst all stakeholders, both inside and outside government. » The need to provide a framework for budgets, implementation, performance management and spatial development. The development of the solar PV Facility will assist with the need to effectively use scarce resources and the need to identify investment opportunities, including private sector-investment. The development of a solar facility reduces the need to make use of non-renewable resources for the generation of electricity and opens up the Province to further future solar energy development.
Free State Provincial Spatial Development Framework (PSDF) 2013 - Executive Summary (Inception Report)	The Free State PSDF is a provincial spatial and strategic planning policy that responds to and complies with, in particular, the National Development Plan Vision 2030 and the National Spatial Development Perspective (NSDP). The latter encourages all spheres of government to prepare spatial development plans and frameworks (such as the PSDF) that promote a developmental state in accordance with the principles of global sustainability as is advocated by, among others, the South African Constitution and the enabling legislation. The Free State Provincial Growth and Development Strategy states that sustainable economic development is the only effective means by which the most significant challenge of the Free State, namely poverty, can be addressed. The PSDF gives practical effect to sustainable development, which is defined as development that meets the

Relevant legislation or policy	Relevance to Harmony Joel Solar PV Facility
	needs of the present generation without compromising the ability of future generations to meet their own needs. The PSDF is prepared in accordance with bioregional planning principles that were adapted to suit the site-specific requirements of the Free State. It incorporates and complies with the relevant protocols, conventions, agreements, legislation and policy at all applicable levels of planning, ranging from the international to the local. The Harmony Joel Solar PV Facility will contribute to sustainable and economic development goals of the Free State PSDF, once completed and formally adopted.
Free State Green Economy Strategy (2014)	This Green Economy Strategy for Free State Province (FSGES) was developed in alignment with the national green economy strategy elaborated in the National Green Economy Framework and Green Economy Accord, as well the Free State Provincial Growth and Development Strategy. The development process was spearheaded by the Department of Economic Development, Tourism and Environmental Affairs (DESTEA). The objective was to develop a green economy strategy to assist the Province to, amongst others, improve environmental quality and economic growth, and to develop green industries and energy efficiency within the Province. The Harmony Joel Solar PV Facility will contribute to the aim of energy efficiency and green industry while promoting economic growth and is therefore consistent with this strategy.
Free State Investment Prospectus (2019)	The Premier of the Free State considers providing access to individual investors to accurate and pertinent information makes it easier for investors to glean investor ready opportunities that are currently available in the Free State. Opportunity of the development of renewable energy is considered in the key sectors overview. The prospectus states that opportunities are opening up in the Province for the energy sector, including renewable energy. Rezoning for the development of multiple solar energy facilities has already been undertaken in the Province. Considering the future opportunities available for the development of renewable energy facilities (including solar PV facilities) the development of the Harmony Joel Solar PV Facility is considered to be in-line with the Investment Prospectus of the Province.

3.3.4 Policy and planning at a Local Level

The local tiers of government relevant to the Harmony Joel Solar PV Facility project are the **Masilonyana Local Municipality**, which forms part of the **Lejweleputswa District Municipality**. Instruments and/or policies at both the district and local level contain objectives which align with the development of Harmony Joel Solar PV Facility. These include, economic growth, job creation, community upliftment and poverty alleviation.

Table 3.4: Relevant district and local legislation and policies for Harmony Joel Solar PV Facility

Relevant policy	Relevance to the Harmony Joel Solar PV facility
Integrated Development Plan (IDP) of the	The IDP entails processes through which a municipality, its constituencies, various sector departments, interested and affected parties come together to prepare clear objectives and strategies which serve to guide allocation and management of

Relevant policy	Relevance to the Harmony Joel Solar PV facility
Lejweleputswa District (2021/2022)	resources within the municipal area of jurisdiction. The Integrated Development Plan spans a five-year period. The IDP is used by the municipality to fulfil its role of "developmental local governance". Central to this role are the objectives and strategies contained in the plan, which guides the municipality in the realm of: Municipal Budgeting Institutional re-structuring in order to fulfil the strategic intent of the plan Integrating various sectors (housing, land use, agriculture) with economic, social dimensions. Performance Management Systems The Integrated Development Plan for Lejweleputswa District Municipality was commissioned and finally adopted in 2002 in terms of the Municipal Systems Act No. 32 of 2000.
Masilonyana Local Municipality Integrated Development Plan IDP (2020 – 2021)	The Masilonyana Local Municipality is committed to effective and transparent governance by being an integrated, safe and harmonious environment with effective service delivery to attract investors. It seeks to: a) Promoting economic development b) Providing sustainable services, and c) Improving the quality of life of all people. Transition to low carbon energy is what the municipality IDP strives to achieve and speed up and expand renewable energy, waste recycling, ensure buildings meet energy efficient standards. As part of its integrated environmental management & Climate change the following needs to be achieved: » Increase the environmental literacy levels of stakeholders » Reduce the major sources of greenhouse gas emissions and digesting the large-scale supply of clean energy » Energy saving The Joel Solar PV Facility indirectly contributes to the overall climate change response plan of the district municipality by providing energy without reliance on fossil fuels and therefore exacerbating climate change at provincial and national level. For the mining sector the major challenges include the over-dependence of the local economies on mining. Linked to these key sectors is the need to consider youth development. The key issues pertaining to both the province and the MLM include: » African youths are the majority in the Free State, and they are also the most disadvantaged. Consequently, all attempts at intervening on behalf of youths should mainly target the African youth. » There is an inherent lack of skills particularly amongst the African and Coloured youths, which leads to high unemployment amongst these groups. » Youths are both perpetrators and victims of wrong social behaviours. They are at risk of being exposed to risky sexual behaviour, HIV & AIDS, and being head of a household.

CHAPTER 4: NEED AND DESIRABILITY & ALTERNATIVES

Appendix 3 of the 2014 EIA Regulations (GNR 326) requires that an EIA Report include a motivation for the need and desirability of the proposed development, including the need and desirability of the activity in the context of the preferred location. The need and desirability of the development needs to consider whether it is the right time and the right place for locating the type of land-use/activity being proposed. The need and desirability of a proposed development is, therefore, associated with the wise use of land, and should be able to respond to the question such as, but not limited to, what the most sustainable use of the land may be.

This Chapter provides an overview of the suitability of the Harmony Joel Solar PV Facility being developed at the preferred project location from an international, national, regional, and site-specific perspective. It provides an overview of the need and desirability, and perceived benefits of the project specifically. This Chapter provides an overview of the various alternatives considered for Harmony Joel Solar PV Facility as part of the EIA Process.

4.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Scope of Assessment and Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
3(1)(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;	The identification and motivation for the preferred project site, the development area within the project site, the proposed activity and the proposed technology is included in **sections 4.3.1, 4.3.3** and **4.3.4.**
3(1)(h)(i) details of the development alternatives considered.	The details of all alternatives considered as part of the Harmony Joel Solar PV Facility are included in **sections 4.3.1 – 4.3.5**.
3(1)(h)(ix) if no alternative development footprint for the activity were investigated, the motivation for not considering such.	The site selection process followed by the developer in order to identify the preferred project site and development footprint is described in **Section 4.3.1**.
3(1)(h)(x) a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report.	Where no alternatives have been considered, motivation has been included. This is included in **Section 4.3**.
(h)(ix) if no alternative development locations for the activity were investigated, the motivation for not considering such	The details of the alternatives considered as part of the Harmony Joel Solar PV and as part of the EIA Phase have been included in **Section 4.7**. Where no alternatives are being considered a motivation has been included.

4.2 Need and Desirability of the Harmony Joel Solar PV Facility

South Africa is a developing country with expanding energy demands and abundant coal supplies which is heavily relied upon to meet energy needs. The country acknowledges that carbon dioxide emissions from

the usage of fossil fuels like coal and petroleum products have heightened worldwide concerns regarding climate change.

In South Africa, the problem of insufficient generation and supply is seen through the lens of global climate change, and the demand for increased investment in sustainable energy production is rapidly increasing. Renewable energy technologies may now compete with fossil-fuel technology because the government has created an enabling environment with an adequate legal and regulatory framework, and the technologies have become more economically feasible. As a result, the renewable energy industry will be able to function, grow, and contribute positively to the economy of South Africa and the global environment.

The National Development Plan 2030 formulated certain principles to guide "the transition to an environmentally sustainable low-carbon economy, moving from policy, to process, to action". The Harmony Joel Solar PV Facility aims to meet these principles to accomplish Harmony Gold's decarbonisation goals by capitalising on the new 100MW embedded generation threshold and supplement the electricity required for operation which are being purchased by the Harmony Joel Mine from Eskom, through the self-generation of electricity from the solar energy resource. This opportunity leverages the potential cost savings of such supplementary supply, while taking advantage of the reduced carbon footprint of the renewable nature of the technology.

In addition, the project would contribute towards meeting the national energy target as set by the Department of Energy (DoE) and assist the government in achieving its proposed renewable energy target of 17 800 MW by 2030. The proposed project would also have international significance as it contributes to South Africa being able to meet some of its international obligations by aligning domestic policy with internationally agreed strategies and standards as set by the United Nations Framework Convention on Climate Change (UNFCCC), Kyoto Protocol, and United Nations Convention on Biological Diversity (UNCBD) all of which South Africa is a signatory to. Renewable energy is critical to South Africa as this source of energy is recognised as a major contribution to climate protection, has a much lower environmental impact, as well as advancing economic and social development.

The need and desirability from the perspective of the local community as reflected in the IDP and SDF for the area has been considered in this EIA Report. In the South African context, developmental needs (community needs) are often determined through the above planning measures (IDP and SDF). Although the renewable energy sector is not explicitly identified as a sector or initiative in all current municipal policy and planning documents as outlined above, it could contribute positively to the needs of the local community, including development, social services, education, and employment opportunities in this area through sustainable provision of energy to the Harmony Joel Mine. The Harmony Joel Solar PV Facility will create employment and business opportunities during the construction and operation phases, as well as the opportunity for skills development for the local community. In addition, indirect benefits and spend in the local area will benefit the local community.

The DFFE (then, the Department of Environmental Affairs) Guideline on Need and Desirability (GN R891, 2014) notes that while addressing the growth of the national economy through the implementation of various national policies and strategies, it is also essential that these policies take cognisance of strategic concerns such as climate change, food security, as well as the sustainability in supply of natural resources and the status of our ecosystem services. The DFFE guideline further notes that at a project level (as part of an EIA process), the need and desirability of the project should take into consideration the content of regional and

local plans, frameworks, and strategies. In light of the above, this section aims to provide an overview of the need and desirability for the proposed Harmony Joel Solar PV Facility by highlighting how it is aligned with the strategic context of international, national, regional, and local development policy and planning, and broader societal needs as appropriate.

4.2.1 Need for the Harmony Joel Solar PV Facility

The uptake of renewable energy sources in the mining sector has been a slow-moving transition – which can largely be attributed to the cost involved in establishing a solar/wind power plant, the added costs associated with storing that energy, regulatory challenges, and a limited track record in the industry.

Pressure from government and investors to improve environmental footprints by reducing carbon emissions is now one of the top five agenda items in business development, and incorporating renewable energy is an easy way to achieve this. In August 2021 with the aim to bolster energy security, President Cyril Ramaphosa announced that the licence threshold for independent power producers would be lifted from 1 MW to 100 MW, opening the door for companies to build their own generation facilities without the need to obtain a generation license from the National Energy Regulator of South Africa (NERSA).

Reliable and cost-effective energy, sourced and generated through private or internal arrangements eliminates the possibility of unexpected power outages and unreliable grid power from government-owned entities such as Eskom. The additional energy supply helps reduce the burden on such entities and reduces the need for energy management alternatives such as load shedding.

In terms of value creation through sustainability it is estimated that the Harmony Gold suite of solar PV projects (of which the Harmony Joel Solar PV Facility is one) will offset the liabilities of anticipated costs pending Scope 2 carbon taxes, against the backdrop of deregulation of the energy sector in South Africa, represents a big step forward for mining and private power industries in South Africa.

The construction of the solar energy plants will be a watershed moment for Harmony, as not only will these transactions help deliver on the Mine's environmental and social obligations and undertakings, but they will also de-risk the business and deliver many socio-economic benefits, including ensuring that investors and other stakeholders continue to derive value and positive returns in a global climate of energy uncertainty.

It is anticipated that this emission profile will decline over time, in line with Harmony Gold production profile, as well as when the renewable energy mix increases in the national electricity grid. However, a number of active decarbonisation measures are currently under way ahead of that amelioration.

Owing to the emissions profile, one of the strongest levers that the Company can pull is the deployment of renewable energy, with three upcoming solar photovoltaic (PV) projects (of which Harmony Joel Solar PV forms part) and wind energy projects to enable rapid decarbonisation of these particular operations.

Phase 3 targets are also being set for those emissions that occur through the third-party processing of the company's concentrate, where electricity will continue to remain the focus of this operation owing to its emissions predominance.

4.2.2 Receptiveness of the proposed development area for the establishment of the Harmony Joel Solar PV Facility

The placement of a PV facility is strongly dependent on several factors including climatic conditions (solar resource), topography, the location of the site, land availability and suitability, the extent of the site and the need and desirability for the project. From a local level perspective, the project site and development area have specifically been identified by the proponent as being highly desirable from a technical perspective for the development of a PV facility due to the following site characteristics:

» **Proximity to the Harmony Joel Mine:** The development area is located in close proximity to the Harmony Joel Mine, which will be the exclusive user of the generated power and is therefore preferred for development of the proposed PV Facility. In addition, there is existing available infrastructure that forms part of the grid connection solution in order to be able to evacuate the generated power from the PV facility and service the Harmony Joel Mine. The grid will tie-in behind the meter of the Harmony customer substation.

» **Land suitability and land use activities** – The project site was identified considering the feasible solar resource and the property is deemed to be technically feasible by the project developer for a PV development. The project site is currently owned by Harmony Gold and has an extent of 1000ha, which is more than sufficient for the development of a 18MW Solar PV facility. The proposed development is located adjacent to the H.J. Joel Private Nature Reserve but will not impede in any tourist activities. The development area is compatible with the surrounding land uses and does not present a conflicting land use.

  The broader project site is currently used for activities associated with mining, agricultural activities (livestock grazing) and tourist activities. The area identified for the PV facility, although on mining land will not impact on the mining activities. The development of the solar PV facility on this property will ensure the continuation of an economically viable land use and will support the long-term operation of the mine. Sites that facilitate easy construction conditions (i.e., relatively flat topography, lack of major rock outcrops etc.) are favoured during the site selection process for a solar PV facility, and the proposed development area fits this criterion.

» **Proximity to Towns with a Need for Socio-Economic Upliftment:** The project is located near the towns of Theunissen and Virginia in the Free State. As per the Integrated Development Planning, these districts still experience high levels of unemployment, poverty, and inequality mainly amongst the youth, women, and people with disabilities. With the development of the Harmony Joel Solar PV Facility, secondary social benefits can be expected in terms of additional spend in the nearby towns due to the increased demand for goods and services. Considering the above, it is clear that a need for employment opportunities and skills development is present within the area.

Taking into consideration the solar resource, proximity to the mine, land availability and suitability, geographical and topographical location, access to road infrastructure and proximity to towns with a need for socio-economic upliftment, the development of the Harmony Joel Solar PV Facility within the project site is considered to be desirable.

4.2.3 Benefits of Renewable Energy and the Need and Desirability in the South African Context

In support of the Paris Agreement and the United Nations Sustainable Development Goals, Harmony Gold plans to Roll out the Phase 1, Phase 2 and Phase 3 of their renewable energy strategy over the next four years, targeting a 20% reduction in carbon dioxide (CO_2) emissions by 2026, as well as achieve carbon neutrality emissions by 2045 as part of the company's Environmental, Social and Governance (ESG) strategy.

High and volatile energy costs are a key concern to the mining industry where above-inflation cost escalations and production interruptions threaten the sustainability of their operations. It has been estimated that Harmony Gold South Africa spends approximately 18% of their annual operating costs on energy consumption. The uncertainty around energy cost escalations in South Africa, underpinned by severe Eskom financial constraints, is compounded by concerns about the reliability of energy supply. Adoption of renewable energy as a supply source partially mitigates these operational risks and in turn improves the sustainability of the Harmony Gold mining operations.

In Phase 1 of Harmony's decarbonisation strategy, the Company has established three plants with a total capacity of 30MW which will deliver more than 68 gigawatt hours ("GWh") of clean power to Harmony's Free State operations, mitigating 65 000 tonnes of carbon dioxide emissions in their first 12 months of operation.

In Phase 2, the Company will be building an additional 144MW of renewable energy at their various longer-life mines. Harmony Gold estimates that the project will deliver over R500 million per annum in electricity cost savings once it reaches full production. The plants rank amongst the biggest solar PV plants for private offtake in South Africa to date, and construction is planned to start by June 2023. The three on-site solar PV plants are to be developed at various Harmony Gold Free State mining operations as part of Harmony's strategy to address its Energy and Decarbonisation goals. The proposed solar PV plants will be connected into their respective substations at the corresponding operational loads. The PV facilities include:

- 100MW Harmony Moab Khotsong Solar PV Facility, Vierfontein, Free State Province
- 14MW Harmony Central Plant Solar PV Facility, Virginia, Free State Province
- 30MW Harmony One Plant Solar PV Facility, Virginia, Free State Province

Phase 3 is still in the planning stage and progressing as anticipated to deliver additional clean power to Harmony's operations. The harmony Joel PV facility forms part of the Phase 3 projects.

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

- **National and Provincial and Local Planning Considerations** - Renewable energy is strongly supported at a national, provincial, and local level. The introduction and adoption of the New Growth Path in South Africa has seen increased emphasis towards developing and growing the green economy within the country, supported among others, by the Industrial Policy Action Plan (IPAP2) of 2010 and revised Integrated Resource Plan (IRP2), additionally the Cabinet approved a number of key supportive policies. The policies in question included the Medium-term Strategic Framework (MTSF) 2009–2014, the Ten-year Innovation Plan, the revised Industrial Policy Action Plan for 2010/11–2012/13 (IPAP2), and others mentioned previously. Nationally, the development and investment in renewable energy is further supported by the National Development Plan (NDP), New Growth Path Framework and National

Infrastructure Plan, which all refer to renewable energy, together with the White Paper on Renewable Energy which has been adopted by Parliament.

- **National and Provincial Sustainable Energy Programs** - Various funding mechanisms and programmes related to renewable energy have also been considered. One of these, the Independent Power Producer Procurement Programme contributes substantially towards socio-economic and environmentally sustainable growth. It is also aimed at stimulating the renewable energy industry in South Africa. This programme has opened the market for renewable energy substantially in South Africa and holds sustainable potential for the Free State Province. The Green Energy Efficiency Fund supports the introduction of self-use renewable energy technologies. Also available are the South African Renewables Initiative and the Renewable Energy Market Transformation Project. There are also a number of mechanisms that support renewable energy production linked to domestic manufacturing and the use of green technologies such as the Manufacturing Competitiveness Enhancement Programme.
- **Free State Sustainable Energy Programs –** The Free State Province has aimed to transition to Green Economy by the year 2030. Each of the four District Municipalities and the Metro has come up with their vision and a mission statement. The Province has drafted long-term and short-term building blocks to the Green Economy transition. The Free State has significant potential for the harvesting of solar energy. Projects in the pipeline for this sector include the manufacturing of solar water geysers and the manufacturing of solar-modules and solar panels assembly facility. The Xhariep region has the second best solar-radiation index after Upington in the Northern Cape. It provides the opportunity to harness the natural sun power and to generate electricity.
- **Socio-economic upliftment of local communities:** The Harmony Joel Solar PV Facility has the potential to create much needed employment for unskilled locals during the construction phase. Where possible, training opportunities will also be afforded to qualified local people who can be upskilled to undertake certain roles during the construction and operation phases. Some of the challenges facing the Local and District municipalities, as detailed in the IDPs include high rates of unemployment and high levels of poverty. The Local and District municipalities are therefore in need of economic development, sustainable employment opportunities and growth in personal income levels. A study undertaken by the DMRE, National Treasury and the Development Bank of Southern Africa (DBSA) in June 2017 found that employment opportunities created during the construction phase of renewable energy projects implemented to date had created 40% more jobs 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.
- **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.
- **Exploitation of significant renewable energy resource:** At present, valuable renewable resources, including biomass by-products, solar irradiation 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 resource and competitive procurement processes, both wind power and solar PV power are now proven in South Africa as cheaper forms of energy generation 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.

- **Pollution reduction**: The release of by-products through the burning of fossil fuels for electricity generation has a particularly hazardous impact on human health and contributes to ecosystem degradation. The use of solar irradiation 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. The development of the Harmony Joel Solar PV Facility and the associated electricity generated as a result of the facility, will result in considerable savings on tons of CO2 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 the Paris Agreement, 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. The construction phase will create temporary employment opportunities and the operation phase will create limited full-time employment opportunities.
- **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.

4.3 Alternatives Considered during the EIA Process

In accordance with the requirements of Appendix 3 of the 2014 Environmental Impact Assessment (EIA) Regulations (GNR 326), reasonable and feasible alternatives including but not limited to site and technology alternatives, as well as the "do-nothing" alternative should be considered. Several other solar renewable energy facilities are planned within the broader study area, supporting the suitability of the area for solar PV projects.

The DFFE 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 Harmony Joel Solar PV Facility, a solar energy facility with capacity of up to 18MW and associated infrastructure proposed to be developed and form part of Harmony Gold's strategic shift to decarbonisation in the mining industry.

4.3.1 Consideration of Fundamentally Different Alternatives

Fundamentally different alternatives are usually assessed at a strategic level and, as a result, project specific EIAs are therefore limited in scope and ability to address fundamentally different alternatives. At a strategic level, electricity generating alternatives have been addressed as part of the DMRE's current Integrated Resource Plan for Electricity 2010 – 2030 (IRP)[17], and will continue to be addressed as part of future revisions.

In this regard, the need for renewable energy power generation from solar PV facilities has been identified as part of the technology mix for power generation in the country for the next 20 years. Of relevance to the proposed project is the IRP 2019 which outlines South Africa's stepping stones to reduce coal's contribution to the energy mix to below 60%, in favour of renewables like wind, and PV technologies, which would account for 25% of the country's energy mix by 2030, furthermore the DMRE plans to repurpose existing coal-fired plants with renewable energy plants and/or battery storage solutions, and training people in new skills to ensure that jobs can be transferred. The IRP includes provision for distributed generation capacity for own-use. The threshold for distributed generation was raised to 100MW in August 2021. Project developers are exempted from applying for a license but are required to register with the National Energy Regulator of South Africa (NERSA) and comply with the relevant grid code(s).

The fundamental energy generation alternatives were assessed and considered within the development of the IRP and the need for the development of renewable energy projects has been defined. Therefore, fundamentally different alternatives to the proposed project are not considered within this EIA process.

4.3.2 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 for:

- The property on which, or location where the activity is proposed to be undertaken.
- The type of activity to be undertaken.
- 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 sub-headings below and where no alternatives are applicable, a motivation has been included.

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

a) Property or Location Alternatives

The placement of a solar PV facility is dependent on several factors, namely, land suitability, climatic conditions (solar irradiation levels), topography, the location and extent of the development area, availability of grid connection infrastructure, and the need and desirability of the project.

The Harmony Joel Solar PV facility is located 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen. The project site is considered highly favourable to establish a solar PV facility based on the evaluation of technical characteristics, including:

- Solar resource characteristics (including Global Horizontal Irradiation (GHI)).
- Land availability.
- Land use and geographical and topographical considerations.
- Access to the mine grid tie in point
- Site accessibility.
- Environmental and social aspects.

The Applicant considers the preferred development area within the study area as being highly favourable and suitable for the establishment of a solar PV facility. The PV facility will be located within close proximity of the Harmony Joel Mine processing plant.

The characteristics listed below were identified by the developer as the main aspects that play a role in the opportunities and limitations for the development of a Solar PV facility. The characteristics considered, and the results thereof, are discussed in the sections below.

- **Solar resource:** Solar resource is the first main driver of site selection and property viability when considering the development of Solar PV facilities. The economic viability of a solar PV facility is directly dependent on the annual direct solar irradiation values of the area within which it will operate. The Global Horizontal Irradiation (GHI) for the study area is between ~2000 - 2180 kWh/m^2/annum, which is considered favourable for the development of a solar PV facility.

- **Topography:** The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. The topography of the corridor can be described as generally favourable, when considering that most of the area consists of slopes of less than 1:5. The site is located at an altitude of between 900 and 940 meters above mean sea level (AMSL).

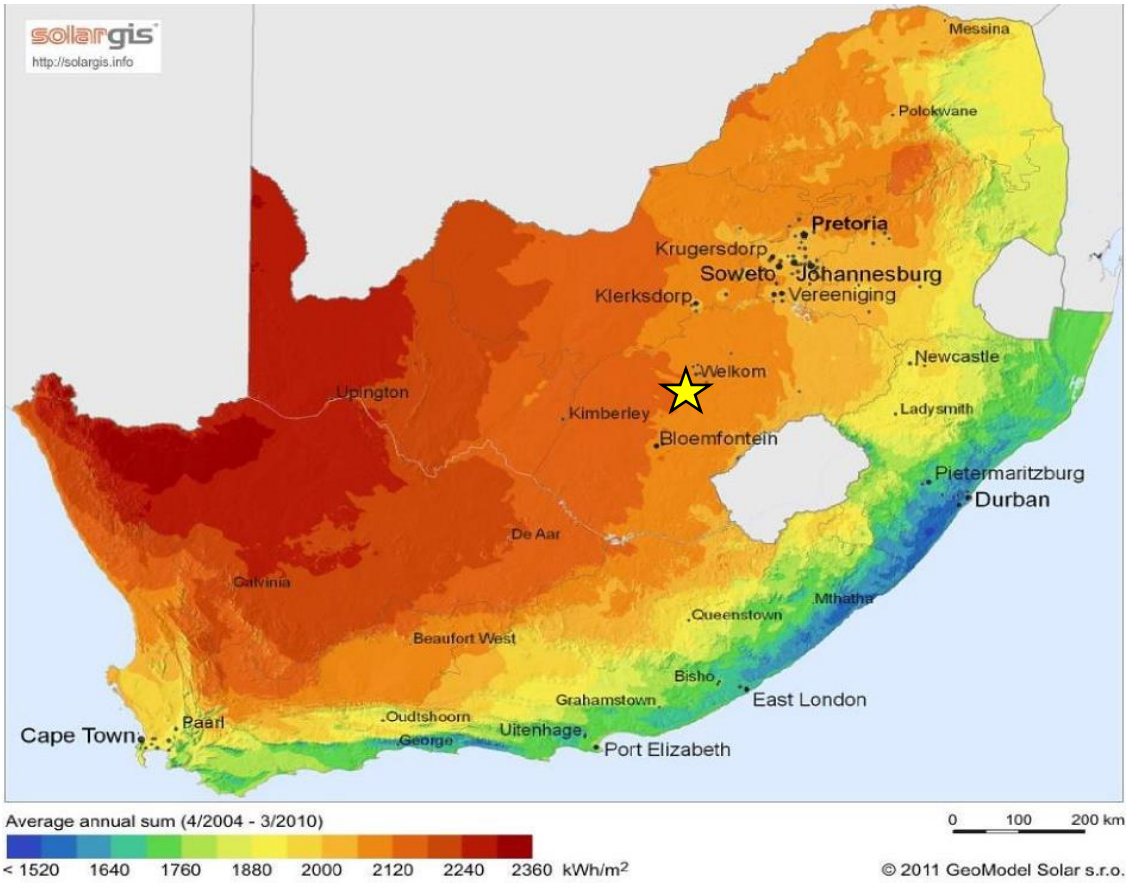


Figure 4.1: Solar irradiation map for South Africa. The approximate location of Harmony Joel Solar PV Facility site is indicated by the yellow star. (Source: adapted from GeoModel Solar, 2011)

» **Site extent and land availability:** The availability of land is a key feasibility criterion in the site selection process. The project site is of a suitable land size for the proposed 18MW facility. The development area, within which the project development footprint will be located, is 220ha. This area is considered to be sufficient for the planned 18MW PV facility and provides an opportunity for the avoidance of sensitive environmental features and areas. The project site is located on the Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but outside of the mining area (the project would not impact on mining activities).

» **Land use:** Land use activities within the broader region are predominantly described as maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site and tourist activities related to the H.J. Joel Private Nature Reserve to the south of the proposed site. The mining activities intensify further north (beyond the study area boundary), towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site.

» **Grid access:** A key factor in the siting of any solar PV facility is that the project must have a viable grid connection in order to evacuate the generated electricity. The grid connection point for the Harmony Joel Solar PV facility will be the Shafts 1 & 2 HJ Joel Mining (6.6/132kV) Substation located to the south-west of

the facility. A short grid connection solution will ensure that potential environmental impacts are kept to a minimum.

» **Access to Road Infrastructure and Site access:** The road network surrounding the site comprises of the R30 to the western side of the development site and there are various unnamed roads. The project site can be readily accessed via the main roads and unnamed Mine access roads. The site will be accessed via existing access points, therefore access spacing restrictions are not envisaged.

Taking into consideration the solar resource, grid access, land suitability, access to road infrastructure, the current land use of the project site and development area, the Harmony Joel Solar PV Facility project site was identified by the developer as being the most technically feasible and viable project site within the broader area for further investigation in support of an application for authorisation. As a result, no property alternatives are proposed as part of this EIA process.

b) Design and Layout Alternatives

The overall aim of the facility layout (i.e., development footprint) is to maximise electricity production through exposure to the solar resource, while minimising infrastructure, operation, and maintenance costs, and social and environmental impacts. The suitability of the site from an environmental perspective for the placement of the Harmony Joel Solar PV Facility in the area will be determined through the EIA process being undertaken for the facility. The findings of the specialist scoping assessments will assist the developer in selecting the optimum position for the PV arrays and associated infrastructures including, but not limited to, access roads, and laydown areas.

The affected property (i.e. 1000ha in which development area (~220ha) and facility footprint (~47ha) (refer to **Figure 4.2**) is sufficient in extent for the installation of a solar PV facility, while allowing for the avoidance of environmental site sensitivities. Findings from specialist field surveys were considered through the Scoping process in order to provide site specific information regarding the development area considered for the Harmony Joel Solar PV Facility.

The site extent is sufficient for the proposed development and therefore reduces the need to consider alternative locations for the PV facility and the associated infrastructure. Potential environmentally sensitive areas that have been identified as part of the Scoping Phase have been further considered within this EIA Phase. The environmental sensitivity identification process informed the layout design for the PV facility, avoiding sensitive areas as far as possible, and thereby ensuring that the layout plan taken forward for assessment during the EIA Phase is considered to be the most optimal from an environmental perspective.

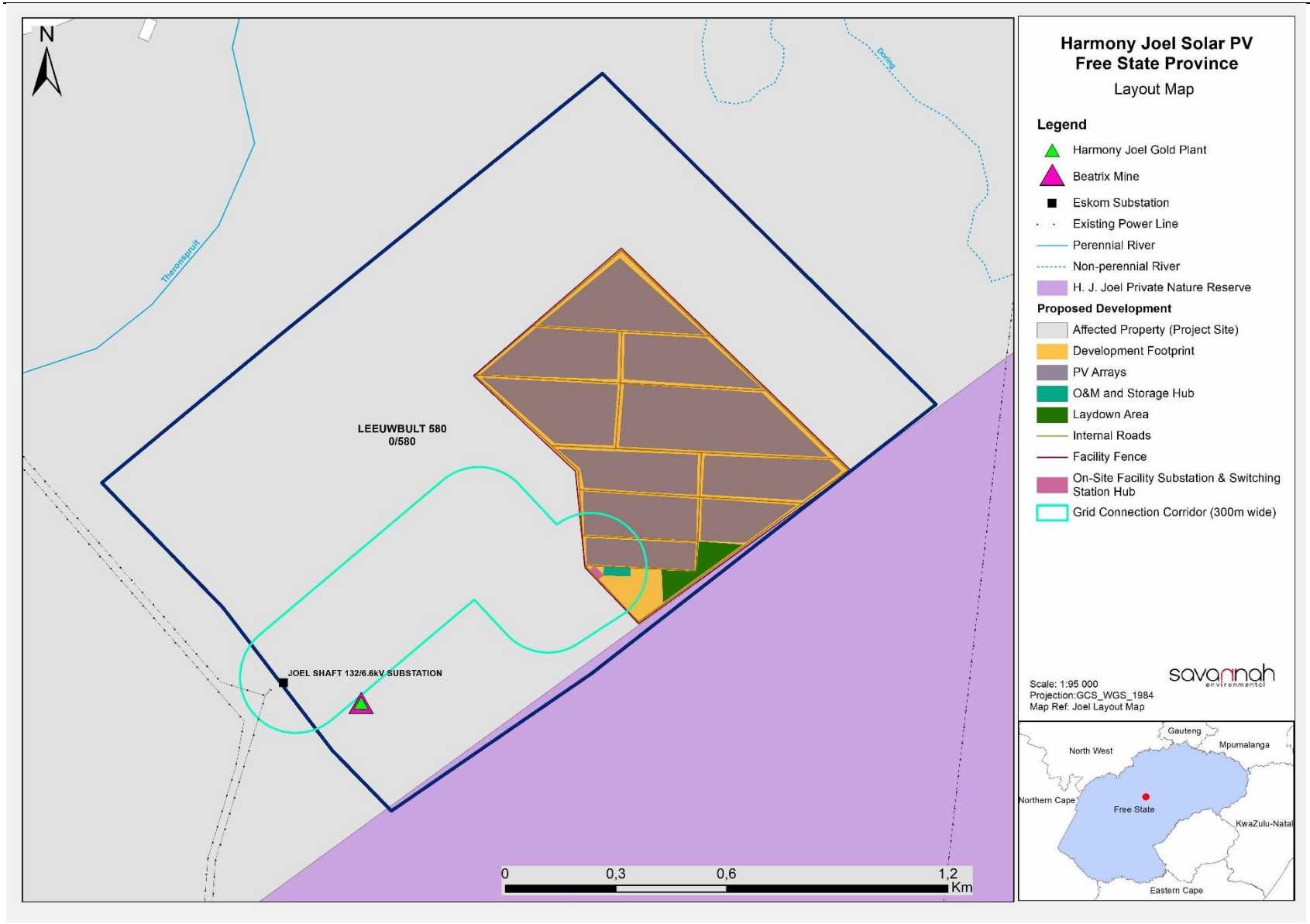


Figure 4.2: Figure indicating the Harmony Joel Solar PV Facility layout within the development area (refer to **Appendix L**). .

c) Activity Alternatives

In an aim to decarbonize, mines are choosing to move away from coal generated power sources, such as those provided by Eskom. The alternatives to electricity supply from coal in South Africa are renewable energy and nuclear energy. Only renewables are considered as a feasible option for the proposed project due to economic and technical considerations.

Possible reasonable and feasible alternatives in terms of renewable energy for the mine include Solar, Biomass, Hydro Energy and Wind Energy. However, based on the preliminary investigations undertaken by the Project Applicant, no other renewable energy technologies are deemed to be appropriate for the site.

Therefore, the implementation of a solar energy facility at the proposed project site is considered as the most favourable and feasible alternative for further investigation. In terms of project and location compatibility, the proposed solar facility is considered to be the most feasible renewable energy land use alternative. Therefore, only the development of a solar PV facility is considered within this report.

d) Technology Alternatives

Freegold Harmony (Pty) Ltd is a renewable energy project developer and as such is only considering renewable energy technologies for the generation of up to 18MW of electricity. The project site is located near the town of Theunissen in the Free State Province. Based on the solar irradiation resource available, the topography of the site, and the current significant restrictions placed on other natural resources such as water, the development of a solar facility is the preferred option from a technology perspective.

Limited technology options are available for solar energy facilities, and the use of those that are considered are usually differentiated by weather and temperature conditions that prevail in the area, so that optimality is obtained by the final site selection. PV technology is the preferred option for implementation on the site in comparison to CSP as it is associated with limited water demand requirements and a lower visual profile.

Based on available information, it is concluded by the developer that the project site is considered best suited for the development of a solar PV facility from a technical perspective. Therefore, no technology alternatives are considered within this EIA Report.

When considering PV as a technology choice, several types of panels are available, including inter alia:

- Bifacial PV panels
- Monofacial PV panels
- 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 PV technologies available relate to the extent of the facility, as well as the height of the facility (visual impacts), however the potential for environmental impacts remains similar in magnitude. 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. However, both options are considered to be acceptable for implementation from an environmental

perspective. Bifacial solar PV panels offer many advantages over monofacial PV panels, as power can be produced on both sides of the module, increasing total energy generation. The preference will therefore be determined on the basis of technical considerations and the site conditions.

The PV panels are designed to operate continuously for more than 20 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 panel selected for implementation.

The environmental impacts and constraints identified during the Scoping phase, were used by Freegold Harmony (Pty) Ltd to identify a preferred technology option. The facility will comprise of PV panels that will stand less than 5m above ground level. The solar panels will include centralised inverter stations, or string inverters mounted above ground.

e) The 'Do-Nothing' Alternatives

The 'do-nothing' alternative is the option of not constructing the Harmony Joel Solar PV facility at the identified site in the Free State. Should this alternative be selected, there would be no environmental impacts or benefits as a result of construction and operation activities associated with the solar PV facility for the Harmony Joel Mine. The 'do-nothing' alternative will therefore likely result in minimising the cumulative impact on the land, although the current land use activities on the project site (mining and agriculture) will continue. The socio-economic benefits associated with the implementation of the project would not be realised. The 'do-nothing alternative has been assessed as part of the EIA Phase (refer to **Chapter 7** and **Chapter 9** of this draft EIA Report).

4.4 Conclusion

The Applicant considers the preferred development footprint as being highly favourable and suitable for the establishment of a solar PV facility. The PV facility will be located within close proximity of the Harmony Mine processing plant. The proposed site was previously used for mining related activities, with relevant infrastructure in place suitable for the PV facility, including fencing, ablutions facilities, and stormwater control facilities. By utilising an already disturbed area, this would mean minimising the potential for cumulative environmental impacts. Furthermore, with the site being near the existing Mine Substation, this ensures that the power line will be relatively short, saving on costs and further reducing cumulative environmental impacts associated with power line infrastructure.

The characteristics considered were identified by the developer as the main aspects that play a role in the opportunities and limitations for the development of a Solar PV facility.

CHAPTER 5: APPROACH TO UNDERTAKING THE SCOPING/EIA PROCESS

In terms of the EIA Regulations of December 2014 (as amended) published in terms of the NEMA (Act No. 107 of 1998) as amended, the construction and operation of Harmony Joel Solar PV Facility is a listed activity requiring Environmental Authorisation (EA). The application for EA is required to be supported by a Scoping & Environmental Impact Assessment (EIA) process based on the clearance of an area of 20ha or more of indigenous vegetation[18]. The Harmony Joel Solar PV Facility will have a footprint of approximately 47ha and Activity 15 of Listing Notice 2 (GNR 325) is triggered.

An EIA process refers to the process undertaken in accordance with the requirements of the relevant EIA Regulations (the 2014 EIA Regulations (GNR 326), as amended), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process comprises two main phases: i.e. Scoping and EIA Phase, and is illustrated in **Figure 5.1**. Public Participation forms an important component of the process and is undertaken throughout both phases.

Figure 5.1: The Phases of an Environmental Impact Assessment (EIA) Process

The Scoping Phase of the EIA process aimed at identifying and describing potential issues associated with the proposed project and defining the extent of studies required within the EIA Phase. This was achieved through an evaluation of the proposed project involving desktop specialist inputs, as well as a consultation process with the Interested and Affected Parties (I&APs), including the decision-making authority, directly impacted landowners/occupiers, adjacent landowners/occupiers, relevant organs of state departments, ward councillors and other key stakeholders. This chapter serves to outline the process followed during the S&EIA process to date.

[18] "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.

5.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Content of Environmental Impact Assessment Report:

Requirement	Relevant Section
3(1)(d)(i) a description of the scope of the proposed activity, including all listed and specified activities triggered and being applied for and (ii) a description of the associated structures and infrastructure related to the development.	All listed activities triggered and applied for are included in **Section 5.2**, **Table 5.1**. The specific project activity relating to the relevant triggered listed activities has also been included in **Table 5.1.**
3(1)(h)(ii) details of the public participation process undertaken in terms of Regulation 41 of the Regulations, including copies of the supporting documents and inputs.	The public participation process followed throughout the EIA process of Harmony Joel Solar PV Facility is included in **Section 5.5.2** and copies of the supporting documents and inputs are included in **Appendix C**.
3(1)(h)(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.	All comments received from the commencement of the EIA process have been included and responded to in the Comments and Responses (C&R) Report (**Appendix C9**).
3(1)(h)(vi) the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives;	The methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks associated with the alternatives are included in **Section 5.5.3**.

5.2 Relevant legislative permitting requirements

The legislative permitting requirements applicable to Harmony Joel Solar PV Facility, as identified at this stage in the process and considered within this EIA process, are described in more detail under the respective sub-headings. Relevant permitting requirements are detailed within **Table 5.5**.

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

NEMA (No. 107 of 1998) 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 Environmental Authorisation (EA).

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 Application for EA.

The EIA process being conducted for Harmony Joel Solar PV Facility is being undertaken in accordance with Section 24(5) of the NEMA, which defines the procedure to be followed in applying for EA, 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 the NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the competent authority subject to the completion of an environmental assessment process (full Scoping and EIA).

Table 5.1 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 the Harmony Joel Solar PV Facility and associated infrastructure, and for which an application for EA has been made to the Department of Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA)

Table 5.1: 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 (as amended)	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 275kV or more. ***Electrical infrastructure is required to connect the PV facility to the existing Shafts 1 & 2 HJ Joel Mining substation and will consist of an on-site substation, switching substation and power lines of more than 33kV and less than 275kV. The site falls outside an urban area.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	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 or c) within 32 meters of a watercourse, measured from the edge of a watercourse ***Wetlands have been identified within the development area and grid connection corridor. The construction of the PV facility and associated infrastructure will require the establishment of infrastructure within a physical footprint exceeding 100 square metres within a watercourse or within 32 metres of a watercourse identified within the project area.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	14	The development and related operation of facilities and infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres. ***The development and operation of the project will require the construction and operation of facilities and infrastructure for the storage and handling of a dangerous good (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the on-site substation and switching substation where such***

Notice Number	Activity Number	Description of listed activity
		storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	19 (ii)	The infilling or depositing of any material of more than 10 cubic meters into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles, or rock of more than 10 cubic meters from a (i)watercourse. ***The development area is directly adjacent to a watercourse and will require the removal of >10 cubic metres of soil and rock from the watercourse during the construction phase of infrastructure, including access roads.***
Listing Notice 1 (GNR 327) 08 December 2014 (as amended)	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 1 hectare; excluding where such land has already been developed for residential, mixed, retail, commercial, industrial or institutional purposes. ***The Harmony Joel Solar PV Facility will be constructed and operated on land which has been used for livestock grazing. The development footprint considered for the establishment of the PV facility is ~47ha in extent and is located outside an urban area.***
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	15	The clearance of an area of 20ha or more of indigenous vegetation[19]. ***The clearance of an area of indigenous vegetation greater than 20ha in extent will be required for the development of the PV facility and associated infrastructure. The development footprint considered for the establishment of the PV facility is ~47ha in extent and is located outside an urban area.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	4(b)(i)(gg)	The development of a road wider than 4 metres with a reserve of less than 13.5 metres. b. Free State i. Outside urban areas: (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, excluding disturbed areas. ***The development of Harmony Joel Solar PV Facility will require the construction of a main gravel access road and internal gravel roads. The site is located in the Free State Province***

[19] "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
		outside of an urban area, and is located adjacent to the H.J. Joel Private Nature Reserve, which classified as Nature reserve in the South African Protected Areas Dataset (SAPAD) as well as NEMPAA.
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	10(b)(i)(gg)(hh)	The development and related operation of facilities or infrastructure for the storage, or storage and handling of a dangerous good where such storage occurs in containers with a combined capacity of 30 but not exceeding 80 cubic metres. b. Free State i. Outside urban areas: (gg) Areas within 10 kilometres from national parks or would heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve; or (hh) Areas within a watercourse or wetlands; or within 100 metres from the edge of a watercourse or wetland. ***The development of the project will require the construction and operation of facilities and infrastructure for the storage and handling of a dangerous good (combustible and flammable liquids, such as oils, lubricants, solvents) associated with the on-site substation and switching substation where such storage will occur inside containers with a combined capacity exceeding 30 cubic meters. The site is located in the Free State Province, outside an urban area, and is located adjacent to the H.J. Joel Private Nature Reserve, which classified as Nature reserve in the South African Protected Areas Dataset (SAPAD) as well as NEMPAA.***
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	12(b)(i)	The clearance of an area of 300 square metres or more of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan. b. Free State i. Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; ***The development of Harmony Joel Solar PV Facility will require the construction of a main gravel access road and internal gravel roads.*** ***The site is located in the Free State Province, outside an urban area and is located adjacent to the H.J. Joel Private Nature Reserve, which classified as Nature reserve in the South African Protected Areas Dataset (SAPAD).***

Notice Number	Activity Number	Description of listed activity
		The site is surrounded by CBA 1 areas, although not in a CBA but in an ESA.
Listing Notice 3 (GNR 324) 08 December 2014 (as amended)	14(ii)((a)(b)(i)(hh)	The development of – (ii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs – (a) within a watercourse; or (c) if no development setback exists, within 32 meters of a watercourse, measured from the edge of a watercourse. b. Free State i. Outside urban areas: (hh) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core area of a biosphere or reserve. ***The development of the Harmony Joel Solar PV Facility will require the establishment of infrastructure (including a power line, and internal access roads) with a physical footprint exceeding 10m² within 32m of a watercourse. The development footprint of the PV facility will be up to ~47ha in extent.*** ***The site is located in the Free State Province, outside an urban area and is located adjacent to the H.J. Joel Private Nature Reserve, which classified as Nature reserve in the South African Protected Areas Dataset (SAPAD) as well as NEMPAA.*** ***The site is surrounded by CBA 1 areas, although not in a CBA but in an ESA.***

5.2.2 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.

In terms of the NFEPA (2011) and the NBAs 2018 National Wetlands Map, two (2) watercourse features are located within the extent of the larger project area. Areas classified as watercourses will therefore be assessed in terms of the DWS regulations to determine if the development footprint will fall within any regulated areas such as the 500m wetland buffer.

Table 5.2 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 5.2: 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 (c)	Impeding or diverting the flow of water in a watercourse ***The development area considered for the establishment of the Harmony Joel Solar PV Facility has some watercourse and wetlands located within the extent of the project site that might be affected by the activities pertaining to the establishment of the solar PV facility.***
NWA (No. 36 of 1998)	Section 21 (i)	Altering the bed, banks, course, or characteristics of a watercourse. ***The development area considered for the establishment of the Harmony Joel Solar PV Facility has some watercourse and wetlands located within the extent of the project site, that might be affected by the activities pertaining to the establishment of the solar PV facility.***

In the event that the flow of water in the watercourses is affected and the bed, banks or course characteristics are altered then a water use authorisation would be required. This will need to be in accordance with the requirements of the Regulations Regarding the Procedural Requirements for Water Use License Applications and Appeals (GN R267), or a GA registered in accordance with the requirements of Revision of General Authorisation. The process of applying for a WUL or GA registration will only be completed once a positive EA has been received. This is in line with the requirements of the Department of Water and Sanitation (DWS).

5.2.3 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 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 South African Heritage Resources Agency (SAHRA) Permit Regulations (GNR 668).

5.3 Overview of the Scoping Phase

The Scoping Phase aimed to:

- Identify, describe and evaluate potential environmental (biophysical and social) impacts and benefits of all phases of the proposed facility (including design, construction, operation and decommissioning) within the site through a desk-top review of existing baseline data and desk-top specialist studies.
- Identify potentially sensitive environmental features and areas within the broader site in order to inform the design process of the facility.
- Define the scope of studies to be undertaken within the EIA process.
- Provide the authorities with sufficient information in order to make a decision regarding the scope of issues to be addressed in the EIA process, as well as regarding the scope and extent of specialist studies that will be required to be undertaken as part of the EIA Phase of the process.

Within this context, the objectives of the Scoping Phase were to, through a consultative process:

- Identify the policies and legislation relevant to the project.
- Motivate the need and desirability of the proposed project, including the need and desirability of the activity in the context of the preferred location.
- Identify and confirm the preferred project and technology alternative.
- Identify and confirm the preferred site.
- Identify the key issues to be addressed in the EIA 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 the project will impose on the preferred site through the life of the project, 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 project site was considered during the Scoping Study for the 18MW for the Harmony Joel Solar PV Facility to identify and delineate any environmental fatal flaws, "no-go" or sensitive areas which should be avoided. The preparation and release of the Scoping Report for a 30-day public review period provided stakeholders and I&APs with an opportunity to verify that the comments they had raised during the Scoping process had been captured and adequately considered and provided a further opportunity for additional key comments to be raised for consideration. The Final Scoping Report and Plan of Study for EIA was submitted to DESTEA and accepted (refer to **Appendix B**). No additional information was requested by the DESTEA in the Acceptance of the Scoping.

5.4 Overview of the 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 development footprint for the activity within the development envelope 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 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.

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

5.4.1 Authority Consultation and Application for Authorisation in terms of the 2014 EIA Regulations (as amended)

As the project is self-generation of electricity from a renewable resource intended for own-use and does not relate to the IRP, the Free State Economic, Small Business Development, Tourism and Environmental Affairs (DESTEA) is the competent authority for the project. Consultation with the Authority has been undertaken throughout the EIA Phase. To date, this consultation has included the following:

- Submission of a Pre-Application Meeting request with DESTEA via email on **15 June 2022**. Following submission of the pre-application request the department determined that no pre-application meeting was considered necessary (refer to **Appendix C9**).
- Submission of the Application for Environmental Authorisation to the DESTEA (as a hard copy).
- Submission of the Scoping Report for review and comment by:

- The competent authority.
- State departments that administer laws relating to a matter affecting the environment relevant to an Application for EA.
- Organs of State which have jurisdiction in respect of the activity to which the application relates.

» Receipt of the Acceptance of Scoping.

The following steps are to be undertaken as part of this EIA phase of the 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 DESTEA for decision making.
» If requested, provide an opportunity for DESTEA to visit and inspect the proposed site and project area.

The submissions, as listed above, are in hard copy, as required by the DESTEA. A record of all authority correspondence undertaken during the Scoping Phase is included in **Appendix B: Authority Correspondence**.

5.4.2 Public Participation Process

Public participation is an essential and regulatory requirement for an environmental authorisation process and is guided by Regulations 41 to 44 of the EIA Regulations 2014 (GN R326) (as amended). This Section of the Scoping Report details the public participation process conducted during the EIA process.

The sharing of information forms the basis of the public participation process and offers the opportunity for I&APs to become actively involved in the EIA process from the outset. The public participation process is designed to provide sufficient and accessible information to I&APs in an objective manner. The public participation process affords I&APs opportunities to provide input into and receive information regarding the EIA process in the following ways:

» During the **Scoping Phase**:
  * provide an opportunity to submit comments regarding the project;
  * assist in identifying reasonable and feasible alternatives, where required;
  * identify potential comments of concern and suggestions for mitigation measures
  * contribute relevant local information and knowledge to the environmental assessment.
  * allow registered I&APs to verify that their comments have been recorded, considered and addressed, where applicable, in the environmental investigations;
  * foster trust and co-operation;
  * generate a sense of joint responsibility and ownership of the environment;
  * comment on the findings of the Scoping Phase results; and
  * Identify comments of concern and suggestions for enhanced benefits.

» During the **EIA Phase**:
  * contribute relevant local information and knowledge to the environmental assessment;
  * verify that comments have been considered in the environmental investigations as far as possible as identified within the Scoping Phase;
  * comment on the findings of the environmental assessments; and

- attend a Focus Group Meeting to be conducted for the project.

» During the **decision-making phase**:
- Notify I&APs of the outcome of the competent authority's decision, and the timelines for appealing the decision.

The Public Participation process therefore aims to ensure that:
» Information containing all relevant facts in respect of the application is made available to potential stakeholders and I&APs for their review;
» The information presented during the public participation process is presented in such a manner, i.e. local language and technical comments, that it avoids the possible alienation of the public and prevents them from participating;
» Public participation is facilitated in such a manner that I&APs are provided with a reasonable opportunity to comment on the project;
» A variety of mechanisms are provided to I&APs to correspond and submit their comments i.e. fax, post, email, telephone, text message (SMS and WhatsApp); and
» An adequate review period is provided for I&APs to comment on the findings of the Scoping and EIA Reports.

In terms of the requirement of Chapter 6 of the EIA Regulations of December 2014, as amended, the following key public participation tasks are required to be undertaken:
» Fix a notice board at a place conspicuous to the public at the boundary or on the fence of—
  (i) the site where the activity to which the application relates is or is to be undertaken; and
  (ii) any alternative site mentioned in the application.
» Give written notice to:
  (i) the owner or person in control of that land if the applicant is not the owner or person in control of the land;
  (ii) the occupiers of the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iii) owners and occupiers of land adjacent to the site where the activity is or is to be undertaken or to any alternative site where the activity is to be undertaken;
  (iv) the municipal councillor of the ward in which the site or alternative site is situated and any organisation of ratepayers that represent the community in the area;
  (v) the municipality which has jurisdiction in the area;
  (vi) any organ of state having jurisdiction in respect of any aspect of the activity; and
  (vii) any other party as required by the competent authority.
» Place an advertisement in a local newspaper.
» Open and maintain a register of I&APs and Organs of State.
» Release of a Scoping/EIA Report for a 30-day review and comment period.
» Prepare a Comments and Responses (C&R) report which documents the comments received on the Scoping/EIA process and during the 30-day review and comment period of the Scoping/EIA Report and the responses provided by the project team.

In compliance with the requirements of Chapter 6: Public Participation of the EIA Regulations, 2014 (as amended), the following summarises the key public participation activities implemented. The schematic below provides an overview of the tools that are available to I&APs and stakeholders to access project information and interact with the public participation team to obtain project information and resolve any queries that may arise, and to meet the requirements for public participation.

i. Stakeholder identification and register of I&APs	•Register as an I&AP on the online platfrom or via completion of a registration form and provison of contact information, by responding to an advert, or text message (SMS and WhatsApp inc. 'please call me') which will be responded to •State interest in the project •Receive all project related information via email
ii. Advertisments and notifications	•Advertisements, site notices and notifications provide information and details on where to access project information •Notifications regarding the EIA proceses and availability of project reports for public review to be sent via email, post (if applicable), text message (SMS and WhatsApp)
iii. Public Involvement and consultation	•Distribution of a BID providing details on the project and how I&APs can become involved in the process •Submission of comments or queries via e-mail, post (as applicable), text message (SMS and WhatsApp) •Availability of project information via the online platform •An opportunity for I&APs and stakeholders to request virtual meetings with the project team. •Direct in-person consultation will only take place as and when required / requested.
iv. Comment on the Scoping and EIA Reports	•Availability of the project reports via the online platform for 30-day comment period •Submission of comments via the online platform, email, post (if applicable), text message (SMS and WhatsApp) to the PP team •Comments recorded and responded to, as part of the process
v. Identification and recording of comments	•Comments and Responses Report, including all comments received, and included within the final Report for decision-making

i. Stakeholder identification and Register of Interested and Affected Parties

42. A proponent or applicant must ensure the opening and maintenance of a register of I&APs and submit such a register to the competent authority, which register must contain the names, contact details and addresses of –
    (a) All persons who, as a consequence of the public participation process conducted in respect of that application, have submitted written comments or attended meetings with the proponent, applicant or EAP;
    (b) All persons who have requested the proponent or applicant, in writing, for their names to be placed on the register; and
    (c) All organs of state which have jurisdiction in respect of the activity to which the application relates.

I&APs have been identified through a process of networking and referral, obtaining information from previous EIA processes undertaken and Savannah Environmental's existing stakeholder databases, liaison

with potentially affected parties in the broader study area and the project site, and a registration process involving completion of a registration and comment sheet. Stakeholders are required to formally register their interest in the project through either directly contacting the Savannah Environmental Public Participation team via phone, text message (SMS and WhatsApp), email or fax, or registering their interest via the online stakeholder engagement platform. The key stakeholder groups identified include authorities, local and district municipalities, ward councillors, government bodies and state-owned companies, directly affected and adjacent landowners, community-based organisations and non-governmental organisations. An initial list of stakeholders identified and registered on the database is listed in **Table 5.4**.

Table 5.4: List of Stakeholders identified for the inclusion in the project database during the public participation process for the Harmony Joel Solar PV Facility.

Organs of State
National Government Departments
Department of Forestry, Fisheries and the Environment (DFFE)
Department of Mineral Resources and Energy (DMRE)
Department of Agriculture, Land Reform, and Rural Development (DALRRD)
Department of Human Settlements, Water and Sanitation
Department of Communications
Government Bodies and State-Owned Companies
Eskom Holdings SOC Limited
National Energy Regulator of South Africa (NERSA)
South African Civil Aviation Authority (CAA)
South African Heritage Resources Agency (SAHRA)
South African National Roads Agency Limited (SANRAL)
Telkom SA SOC Ltd
Provincial Government Departments
Free State Department: Agriculture and Rural Development
Free State Department of Small Business Development, Tourism and Environmental Affairs (DESTEA)
Free State Department of Public Works & Infrastructure
Free State Heritage Resources Authority (FSHRA)
Local Government Departments
Lejweleputswa District Municipality
Masilonyana Local Municipality- including the Ward Councillor, ward committee members, community representative or local community forum members
Commenting Stakeholders
BirdLife South Africa
Endangered Wildlife Trust (EWT)
Agri SA
Affected landowners, tenants and occupiers
Neighbouring landowners, tenants and occupiers

As per Regulation 42 of the EIA Regulations, 2014 (as amended), all relevant stakeholder and I&AP information has been recorded within a register of I&APs (refer to **Appendix C1** for a listing of the recorded parties). In addition to the above-mentioned EIA Regulations, point 4.1 of the Public Participation Guidelines has also been followed. The register of I&APs contains the names[20] of:

[20] Contact details and addresses have not been included in the I&AP database as this information is protected by the Protection of Personal Information Act (No 4 of 2013).

- all persons who requested to be registered on the database through the use of the online automated registration on the website or in writing, including the disclosure of their interest in the project;
- all Organs of State which hold jurisdiction in respect of the activity to which the application relates; and
- all persons who submitted written comments or attended virtual meetings (or in-person consultation where sanitary conditions can be maintained) and viewed the narrated presentations on the Savannah Environmental online platform during the public participation process.

I&APs have been encouraged to register their interest in the EIA process from the onset of the project, and the identification and registration of I&APs will be on-going for the duration of the EIA process. The database is a working document of I&APs and has been updated throughout the EIA process and acted as a record of all I&APs involved in the public participation process.

The Scoping/EIA process was announced with the notification of the availability of the EIA report for review and comment. This was achieved as follows:

- A letter advising registered parties of the Acceptance of Scoping received from DESTEA and the availability of the EIA Report distributed on **23 March 2023 .**
- The above letter also served to notify all registered I&APs on the project database.
- An advertisement announcing the availability of and inviting comment on the EIA Report was placed in the Volksblad Newspaper (in English), a local newspaper, on **24 March 2023**. The tearsheet of the newspaper advert is included in **Appendix C2** of the EIA Report.
- The EIA Report made available for review by I&APs for a 30-day review and comment period from **24 March 2023 – 26 April 2023.** The EIA Report has been made available on the Savannah Environmental website and all registered I&APs have been notified of the availability on **24 March 2023** via email, which included the link to access the report on the Savannah Environmental website. I&APs have been encouraged to view the EIA Report and submit their written comment/s to the Public Participation Team. Organs of State have also been notified via e-mail of the availability of the EIA Report and will be circulated via electronic transfer (Dropbox, WeTransfer, etc), or CD and/or hardcopy as per individual request.

ii. <u>Public Involvement and Consultation</u>

In order to accommodate the varying needs of stakeholders and I&APs within the surrounding area, as well as capture their views, comments, and concerns regarding the project, various opportunities have been provided to I&APs to note their comments. I&APs were being consulted through the following means:

- Opportunity for review of the EIA report for a 30-day period from **24 March 2023 – 26 April 2023.** Comments received during this review and comment period will be captured within a Comments and Responses Report (refer to **Appendix C8: Comments & Responses Report**), which will be included within the Final EIA Report.
- Focus group meetings:
  - Virtual Focus Group Meetings (FGMs) will be held with affected and adjacent landowners, and any other stakeholder group identified or requested a virtual FGM.
  - Virtual Key Stakeholder Workshop will be held with various Organs of State (including District and Local Municipality Officials), and Key Stakeholders.
- Telephonic consultation sessions.
- E-mail correspondence.

All written comments received during the 30-day review period will be included in **Appendix C6** and notes of meetings held during the review period will be included in **Appendix C7** of the Final EIA report.

Table 5.5: Summary of public involvement for Harmony Joel Solar PV Facility (refer to Appendix C)

Activity	Date
Distribution of the BID, process notification letters and stakeholder reply form announcing the EIA process and inviting I&APs to register on the project database. The BID and electronic reply form was also made available on the online stakeholder engagement platform.	**22 August 2022**
Placement of site notices.	**18 August 2022**
Announcement of the EIA process in one local newspaper: The Volksblad Newspaper	**14 November 2022**
Distribution of notification letters announcing the availability of the Scoping Report for a 30-day review and comment period. These letters were distributed to Organs of State, Government Departments, Ward Councillors, landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	**14 November 2022**
30-day review and comment period of the Scoping Report.	**14 November 2022 - 14 December 2022**
Virtual and in person meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Affected and Adjacent landowners » Authorities and key stakeholders (including District and Local municipal Officials, and official representatives of community-based organisations).	**6 September 2022 at 09h00: Virtual Focus Group Meeting with Officials of the Lejweleputswa District, Masilonyana and Matjabeng Local Municipalities** **14 September 2022 at 09h00: Virtual Key Stakeholder Workshop held with various Organs of State and Key Stakeholders** **20 October 2022 at 14h00: Second virtual Key Stakeholders Workshop with National, Provincial and Local Authorities and Key Stakeholders i.e. Air Traffic Navigation Services, and the Endangered Wildlife Trust.**
Distribution of notification letters announcing the acceptance of scoping and approval of the Plan of Study for the EIA phase and availability of the EIA Report for a 30-day review and comment period. The letter was distributed to Organs of State (including Government Departments, Municipal Officials, Ward Councillors, etc), landowners within the surrounding area (including neighbouring landowners) and key stakeholder groups.	**23 March 2023**
Advertising of the availability of the EIA Report for a 30-day review and comment period in Volksblad Newspaper, including details on how to access the EIA Report via Savannah Environmental's website	**24 March 2023**
30-day review and comment period of the EIA Report	**24 March 2023 – 26 April 2023**
Virtual and in person meetings, if requested, through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » Affected and Adjacent landowners	**To be held during the 30-day review and comment period**

» Authorities and key stakeholders (including District and Local municipal Officials, and official representatives of community-based organisations).	
On-going consultation (i.e. telephone liaison; e-mail communication) with all I&APs.	**Throughout the EIA process**

iii. Registered I&APs entitled to Comment on the Scoping/EIA process

43.(1) A registered I&AP is entitled to comment, in writing, on all reports or plans submitted to such party during the public participation process contemplated in these Regulations and to bring to the attention of the proponent or applicant any issues which that party believes may be of significance to the consideration of the application, provided that the interested and affected party discloses any direct business, financial, personal or other interest which that party may have in the approval or refusal of the application.

(2) In order to give effect to section 24O of the Act, any State department that administers a law relating to a matter affecting the environment must be requested, subject to regulation 7(2), to comment within 30 days.

44.(1) The applicant must ensure that the comments of interested and affected parties are recorded in reports and plans and that such written comments, including responses to such comments and records of meetings, are attached to the reports and plans that are submitted to the competent authority in terms of these Regulations.

(2) Where a person desires but is unable to access written comments as contemplated in subregulation (1) due to –

(a) A lack of skills to read or write;
(b) Disability; or
(c) Any other disadvantage;

Reasonable alternative methods of recording comments must be provided for.

I&APs registered on the database were notified by means of a notification letter of the release of the Scoping Report for a 30-day review and comment period. Similarly, I&APs registered on the database have been notified by means of a notification letter of the release of the EIA Report for a 30-day review and comment period, invited to provide comment on the EIA Report, and informed of the manner in which, and timeframe within which such comment must be made. The notification letter of the availability of the EIAr also served to advise registered I&APs that opportunity will be provided to attend public participation meetings, and the details of these would be circulated.

The EIA Report has been made available on the Savannah Environmental website (i.e. online stakeholder engagement platform) (https://savannahsa.com/public-documents/energy-generation/harmony-joel-solar-pv/)

All comments raised as part of the discussions and written comments submitted during the 30-day review and comment period will be recorded and included in **Appendix C6** of the final EIA Report.

iv. Identification and Recording of Comments

Comments raised by I&APs to date have been collated into a Comments and Responses (C&R) Report which is included in **Appendix C8** of the EIA Report. The C&R Report includes detailed responses from members of the EIA project team and/or the project proponent, and where applicable the relevant specialist, to the issues and comments raised. The C&R Report consists of all written comments received.

Meeting notes of all virtual meetings, in person meetings (as and when applicable) and discussions undertaken during the 30-day review and comment period will be included in **Appendix C7** of the final EIA Report.

The C&R Report will be updated with all comments received during the 30-day review and comment period and will be included as **Appendix C8** in the final EIA Report that will be submitted to the DESTEA for decision-making.

5.5 Outcomes of the DFFE Web-Based Screening Tool

In terms of GN R960 (promulgated on 5 July 2019) and Regulation 16(1)(b)(v) of the 2014 EIA Regulations (as amended), the submission of a Screening Report generated from the national web based environmental screening tool is compulsory for the submission of applications in terms of Regulations 19 and 21 of the EIA Regulations.

The requirement for the submission of a Screening Report (included as **Appendix K** of the EIA Report) for the Harmony Joel Solar PV Facility is applicable as it triggers Regulation 19 of the EIA Regulations, 2014, as amended. **Table 5.6** provides a summary of the specialist assessments identified in terms of the screening tool and responses to each assessment from the project team considering the development area under consideration.

Table 5.6: Sensitivity ratings from the DFFE's web-based online Screening Tool associated with the development of the Harmony Joel Solar PV Facility

Specialist Assessment	Sensitivity Rating and Specialist Input Identified in Terms of the DFFE Screening Tool	Verification of Site-Specific Sensitivity and Motivation of the Need for Specialist Investigation
Agricultural Impact Assessment	Screening tool: Medium Sensitivity Required an agricultural impact assessment (in accordance with the protocol prescribed in GNR 320). Verified Sensitivity by Specialist: **Low Sensitivity**	Following the consideration of all the desktop and gathered baseline data above, the findings of the report are not consistent with the results from the Environmental Screening Tool. The soil forms present within the project area are mainly of the Sepane and Technosol/Johannesburg soil forms, which has a Low-Moderate (06) and Low-Very low (04) land capability respectively. The area has historically not been used for crop production recently. No irrigation infrastructure, such as centre pivots or drip irrigation, are present within the project area and irrigated agricultural is currently not practiced in the area. The area is not currently used for livestock farming although the Joel PV Facility project area can support 36 head of cattle at the long-term grazing capacity of 6ha/LSU. Considering the soil properties, land capability and calculated land capability of the development area, the area is defined as having a Low Agricultural Sensitivity. Soil in the project area will have Low sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction, and pollution. The Soils and Agricultural Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as **Appendix F**.
Landscape/Visual Impact Assessment	Screening tool: Very High Sensitivity	The findings of the Visual Impact Assessment undertaken for the proposed 18MW PV facility is that the visual environment surrounding the site, especially within a 1 - 6km radius, may be

	(General Assessment Protocols) Verified Sensitivity by Specialist: **Medium to low Sensitivity**	visually impacted during the anticipated operational lifespan of the facility (i.e., a minimum of 25 years). The anticipated visual impacts range from **moderate to low significance.** Anticipated visual impacts on sensitive visual receptors (if and where present) in close proximity to the proposed facility are not considered to be fatal flaws for the proposed PV facility. A Visual Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as **Appendix H**.
Archaeological and Cultural Heritage Impact Assessment	Screening tool: Low Sensitivity Required an archaeological & cultural impact assessments (No specific protocol- consider general requirements (GG 45421 of 10/05/2019) _DRAFT)) Verified Sensitivity by Specialist: **Low Sensitivity**	The Archaeological Impact Assessment (included as an Appendix to the HIA) determined that the potential for finding a dateable in-situ archaeological horizon at Joel based on current surface observations outlined above appears to be low. The documented archaeology at the Joel site is therefore classified as scientifically Low Significance apart from the site at JL5 which is classified as Moderate Significance. Concerning the archaeology observed during the survey of the potentially affected area at the Joel site, there are no objections to the authorization of the proposed development, that the monitoring recommendations outlined in the HIA are adhered to, and provided that if any evidence of human remains are exposed during excavation, that development activities cease in the area of the identified remains. A Heritage Impact Assessment which covers both archaeological and cultural aspects of the project site has been undertaken for the proposed project and is included in this Report as **Appendix G**.
Palaeontology Impact Assessment	Screening tool: Very High Sensitivity Verified Sensitivity by Specialist: **Low Sensitivity**	Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age to contain fossils but are covered by soils. Furthermore, the material to be excavated are soils and this does not preserve fossils. Taking account of the defined criteria, the potential impact to fossil heritage resources is low. Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying sands and soils of the Quaternary. Since there is a very small chance that fossils were trapped in pans or springs that might occur below the soils and may be disturbed. Vertebrate fossils may occur but there is no outcrop. A Fossil Chance Find Protocol has been added to the EMPr. A Heritage Impact Assessment (which includes a palaeontological assessment of the project site) is included in this EIA Report as **Appendix G.**
Terrestrial Biodiversity Impact Assessment	Screening tool: Very High Sensitivity	The ecological impact assessment identified that the majority of the site still consists of natural vegetation without previous

	Required a terrestrial biodiversity impact assessment and a plant species assessment (Terrestrial Biodiversity Assessment Protocols) Verified Sensitivity by Specialist: **Medium Sensitivity**	modification although mining operations situated on and around the site do result in transformation of the surroundings. The natural vegetation types in the area, Highveld Alluvial Vegetation and Central Free State Grassland, are both only listed as being of Least Concern and are therefore not of high conservation value. The area is also listed an Ecological Support Areas 1 & 2, and therefore the area is not essential to meeting conservation targets but forms part of the functioning of the Doring River adjacent to the site. A Critical Biodiversity Area 2 is situated to the west of the site and marginally intersects with the western border of the site. This CBA 2 is associated with surrounding natural grassland of Vaal-Vet Sandy Grassland, an Endangered vegetation type though the marginal portion extending into the study area overlaps with the existing mining plant, and is therefore not relevant to the development. The site would therefore have an overall Moderate level of sensitivity. The Doring River situated adjacent to the site does have a high conservation value and is considered highly sensitive, but as long as development does not encroach into the riparian zone and 1:100 year floodline of the river it should remain largely unaffected by the development. The impact significance has been determined and should development take place without mitigation it is anticipated that the majority of impacts will be moderate. An Ecological Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as **Appendix D**.
Aquatic Biodiversity Impact Assessment	Screening tool: Low Sensitivity Required an Aquatic Biodiversity impact assessment (in accordance with the protocol prescribed in GNR 320, Aquatic Biodiversity Assessment Protocols). Verified Sensitivity by Specialist: **Medium Sensitivity**	The surface water features of the study area is dominated by the Doring River which is situated adjacent to the site along its eastern, northern and western borders and may in some areas occur in close proximity to it. Associated with the Doring River is an extensive floodplain which may also extend onto the site. This is also dependent on the 1:100 year floodline of this watercourse. The impact on the Doring River and its tributaries may be high. Adequate mitigation may however significantly reduce these impacts though several will remain moderate. This is also dependant on the development excluding the 1:100 year floodline of the Doring River An Ecological Impact Assessment (which includes the assessment of the freshwater systems and aquatic biodiversity) has been undertaken for the proposed project and is included in this EIA Report as **Appendix D**.

Avian Impact Assessment	Screening tool: Low Sensitivity Verified Sensitivity by Specialist: Medium to Low (depending on the impact considered)	Sensitivities were compiled for the avifauna study based on the field results and desktop information. Based on the criteria provided in the specialist report, all habitats within the assessment area of the proposed project were allocated a sensitivity category. Three prominent avifaunal habitat types were identified on the development area, which consisted of open grassland with bush clump mosaics, the Doring River system with riverine woodland and transformed units (ranging from build-up land and mining infrastructure). An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana* and Egyptian Goose *Alopochen aegyptiacus*) colliding with the PV infrastructure remained eminent due to the presence of wetland-associated features and the nearby Doring river system. It is recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project. An Avifauna Impact Assessment has been undertaken for the Harmony Joel Solar PV Facility and is included as **Appendix E** of the EIA Report. The assessment has been undertaken in accordance with the requirements of the BirdLife SA Best Practice Guidelines for Solar Developments.
Civil Aviation Assessment	Screening tool: Medium Sensitivity Verified Sensitivity: **Low Sensitivity**	The Harmony Joel Solar PV facility is located within 5km east of a landing strip and ~3km north east of a helipad. The risk is considered to be low to moderate. The Civil Aviation Authority has been included as a stakeholder in order to provide comment on the proposed development. In terms of Obstacle Notice 3/2020 (Replacement for 17/11/2017): Additional Requirements for Solar Project Applications, a Glint & Glare Assessment will only be required where the proposed site is located within a 3km radius around an aerodrome.
Defence Assessment	Screening tool: Low Sensitivity	A defence or military base is not located within close proximity to the PV facility. Further consultation is not required.
RFI Assessment	Screening tool: Low Sensitivity Verified Sensitivity: Low	The project site under consideration for the development of the Harmony Joel Solar PV Facility is located within an area that as classified as having low sensitivity for telecommunication. Telecommunication stakeholders have been requested to provide comment on the proposed development.
Plant Species Assessment	Screening tool: Low Sensitivity	The ecological impact assessment identified that the majority of the site still consists of natural vegetation without previous modification although mining operations situated on and around the site do result in transformation of the surroundings. The natural vegetation types in the area, Highveld Alluvial Vegetation and Central Free State Grassland, are both only listed as being of Least Concern and is therefore not of high
Animal Species Assessment	Screening tool: Medium Sensitivity	

	Necessitating an animal species assessment (in accordance with Animal Species Assessment Protocols prescribed in GN 43855) Verified Sensitivity by Specialist: **Very Low Sensitivity**	conservation value. The area is also listed an Ecological Support Areas 1 & 2, and therefore the area is not essential to meeting conservation targets but forms part of the functioning of the Doring River adjacent to the site. A Critical Biodiversity Area 2 is situated to the west of the site and marginally intersects with the western border of the site. This CBA 2 is associated with surrounding natural grassland of Vaal-Vet Sandy Grassland, an Endangered vegetation type though the marginal portion extending into the study area overlaps with the existing mining plant and is therefore not relevant to the development. The site would therefore have an overall Moderate level of sensitivity. Geophytic species observed include Moraea pallida, Oxalis depressa, Boophone distichia, Eriospermum porphyrium, Colchicum burkei, Eucomis autumnalis, Bulbine abyssinica and Chlorophytum sp. Of these, B. distichia and E. autumnalis are also listed as protected in the Free State Province and are therefore of significant conservation value. Where the development will affect these species, permits will also have to be obtained and affected plants transplanted to adjacent areas where they will remain unaffected. A few small specimens of the protected Wild Olive Tree (*Olea europaea subsp. africana*) also occur on the site and permits will also have to be obtained to remove these. Signs and tracks of mammals are present on the site but notably less when compared to the natural condition. This is most likely a consequence of the proximity of the mining operations and frequent human activities in the area. Being dominated by natural vegetation the site itself will therefore still have capacity for a natural mammal population though the actual mammal population will be smaller and dominated by generalist species. Rare and endangered mammals are often reclusive and avoid areas in close proximity to human activities and are also dependant on habitat in pristine condition. Such species are therefore considered unlikely to occur in the area though the Doring River may still provide suitable habitat for Cape Clawless Otter (*Aonyx capensis*) though should remain largely unaffected by the development as long as the development footprint is kept outside the 1:100 year floodline of the river. An Ecological Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as **Appendix D**.

5.7 Assessment of Issues Identified through the EIA Process

Issues (both direct and indirect environmental impacts) associated with the Harmony Joel Solar PV facility identified within the scoping process have been evaluated through specialist studies by specialist consultants. These specialists include:

Specialist	Area of Expertise	Refer Appendix
Darius Van Rensburg of DPR Ecologists & Environmental Services	Ecology (Terrestrial and Freshwater)	Appendix D
Lukas Niemand of Pachnoda Consulting	Avifauna	Appendix E
Marine Pienaar of TerraAfrica	Soils & Agricultural Potential	Appendix F
Jenna Lavin of CTS Heritage	Heritage (including archaeology, cultural landscape and palaeontology)	Appendix G
Brogan Geldenhuys of Eco-Thunder Consulting	Visual	Appendix H
Marti Le Roux of Eco-Thunder Consulting	Social	Appendix I

Specialist studies considered direct and indirect environmental impacts associated with the development of all components of the facility. Identified impacts are assessed in terms of the following criteria:

- The **nature**, a description of what causes the effect, what will be affected, and how it will be affected
- 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
- 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)

Specialist studies also considered cumulative impacts associated with similar developments within a 30km radius of the proposed project. The purpose of the cumulative assessment is to test if such impacts are relevant to the proposed project in the proposed location (i.e. whether the addition of the proposed project in the area will increase the impact). In this regard, specialist studies considered whether the construction of the proposed development will result in:

- Unacceptable risk
- Unacceptable loss
- Complete or whole-scale changes to the environment or sense of place
- Unacceptable increase in impact

A conclusion regarding whether the proposed development will result in any unacceptable loss or impact considering all the projects proposed in the area is included in the respective specialist reports.

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 Environmental Management Programme (EMPr) that includes all the mitigation measures recommended by the specialists for the management of significant impacts is included as **Appendix K** to this EIA Report.

5.6 Assumptions and Limitations of the EIA Process

The following assumptions and limitations are applicable to the EIA process for the Harmony Joel Solar PV Facility:

- 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 area for the solar PV facility identified by the developer represents a technically suitable site for the establishment of the Harmony Joel PV Facility which is based on the design undertaken by technical consultants for the project.

- The development footprint (the area that will be affected during the operation phase) will include the footprint for the PV facility and associated infrastructure (i.e. internal access roads, BESS and grid connection infrastructure).
- 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 report and its investigations are project-specific, and consequently the environmental team did not evaluate any other power generation alternatives.

The specialist studies in **Appendices D-I** include specialist study-specific limitations.

5.7 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 EIA Report:

- National Environmental Management Act (Act No. 107 of 1998);
- EIA Regulations of December 2014, published under Chapter 5 of NEMA (as amended);
- Department of Environmental Affairs (2017), Public Participation guidelines in terms of NEMA EIA Regulations;
- Procedures for the assessment and minimum criteria for reporting on identified environmental themes in terms of sections 24(5)(a) and (h) and 44 of the National Environmental Management Act, 1998, when applying for environmental authorisation; and
- International guidelines – the Equator Principles, the IFC Performance Standards, the Sustainable Development Goals, World Bank Environmental and Social Framework, and the and World Bank Group Environmental, Health, and Safety Guidelines (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 5.7**.

Table 5.7: Relevant legislative permitting requirements applicable to Harmony Joel Solar PV Facility

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.	Free State DESTEA – Competent 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 EIA process will culminate in the submission of a Final EIA Report to DESTEA for review and decision-making. Considering the size of the Harmony Joel Solar PV Facility (i.e. a footprint of 47ha) and the triggering of Activity 15 of Listing Notice 2 (GNR 325) a full Scoping and EIA process is required 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.	Free State DESTEA – Competent Authority	While no permitting or licensing requirements arise directly by virtue of the proposed project, this section finds application 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).	Free State DESTEA – Competent Authority Matjhabeng Local Municipality	Noise impacts are expected to be associated with the construction phase of the project. Considering the location of the development area in relation to residential areas and provided that appropriate mitigation measures are implemented, construction noise is unlikely 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 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.	Regional Department of Water and Sanitation	An Ecological Impact Assessment (including freshwater) has been undertaken for the PV facility and is included as **Appendix D** of the EIA Report.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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 water course (Section 21(c)), and altering of bed, banks or characteristics of a watercourse (Section 21(i)).		Freshwater features are identified for the project area. A water use authorisation for the project may be required from 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.	Department of Mineral Resources and Energy (DMRE)	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 in this regard 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 approval in the prescribed manner.		In terms of Section 53 of the MPRDA approval is required from the Minister of Mineral Resources and Energy to ensure that the proposed development does not sterilise a 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.	Free State DESTEA Lejweleputswa District Municipality	In the event that the project results in the generation of excessive levels of dust the possibility could exist that a dust fall monitoring programme would be required for the project, in which case dust fall monitoring results from

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		the dust fall monitoring programme would need to be included in a dust monitoring report, and a dust management plan would need to be developed.
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 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.	South African Heritage Resources Agency (SAHRA) Free State Provincial Heritage Resources Agency (FS PHRA)	A full Heritage Impact Assessment (HIA) (with field work) has been undertaken as part of the EIA process (refer to **Appendix G** of this EIA Report). Two sites (JL2 and JL5) of archaeological significance, containing a concentration of artefacts, was identified within the project site. Site JL2 was graded IIIC and a 20m no-development buffer has been recommended by the specialist. Whereas site JL5 was graded IIIB and a 50m no-development buffer has been recommended by the specialist. Should a heritage resource be impacted upon, a permit may be required from SAHRA or the Free State Provincial Heritage Resources Agency (FS PHRA) in accordance with of Section 48 of the NHRA, and the SAHRA Permit Regulations (GN R668).

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
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, GNR 324), 29 April 2014).	DFFE Free State DESTEA	Under NEM:BA, a permit would be required for any activity that is of a nature that may negatively impact on the survival of a listed protected species. During the survey no plant SCC was recorded (refer to the Ecological Impact Assessment Report (**Appendix D**)).
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).	DFFE Free State DESTEA	An Ecological Impact Assessment has been undertaken for the PV facility and grid connection and is included as **Appendix D** of the EIA Report.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
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 GN R1048 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 GN R1048 published under CARA provides requirement and methods to implement control measures for different categories of alien and invasive plant species.	Department of Agriculture, Rural Development, and Land Reform (DARDLR)	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. In terms of Regulation 15E (GN R1048) 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: » 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.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
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 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".	DFFE	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 in the development footprint for the submission of relevant permits to authorities prior to the disturbance of these individuals. An Ecological Impact Assessment has been undertaken for the PV facility and is included as **Appendix D** of the EIA Report.
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 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.	DFFE	While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of Harmony Joel Solar PV Facility, in terms of the preparation and maintenance of firebreaks, and the need to provide appropriate equipment and trained personnel for firefighting purposes.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
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 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. 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.	DFFE – Hazardous Waste Free State DESTEA – General Waste	No waste listed activities are triggered by Harmony Joel Solar PV Facility; therefore, no Waste Management License is required to be obtained. General and hazardous waste 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.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	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.		
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 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	South African National Roads Agency (SANRAL) – national roads North West Department of Public Works and Roads (NWDPWR)	An abnormal load / vehicle permit may be required to transport the various components to site for construction. These include route clearances and permits required for vehicles carrying abnormally heavy or abnormally dimensioned loads and transport vehicles exceeding the dimensional limitations (length) of 22m. Depending on the trailer configuration and height when loaded, some of the on-site substation and BESS components may not meet specified dimensional limitations (height and width) which will require a permit.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	the requirements of the National Road Traffic Act and the relevant Regulations.		
Provincial Policies / Legislation			
Bophuthatswana Nature Conservation Act. No. 3 of 1973.	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.	Free State DESTEA	A collection/destruction permit must be obtained from Free State (DESTEA) for the removal of any protected plant or animal species found on site. Geophytic species observed *include Moraea pallida, Oxalis depressa, Boophone distichia, Eriospermum porphyrium, Colchicum burkei, Eucomis autumnalis, Bulbine abyssinica* and *Chlorophytum sp. Of these, B. distichia and E. autumnalis* are also listed as protected in the Free State Province and are therefore of significant conservation value. Where the development will affect these species, permits will also have to be obtained and affected plants transplanted to adjacent areas where they will remain unaffected. A few small specimens of the protected Wild Olive Tree (*Olea europaea subsp. africana*) also occur on the site and permits will also have to be obtained to remove these. Refer to the Ecological Impact Assessment Report (**Appendix D**).

5.7.1 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 Environmental Assessment Practitioners (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 5.8** 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 5.8: 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.

Bird distribution patterns fluctuate widely in response to environmental conditions (e.g. local rainfall patterns, nomadism, migration patterns, seasonality), meaning that a composition noted at a particular moment in time will differ during another time period at the same locality. For this reason, a dry season and wet season bird monitoring survey will be conducted in line with Regime 2 for the Harmony Joel Solar PV Facility. The dry season survey has already been conducted in June 2022 & July 2022; the findings has been used to inform the avifauna scoping report completed for the Scoping phase. The result from the wet season bird monitoring will be used to inform both the development footprint as well as Avifauna Impact Assessment report, to be completed for the EIA Report.

5.7.2 The IFC Environmental Health and Safety (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

5.7.3 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 (IFC PS).

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

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 the 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 Harmony Joel Solar PV Facility and attached as **Appendix K** to this BA Report.

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.

Further, many projects are likely to be constructed in areas with a scarcity of water and electricity. Therefore, the use of these resources during construction and operation of the plant may have an impact on the local economy. Careful siting and design of the projects should minimise this potential impact.

Response:
Water will be required for the construction and operation phases of the facility. Water will be sourced from the Harmony Joel Mining operations.

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 and construction camps (if any). 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:
The Harmony Joel Solar PV Facility and its associated infrastructure is proposed on properties owned by the Mine. Therefore, landowner / lease agreement will not be required for the development of the solar facility and its associated infrastructure. No involuntary land acquisition or resettlement is required or will take place as a result of the project.

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 the Harmony Joel Solar PV Facility have been assessed as part of the Visual Impact Assessment specialist study conducted as part of the EIA process. Measures required 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 EIA Report.

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 the Harmony Joel Solar PV Facility 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 have been utilised to inform the development footprint so that such areas are suitably avoided.

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 the Harmony Joel Solar PV Facility have been assessed as part of the Heritage Impact Assessment conducted as part of the EIA process (refer to **Appendix G**), which includes the 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.

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:
The project site can be readily accessed via existing access roads in the region. Within the facility development footprint, access will be required from new / existing roads for construction purposes (and limited access for maintenance during operation). The facility 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 PV facility. Some of the components (i.e. on-site 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 the Act.

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 draft stormwater management plan has been prepared and is included within the project EMPr attached as **Appendix K** of this EIA Report.

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.

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 t**o this EIA Report.

CHAPTER 6: DESCRIPTION OF THE RECEIVING ENVIRONMENT

This chapter provides a description of the local environment. This information is provided in order to assist the reader in understanding the possible effects of the project on the environment within which it is proposed to be developed. Aspects of the biophysical, social and economic environment that could be directly or indirectly affected by, or could affect, the Harmony Joel Solar PV facility have been described. This information has been sourced from both existing information available for the area as well as collected field data by specialist consultants and aims to provide the context within which this EIA process is being conducted.

6.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report

This chapter includes the following information required in terms of Appendix 3: Content of an EIA report:

Requirement	Relevant Section
3(1)(h)(iv) the environmental attributes associated with the alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects.	The environmental attributes associated with the development of Harmony Joel Solar PV facility is included as a whole within this chapter. The environmental attributes that are assessed within this chapter includes the following: » The regional setting of the broader study area indicates the geographical aspects associated with Harmony Joel Solar PV facility. This is included in **Section 6.2**. » The climatic conditions for the Theunissen area have been included in **Section 6.3**. » The biophysical characteristics of the project site and the surrounding areas are included in **Section 6.4**. The characteristics considered are topography and terrain, geology, soils and agricultural potential and the ecological profile which includes the vegetation patterns, listed plant species, critical biodiversity areas and broad-scale processes, freshwater resources, terrestrial fauna and avifauna. » The heritage and cultural aspects (including archaeology, cultural landscape and palaeontology) has been included in **Section 6.5**. » The social and socio-economic characteristics associated with the study area and the project site has been included in **Section 6.7**

A more detailed description of each aspect of the affected environment is included in the specialist reports included in **Appendices D to I** of this EIA report.

6.2. Regional Setting

The Harmony Joel Solar PV Facility is located near Theunissen and lies completely within the Middle Vaal Water Management Area (WMA) and entirely within the Highveld ecoregion. The district is predominantly known as the Free State Goldfield which forms a part of the larger Witwatersrand basin. The economy of the region is dominated by the gold mining industry and agriculture sectors in particular maize production.

The Masilonyana Local Municipality includes Theunissen/ Masilo, Brandfort/ Majwemasweu, Winburg/ Makeleketla, Soutpan/ Ikgomotseng, Verkeerdevlei/ Tshepong with a combined population of 80 090 people. The economy of the Matjhabeng Municipality area centres around the mining activities located in and around Allanridge, Odendaalsrus, Welkom and Virginia.

The most prominent (and visible) land use within the region is cattle grazing and maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The mining activities intensify further north (beyond the study area boundary) towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area.

The R30 main road provides access to the region and is the main connecting route between the N1 and the town of Theunissen. The proposed PV facility site is accessible from the R30 via adjoining secondary roads.

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. The proposed Harmony Joel Solar PV Facility is located approximately 26 km north of an airfield.

The Free State Province is located on the Highveld, a plateau rising to elevations of 1800m in the east and sloping to about 1200m in the west. The proposed development site itself is located at an average elevation of 1 390m above sea level and has a slightly even slope to the south. The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. Based on the suitable and preferable topography, no location alternatives are considered for the development.

The natural vegetation in the study area is dominated by two types of grasslands: the Central Free State Grassland and the Highveld Alluvial Grassland. A small portion in the central portion of the site is clearly transformed and associated with a historical tailings dump but has a limited extent of approximately 5ha and is the prominently transformed area of the site (apart from the existing mining plant).

There is a privately protected / conservation area just directly adjacent to the south of to the PV facility known as the H.J Joel Private Nature Reserve.

Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site. The population density of the region is indicated as approximately 110 people per km^2. An existing Eskom power line runs diagonally across the project site, with a substation located in the western portion of the development area. The built environment surrounding the proposed development area ranges from high density low-income housing and informal rural type settlements to large mining and agriculture developments. Developments located adjacent to the proposed settlement are informal settlement, with limited infrastructure that only meets RDP Standards. Social facilities within the area are lacking, with the nearest school being located some few kilometres from

the site. An existing Eskom power line runs along the north-eastern boundary of the farm portion, enabling a short distance for grid connection with minimal possible impact on avifauna or ecology. Land capability is the combination of soil suitability and climate factors. In terms of future economic development, there is likely to be a decline in the role played by mining, which will also negatively impact employment in the Free State Province.

Free State Province

The Free State Province lies in the center of South Africa, located between the Vaal River in the north and the Orange River in the south. The region is one of flat, rolling grassland and fields of crops, rising to mountains in the north-east.

The Province is the granary of South Africa, with agriculture central to its economy, while mining in the goldfield reefs is its largest employer.

Economic towns include Bloemfontein, Welkom, Kroonstad, Parys, QwaQwa, and Bethlehem. The Free State is the third- largest Province in South Africa, but it has the second-smallest population and the second-lowest population density. The culture is centered on traditional cultures but built on the influences of the early European settlers.

Close to 2.8-million people live in the Free State, with two-thirds speaking Sesotho, followed by Afrikaans, Zulu, Tswana, Xhosa and English.

The Free State is strategically placed to take advantage of the national transport infrastructure. Two corridors are of particular importance: the Harrismith node on the N3 corridor between Gauteng and KwaZulu-Natal, and the N8. The N1 connects Gauteng to the Western Cape. Bram Fischer International Airport in Bloemfontein handles about 250 000 passengers and 221 000 tons of cargo a year.

The Free State Province comprises of four (4) Districts, namely Fezile Dabi, Lejweleputswa, Thabo Mofutsanyana and Xhariep (refer to **Figure 6.1**)

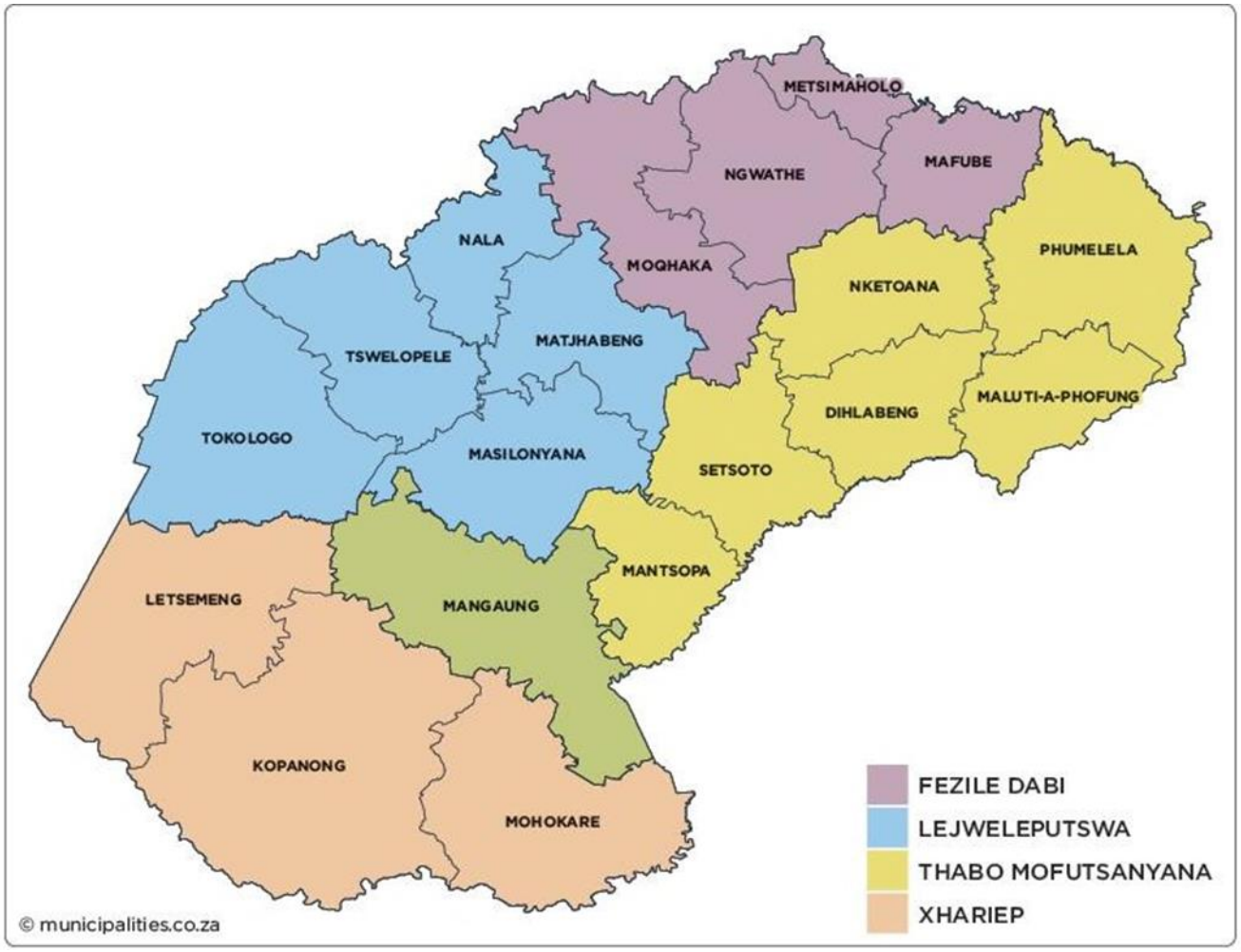


Figure 6.1: District municipalities of the Free State Province (Source: Municipalities of South Africa)

Lejweleputswa District Municipality

Lejweleputswa District Municipality is situated in the mid-western part of the Free State Province, with an estimated area of about 31 930km^2 (*Local government hand book, 2013*). The district borders the North West province to the north, Fezile Dabi District Municipality to the north-east, and Thabo Mofutsanyane District Municipality to the east. It also borders Mangaung Metro and Xhariep District to the south and the Northern Cape Province to the west. It consists of 22.9% of the population of the Free State Province (*IHS Global Insight, 2015*). The district is made up of five local municipalities, namely, Matjhabeng, Tokologo, Tswelopele, Nala and Masilonyana with about 17 towns.

The economy of the district relies heavily on the gold mining sector as the largest sector, dominant in two of the municipalities, Matjhabeng and Masilonyana, while the other Municipalities are dominated by agriculture. There is less diversification of the district's economy relying heavily on the mining sector and community service sector as the largest employers in the district. Matjhabeng is the largest municipality in the district and contributes the largest share of GVA-R in the District. The average annual GDP-R growth rate stands at -1.5 percent in 2014 for the district and is forecasted to decline even further to -2.9 percent in 2016 according to IHS Global Insight, as a result of low international commodity prices and a persistent drought in the agricultural sector. Output in agriculture is forecast downwards and prices in agricultural goods are expected to rise due to low output levels as given by the South African Reserve Bank in their monetary policy statement in September 2015 for the country in general.

Figure 6.2: Map showing the district and local municipalities (Source: Municipalities of South Africa)

Masilonyana Local Municipality

Masilonyana Local Municipality is named after the mountain in the area. It is one of five municipalities in the district extending over 6 618km². It is situated between the Province's biggest municipality, Mangaung Metro, in the south and the second- biggest municipality, Matjhabeng, in the north. The municipality is as a result of the merging of former Transitional Local Councils which included Theunissen, Brandfort, Winburg, Soutpan and Verkeerdevlei.

It is an impoverished semi-urban area with a high unemployment rate. The municipality plays host to two toll plazas on two major roads in the Province; the Verkeerdevlei Plaza on the N1 is the last before entering Bloemfontein from the north, and the Brandfort Plaza on the former R30 (now ZR Mahabane Road) is situated between Brandfort and Bloemfontein.

In terms of economic contribution, the Masilonyana Local Municipality is heavily reliant on the mining sector, although the sector's share is on a decline. The mining sector contributed about 52.4% to the Municipality's economic output in 2016. The second largest sector was the community services (15.0%) followed by finance (8.5%) and trade (7.4%). On the other end of the spectrum, the smallest sectors were electricity and water (1.6%), construction (1.7%) and manufacturing.

6.3. Climatic Conditions

Theunissen is located at an elevation of approximately 1 350m above sea level and is influenced by the local steppe climate with rainfall mainly occurring during summer. Theunissen experiences significant seasonal variation in monthly rainfall. The wet period of the year lasts for 9 months, from August to May, with an average annual rainfall of 33.16mm per annum. Local thunderstorms and showers are responsible for most of the precipitation during the summer months. Hail is sometimes associated with the thunderstorms and mainly occurs in the early summer.

The summers are long and warm, with summer temperatures ranging typically between 16°C and 29°C. The winters are short, cold and dry, with wintertime temperatures ranging typically between -1°C to 17°C. An average of 36 frost days occur each winter.

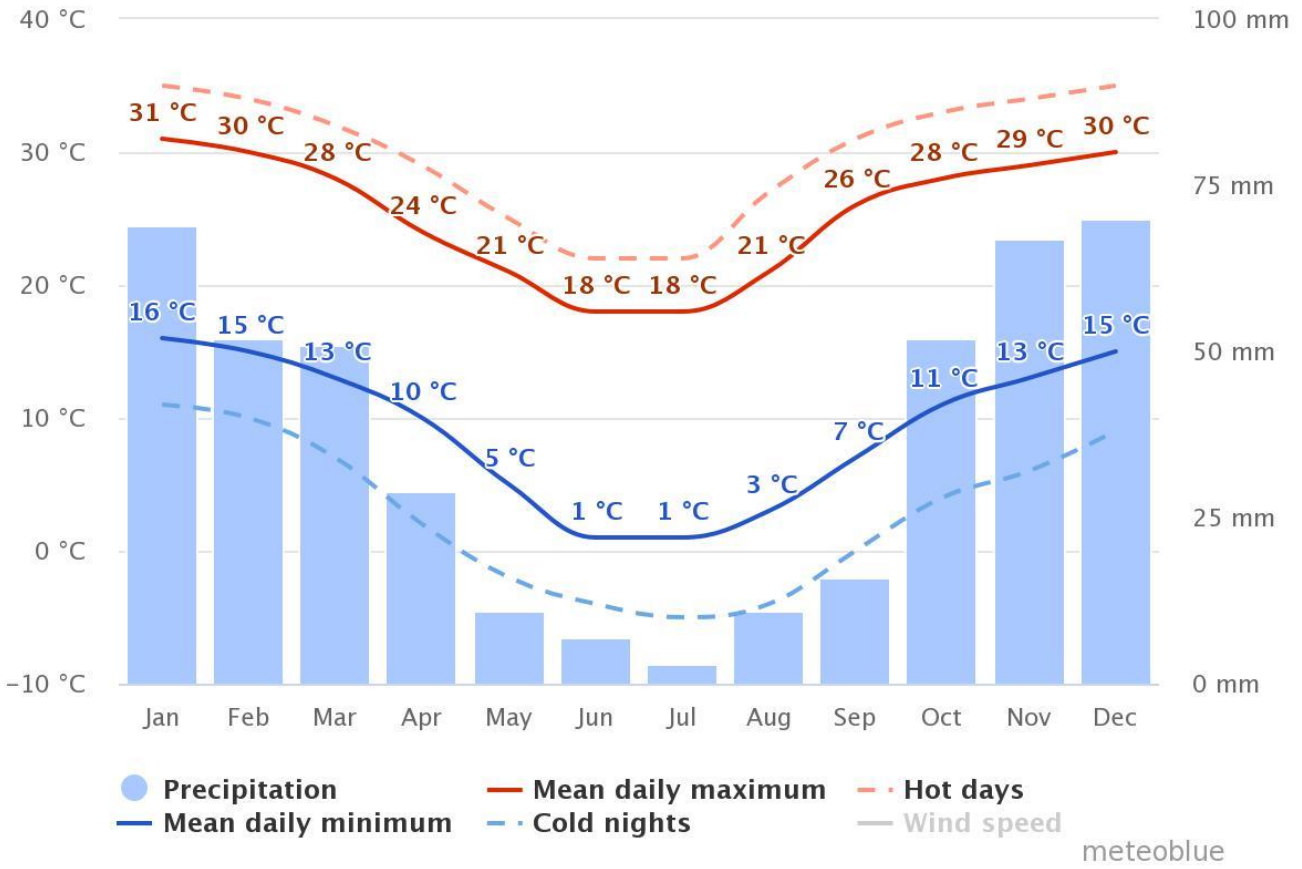


Figure 6.3: Climate graph for the Theunissen area, Free State Province within which the project site is located (source: Meteoblue 2023)

6.4. Biophysical Characteristics of the Development Area

The following section provides an overview and description of the biophysical characteristics of the development area and has been informed by specialist studies (**Appendix D-I**) undertaken for this EIA Report.

6.4.1. Topographical profile

The Harmony Joel Solar PV site has an elevation of approximately 1390m. The topography is characterised by slightly undulating plains with wetlands and / or drainage channels bisecting the area. There are some areas in which the topography is relatively flat with little to no tall vegetation. Most of the development area is characterised by a slope percentage between 0 and 2%, with some small patches within the development area characterised by a slope percentage in excess of 20%.

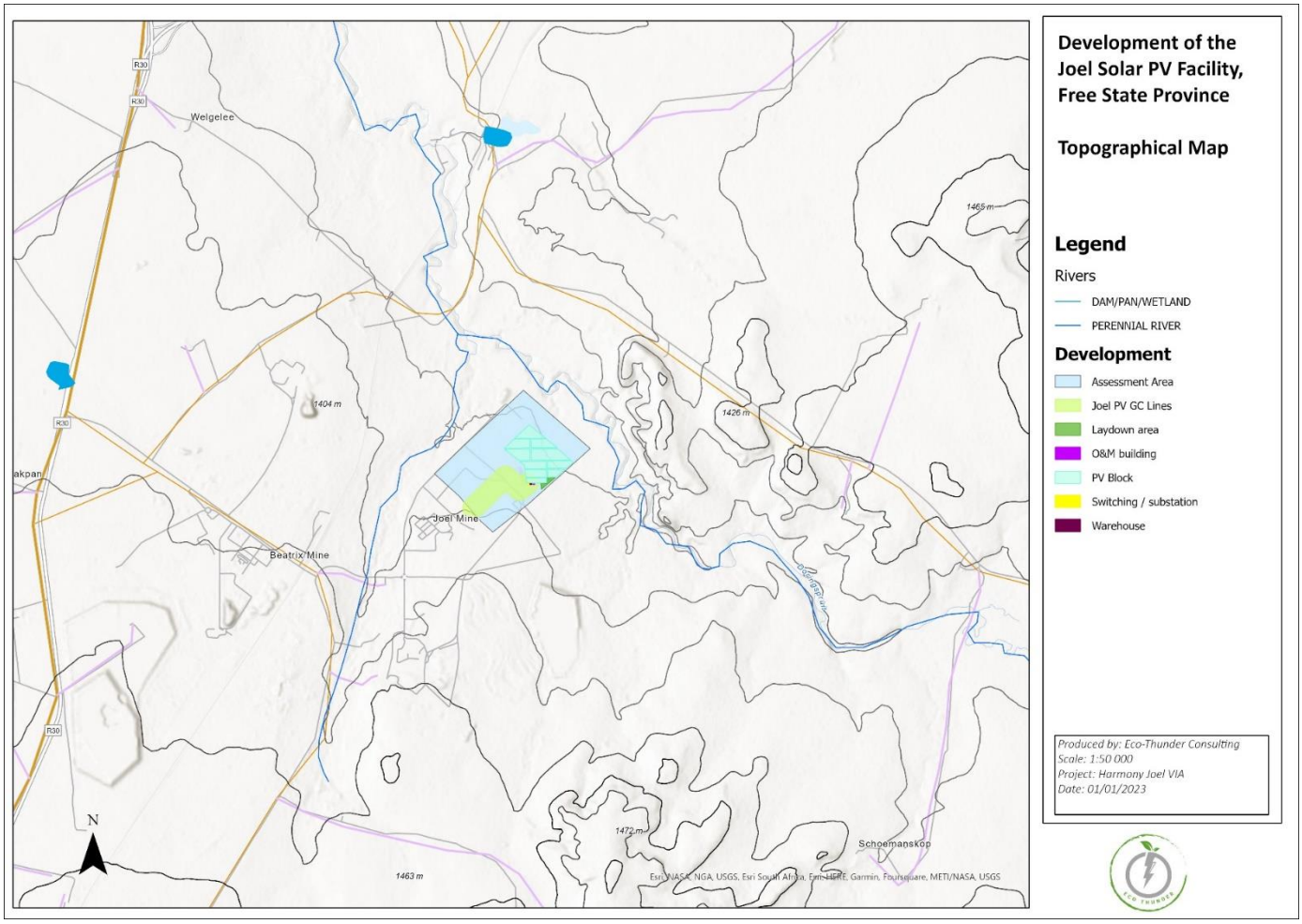


Figure 6.4: Topography for the Welkom area, in the Free State Province

6.4.2. Geology, Soils and Agricultural Potential

The site for development is on the Adelaide Subgroup with the margins on the Quaternary Kalahari Group sands. Six formations are recognised in the Kalahari Group but they are not often indicated on the geological maps. A more recent review by Botha (2021) attempts to correlate the Quaternary sediments but they are di cult to date or to determine their source. In this part of the Free State, the Hoopstad Aeolian sands are present. According to Harmse (1963, in Botha, 2021) this extensive red and grey sandy soil cover is associated with three generations of aeolian sand sheets. Moreover, these generations of aeolian sand form the soil substrate in the heart of the nation's maize cultivation region, yet their geological origin and age remains understudied.

The land type unit represented within the corridor include the Bd20 and Dc16 land types. Bd20 is eutrophic; red soils not widespread upland duplex and margalitic soils rare. Dc16 is prismacutanic and/or pedocutanic diagnostic horizons dominant. In addition, one or more of vertic melanic red structured diagnostic horizons.

The A horizon is normally coarse textured, and the B horizon is fine textured. The coarse textured A horizon has a law water holding capacity and the structure is usually weak (Tekle, 2004). The slopes are typically covered by well weathered unstructured red or yellow soils, while the valleys have clay deposits washed down from the slopes.

6.4.3. Land Use

The development area is approximately 20km north east of central Theunissen and 14km north of the town Virginia. The most prominent (and visible) land use within the region is maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The mining activities intensify further north (beyond the study area boundary), towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area.

Small residential areas located adjacent to the proposed development are informal settlement, with limited infrastructure that only meets RDP Standards. Social facilities within the area are lacking, with the nearest school being located some few kilometres from the site. No infrastructure is currently in place on site; however, electricity, sewers and water will be connected onto existing bulk infrastructure currently servicing the surrounding areas. Access to the majority of the area can be obtained via the main road as well as unnamed mine access roads surrounding the development area.

The extent of the project site consists of mining activities and livestock grazing.

- The project site was previously utilised for agricultural purpose and mainly for cultivation of crops and grazing purposes.
- Transformed areas include mines and quarries, as well as built-up areas.
- The area predominantly consists natural grassland which is part of the Central Free State Grassland vegetation type. However, mining activities and mine-related infrastructure occurs on the western and southern section of the study site. The majority of the study site (consisting of natural grassland) is primarily vacant and used for livestock grazing. Note that the Doring river and one of its tributaries are located north of the study site (within 200m from the study site boundary).

6.4.4. Ecological Profile of the Study Area and the Development Area

i. Vegetation Type

The study area is fairly large with an approximate extent of 200 hectares and dominated by thicket, of which a large portion are considered riparian thicket associated with the Doring River adjacent to the site (refer to **Figure 6.5**). The majority of the site still consists of natural vegetation without previous modification although mining operations situated on and around the site do result in transformation of the surroundings.

The study area is still largely natural (apart from the portion occupied by the mining operations). This is also confirmed by the National Biodiversity Assessment (2018) which indicates the site to still consist of natural Central Free State Grassland. The site is however also situated adjacent to the Doring River and the vegetation structure is much better affiliated with Highveld Alluvial Vegetation (Aza 5) which is a riparian vegetation type and dominated by riparian thicket which is quite prominent on the site. The site is fairly uniform and dominated by a mosaic of fairly dense thicket and open grassland and will be discussed as a whole. A small portion in the central portion of the site is clearly transformed and associated with a historical tailings dump but has a limited extent of approximately 5ha and is the prominently transformed area of the site (apart from the existing mining plant).

The immediate surroundings consist of Central Free State Grassland (Gh 6). The vegetation type is currently listed as being of Least Concern (LC) according to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Although it is quite heavily affected by transformation for dryland crop cultivation, it is not yet considered as severe enough to be regarded a Threatened Ecosystem. Remaining natural areas of this vegetation type will therefore not have a high conservation value, however, elements of conservation concern may still be present in natural areas. However, the site is also situated adjacent to the Doring River and from the survey it was also evident that the vegetation on the site is much more representative of the Highveld Alluvial Vegetation (AZa 5) type which is associated with riparian areas. This vegetation type is also listed as being of Least Concern (LC) which will also be taken into account in the assessment of the site.

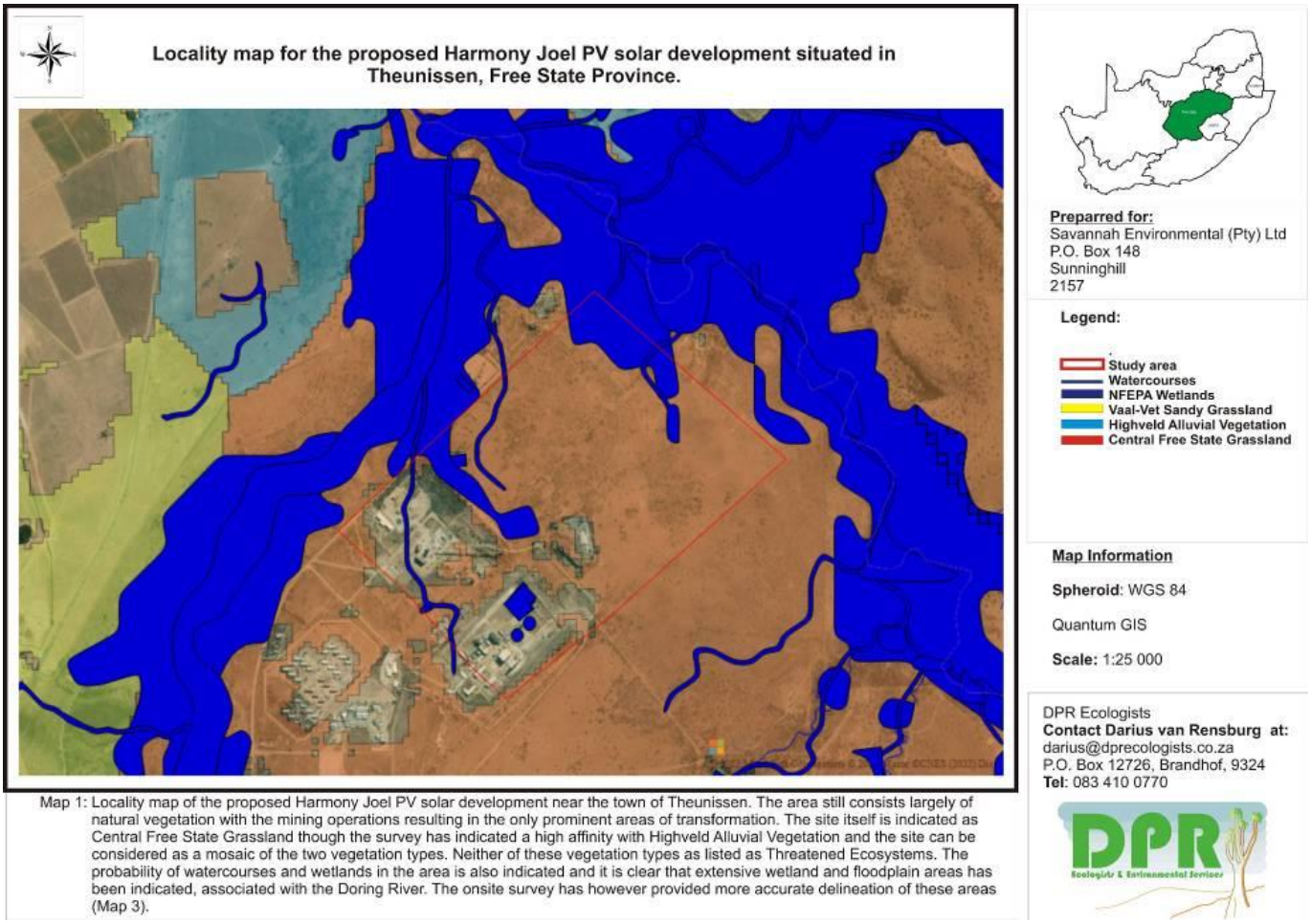


Figure 6.5: Vegetation map of the project site showing the Harmony Joel Solar PV facility study area

The full extent of the development area is described below.

Central Free State Grassland Highveld Alluvial Vegetation

The majority of the development area consists of grassland, which is characterised by undulating plains dominated by grassland while lower lying areas may be affected by increased encroachment by the tree, *Vachellia karroo*, where overgrazing and trampling occurs. The lower lying areas along the Doring River and Theronspruit, consists of alluvial vegetation. This vegetation type is characterised by flat topography with riparian thickets dominated by *Vachellia karroo*, accompanied by seasonally flooded grassland and disturbed herblands often dominated by exotic weeds. The area consists of a mixture of Central Free State Grassland and Highveld Alluvial Vegetation which may also have been affected by increased encroachment of *Vachellia karroo* as a result of overgrazing and trampling.

The thicket layer is dominated to a large degree by *Vachellia karroo* (Sweetthorn) which may have increased in density due to previous overgrazing and trampling.

- **Trees and shrubs:** *Diospyros lycioides, Ziziphus mucronata, Searsia pyroides, Asparagus larcinus* and *Searsia lancea.*
- **Climax grasses:** *Themeda triandra, Cymbopogon pospischillii, Eragrostis chloromelas, Digitaria eriantha, Fingerhuthia africana* and *Themeda triandra.*

- **Pioneer grasses:** *Aristida congesta, Chloris virgata, Eragrostis echinochloide, Melinis nerviglumis* and *Eragrostis gummiflua.*
- **Riparian grasses**: *Panicum coloratum, Setaria sphacelatum* and *Cynodon dactylon.*
- **Herbaceous component:** *Nidorella resedifolia, Solanum incanum, Blepharis subvolubilis, Gomphocarpus fruticosus, Hermannia depressa, Sebaea pentandra, Salvia verbenaca* and *Arctotis arctotoides.*
- **Geophytic species**: *Moraea pallida, Oxalis depressa, Boophone distichia, Eriospermum porphyrium, Colchicum burkei, Eucomis autumnalis, Bulbine abyssinica* and *Chlorophytum sp*. Of these, *B. distichia* and *E. autumnalis* are also listed as protected in the Free State Province and are therefore of significant conservation value.
- **Protected trees:** Wild Olive Tree (*Olea europaea subsp. africana)*
- **Exotic weeds:** *Bidens bipinnata, Tagetes minuta, Conyza bonariensis, Opuntia humifusa, Xanthium spinosum, Verbena bonariensis* and *Verbena tenuisecta.*
- **Invasive plants:** *Melia azedarach, Tamarix chinensis* and *Cortaderia selloana*

The vegetation on the site is clearly still natural and is mostly affiliated with Highveld Alluvial Vegetation though it does also contain elements of Central Free State Grassland. Both of these vegetation types are however listed as being of Least Concern (LC) and do not significantly contribute toward the conservation value of the site. Although natural, the vegetation on the site indicates a significant degree of disturbance. The site also does not contain a significant species diversity and does not contain elements of high conservation value.

ii. Critical Biodiversity and Ecological Support Areas

The conservation of CBAs is crucial, in that if these areas are not maintained in a natural or near-natural state, biodiversity conservation targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

The Free State Province Biodiversity Management Plan (2015) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas. The site for the proposed solar development is listed as being an Ecological Support Areas 1 & 2 (ESA1 and ESA2) (refer to **Figure 6.6**). This indicates that the area is not essential to meeting conservation targets but forms part of the functioning of the Doring River adjacent to the site and as a result does provide important functions in the support of this system. A Critical Biodiversity Area 2 (CBA 2) is situated to the west of the site and marginally intersects with the western border of the site. This CBA2 is associated with surrounding natural grassland of Vaal-Vet Sandy Grassland, an Endangered vegetation type though the marginal portion extending into the study area overlaps with the existing mining plant and is therefore not relevant to the development.

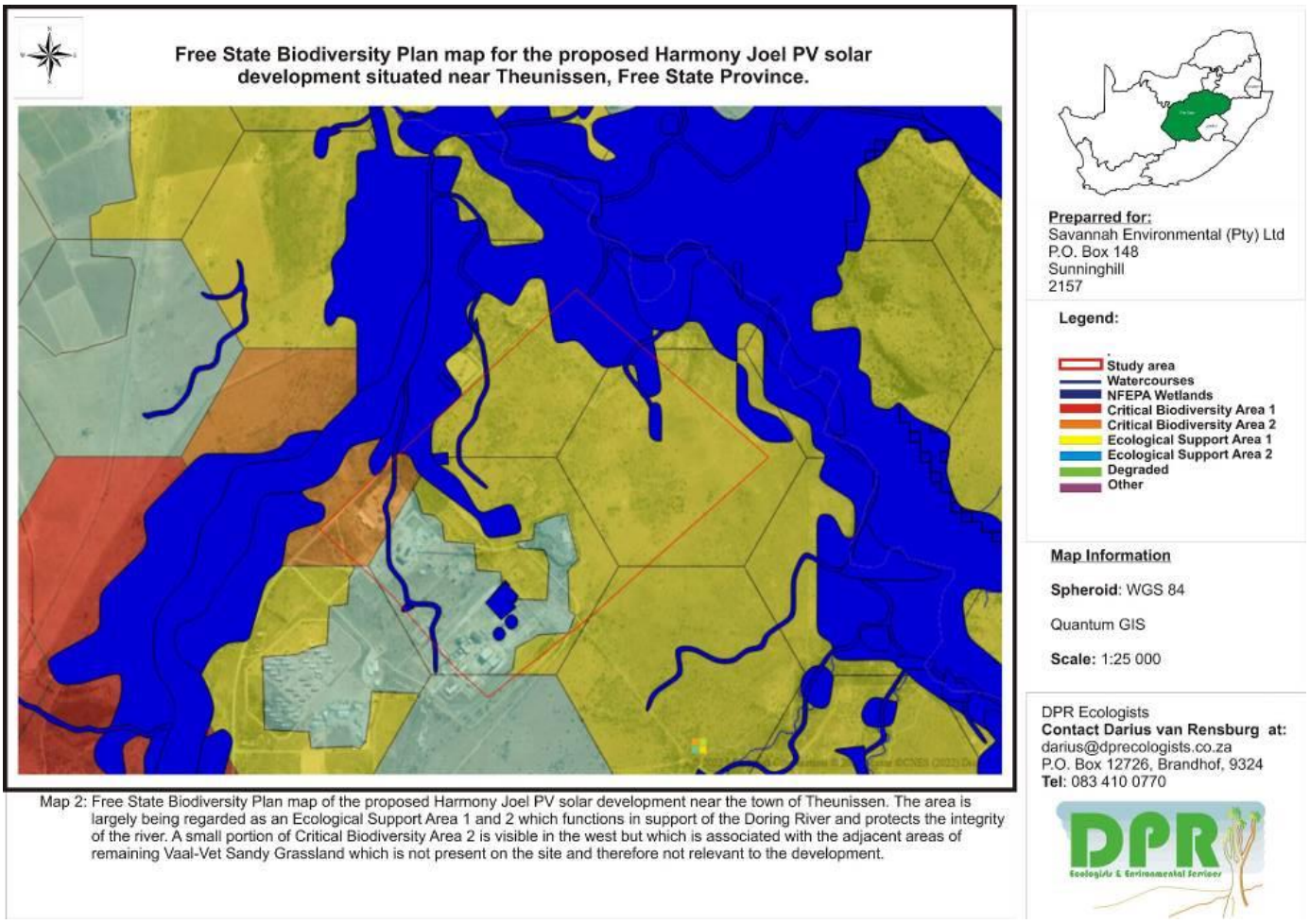


Figure 6.6: Map illustrating the project area superimposed on the CBA maps. The project development area falls within the ESA1.

iii. Terrestrial Fauna Communities in the Study Area

As the Screening Tool contains datasets that are mapped at a national scale, there may be areas where the Screening Tool erroneously assigns, or misses, environmental sensitivities because of mapping resolution and a high paucity of available and accurate data. Broad-scale site investigations will provide for an augmented and site-specific evaluation of the accuracy and 'infilling' of obvious and large-scale inaccuracies. Information extracted from the National Web-based Environmental Screening Tool (Department of Environmental Affairs, 2020), indicated that the study site and immediate surroundings hold a **medium to high** sensitivity with respect to the relative animal species protocol:

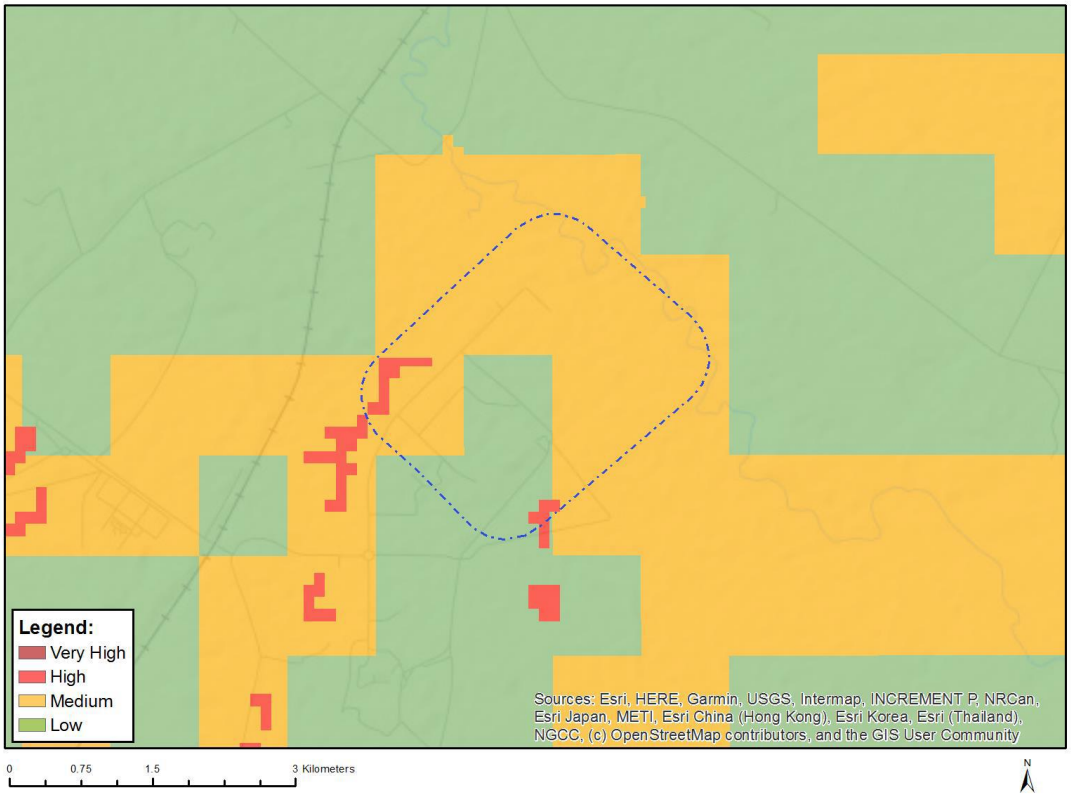


Figure 6.7: The animal species sensitivity of the study site and immediate surroundings according to the Screening Tool.

Signs and tracks of mammals are present on the site but notably less when compared to the presence of these mammals within natural areas. This is most likely a consequence of the proximity of the mining operations and frequent human activities in the area. Being dominated by natural vegetation the site itself will therefore still have capacity for a natural mammal population though the actual mammal population will be smaller and dominated by generalist species. Rare and endangered mammals are often reclusive and avoid areas in close proximity to human activities and are also dependant on habitat in pristine condition. Such species are therefore considered unlikely to occur in the area, although the Doring River may still provide suitable habitat for Cape Clawless Otter (*Aonyx capensis*). This area and the 1:100 year floodline of the river lies outside of the development area and would remain unaffected by the development.

Wetland and riparian habitats also generally provide a higher abundance of resources and subsequently are also able to sustain a diverse and large mammal population. The mammal survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. From the survey the following actual observations of mammals were recorded:

- Soil mounds of the Common Molerat (*Cryptomys hottentotus*) were common in most areas of the study area. This is a widespread species which has even become adapted to urban areas. It is a generalist species anticipated to occur in this area.
- Scat and burrows of Yellow Mongoose (*Cynictis penicillata*) occur in the study area. This species is widespread and common and found in most natural or disturbed habitats.
- Several burrows of small mammals were noted which could not be identified but do indicate a significant mammal population in the area.

» Observation of a Steenbok (*Raphicerus campestris*). This species is widespread but confined to fairly natural or agricultural areas and generally avoid urban areas.
» An active burrow of Aardvark (*Orycteropus afer*) occurs in the study area. This is also a fairly widespread and common species but is highly reclusive and is also listed as a protected species and is therefore of significant conservation value.

The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. As indicated, the site does still consist of natural vegetation though it is still fairly uniform and with moderate habitat diversity and consequently the mammal population is also not anticipated to be diverse. The impact on the loss of habitat would therefore be significant but is unlikely to exceed high values. In addition, extensive natural areas still remain in the surroundings into which mammals on the site can move to without resulting in high habitat pressures.

The survey has indicated that though the mammal population will consist largely of widespread, generalist species, there remains a low likelihood that Red Listed species occur in the area. From historical records, it is evident that the area contained a large number of mammals and numerous Red Listed mammals. Of these the larger antelope would only be found within conservation areas, and are not of consequence to the development. The smaller Red Listed mammal species may still occur in the area, including the Black-footed Cat (*Felis nigripes*), Brown Hyena (*Hyaena brunnea*), and African White-tailed Rat (*Mystromys albicaudatus*). These species are considered unlikely to occur in the area.

The Sungazer Lizard (*Smaug giganteus*) is a highly endangered reptile known to occur in the sandy grassland habitats of this region. The survey also specifically targeted this species but was found to be absent from the area. The habitat on the site is also unsuitable for this species while its distribution range is also situated to the north of the site. It is therefore not relevant to this development.

iv. Wetlands and Freshwater Resources

The surface water features of the study area is dominated by the Doring River which is situated adjacent to the site along its eastern, northern and western borders and may in some areas occur in close proximity to it (**Figure 6.8**). Associated with the Doring River is an extensive floodplain which may also extend onto the site. This is also dependent on the 1:100 year floodline of this watercourse. Within this floodplain an area of temporary saturation has also been identified which forms part of a floodplain wetland area although observed wetland conditions are only of a temporary nature and this area is therefore not clearly defined. The river itself is a tributary of the Sand River and is therefore a smaller system though still significant. It is regarded as perennial or nearly so, flowing for the most part of the year. The river also drains a large catchment which seems to be largely natural and the river should therefore be in a quite good condition, however, immediate upstream gold mining operations does seem to significantly contribute toward poor water quality which is likely to have a significant effect on it.

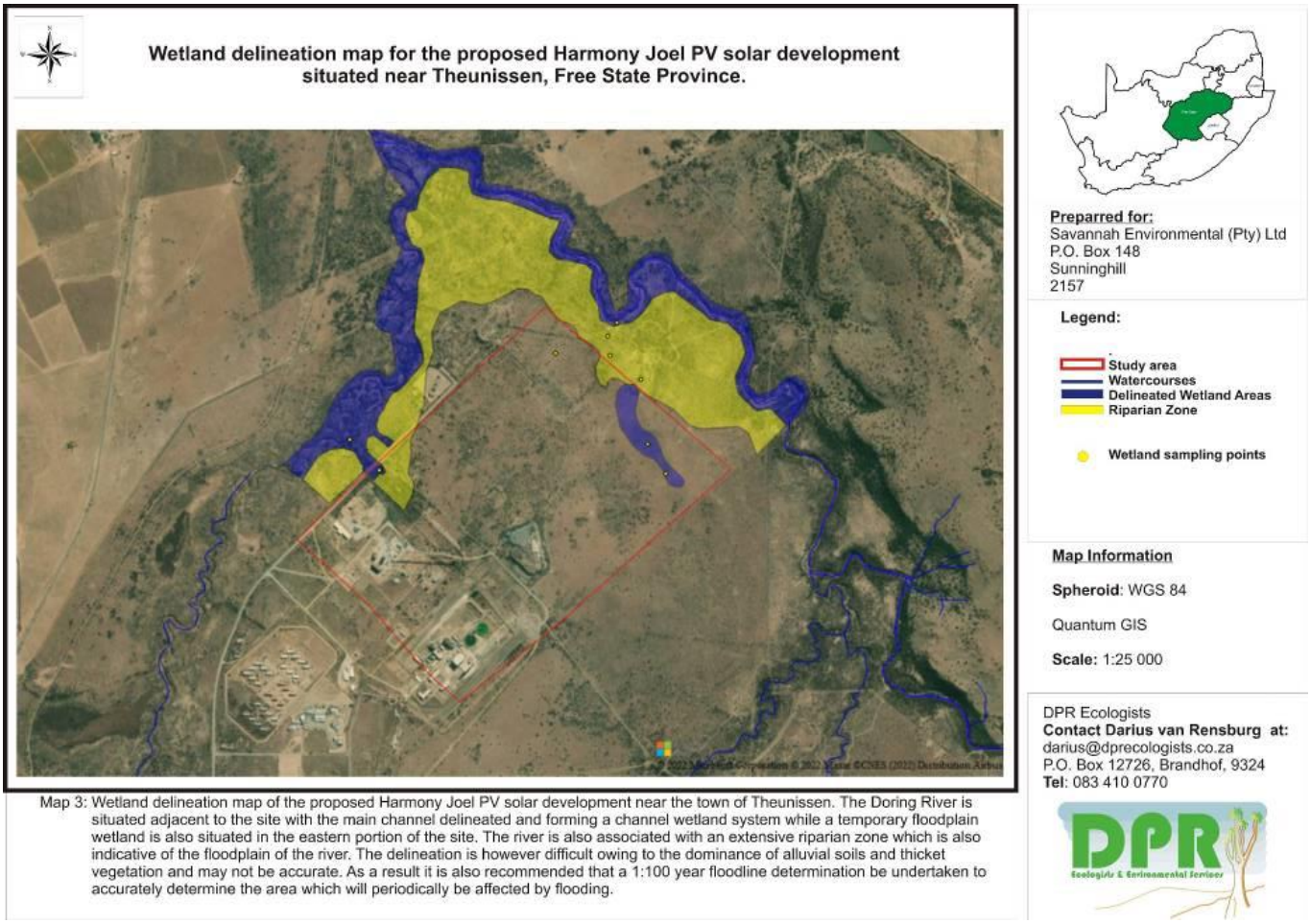


Figure 6.8: Wetland delineation areas relative to the development area

The vegetation survey indicated that obligate wetland vegetation occurs along the banks of the Doring River but does not extend into the floodplain. The floodplain of the river is dominated by alluvial clays which, although they do not contain wetland conditions, are clearly a consequence of alluvial deposition after flooding and which confirms the presence of an extensive floodplain. However, a portion in the north eastern corner of the study area contains a grassy floodplain where Facultative Wetland grasses dominate and which therefore indicates a temporary wetland zone. This was also confirmed by soil samples which confirmed temporary soil saturation.

Classification of wetland systems

The wetland conditions associated with the main channel and banks of the Doring River can be characterised as a channel wetland system (SANBI 2009). The wetland areas forming within the floodplain of the Doring River situated in the north east of the site can be categorised as a floodplain wetland (SANBI 2009).

Description of watercourses and wetlands

Obligate wetland vegetation was also used to determine the presence of wetland conditions. Obligate wetland species are confined to wetlands and are only able to occur in wetlands. They are therefore reliable indicators of wetland conditions.

Table 6.2: Description of the individual watercourses and wetlands which forms part of the larger study area

Watercourse name:	**Coordinates of sampling:**	**Flow regime:**
#1 Doring River – a mostly perennial and prominent watercourse (outside of the development footprint)	**S 28.243091°, E 26.834375°** **S 28.248495°, E 26.820406°**	**Perennial**

Description of watercourse:

A lateral transect to the north and west of the site along the floodplain and to the main channel was taken for the Doring River. This provides a fairly good description of the banks of the river, the floodplain and the current impacts affecting the system.

The river is still fairly natural, especially when considering the catchment which is still largely natural. However, the main channel does indicate at least some contamination caused by upstream seepage of mining areas. The likelihood that the Joel, Beatrix and Oryx mines are causing pollution of the Doring River has also been confirmed by DWS (2015). Other lesser impacts in the area include a few dirt tracks that act as obstructions to surface flow and trampling caused by domestic livestock which leads to a decrease in riparian vegetation and increased sedimentation of the river. These impacts will contribute to at least some modification of the system.

The river contains a clearly defined, fairly deep main channel with distinct riparian zonation. It follows a meandering flow pattern though generally flows from south east to north west. The river also drains into the Sand River approximately 20 km to the north west of the site. The channel of the river is prominent and fairly wide at approximately 8 meters. An extensive floodplain is situated along the river though the exact border could not be accurately determined. The area is dominated by alluvial soils and thicket which all indicate the presence of a riparian zone though the exact border of the floodplain should be determined by a 1:100 year floodline determination. Toward the north east of the site the floodplain also contains temporary wetland conditions which indicate the presence of a floodplain wetland. The development should, as far possible, refrain from encroaching into the 1:100 year floodline of the river and where it will not be possible to completely avoid the floodline of the river, that the necessary flood protection structures be implemented.

Obligate wetland vegetation dominates along the main channel, which include a variety of sedges, rushes and grasses in the marginal zone while dense aquatic vegetation may also be present in some portions of the stream. Dense algal mats were also notable and may be a consequence of increase nutrient inflow caused by upstream impacts. The lower zone is also dominated by many obligate wetland plants such as sedges and grasses with terrestrial plants being largely absent. This indicates wetland conditions extending up the banks of the river. The upper zone also contains some obligate wetland plants though terrestrial species are quite abundant and dominates in many areas. This indicates a decrease in the moisture regime in the upper zone which contains only a temporary zone of wetness. Riparian trees and shrubs dominate in the upper zone while being absent in the other zones. However, the floodplain is dominated by thicket which is fairly dense overall. Here terrestrial plants dominate though it was noted that patches of higher moisture regime do also contain facultative wetland grasses which indicate a higher moisture regime in the floodplain. Overall, the species composition along the river and floodplain is in a relatively natural condition although exotic weeds are also quite abundant. This is however to be expected within the riparian thicket. The system is therefore still considered to largely natural although some disturbance is evident. The border between the floodplain or riparian zone and the surrounding terrestrial areas are not well defined with the area being dominated by alluvial clay soils. The approximate floodplain has been delineated though a 1:100 year floodline determination should also be undertaken to accurately determine the extent that flooding may occur.

Dominant plant species:

Riverbanks*: Artemisia afra, Imperata cylindria (OW), Equisetum ramosissimum var. ramosissimum, Cyperus marginatus (OW), Celtis africana, Pergularia daemia, Typha capensis (OW)*.

Floodplain*: Berkheya radula, Setaria verticillata, Gomphocarpus fruticosus, Cynodon dactylon, Ziziphus mucronata, Setaria sphacelata (FW), Diospyros lycioides, Vachellia karroo, Salsola rabieana, Microloma aramatum, Kalanchoe rotundifolia.*

Protected plant species:

Pergularia daemia, Microloma armatum.

Soil sample:

The Doring River contains a prominent and fairly wide channel with steep banks.

Dense riparian thicket is clearly present in the floodplain though the border with the surrounding terrestrial areas are not well defined.

Flooding within the river can be extensive during the riany season, here indicated by the level of flood debris in trees (red).

Dense algal mats in the main channel indicate high levels of nutrients which may be consequence of upstream mining impacts.

Watercourse name:	Coordinates of sampling:	Flow regime:
#2 Floodplain wetland – Area of temporary saturation in the north east of the site (outside of the development footprint)	**S 28.248697°, E 26.835987°** **S 28.250044°, E 26.836936°**	**Temporary**

Description of watercourse:

The north eastern portion of the site contains a flat area adjacent to the Doring River which is dominated by facultative wetland grasses and indicates at least temporary saturation during the rainy season. This indicates the presence of a floodplain wetland area. It forms a part of the Doring River but is included separately here in order to give a specific description of this area. It is not a prominent wetland area and is border with surrounding thicket habitats is not well defined though the floodplain wetland itself is still clearly differentiable from the surroundings. This floodplain wetland has an elongated form and drains into the Doring River via an erosion feature in the floodplain. This gulley erosion is a common feature along the watercourses in this region and is still considered as a natural feature. The floodplain wetland has an approximate length of 480 meters. The floodplain wetland is imbedded within the surrounding thicket

vegetation but is clearly differentiated from it in that it is almost devoid of trees and shrubs (a possible consequence of temporary saturation) while it is dominated by facultative wetland grasses. This also confirms at least temporary wetland conditions. It will also form part of the floodplain of the river and it is recommended that this portion be completely excluded from development.

The floodplain wetland is a completely flat area situated within the floodplain, adjacent to the river and corresponds well with the characteristics of a floodplain wetland. Vegetation also consists of facultative wetland grasses and therefore indicate at least temporary saturation though it is clear that prominent wetland areas are not present. Soil samples also indicate soils with a very high clay content and with feint mottling also being visible. This also confirms the presence of temporary wetland conditions.

Dominant plant species:
Setaria sphacelata (FW), Panicum coloratum (FW).

Protected plant species:
None observed.

Soil sample:

The floodplain wetland clearly do not contain prominent wetland conditions but is dominated by dense facultative grasses which indicate a temporary zone of saturation. Note also the absence of trees and shrubs.

The floodplain wetland also drains into the Doring River via an erosional feature at the north western end.

6.4.5. Avifauna profile for the project area

Regional Vegetation Description

Bird diversity is positively correlated with vegetation structure, and floristic richness is not often regarded to be a significant contributor of patterns in bird abundance and their spatial distributions. Although grasslands are generally poor in woody plant species, and subsequently support lower bird richness values, it is often considered as an important habitat for many terrestrial bird species such as larks, pipits, korhaans, cisticolas, widowbirds including large terrestrial birds such as Secretarybirds, cranes and storks. Many of these species are also endemic to South Africa and display particularly narrow distribution ranges. Due to the restricted spatial occurrence of the Grassland Biome and severe habitat transformation, many of the bird species that are restricted to the grasslands are also threatened or experiencing declining population sizes.

Conservation Areas, Protected Areas and Important Bird Areas

The study site does not coincide with any statutory/formal conservation area or Important Bird and Biodiversity Area (IBA). The nearest formal conservation area to the proposed study site is the Willem Pretorius Game Reserve, which is located 28 km east of the study site. The Willem Pretorius Game Reserve is also a recognised IBA (SA044). The H.J. Joel Private Nature Reserve is located adjacent to the eastern boundary of the study site.

Preliminary avifaunal habitat types

Apart from the regional vegetation type, the local composition and distribution of the vegetation associations on the study area are a consequence of a combination of factors simulated by soil type, anthropogenic activities and grazing intensity (presence of livestock) which have culminated in three major broad-scale habitat units that deserve further discussion (**Figure 6.9**):

» ***Open savannoid grassland with bush clumps:*** This unit is dominant on the study site and covers a significant extent in surface area of the facility development area. It is represented by two discrete floristic variations which also provide habitat for two discrete avifaunal associations. The first floristic variation consists of open grazed Central Free State Grassland dominated by *Themeda triandra*. It is occupied by a grassland bird composition dominated by insectivorous and granivore passerine bird species such as Desert Cisticola, (*Cisticola aridulus*), Ant-eating Chat and Cape Longclaw (*Macronyx capensis*). The overall bird richness was low.

The bush clumps form a prominent mosaic characterised by the dominance of a woody layer of *Vachellia karoo* on clay soils. The eminent increase in vertical heterogeneity provided by the woody layer is colonised by a "Bushveld" bird association consisting of insectivorous passerines such as Black-chested Prinia (*Prinia flavicans*), Chestnut-vented Warbler (*Curruca subcoerulea*), Kalahari Scrub Robin (*Cercotrichas paena*), Neddicky (*Cisticola fulvicapilla*), African Red-eyed Bulbul (*Pycnonotus nigricans*), Orange-river White-eye (*Zosterops pallidus*) as well as granivores such as Yellow Canary (*Crithagra flaviventris*), Blue Waxbill (*Uraeginthus angolensis*) and Black-faced Waxbill (*Brunhilda erythronotos*). Non-passerine bird taxa are represented by Ring-necked Dove (*Streptopelia capicola*), Acacia Pied Barbet (*Tricholaema leucomelas*) and White-backed Mousebird (*Colius colius*).

- ***Transformed areas*:** These areas are represented by build-up land and mining infrastructure. These features are invariably artificial and present an urban and industrial landscape which is colonised by generalist bird taxa such as Speckled Pigeon (*Columba guinea*), House Sparrow (*Passer domesticus*) and Cape Sparrow (*Passer melanurus*).

- ***Doring River and associated tributaries (riverine woodland)*:** The perennial Doring River and one of its tributaries occur north of the study site (approximately 200m from the development area). The system is characterised by a very narrow marginal and floodplain zone, and relatively deeply incised banks. Therefore, the marginal zone is often colonised by a variety of facultative wetland vegetation which include amongst others taxa such as *Imperata cylindrica, Pennisetum* spp., *Miscanthus cf. junceus*, while the riverbanks are covered on vegetation that is similar to the savannoid grassland habitat although the prevalence of woody vegetation is higher with a high abundance cover (e.g. *Asparagus laricinus*). The marginal zone provides potential habitat for bird species such as the Levaillant's Cisticola (*Cisticola tinniens*) and African Stonechat (*Saxicola torquatus*), while the river canal itself (open surface water) provides foraging habitat for waterfowl such as the Yellow-billed Duck (*Anas undulata*), South African Shelduck (*Tadorna cana*) and Egyptian Goose (*Alopochen aegyptiacus*).

It is evident from **Figure 6.9** that the development footprint is characterised by open savannoid grassland with bush clumps.

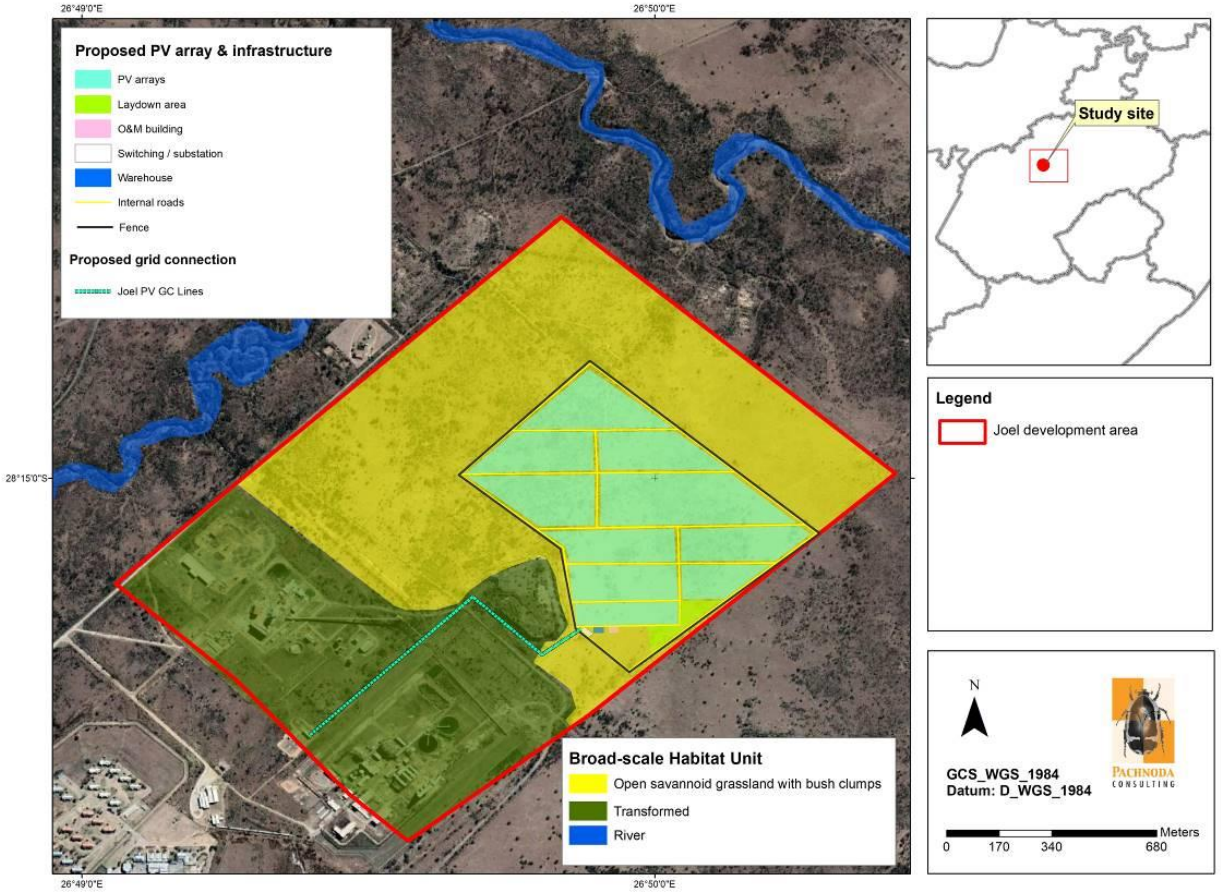


Figure 6.9: A habitat map illustrating the avifaunal habitat types on the study site and immediate surroundings (the habitat types are subject to change pending the outcome of a detailed baseline surveys)

Species Richness and Predicted summary statistics

Approximately ~162 bird species have been recorded within the study area, although it is more likely that between 90-100 bird species could occur within the physical boundaries of the study area (according to the habitat types and the ecological condition thereof). The richness was inferred from the South African Bird Atlas Project (SABAP2)[21] and the presence of suitable habitat in the study area. This equates to 16 % of the approximate 990[22] species listed for the southern African subregion[23] (and approximately 18.5% of the 871 species recorded within South Africa[24]). However, an average number of 47 species for each full protocol card submitted were recorded for the pentad grids corresponding to the study area (for observations of two hours or more; range= 19 - 79 species). It provides a more realistic species tally of the bird composition on the physical study area. In addition, three of the observed species represented new records for the study area and included the Cape White-eye (*Zosterops virens*), Cape Penduline Tit (*Anthoscopus minutus*) and the Long-billed Crombec (*Sylvietta rufescens*).

[21] The expected richness statistic was derived from pentad grid 2810_2645, 2810_2650, 2815_2645 and 2815_2650 totalling 161 bird species (based on 22 full protocol cards). The Common Ostrich (*Struthio camelus*) was removed from the expected list since these represent introduced individuals that are not natural (free-range) birds.

22 *sensu* www.zestforbirds.co.za (Hardaker, 2022), including recently confirmed bird species (vagrants.

23 A geographical area south of the Cunene and Zambezi Rivers (includes Namibia, Botswana, Zimbabwe, southern Mozambique, South Africa, eSwatini and Lesotho).

24 With reference to South Africa (including Lesotho and eSwatini (BirdLife South Africa, 2022).

According to **Table 6.1**, the study area is poorly represented by biome-restricted and local endemic and near-endemic bird species. It supports *ca*. 30% of the near -endemic species present in the subregion. A higher proportion of the endemic and threatened bird species will become displaced from the study area due to the loss of habitat, when compared to the number of species that are at risk of colliding with the PV/electrical infrastructure.

Table 6.1: A summary table of the total number of species, Red listed species (according to Taylor et al., 2015 and the IUCN, 2022), endemics and biome-restricted species (Marnewick et al., 2015) expected (*sensu* SABAP2) to occur in the study site and immediate surroundings.

Description	Expected Richness Value	Observed Richness Value
Total number of species*	162 (16 %)	91 (56 %)
Number of Red Listed species*	4 (3%)[#]	0 (0 %)
Number of biome-restricted species – Zambezian and Kalahari-Highveld Biomes)*	3 (9%)	2 (67 %)
Number of local endemics (BirdLife SA, 2022)*	2 (5 %)	0 (0 %)
Number of local near-endemics (BirdLife SA, 2022)*	6 (20 %)	4 (67 %)
Number of regional endemics (Hockey *et al.*, 2005)**	15 (14 %)	11 (73 %)
Number of regional near-endemics (Hockey *et al.*, 2005)**	19 (31 %)	13 (68 %)

Table 6.2: Expected biome-restricted species (Marnewick *et al*, 2015) likely to occur on the study site and immediate surroundings.

Species	Zambezian	Kalahari-Highveld	Namib-Karoo	Expected Frequency of occurrence
Kalahari Scrub-robin (*Cercotrichas paena)*		X		Common
Sickle-winged Chat (*Emarginata sinuata*)			X	Vagrant and highly nomadic (known from a single record during 22 April 2022; sensu SABAP2)
White-bellied Sunbird (*Cinnyris talatala*)	X			Common

Bird species of conservation concern

Table 6.3 provides an overview of bird species of conservation concern that could occur on the study site and immediate surroundings based on their historical distribution ranges and the presence of suitable habitat. According to **Table 6.3**, total of four species could occur on the study area which include two globally threatened species and two regionally threatened species.

It is evident from **Table 6.3** that the occurrence of threatened species on the study site was low (sensu SABAP2). Suitable habitat for the occurrence of the globally endangered Maccoa Duck (*Oxyura maccoa*) and the regionally endangered African Marsh Harrier (*Circus ranivorus*) was sub-optimal, thereby suggesting that the probability that these species could occur within the physical boundaries of the study site is low.

The regionally vulnerable Lanner Falcon (*Falco biarmicus*) appears to be resident on the study site, where it as observed hunting pigeons and doves between the Harmony Joel plant and the onsite substation. This

species was previously overlooked since it was last recorded during 2014 in the study area (sensu SABAP2). Optimal habitat for the African Marsh Harrier (*Circus ranivorus*) occurs within the "pan corridor" west of the town of Welkom where the pan edges and extensive *Phragmites* and *Typha* stands associated with pan floodplains provide suitable habitat for this species to breed. In addition, suitable foraging habitat corresponding to open grassy floodplain habitat (as opposed to the well-wooded and deeply incised stream channel adjacent to the study area) was observed along the upper catchment of the Doring River system south of the study site (e.g. Farm Malgaskraal 374 and Farm Wiids Draai 53).

In addition, the open grassland-bush clump mosaics provides ephemeral foraging habitat for the occurrence of the globally endangered Secretarybird (*Sagittarius serpentarius*) and the regionally vulnerable Lanner Falcon (*Falco biarmicus*). The former species was probably displaced from the study site due to livestock farming regimes and mining activities although suitable habitat was observed approximately 5 km south-east of the study site at the border between Farm Leeuwfontein 256 and Farm Schoemanskop 654. The latter species is regarded as an occasional foraging visitor to the study site.

Table 6.3: Bird species of conservation concern that could utilise the study site based on their historical distribution range and the presence of suitable habitat. Red list categories according to the IUCN (2022)* and Taylor et al. (2015)

Species	Global Conservation Status*	National Conservation Status**	SABAP 2 reporting rate	Preferred Habitat	Potential Likelihood of Occurrence
Circus ranivorus (African Marsh Harrier)	-	Endangered	5.26 (ad hoc record)	Restricted to permanent wetlands with extensive reedbeds.	Probably absent from the study site and adjacent Doring river due to the absence of extensive floodplains and reedbeds (suitable habitat absent) Only known from a single old observation during 2008 (sensu SABAP2). in the study region.
Falco biarmicus (Lanner Falcon)	-	Vulnerable	Not observed/recorded	Varied, but prefers to breed in mountainous areas although also using old disused mine voids.	Could be an occasional foraging visitor to the study site.
Oxyura maccoa (Maccoa Duck)	Endangered	Vulnerable	5.26 (ad hoc record)	Large saline pans and shallow impoundments.	Probably absent on the physical study site due to the absence of suitable habitat. It was last recorded during 07 April 2008 on the wider study region (sensu SABAP2).
Eupodotis caerulescens (Blue Korhaan)	Near-threatened	(delisted)	2.56	Prefers extensive open short grassland and cultivated land.	Vagrant, probably absent and historically displaced due to anthropogenic activities. It has not been recently observed on the study area (it was last recorded during 2012; *sensu* SABAP2).
Sagittarius serpentarius (Secretarybird)	Endangered	Endangered	8.70	Prefers open grassland or lightly wooded habitat.	An irregular foraging visitor to the study site. Potentially displaced from study area due to agricultural and mining activities. It is known from two records obtained from grid 2815_2650, where optimal habitat was observed approx. 5km south-east of the study site at the border between Farm Leeuwfontein 256 and Farm Schoemanskop 654.

6.5. Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape

6.5.1. State of the Site

The development area is located across the Joel mining area in the goldfields region of the Lejweleputswa district of the Free State Province. The Joel area is substantially less affected by modern activities and significant portions of the original landscape are retained that have thick shrubs and grasses, although portions of the property owned by the Mine are used for cattle grazing, and one small central area has been affected by historical mining (evidenced by an abandoned shaft CJL13).

The footprint is located in the vicinity of the Free State Doring meandering river system. Portions of the affected property are located on the terraces of this drainage system, with evidence of banded chert nodules (4-11cm in maximum diameter – a high quality raw-material for artefact manufacture) (CJL2), and thick fluvially deposited sands (CJL11). Importantly, only marginal topsoil formation was evident in the area, which may be a further indicator of the erosional effects of a past active high-energy river system. Several remnants of dam structures were recorded, implicating the historical anthropogenic capture of naturally available water in the summer rainfall season (CJL3 and CHL6). Although the affected area is relatively flat, there are more resistant raised areas that are richer in archaeological materials relative to the deflated areas between (CJL11). There is also more evidence for soil formation in the raised portions, indicating that parts of the landscape have been differentially eroded by natural (flooding) and/or anthropogenic processes (agriculture) over time.

6.5.2. Archaeology

According to Fourie (2021), "The Free State has a rich archaeological and historical history going back millions of years and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. The general surroundings of the study area became a melting pot of contact and conflict as it represents one of many frontiers where San hunter-gatherers, Nguni and Sotho-Tswana agro-pastoralists, Dutch Voortrekkers and British Colonists all came together. The ravages of war also swept across these plains, and in particular the South African War (1899-1902) as well as the Boer Rebellion (1914-1915)." No heritage resources of significance were identified by Van der Walt (2013) in his assessment of a nearby farm. Van der Walt (2013) notes that "some MSA finds might be possible around pans on the farm. It is important to note that the lack of sites can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools. No Sites dating to the Early or Middle Iron Age have been recorded or are expected for the study area. The same goes for the Later Iron Age period where the study area is situated outside the western periphery of the distribution of Late Iron Age settlements in the Free State. However, to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986)".

Based on the known archaeological sensitivity of the broader context, it is unlikely that the development footprint will impact on significant Stone Age or Iron Age archaeological heritage; however it is possible that informal or unmarked graves may be present within the development area.

6.5.3. Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and very high fossil sensitivity. The Adelaide Subgroup of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2826 Winberg Geology Map. According to the updated biostratigraphy (Smith et al., 2020), the whole of the Adelaide Subgroup has been divided into five Assemblage Zones based on the dominant or temporally exclusive vertebrate fossils. If vertebrate fossils were common in this region and had been well mapped then the specific Assemblage Zone would have been indicated in the literature. Common names for the fossils that could occur here are fish, amphibians, reptiles, therapsids, terrestrial and freshwater tetrapods, as well as freshwater bivalves, trace fossils including tetrapod trackways and burrows. Where the vertebrates do not occur it is possible to find sparse to rich assemblages of vascular plants of the late Glossopteris Flora, including some petrified logs), and insects are also prevalent at some sites.

Millsteed (2013) notes that "The Cainozoic regolith and the Adelaide Subgroup are both potentially fossiliferous and their stratigraphic equivalents are known to contain scientifically important fossil assemblages elsewhere in South Africa. Accordingly, it may be reasonably expected that significant fossils may be present within the project area." He goes on to note that "Thus, the historical farming processes have probably destroyed any fossil materials that may have been present at surface in these areas. Similarly, where present the regolith cover would hide any fossils contained within the underlying Adelaide Subgroup from discovery. The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. Any fossil materials that may have been present at/or near the surface in the cultivated regolith will have been historically destroyed and the likelihood of any negative impact is categorised as negligible. The possibility of a negative impact on the depth interval between the maximum depth of ploughing and the maximum depth of excavations within the regolith is categorised as low (due to the scarcity of fossils in general)."

6.6 Visual Quality

The development area is located on a terrain unit of rolling or irregular plains with low hills at an altitude of between 1370m and 1410m. The surrounding area comprises mostly of agricultural land, mining activities and to the south industrial and residential activities from the town of Theunissen and to the north mining and residential activities from the town of Virginia.

The most prominent (and visible) land use within the region is maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The mining activities intensify further north (beyond the study area boundary), towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site.

Towns or residential areas primarily associated with the mines in the region include:

- Welkom
- Bronville
- Naudeville
- Bedelia
- Silwerstraal
- Bloudrif

- Virginia
- Meloding
- Whites
- Riebeekstad
- Odendaalsrus

The PV facility site is accessible from both the R30 to the west and the R73 to the east via adjoining secondary roads. Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines.

There is a privately protected / conservation area just directly adjacent to the south of to the PV facility known as the H.J Joel Private Nature Reserve.

6.7 Social Context

6.7.1 Profile of the Broader Area

The Free State Province is the landlocked core of the country. It is centrally placed, with good transport corridors to the north and the coast. It is the third biggest of South Africa's nine provinces in terms of size, and primary agriculture is a key economic sector. Mining is also important but has been declining steadily since 2008. Although the Free State is the third largest province in South Africa, it has the second smallest population and the second lowest of 129 825km² and has a population of 2 834 714. It covers an area 5.1% of the national population. Languages spoken include Sesotho (64.4%), Afrikaans (11.9%) and Zulu (9.1%). The Free State Province contributes 5.4% to South Africa 's total gross domestic product (2006).

Agriculture is a key economic sector 8% of the country's produce comes from Free State. In 2010, agriculture provided 19.2% of all formal employment opportunities in the region. The economy is dominated by agriculture, mining, and manufacturing. Known as the 'breadbasket' of South Africa, about 90% of the Province is under cultivation for crop production. It produces approximately 34% of the total maize production of South Africa, 37% of wheat, 53% of sorghum, and 33% of potatoes. The Province is the world's fifth largest gold producer, with mining the major employer.

The Harmony Joel Solar PV is located within the Masilonyana Local Municipality (MLM), which is one of five local municipalities that make up the Lejweleputswa District Municipality (LDM) in the Free State Province. The town of Welkom is the administrative seat for both the LDM and MLM. It is an impoverished semi-urban area with a high unemployment rate.

6.7.2 Population

According to CS 2016, there were 62770 persons living in the Masilonyana LM area of jurisdiction translating into 21558 households; 89.1% of the population belongs to the Black African population group, 9.8% to the White population group, 0.9% to the Coloured population group and 0.2% to the Asian/Indian population.

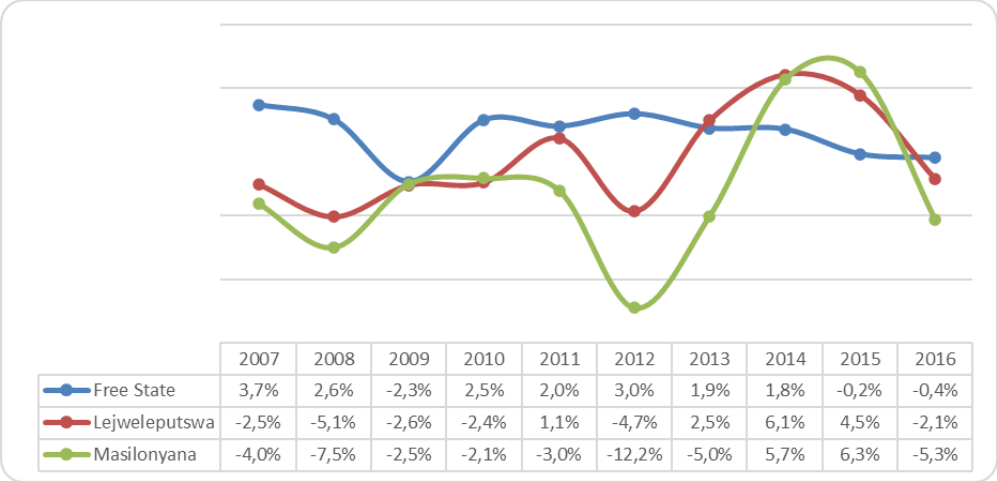
Table 6.4: Population and population interdental growth of Masilonyana Local Municipality

	Total population	Population interdental growth (2011 - 2016)
Census 2011	59 895	2 875
CS 2016	62 770	

Table 6.4 indicates the population of Masilonyana local municipality and population interdental growth. This municipality has shown a population growth from 59 895 residents in 2011 to 62 770 in 2016, population has increased between 2011 and 2016 with interdental growth of 2 875 thousand.

6.7.3 Economy

The economy of Masilonyana Local Municipality is heavily reliant on the mining sector, although the sector's share is on a decline. The mining sector contributed about 52.4% to the municipality's economic output in 2016. The second largest sector was the community services (15.0%) followed by finance (8.5%) and trade (7.4%). On the other end of the spectrum, the smallest sectors were electricity and water (1.6%), construction (1.7%) and manufacturing.



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Free State	3,7%	2,6%	-2,3%	2,5%	2,0%	3,0%	1,9%	1,8%	-0,2%	-0,4%
Lejweleputswa	-2,5%	-5,1%	-2,6%	-2,4%	1,1%	-4,7%	2,5%	6,1%	4,5%	-2,1%
Masilonyana	-4,0%	-7,5%	-2,5%	-2,1%	-3,0%	-12,2%	-5,0%	5,7%	6,3%	-5,3%

Figure 6.10: GDP growth rates by region

In terms of economic sectors, the economic outlook for Masilonyana is a bit dismal. In 2016, all sectors in the economy contracted with the worst performing being in the primary industries, which happen to be the biggest industry in the municipality's economy. The biggest sectors in the economy, mining and community services, contracted by 14.1% and 1.5% respectively. In order to rescue the economy from this sustained period of negative growth, these two sector must begin to grow positive.

6.7.4 Employment

Unemployment is without a doubt one of the biggest challenges facing the Free State Province. During the period 2007 to 2016, the unemployment rate in the Free State averaged 29.6%. The Lejweleputswa District's unemployment rate averaged 33.7% during the same period, while that of Masilonyana averaged 37.8%. According to IHS Global Insight (2017), Masilonyana had the highest unemployment rate within the Lejweleputswa District, followed by Matjhabeng (33.5%), Nala (34.3%), Tswelopele (33.2%) and Tokologo (28.4%) respectively

The biggest employers in the municipality of Masilonyana in 2016 were trade (22%), community services (19%), agriculture (16%) and private households (14%). On the other hand, the smallest employers were electricity and water (1%), transport (3%), construction (4%), and manufacturing (6%). It is interesting to note that although the mining contributes over 50% to economic output, it only contributes 8% to employment.

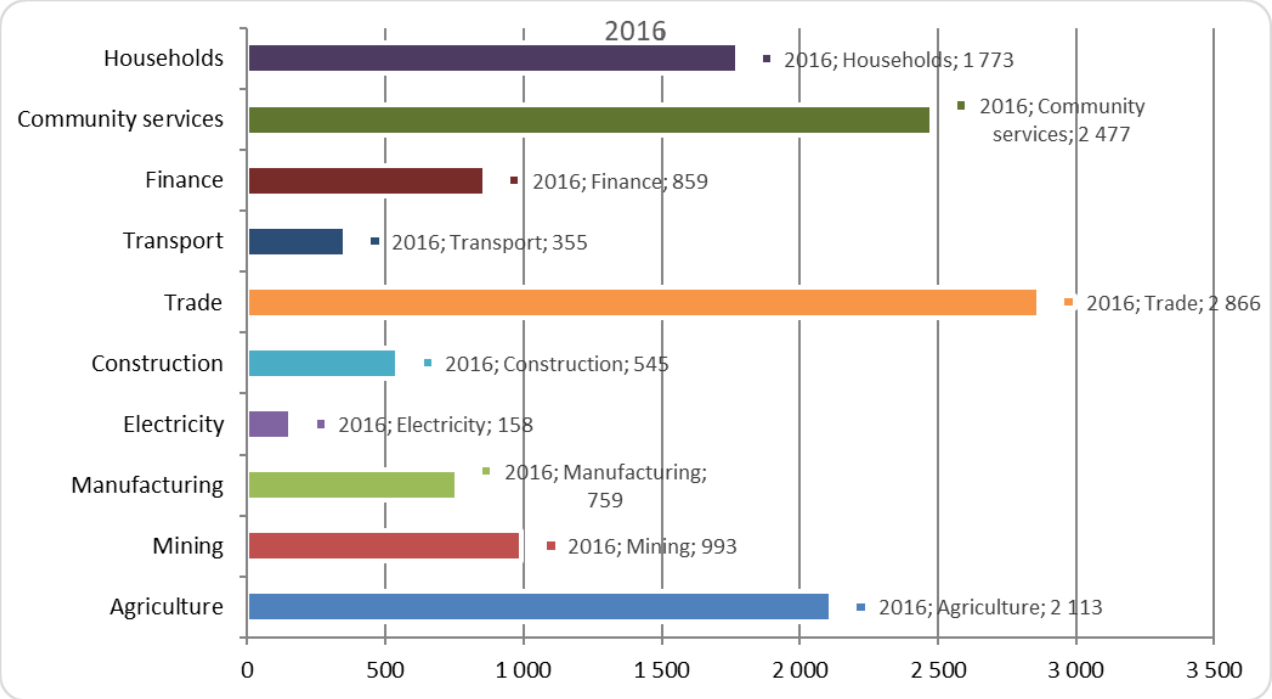
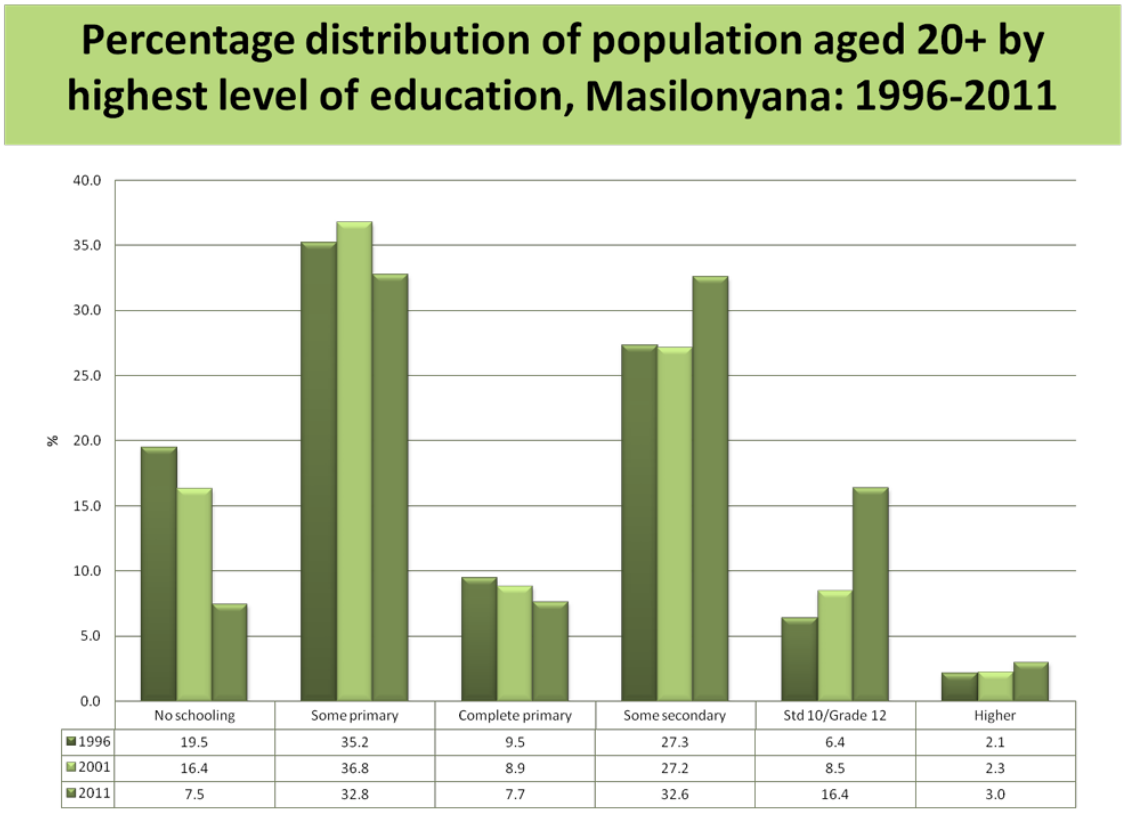


Figure 6.11: Overview of Employment Statistics in the study area

6.7.5 Education

Figure 6.12 presents percentage distribution of population aged 20+ years by highest level of education of Masilonyana Local Municipality. It shows that among population aged 20 years and above, a significant decrease of 12 percent of population reported to have no schooling from 19.5% in census 1996 to 7.5% in census 2011 respectively. The figures further show an increase of 5.4% and 7.9% among the population reported to have some secondary and matric education in 2001 and 2011 censuses respectively.



	No schooling	Some primary	Complete primary	Some secondary	Std 10/Grade 12	Higher
1996	19.5	35.2	9.5	27.3	6.4	2.1
2001	16.4	36.8	8.9	27.2	8.5	2.3
2011	7.5	32.8	7.7	32.6	16.4	3.0

Figure 6.12: Overview of Education Distribution in the study area

Languages spoken include Sesotho (64.4%), Afrikaans (11.9%) and Zulu (9.1%). The Free State Province contributes 5.4% to South Africa 's total gross domestic product (2006).

CHAPTER 7: ASSESSMENT OF IMPACTS

This chapter serves to assess the significance of the positive and negative environmental impacts (direct, and indirect) expected to be associated with the development of the Harmony Joel Solar PV Facility and its associated infrastructure. This assessment has considered the construction and operation of a PV facility with a contracted capacity of up to 18MW with a development footprint of approximately ~47ha. The project will comprise the following key infrastructure and components:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Grid connection solution including an on-site facility substation and switching substation, to be connected via an overhead power line to the Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint).

The full extent of the project site was considered through the EIA phase by the independent specialists and the EAP. On-site sensitivities were identified through the review of existing information, desk-top 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. **Figure 7.1** illustrates the Harmony Joel Solar PV development area, including the grid connection infrastructure.

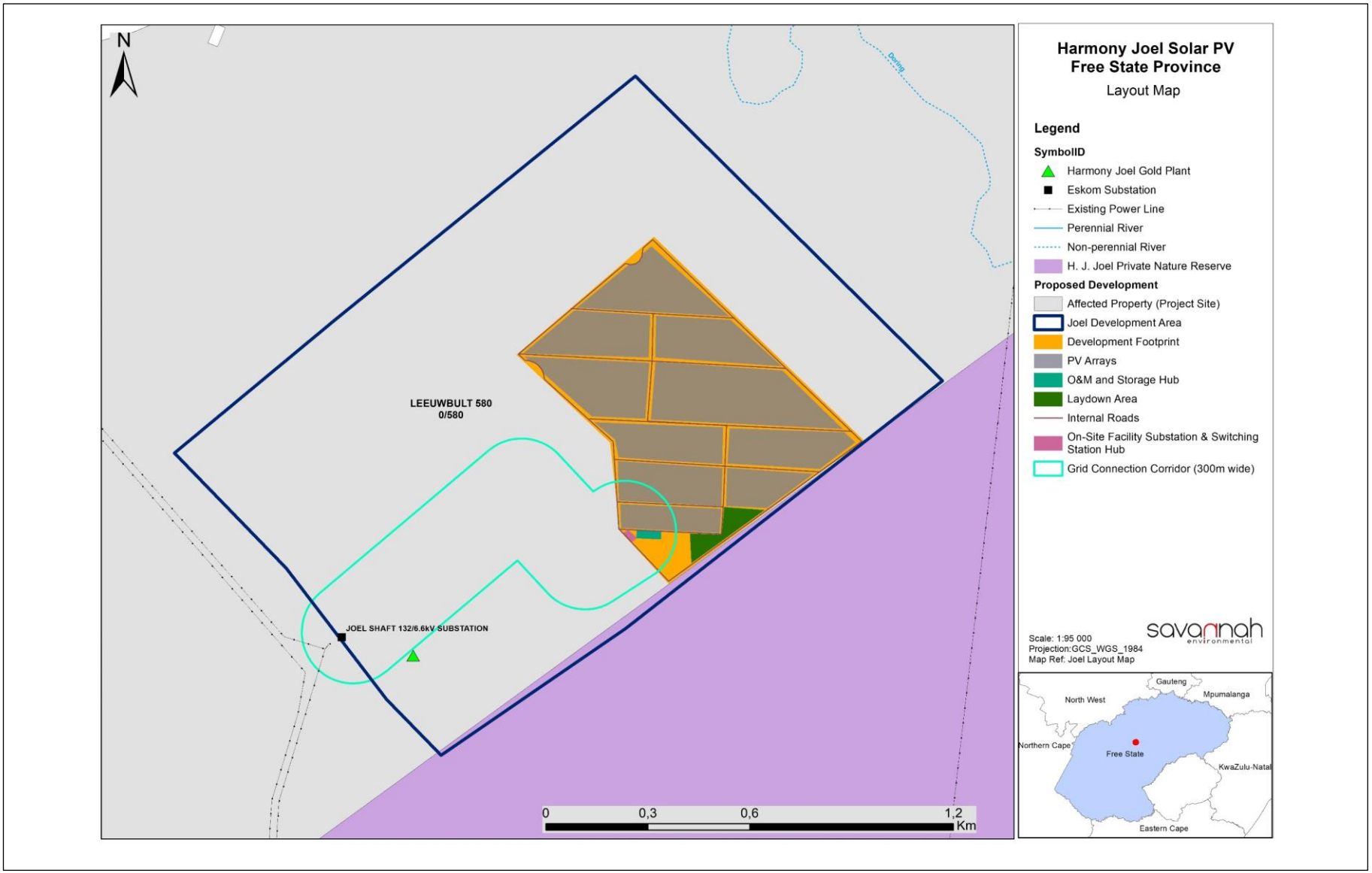


Figure 7.1: Map of the Harmony Joel Solar PV Facility development area, infrastructure and grid connection corridor (refer to **Appendix L**).

The development of the Harmony Joel Solar PV Facility 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 (including PV panels and substation); 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 is estimated at 6 - 12 months.
- *Operation* – will include the operation of the PV 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 is expected to be up to 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 PV 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 impacts associated with construction and decommissioning activities may include, among others, threats to biodiversity and ecological processes, including habitat alteration and impacts to fauna, avifauna and flora, impacts to sites of heritage value, soil contamination, erosion and loss of agricultural land, nuisance from the movement of vehicles transporting equipment and materials, and loss of income from agricultural land.

Environmental impacts associated with the operation phase includes soil contamination, erosion and potential invasion by alien and invasive plant species. Other impacts include visual impacts and social impacts.

7.1. Quantification of Areas of Disturbance on the Site

Site-specific impacts associated with the construction and operation of the Harmony Joel Solar PV Facility relate to the direct loss of vegetation and species of special concern, disturbance of animals (including avifauna) and loss of habitat and impacts to soils. In order to assess the impacts associated with the Harmony Joel Solar PV Facility, it is necessary to understand the extent of the affected area.

- The Harmony Joel Solar PV Facility requires a development footprint of approximately 47ha. This area includes infrastructure such as PV modules and mounting structures, inverters and transformers, temporary and permanent laydown areas, O&M and storage hub – including site offices and maintenance buildings, workshop areas for maintenance and storage, and site and internal access roads.
- The grid connection solution includes a power line within a grid connection corridor (300m assessed corridor), an on-site facility substation (footprint area up to 2ha in extent) and Eskom switching station (footprint area up to 2ha in extent).

7.2. Potential Impacts on Terrestrial Ecology and Wetlands

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. The significance of the impacts on terrestrial ecology and wetlands expected with the development of the Harmony Joel Solar PV Facility has been assessed as medium, 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 D** for more details).

7.2.1 Results of the Terrestrial Ecology Impact Assessment

Terrestrial Flora

The development area is fairly large with an approximate extent of 200 hectares and dominated by thicket, of which a large portion are considered riparian thicket associated with the Doring River adjacent to the site. The majority of the site still consists of natural vegetation without previous modification although mining operations situated on and around the site do result in transformation of the surroundings. The site consists of the Central Free State Grassland vegetation. The vegetation type is currently listed as being of Least Concern (LC) according to the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004). Although it is quite heavily affected by transformation for dryland crop cultivation, it is not yet considered as severe enough to be regarded a Threatened Ecosystem. Remaining natural areas of this vegetation type will therefore not have a high conservation value, however, elements of conservation concern may still be present in natural areas. However, the site is also situated adjacent to the Doring River and from the survey it was also evident that the vegetation on the site is much more representative of the Highveld Alluvial Vegetation type which is associated with riparian areas. This vegetation type is also listed as being of Least Concern (LC) which will also be taken into account in the assessment of the site.

The site for the proposed solar development is listed as being an Ecological Support Areas 1 & 2 (ESA1 and ESA2). This indicates that the area is not essential to meeting conservation targets but forms part of the functioning of the Doring River adjacent to the site and as a result does provide important functions in the support of this system. A Critical Biodiversity Area 2 (CBA2) is situated to the west of the site and marginally intersects with the western border of the site. This CBA2 is associated with surrounding natural grassland of Vaal-Vet Sandy Grassland, an Endangered vegetation type though the marginal portion extending into the study area overlaps with the existing mining plant and is therefore not relevant to the development.

The site is fairly uniform and dominated by a mosaic of fairly dense thicket and open grassland. A portion (~5ha) in the central area of the site is clearly transformed and associated with a historical tailings dump. The area is being utilised as grazing for domestic livestock and this also contributes toward at least a moderate level of overgrazing and trampling.

While the assessment and significance rating consider the full extent of the development area, the implementation of avoidance of sensitive areas as a mitigation strategy has been adopted. The northern portion of the development area (comprising of the Doring River) has been excluded entirely from the development footprint and the necessary mitigation implemented to ensure no indirect impacts affect the sensitive habitats.

The following impacts on the ecosystem, ecology and biodiversity are assessed:

- Loss of vegetation and consequently habitat and species diversity as a result.
- Loss of protected, rare or threatened plant species.
- Impacts on watercourses, wetlands or the general catchment.
- The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.
- Any increased erosion that the development may cause.
- Fragmentation of habitat, disruption of ecological connectivity and functioning in terms of the surrounding areas.
- Impacts that will result on the mammal population on and around the site.
- Any significant cumulative impacts that the development will contribute towards.

Terrestrial Fauna

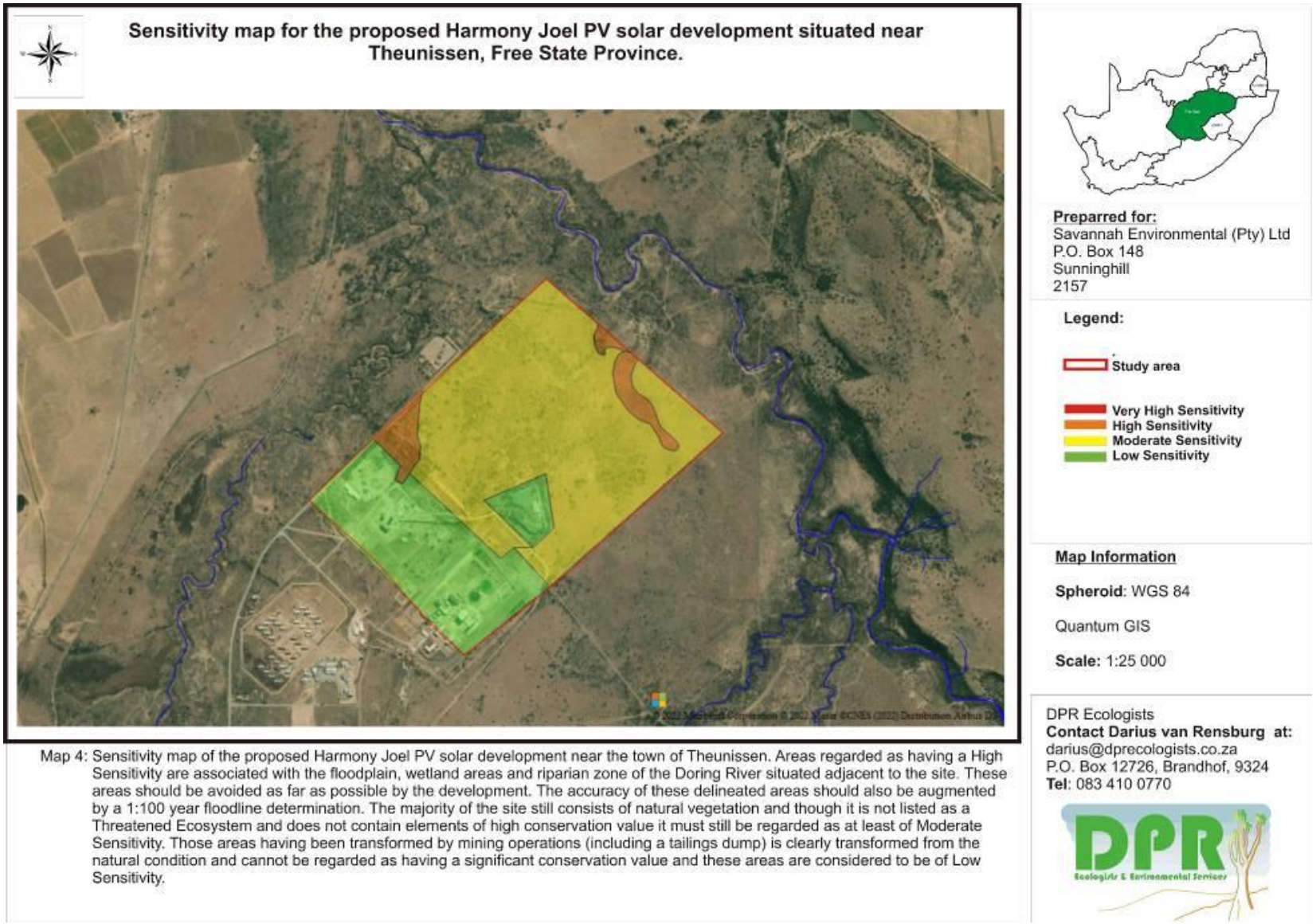
Signs and tracks of mammals are present on the site but notably less when compared to the natural condition. This is most likely a consequence of the proximity of the mining operations and frequent human activities in the area. Being dominated by natural vegetation the site itself will therefore still have capacity for a natural mammal population though the actual mammal population will be smaller and dominated by generalist species. Rare and endangered mammals are often reclusive and avoid areas in close proximity to human activities and are also dependant on habitat in pristine condition. Such species are therefore considered unlikely to occur in the area though the Doring River may still provide suitable habitat for Cape Clawless Otter (*Aonyx capensis*) though should remain largely unaffected by the development as long as the development footprint is kept outside the 1:100 year floodline of the river.

Wetland and riparian habitats also generally provide a higher abundance of resources and subsequently are also able to sustain a diverse and large mammal population. This will also be the case for the Doring River adjacent to the site. It is therefore also important that this system not be affected by the development. As long as the development footprint is kept outside the 1:100 year floodline of the river, the impact on the mammal population along the river should remain low.

The mammal survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. From the survey the following actual observations of mammals were recorded. The species identified on the site indicate only a moderate species diversity of largely widespread and generalist species and is indicative of a modified natural mammal population. A similar mammal population should also be able to re-establish in the solar development footprint after construction has taken place.

The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. The site does still consist of natural vegetation though it is still fairly uniform and with moderate habitat diversity and consequently the mammal population is also not anticipated to be diverse. The impact on the loss of habitat would therefore be significant but is unlikely to exceed high values. In addition, extensive natural areas still remain in the surroundings into which mammals on the site can move to without resulting in high habitat pressures.

The impact significance has been determined to be moderate with or without mitigation. The relevant ecological sensitivities of the project site are presented in **Figure 7.2.**

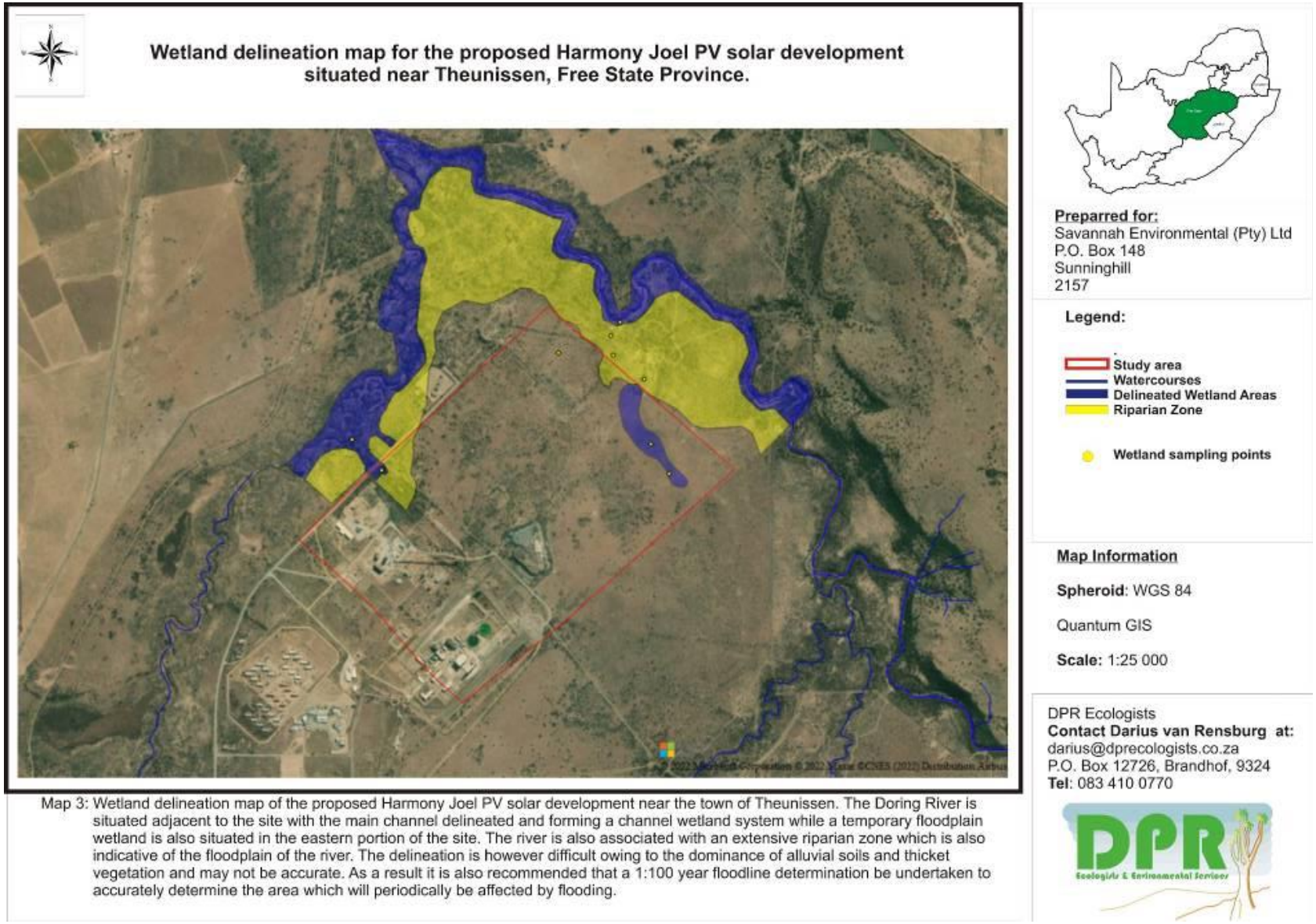


Map 4: Sensitivity map of the proposed Harmony Joel PV solar development near the town of Theunissen. Areas regarded as having a High Sensitivity are associated with the floodplain, wetland areas and riparian zone of the Doring River situated adjacent to the site. These areas should be avoided as far as possible by the development. The accuracy of these delineated areas should also be augmented by a 1:100 year floodline determination. The majority of the site still consists of natural vegetation and though it is not listed as a Threatened Ecosystem and does not contain elements of high conservation value it must still be regarded as at least of Moderate Sensitivity. Those areas having been transformed by mining operations (including a tailings dump) is clearly transformed from the natural condition and cannot be regarded as having a significant conservation value and these areas are considered to be of Low Sensitivity.

Figure 7.2: Ecological sensitivity map for the Harmony Joel Solar PV Facility.

7.2.2 Results of the Wetland Impact Assessment

The freshwater features of the study area is dominated by the Doring River which is situated adjacent to the site along its eastern, northern and western borders and may in some areas occur in close proximity to it. Associated with the Doring River is an extensive floodplain which may also extend onto the site. This is also dependent on the 1:100 year floodline of this watercourse. Within this floodplain an area of temporary saturation has also been identified which forms part of a floodplain wetland area (refer to **Figure 7.3**) although observed wetland conditions are only of a temporary nature and this area is therefore not clearly defined. The river itself is a tributary of the Sand River and is therefore a smaller system though still significant. It is regarded as perennial or nearly so, flowing for the most part of the year. The river also drains a large catchment which seems to be largely natural and the river should therefore be in a quite good condition, however, immediate upstream gold mining operations does seem to significantly contribute toward poor water quality which is likely to have a significant affect on it. The assessment was, therefore, based on the Doring River and its associated floodplain.



Map 3: Wetland delineation map of the proposed Harmony Joel PV solar development near the town of Theunissen. The Doring River is situated adjacent to the site with the main channel delineated and forming a channel wetland system while a temporary floodplain wetland is also situated in the eastern portion of the site. The river is also associated with an extensive riparian zone which is also indicative of the floodplain of the river. The delineation is however difficult owing to the dominance of alluvial soils and thicket vegetation and may not be accurate. As a result it is also recommended that a 1:100 year floodline determination be undertaken to accurately determine the area which will periodically be affected by flooding.

Figure 7.3: Wetland delineation map for the Harmony Joel Solar PV Facility

Implementation of a stormwater management system should adequately mitigate any impacts on runoff and erosion. Development within 500 meters of the wetland areas will require authorisation from DWS.

7.2.3 Impact tables summarising the significance of impacts on ecology related to the PV facility, substations and the grid line during construction and operation (with and without mitigation)

Nature:
Loss of vegetation and consequently habitat and species diversity as a result.

Impact Description:
Solar PV developments usually entail the removal of surface vegetation and may also involve modification of the surface topography. This therefore has a large impact in terms of the loss of vegetation, vegetation type and consequently habitat. As indicated from the discussion of the study area, it is still largely dominated by natural vegetation though a degree of disturbance is notable. The loss of natural vegetation, habitat and species diversity is therefore inevitable. However, the natural vegetation types in the area, Highveld Alluvial Vegetation and Central Free State Grassland are both only listed as being of Least Concern (LC) and is therefore not of high conservation value. The area is also listed as an Ecological Support Area and therefore the area is not essential to meeting conservation targets but forms part of the functioning of the Doring River adjacent to the site. The site would therefore have an overall Moderate level of sensitivity.

	Without mitigation	**With mitigation**
Extent	Limited development footprint (1)	Limited development footprint (1)
Duration	Permanent (5)	Permanent (5)
Magnitude	Moderate conservation value (5)	Moderate conservation value (5)
Probability	Impact is unavoidable (5)	Impact is unavoidable (5)
Significance	**Medium (55)**	**Medium (55)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	No	

Mitigation:
The loss of natural vegetation, habitat and species diversity is inevitable, and no significant mitigation will decrease the anticipated impact. However, the site is considered to have an overall Moderate level of sensitivity. The development will therefore result in the loss of natural vegetation, but which is considered to have only a moderate conservation value. The development would therefore still result in significant impacts, but which is unlikely to exceed moderate values.

Residual Impacts:
The study area is still largely dominated by natural vegetation though a degree of disturbance is notable. The loss of natural vegetation, habitat and species diversity is therefore inevitable.

Nature:
Loss of protected, rare or threatened plant species.

Impact Description:
The remaining natural vegetation on the site is generally fairly uniform and species diversity remain moderate over the entire site. There are however still a few protected plant species and these also retain a significant conservation value. Where the protected geophytic species, *Boophone distichia* and *Eucomis autumnalis* will be affected by the development, permits will have to be obtained and affected plants transplanted to adjacent areas where they will remain unaffected. A few small specimens of the protected Wild Olive Tree (*Olea europaea susp. africana*) also occur on the site and permits will also have to be obtained to remove these. Provided that this mitigation is successfully implemented, the anticipated impact should remain moderate to low.

	Without mitigation	**With mitigation**
Extent	Limited development footprint (1)	Limited development footprint (1)
Duration	Permanent (5)	Permanent (5)

Magnitude	High likelihood for the loss of protected species (8)	Loss of fewer protected species, provided mitigation is successfully implemented (4)
Probability	Only a few protected species known to occur on the site and therefore probability is moderate (3)	Probable that at least some protected species will be lost (3)
Significance	**Medium (42)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» A walk-through survey would be recommended before construction commences. Any flora search and rescue will likely include a few individuals of widespread, cosmopolitan or common but protected species.
» Respective permits to be obtained beforehand for the removal of these protected species.

Residual Impacts:

Despite comprehensive mitigation (dependant on this mitigation being successfully implemented) a residual loss of some protected species is still unavoidable.

Nature:

Impacts on watercourses, wetlands or the general catchment.

Impact Description:

The Doring River and associated floodplain and wetland areas are situated adjacent to the site and it remains likely that they will be affected by the proposed development. Solar developments are well known to have significant impacts on surface water features as a result of the rain shadow caused by the panels and the coupled runoff and infiltration patterns, erosion caused by these runoff patterns and disruption of surface watercourses. The Doring River and its associated floodplain should therefore be excluded from the development and the necessary mitigation implemented to ensure no indirect impacts affect the river system. Development in close proximity (within 100 meters of riparian and within 500 meters of wetland areas) to the Doring River will require authorisation from DWS. Should it be possible to avoid the 1:100 year floodline of the Doring River the anticipated impact will remain low, however, where the development encroaches into the floodplain of the river the impacts will be considerably higher.

	Without mitigation	**With mitigation**
Extent	Spill over of impacts into downstream areas (3)	Development footprint remains outside the 1:100 year floodline of the river (2)
Duration	Permanent (5)	Permanent (5)
Magnitude	Direct wetland loss (10)	Impacts on the river still significant (4)
Probability	Impact is unavoidable (5)	Impact probability is moderate (3)
Significance	**High (90)**	**Medium (33)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» Should the facility layout remain outside the 1:100 year floodline of the river, the freshwater features will not be directly affected. However, the indirect impact will remain moderate.
» Design and implement a comprehensive storm water management system in order to manage runoff and prevent erosion which will affect the river system.

Residual Impacts:

Where the development remains outside the 1:100 year floodline of the river it should not be directly affected, however, it may still be indirectly affected by the development, most probably as a result of increased runoff from the panels and an increased sediment load. Erosion is therefore also probable.

Nature:

The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.

Impact Description:

As was observed during the survey of the study area, those portions of high disturbance also contains several exotic plant species of which a few are also well known invasive and problematic plants such as *Melia azedarach, Tamarix chinensis and Cortaderia selloana.* Without mitigation, these will also pose a risk of spreading into surrounding natural areas, especially as construction of the solar development will increase disturbance in the area. The proposed development will also have to implement a comprehensive monitoring and eradication programme to ensure that invasive plant species are removed from the area and prevented from re-establishing.

	Without mitigation	**With mitigation**
Extent	Spreading of infestation into neighbouring areas (3)	Limiting extent through monitoring and eradication (1)
Duration	Long-term infestation (4)	Limited duration if monitoring and eradication is maintained (3)
Magnitude	Infestation of surrounding natural areas (6)	Limited but unavoidable infestation (6)
Probability	Impact is highly likely (4)	Moderate probability remains (3)
Significance	**Medium (52)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

» Alien species (including alien invasive trees) and weeds must be removed from the site as per CARA/NEMBA requirements.
» A suitable weed/alien invasives management strategy to be implemented during construction and operation phases. It is imperative that any actions are implemented timeously as once alien and weed species generate seeds, the problem is exacerbated.
» After clearing and construction is completed, an appropriate cover may be required, should natural re-establishment of grasses not take place in a timely manner along road verges. This will also minimise dust.Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

Residual Impacts:

Without mitigation this will significantly increase the establishment of exotics and is likely to spread into the surrounding areas.

Nature:

An increase in erosion as a result of the development.

Impact Description:

Where solar PV developments result in the removal of vegetation, this reduces infiltration and promotes runoff. Coupled with the rain shadow caused by panels and the resulting dripline, this has the potential to increase runoff and erosion. This may also have a moderate impact on the wetland systems adjacent to the site.

	Without mitigation	**With mitigation**
Extent	Spreading of erosion into neighbouring areas (3)	Limiting extent through storm water management (1)
Duration	Permanent modification of surface topography (5)	Permanent modification of surface topography (5)
Magnitude	Limited magnitude due to the flat topography (6)	Limited magnitude due to the flat topography (4)
Probability	Highly likely to take place (4)	Unlikely to occur as long as storm water management is maintained (2)
Significance	**Medium (56)**	**Low (20)**
Status (positive or negative)	Negative	Negative

Can impacts be mitigated?	Yes, to a large extent

Mitigation:

Implementation of a comprehensive stormwater management system which should ensure that the surface runoff patterns are retained as is, especially pertaining to solar panels, and that the development does not contribute toward increased surface flow, erosion and any impacts on downslope areas.

Residual Impacts:

Erosion may also have a significant impact on the Doring River adjacent to the site.

Nature:

Fragmentation of habitat, disruption of ecological connectivity and -functioning in terms of the surrounding areas.

Impact Description:

The region around the study area, especially to the east of it, is still dominated by extensive natural areas and consequently ecosystem functions, habitat fragmentation and the disruption of ecosystem processes is still fairly low. However, the development will also require the transformation of thicket and grassland in fairly good condition and will therefore result in habitat loss and fragmentation. This will, however, be limited to the development footprint area. The surroundings are still dominated by natural vegetation.

The study area is still listed as an Ecological Support Area 1 (ESA) and aids in the functioning of the adjacent Doring River in terms of ecological connectivity and aids in preserving the integrity of the system. The development may therefore still affect this functioning of the river and adequate mitigation as indicated should still be implemented, i.e. the implementation of a comprehensive stormwater system and exclusion of the 1:100 year floodline of the river. The development will also result in the loss of some natural vegetation which would contribute to at least a moderate impact in terms of habitat fragmentation and the loss of ecosystem processes.

	Without mitigation	**With mitigation**
Extent	Limited loss of natural areas (2)	Limited loss of natural areas (2)
Duration	Permanent loss and fragmentation of habitat (5)	Permanent loss and fragmentation of habitat (5)
Magnitude	Moderate impact on the functioning of the Doring River (5)	Moderate impact on the functioning of the Doring River (5)
Probability	Highly likely to take place (4)	Lower probability if adequate mitigation is implemented (3)
Significance	**Medium (48)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	

Mitigation:

- Should the facility layout remain outside the 1:100 year floodline of the river, the freshwater features will not be directly affected. However, the indirect impact will remain moderate.
- Design and implement a comprehensive storm water management system in order to manage runoff and prevent erosion which will affect the river system.

Residual Impacts:

The area is largely still dominated by natural vegetation in fairly good condition and it is unavoidable that the development will result in transformation of a significant portion of natural vegetation and consequently the residual impact on habitat fragmentation and the loss of ecosystem processes would remain significant.

Nature:

Impacts that will result on the mammal population on and around the site.

Impact Description:

The most significant impact on mammals anticipated on the site itself is primarily concerned with the loss and fragmentation of available habitat. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. As indicated, the site does still consist of natural vegetation

though it is still fairly uniform and with moderate habitat diversity and consequently the mammal population is also not anticipated to be diverse. The impact on the loss of habitat would therefore be significant but is unlikely to exceed high values. In addition, extensive natural areas still remain in the surroundings into which mammals on the site can move to without resulting in high habitat pressures. Construction itself may also affect the mammal population and care should therefore be taken to ensure none of the faunal species on site is harmed.		
	Without mitigation	**With mitigation**
Extent	Limited loss of natural areas (2)	Limited loss of natural areas (2)
Duration	Limited to a semi-permanent impact if some vegetation re-establishes within the development (4)	Limited to a semi-permanent impact if some vegetation re-establishes within the development (4)
Magnitude	Moderate given the uniform population diversity (6)	Moderate given the uniform population diversity (6)
Probability	Fairly high since the impact is largely unavoidable (4)	Fairly high since the impact is largely unavoidable (4)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	No	
Mitigation: » The hunting, capturing or harming in any way of mammals on the site should not be allowed. » Voids and excavations may also act as pitfall traps to fauna and these should continuously be monitored and any trapped fauna removed and released in adjacent natural areas. » Blanket clearing of vegetation must be limited to the footprint. » A pre-construction walk-through survey is recommended, but not necessarily required. Respective permits to be obtained beforehand.		
Residual Impacts: Transformation of the indigenous vegetation on the site will result in a decrease in the mammal population size as available habitat decreases.		

7.2.4 Conclusion

From the outcomes of the studies undertaken, it is concluded that

- » No highly sensitive features (after mitigation) and "No-Go" areas were identified.
- » The bulk of the project site located within an area of Medium ecological sensitivity, and
- » No significant terrestrial ecology flaws that could pose a problem to the PV Facility development were identified during the EIA phase assessment.

The study area is fairly large and is dominated by thicket, of which a large portion is considered riparian thicket associated with the Doring River adjacent to the site. The extent of the development area is approximately 200 hectares. The majority of the site still consists of natural vegetation without previous modification, although mining operations situated on and around the site do result in transformation of the surroundings. The study area is still largely dominated by natural grassland (Central Free State Grassland) vegetation associated with riparian areas (Highveld Alluvial Vegetation) closer to the Doring River.

The development will result in the loss of natural vegetation but which is considered to have only a moderate conservation value. The development would therefore still result in impacts which are unlikely to exceed moderate significance values. Current layout plans do indicate that areas of High Sensitivity are entirely avoided by the PV development footprint.

The areas surrounding the site does still contain fairly extensive natural portions, although mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation.

The proposed solar development would therefore not result in a high cumulative impact, although would contribute toward the overall cumulative transformation of the area.

A Risk Assessment for the proposed solar facility which will affect the Doring River and associated floodplain has been undertaken according to the Department of Water and Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use. Aspects of the development that may have an impact on the surface water features of the site include, construction of the solar facility in close proximity to the Doring River and floodplain and also possibly encroaching into the floodplain of the river.

Moderate impacts include the loss of protected plant species, increased infestation by exotic weeds, increased habitat fragmentation, the impact on mammals (which also includes a Near Threatened species) and the increased cumulative impact. The implementation of the proposed mitigation measures will reduce these impacts to moderate (with a lower impact score). This will mostly be achieved by excluding areas of high conservation value as listed which will in turn decrease the severity of the impacts and will also decrease the extent and in so doing the anticipated impacts will be somewhat lower. Current layout plans do indicate that areas of High Sensitivity are being avoided while retaining development within areas of Moderate Sensitivity.

7.3. Potential Impacts on Avifauna

The significance of the impacts on avifauna expected with the development of the Harmony Joel Solar PV Facility has been assessed as moderate to low after mitigation. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix E** for more details).

7.3.1 Results of the Avifauna Impact Assessment

From an avifauna perspective it is evident that bird diversity is positively correlated with vegetation structure, and floristic richness is not often regarded to be a significant contributor of patterns in bird abundance and their spatial distributions. Although grasslands are generally poor in woody plant species, and subsequently support lower bird richness values, it is often considered as an important habitat for many terrestrial bird species such as larks, pipits, korhaans, cisticolas, widowbirds including large terrestrial birds such as Secretarybirds, cranes and storks. Many of these species are also endemic to South Africa and display particularly narrow distribution ranges. Due to the restricted spatial occurrence of the Grassland Biome and severe habitat transformation, many of the bird species that are restricted to the grasslands are also threatened or experiencing declining population sizes.

According to field observations, the total number of species observed on the study area is 91 species. Furthermore, 4 near-endemic species were confirmed on the study area and the immediate surroundings. However, a large percentage of the species recorded in the study area was represented by waterbirds and shorebird taxa.

Habitat units comprising potential avifauna sensitive elements have been identified within the project site. These sensitive elements have been classified as being of a medium sensitivity and are described below.

» Areas of high sensitivity

Areas of high sensitivity include the nearby Doring River and its tributaries and the proposed buffer zones (500m).

The Doring River system provides foraging habitat for a number of waterbird taxa (mainly waterfowl of the *genera Anas, Alopochen, Tadorna and Plectropterus*), of which these taxa may collide with the PV panels and infrastructure when dispersing (especially when dispersing towards nearby impoundments, dams and inundated wetland features). More importantly, the linear configuration of the Doring River and its associated tributaries are important flyways for waterbird taxa in the region, and should preferably be buffered by at least 500m to avoid or minimise the risk of these bird interacting with the proposed PV infrastructure.

» Areas of medium sensitivity

Areas of medium sensitivity represent habitat units of open savannoid grassland and bush clump mosaics. These habitat types provide ephemeral foraging habitat for certain threatened bird species (e.g. Secretarybird), as well as terrestrial bird species (e.g. Northern Black Korhaan) with the potential to interact (e.g. collide) with the proposed electrical infrastructure. However, reporting rates for threatened bird species was relatively low, thereby suggesting a medium sensitivity rating instead of a high sensitivity even though the majority of the habitat units were natural.

» Areas of low sensitivity

Areas of low sensitivity include habitat units represented by transformed types and mining infrastructure, thereby contributing little towards local biodiversity.

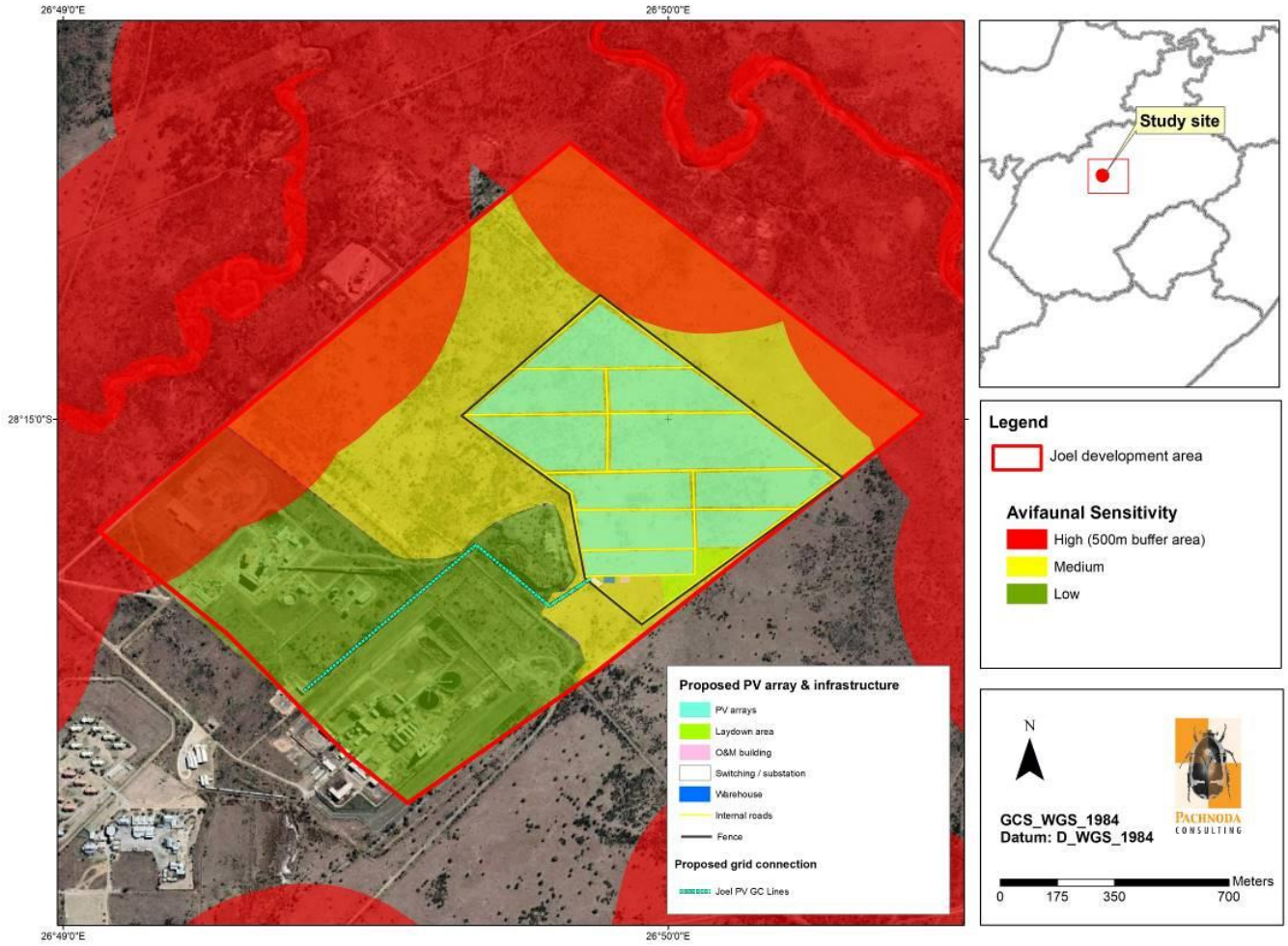


Figure 7.4: Avifauna sensitivity map for the Harmony Joel Solar PV Facility

7.3.2 Description of Avifaunal Impacts

Negative avifauna impacts expected to occur with the development of the Harmony Joel Solar PV Facility includes a loss of habitat and displacement of birds, the creation of "new" avian habitat and bird pollution, collision trauma caused by PV panels and interaction with the power line.

Loss of habitat and displacement of birds

Approximately 47ha will be cleared of vegetation and habitat to accommodate the panel arrays and associated infrastructure. Clearing of vegetation will inevitably result in the loss of habitat and displacement of bird species. From the results, approximately 14.43 species.ha^{-1} and 21.05 birds.ha^{-1} will become displaced should the activity occur (as per Jenkins et al., 2017). Displacement will mainly affect regional endemic passerine and smaller non-passerine species inhabiting the open grassland and bush clump mosaics of medium avifaunal sensitivity.

The following bird species are most likely to be impacted by the loss of habitat due to their habitat requirements, endemism and conservation status (although not limited to) due to the proposed development:

- White-backed Mousebird (*Colius colius*);

- » Fairy Flycatcher (*Stenostira scita*);
- » Pririt Batis (*Batis pririt*);
- » Orange River Francolin (*Scleroptila gutturalis*);
- » Gabar Goshawk (*Micronisus gabar*)
- » Kalahari Scrub Robin (*Cercotrichas paena*); and
- » to a lesser extent also Northern Black Korhaan (*Afrotis afraoides*).

Creation of "new" avian habitat and bird pollution

It is possible that the PV infrastructure (during operation) could attract bird species which may occupy the site or interact with the local bird assemblages in the wider region. These include alien and cosmopolitan species, as well as aggressive omnivorous passerines which could displace other bird species from the area:

- » House Sparrow (*Passer domesticus*);
- » Common Myna (*Acridotheres tristis*);
- » Pied Crow (*Corvus albus*);
- » Speckled Pigeon (*Columba guinea*); and potentially also
- » Egyptian Goose (*Alopochen aegyptiacus*).

The infrastructure may attract large numbers of roosting columbid taxa, especially Speckled Pigeons (*Columba guinea*), which may result in avian "pollution" through excreta, thereby fouling the panel surfaces. The same applies to the locally abundant Egyptian Goose (*Alopochen aegyptiacus*) which may roost on the infrastructure. The impact is manageable and will result in a low significance.

Collision trauma caused by PV panels (the " lake-effect")

The presence of the Doring river system, as well as a number of dams and impoundments in close proximity to the study site increase the risk of waterbirds and shorebird taxa interacting with the PV panels. A number of species were observed with a high frequency of occurrence which dispersed along the nearby Doring river system on a daily basis which could also potentially interact with the PV panels.

Placement of the proposed PV panels will be critical and should preferably avoid areas of high sensitivity. Appropriate bird deterrent devices should be installed at strategic localities, and these should include a combination of rotating flashers/reflectors to increase the visibility of the infrastructure. In addition, post construction monitoring to quantify mortalities will be important during the early operation phase in order to determine "hotspot" areas (areas where high mortalities are prevalent) which may require additional mitigation measures. Waterbirds with a high frequency of occurrence which could interact with the PV panels are the Egyptian Goose (*Alopochen aegyptiaca*), South African Shelduck (*Tadorna cana*), Yellow-billed Duck (*Anas undulata*), African Black Duck (*Anas sparsa*), Spur-winged Goose (*Plectropterus gambiensis*) and potentially also Reed Cormorant (Microcarbo africanus), Red-knobbed Coot (*Fulica cristata*), Common Moorhen (*Gallinula chloropus*), Little Grebe (*Tachybaptus ruficollis*) and Cape Shoveller (*Anas smithii*).

Desktop results and site observations show that the following species could interact with the panel infrastructure:

- » South African Shelduck (*Tadorna cana*);
- » Egyptian Goose (*Alopochen aegyptiaca*);
- » Spur-winged Goose (*Plectropterus gambiensis*);
- » Hamerkop (*Scopus umbretta*);

- Yellow-billed Duck (*Anas undulata*);
- White-faced Duck (*Dendrocygna viduata*);
- Red-billed Teal (*Anas erythrorhynchus*);
- Cape Teal (*Anas capensis*);
- Cape Shoveller (*Anas smithii*);
- Glossy Ibis (*Plegadis falcinellus*);
- Black-winged Stilt (*Himantopus himantopus*);
- Three-banded Plover (*Charadrius tricollaris*); and potentially also
- Greater Flamingo (*Phoenicopterus roseus*);
- Lesser Flamingo (*Phoeniconaias minor*);
- Maccoa Duck (*Oxyura maccoa*);
- White-breasted Cormorant (*Phalacrocorax lucidus*)
- Reed Cormorant (*Microcarbo africanus*);
- African Sacred Ibis (*Threskiornis aethiopicus*) and potentially also
- Little Grebe (*Tachybaptus ruficollis*);
- Black-headed Heron (*Ardea melanocephala*);
- Red-knobbed Coot (*Fulica cristata*);
- Grey Heron (*Ardea cinerea*);
- Little Egret (*Egretta garzetta*);
- Great Egret (*Ardea alba*);
- African Darter (*Anhinga rufa*);
- Common Moorhen (*Gallinula chloropus*) and
- African Swamphen (*Porphyrio madagascariensis*).

Interaction with overhead power lines and reticulation

A 132kV overhead powerline is proposed to tie-in to Shafts 1&2 HJ Joel Mining substation. The proposed overhead power line will traverse habitat of low avifaunal sensitivity (e.g. transformed habitat), whereby the anticipated impact will be reduced.

Overhead powerlines impact birds in three ways. A common rule is that large and heavy-bodied terrestrial bird species are more at risk of being affected in a negative way when interacting with powerlines in general. These include the following:

Electrocution

Electrocution happens when a bird bridges the gap between the live components or a combination of a live and earth component of a power line, thereby creating a short circuit. This happens when a bird, mainly a species with a fairly large wingspan attempts to perch on a tower or attempts to fly-off a tower. Many of these species include vultures (of the genera Gyps and Torgos) as well as other large birds of prey such as the Martial Eagle (*Polemaetus bellicosus*) (Ledger & Annegarn, 1981; Kruger, 1999; Van Rooyen, 2000). These species will attempt to roost and even breed on the tower structures if available nesting platforms are a scarce commodity in the area. Other types of electrocutions happen by means of so-called "bird-streamers". This happens when a bird, especially when taking off, excretes and thereby causes a short-circuit through the fluidity excreta (Van Rooyen & Taylor, 1999).

Large transmission lines (from 220 kV to 765 kV) are seldom a risk of electrocution, although smaller distribution lines (88 – 132kV) pose a higher risk. However, for this project, the design of the pylon is an important consideration in preventing bird electrocutions.

Collision

Collisions with earth wires have probably accounted for most bird-powerline interactions in South Africa. In general, the earth wires are much thinner in diameter when compared to the live components, and therefore less visible to approaching birds. Many of the species likely to be affected include heavy, large-bodied terrestrial species such as bustards, korhaans and a variety of waterbirds that are not very agile or manoeuvrable once airborne. These species, especially those with the habit of flying with outstretched necks (e.g. most species of storks) find it difficult to make a sudden change in direction while flying – resulting in the bird flying into the earth wires.

Areas where bird collisions are likely to be high could be ameliorated by marking the lines with appropriate bird deterrent devices such as "bird diverters" and "flappers" to increase the visibility of the lines.

Physical disturbances and habitat destruction caused during construction and maintenance

It is anticipated that part of the powerline line servitude will be cleared of vegetation. In addition, construction activities go hand in hand with high ambient noise levels. Although construction is considered temporary, many species will vacate the area during the construction phase and will become temporarily displaced.

7.3.3 Impact tables summarising the significance of impacts on avifauna related to the PV facility and its infrastructure.

Nature: Losses of natural habitat and displacement of birds through physical transformation, modifications, removals and land clearance. This impact is mainly restricted to the construction phase and is permanent.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (6)
Probability	Definite (5)	Highly Probable (4)
Significance	**High (70)**	**Medium (48)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes, to some extent	
Mitigation: It is difficult to mitigate against the loss of habitat since clearing of vegetation (or habitat) will be required for the infrastructure associated with the project. Both the PV facility and associated infrastructure occur predominantly on habitat types of medium and low sensitivity. The best practicable mitigation will be to consolidate infrastructure (e.g. proposed powerlines) to areas where existing impacts occur (e.g. placing the proposed powerline alongside existing powerlines) and to avoid areas of high sensitivity.		
Residual Impacts: Decreased bird species richness, low evenness values and subsequent loss of avian diversity on a local scale. The impact will also result in sterilisation of local landscapes and increased fragmentation of habitat.		

Nature: The creation of novel or new avian habitat for commensal bird species or superior competitive species. This is expected to occur during the operation phase of the facility.		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Footprint (1)	Footprint (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	**Low (18)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes, to some extent	
Mitigation: Apply bird deterrent devices and remove nest structures constructed on infrastructure associated with the PV facility under the guidance of the ECO.		
Residual Impacts: Secondary displacement by completive bird species such as crows and increased fecundity rate for commensal bird species that are adapted to anthropogenic activities. The impact is regarded as low.		

Nature: Avian collision impacts related to the PV facility during the operation phase (collision with the PV panels).		
PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Site and immediate surroundings (4)	Site and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Probable (3)
Significance	**High (64)**	**Medium (39)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes, potential loss of waterfowl and certain shorebird taxa species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » Apply bird deterrent devices such as rotating flashers/reflectors to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels - these should especially be placed at panels nearest to wetland features and river systems. » Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also proved effective to quantify mortalities). » Buffer rivers/streams by at least 500m. » If post-construction monitoring predicts and/or confirms bird mortalities, an option is to employ video cameras at selected areas to document bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis.		
Residual Impacts: Direct mortality is possible and may still occur irrespective of applied mitigation measures. Regular and systematic monitoring is proposed to assess the efficacy of applied mitigation and further research and testing is suggested to improve mitigation measures (e.g. bird deterrent devices). The residual impact is regarded as moderate.		

Nature: Avian collision impacts related to overhead power lines during operation.		
Grid Corridor	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of terrestrial bird and waterbird species.	Yes
Can impacts be mitigated?	Yes	
Mitigation: » Apply bird deterrent devices to the power lines and make use of "bird-friendly" pylon structures. » To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis. » Collisions will be reduced if the proposed corridors are placed alongside existing powerlines.		
Residual Impacts: Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.		

Nature: Avian electrocution related to the new distribution line during operation.		
Grid Corridor	**Without mitigation**	**With mitigation**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	**Medium (36)**	**Low (24)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of terrestrial bird and waterbird species.	Yes (to some extent), owing to the potential loss of terrestrial bird and waterbird species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: Avoid the placement of overhead electrical infrastructure in close proximity to wetland features and river/streams. Make use of bird-friendly pylons and bird guards as recommended by EWT.		
Residual Impacts: Direct mortality is possible and may still happen irrespective of applied mitigation measures. The residual impact will be low.		

7.3.4 Conclusion

From the outcomes of the studies undertaken, it is concluded that

» No highly sensitive features (after mitigation) and “No-Go” areas were identified.

- Areas of high sensitivity include the nearby Doring River and its tributaries and the proposed buffer zones (500m). These areas are located around the development footprint which are entirely avoided by the PV layout.
- The entire development footprint forms part of areas classified as medium sensitivity which are represented by habitat units of open savannoid grassland and bush clump mosaics that provide foraging habitat for certain threatened bird species (eg. Secretarybird), as well as terrestrial bird species (e.g. Northern Black Korhaan).
- Areas of low sensitivity include habitat units represented by transformed types and mining infrastructure, thereby contributing little towards local biodiversity.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana* and Egyptian Goose *Alopochen aegyptiacus*) colliding with the PV infrastructure remained eminent due to the presence of wetland-associated features and the nearby Doring river system (including the Theronspruit river to the west). Post-construction monitoring was recommended along with the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds.

No fatal-flaws were identified during the assessment, although it was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post construction monitoring) be implemented during the construction and operational phase of the project.

7.4. Assessment of Impacts on Land Use, Soil and Agricultural Potential

The impact of the Harmony Joel Solar PV Facility on the soils, land use, land capability and agricultural potential has been assessed as low to medium (after mitigation), depending on the impact being considered. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix F** – Soils Impact Assessment for more details).

7.4.1 Results of the Land Use, Soil and Agricultural Potential Study

Soil properties

Four natural soil forms and one anthropogenic soil (Technosols) are present within the Harmony Joel Solar PV Facility development area. The area of each soil form as well as the horizon organisation and depths are depicted in **Figure 7.7.**

The Sepane soil form (**Figure 7.5**) is found throughout the study area and is the soil form most found in the development area (133.29 ha). The Sepane soil consists of an orthic horizon, overlying a pedocutanic horizon with a gleyic underneath. The peducutanic had a moderate structure with cutans present. The gleyic horizon was found between 0.7m and 1m and had a moderate structure with grey colours on the external surfaces. The gleyic horizon is an indication of low-moderate water saturation. Therefore, the soil is not recommended for agricultural use as water logging could be a risk as the gleyic was found between 0.7m and 1m.

The Technosol soil covers the second largest area (71.88 ha) and was found in the southern parts of the development area. The Technosol/Johannesburg are urban technosols consisting of material present in an urban environment where significant areas are disturbed or covered by means of constructions including but not limited to, roads, buildings, sport fields and waste dumps. Technosols are not recommended for agricultural use. The Technosols found in the development area is highly disturbed with stockpiles.

The remainder of the development area consists of the Glen horizon (10.50ha), Glenrosa soil form (1.41ha) and the Swartland soil form (4.13ha).

Figure 7.5: Example of the Sepane soil form within the development area.

Figure 7.6: Example of the Technosol soil form within the development area

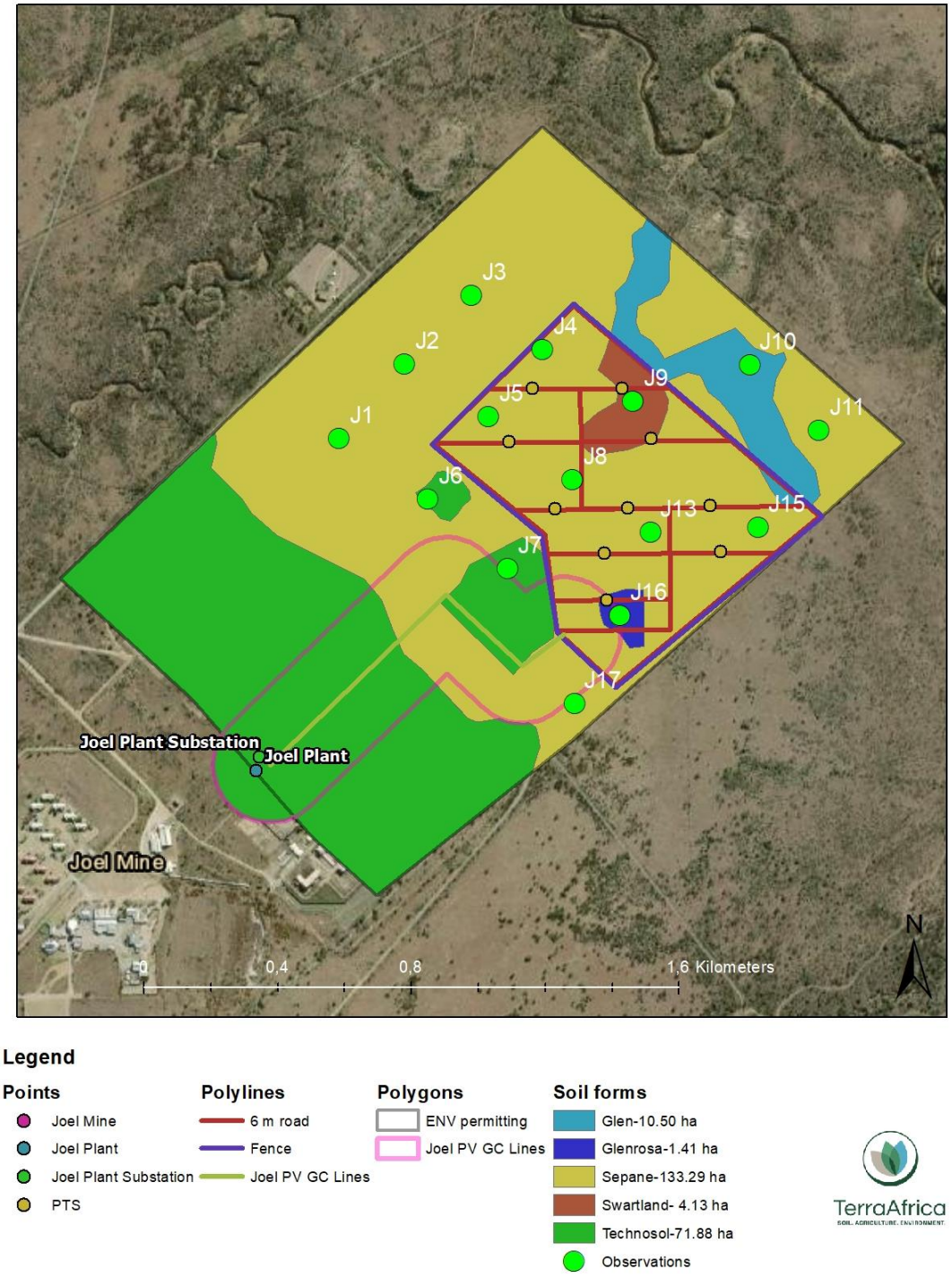


Figure 7.7: Soil delineation map of the Harmony Joel Solar PV Facility development area

Land capability

According to DALRRD (2016), land capability is defined as the most intensive long-term use of land for purposed of rainfed farming determined by the interaction of climate, soil and terrain.

The Harmony Joel Solar PV Facility development area includes five different land capability classes according to the land capability data (DALRRD, 2016). **Figure 7.8** shows the position of the different classes within the farm portions that form the proposed development area. The largest part of the development area largely consists of land with Low-Moderate (Class 06 and 07) land capability. This land capability class

is present within the centre of the development area while the eastern and north western section of the boundary consists of land with Moderate (Class 08) land capability. Low (Class 05) land capability is found in the centre of the development area.

Following the classification of the soil and the consideration of the soil properties and limiting factors to rainfed crop production, the land capability within the development area was determined. The calculated land capability of the area is depicted in **Figure 7.8** and was calculated using Terrain, Soil and Climate capabilities. The low land capabilities are mainly contributed to the Low-Moderate (Class 04) climate capability.

The largest part of the total area assessed, has Low-Moderate land capability (143.79ha). Low-Moderate land capability has been assigned to the Sepane and Glen soil form. Low (05) land capability (5.54ha) was assigned to the Glenrosa and Swartland soil forms as these soils had a shallow depth and a lithic horizon restricting infiltration. Low-very low (04) land capability was assigned to the Technosol/Johannesburg soils as these soils are not recommend for agricultural use due to the disturbance.

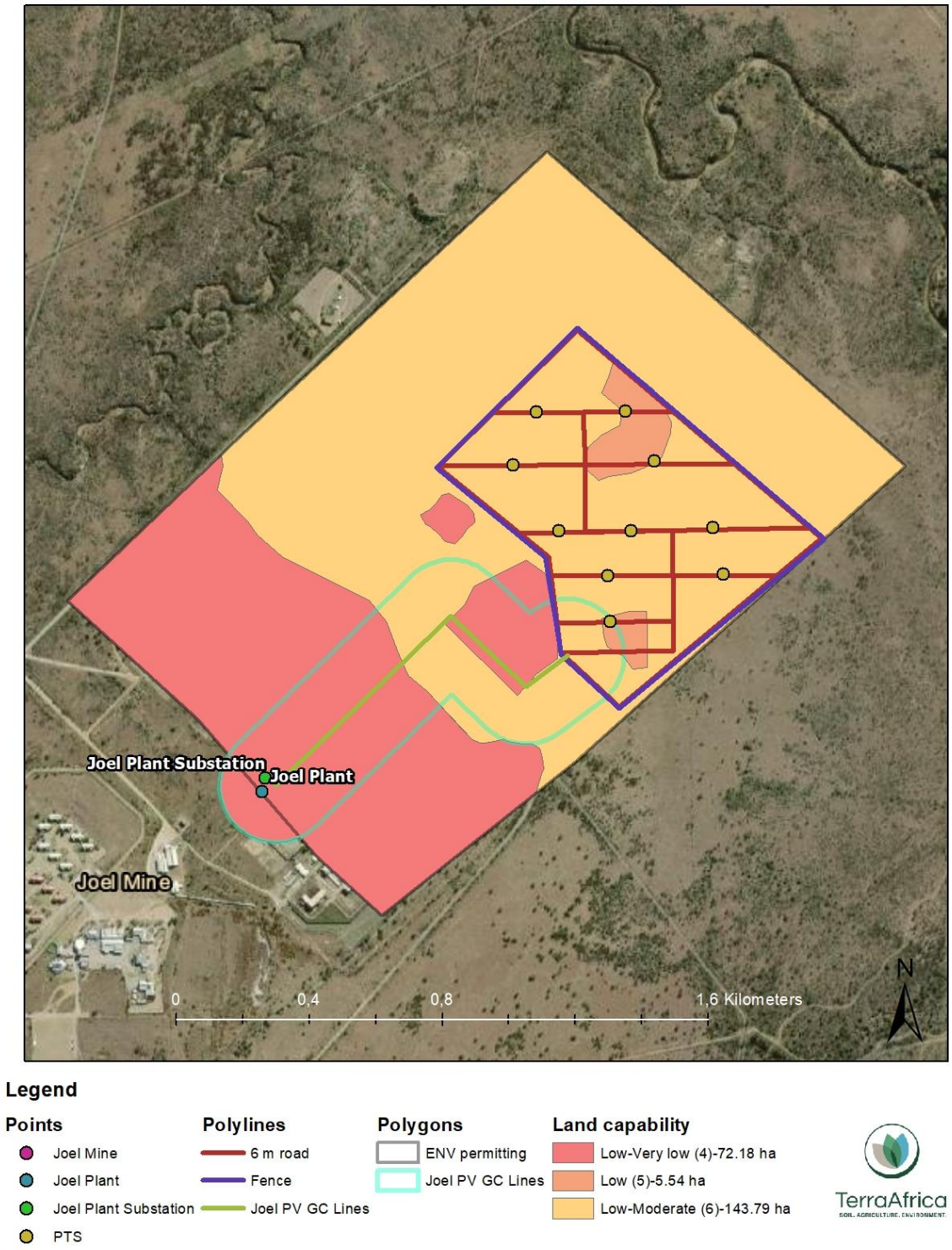


Figure 7.8: Verified land capability classification of the Harmony Joel Solar PV Facility development area

Following the metadata layer obtained from DALRRD, the long-term grazing capacity of the entire project area is 6 ha/LSU. The ideal grazing capacity is an indication of the long-term production potential of the vegetation layer growing in an area. More specifically, it relates to its ability to maintain an animal with an average weight of 450 kg (defined as 1 Large Stock Unit (LSU)), with an average feed intake of 10 kg dry mass per day over the period of approximately a year. This definition includes the condition that this feed consumption should also prevent the degradation of the soil and the vegetation. The grazing capacity is therefore expressed in several hectares per LSU (ha/LSU) (DALRRD, 2018).

Using the long-term grazing capacity of 6ha/LSU, the Joel PV Facility development footprint and connection corridor of 220 ha can provide forage to 36 head of cattle. The grazing capacity is moderate in comparison to the grazing capacity of the rest of the country. The grass cover shows no signs of regular grazing and most of the area was dominated by shrubs and trees.

The Low and Low-Moderate land capability of the soils within the development area is confirmed by the field crop boundaries area data of DALRRD (2019). No rainfed crops or old fields are found within the development area. During the site verification visit, it was confirmed that the area consists of grassland, shrubs, and trees and that there is no crop cultivation in the area.

Sensitivity analysis

Following the consideration of all the baseline and desktop data discussed in the sections above, the proposed Harmony Joel Solar PV Facility development area can be as having a Low sensitivity. The entire development area has Low sensitivity (221.2ha) (refer to **Figure 7.9**). The soil forms present within the project area are mainly of the Sepane and Technosol/Johannesburg soil forms, which has a Low-Moderate (06) and Low-Very low (04) land capability respectively. The area has historically not been used for crop production recently, as confirmed by the data of DALRRD (2019). No irrigation infrastructure, such as centre pivots or drip irrigation, are present within the project area and irrigated agricultural is currently not practiced in the area.

The area is not currently used for livestock farming although the Joel PV Facility project area can support 36 head of cattle at the long-term grazing capacity of 6ha/LSU (DALRRD, 2018). Soil in the project area will have Low sensitivity, depending on the successful implementation of mitigation measures to prevent soil erosion, compaction, and pollution.

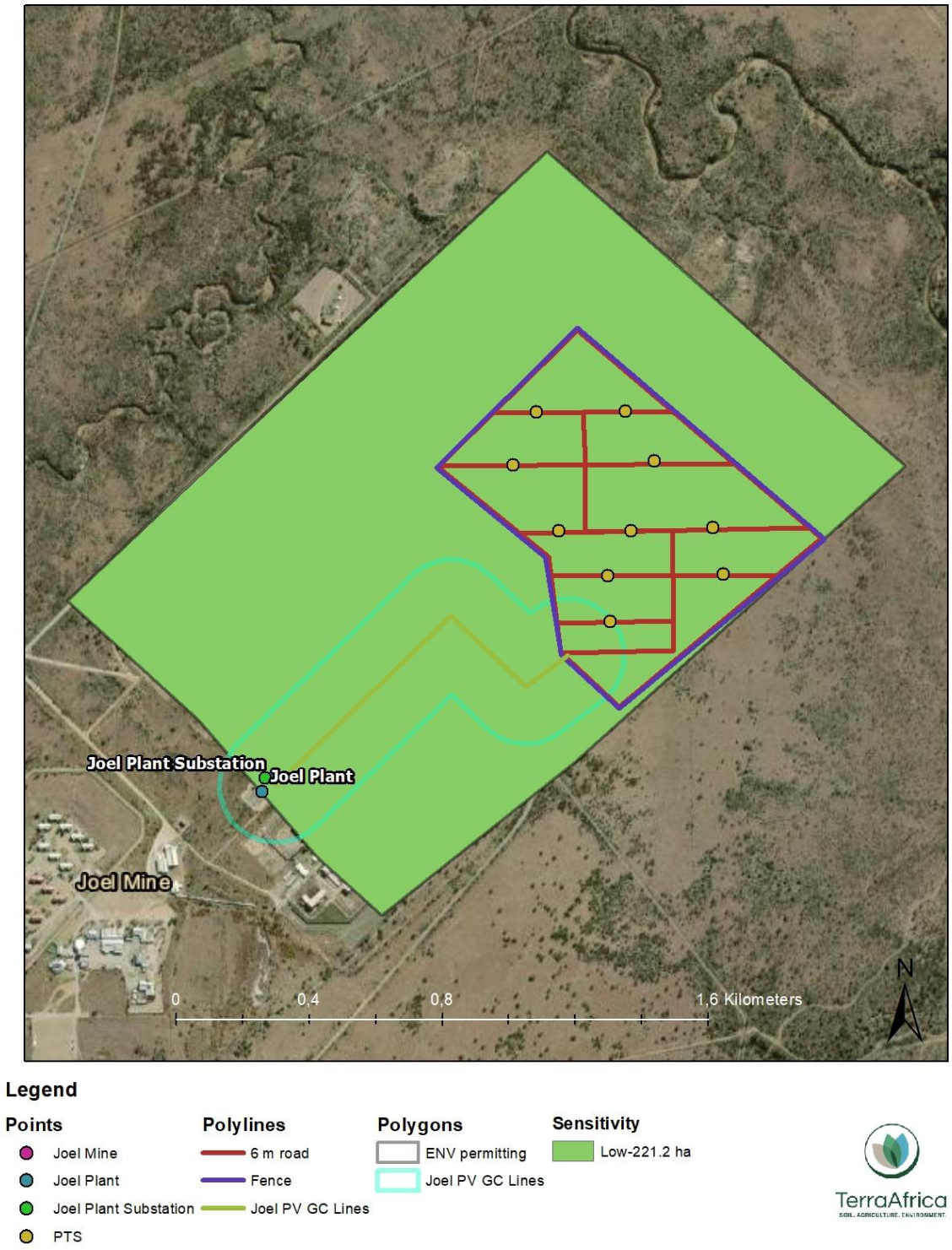


Figure 7.9: Agricultural sensitivity of the Harmony Joel development area

7.4.2 Description of Land Use, Soil and Agricultural Potential Impacts

The most significant impacts of the proposed project on soil and agricultural productivity will occur during the construction phase when the vegetation is removed and the soil surface is prepared for the delivery of materials and erection of the infrastructure. During the operation phase, the risk remains that soil will be

polluted by the waste generated or in the case of a spill incident. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface.

7.4.3 Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)

Construction phase

Impact: *Change in land use from livestock grazing to energy generation* **Nature:** Prior to construction of the project infrastructure, the PV development area will be fenced off and livestock farming will be excluded from the development footprint area.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium duration (3)	Medium duration (3)
Magnitude	Moderate (6)	Low (4)
Probability	Definite (4)	Definite (4)
Significance	**Medium (40)**	**Medium (32)**
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation: » Vegetation clearance must be restricted to areas where infrastructure is constructed. » No materials removed from development area must be allowed to be dumped in nearby livestock farming areas. » All left-over construction material must be removed from site once construction on a land portion is completed. » No open fires made by the construction teams are allowable during the construction phase.		
Residual: The residual impact is considered medium.		

Impact: *Soil Erosion* ***Nature:*** All areas where vegetation is removed from the soil surface in preparation for the infrastructure construction will result in exposed soil surfaces that will be prone to erosion. Both wind and water erosion are a risk, as the area falls within a region that experiences thunderstorms in the summer months and sometimes strong winds during the dry winter months, especially August and September.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
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 and only within the development footprint; » Unnecessary land clearance must be avoided; » Level any remaining soil removed from excavation pits (where the PV modules will be mounted) that remained on the surface, instead of allowing small stockpiles of soil to remain on the surface;		

» Where possible, conduct the construction activities outside of the rainy season; and
» Stormwater channels must be designed to minimise soil erosion risk resulting from surface water runoff.

Residual:
The residual impact from the construction and operation of the project on the susceptibility to erosion is considered low.

Impact: *Soil Compaction*
Nature: The clearing and levelling of land for construction of the infrastructure will result in soil compaction. In the area where the access roads and substation will be constructed, topsoil will be removed, and the remaining soil material will be deliberately compacted to ensure a stable surface prior to construction.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:
» Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
» Unnecessary land clearance must be avoided;
» Materials must be off-loaded and stored in designated laydown areas;
» Where possible, conduct the construction activities outside of the rainy season; and
» Vehicles and equipment must park in designated parking areas.

Residual:
The residual impact from the construction and operation of the project on soil compaction is considered low.

Impact: *Soil Pollution*
During the construction phase, construction workers will access the land for the preparation of the terrain and the construction of the thermal plant and access road. Potential spills and leaks from construction vehicles and equipment and waste generation on site can result in soil pollution.

Nature: The following construction activities can result in the chemical pollution of the soil:
» Petroleum hydrocarbon (present in oil and diesel) spills by machinery and vehicles during earthworks and the removal of vegetation as part of site preparation;
» 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 workers;
» Spills from fuel storage tanks during construction;
» Pollution from concrete mixing;
» Pollution from road-building materials; and
» Any construction material remaining within the construction area once construction is completed.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	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:

- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams;
- Any left-over construction materials must be removed from site;
- The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping;
- Ensure battery transport and installation by accredited staff / contractors; and
- Compile (and adhere to) a procedure for the safe handling of battery cells during transport and installation.

Residual:

The residual impact from the construction and operation of the proposed project will be low to negligible.

Operation phase

Impact: *Soil Erosion*

Staff and maintenance personnel will access the project area daily

Nature: The areas where vegetation was cleared will remain at risk of soil erosion, especially during a rainfall event when runoff from the cleared surfaces will increase the risk of soil erosion in the areas directly surrounding the Harmony Joel Solar PV Facility.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	

Mitigation:

- The area around the project, including the internal access roads, must regularly be monitored to detect early signs of soil erosion on-set; and
- If soil erosion is detected, the area must be stabilised using geo-textiles and facilitated re-vegetation.

Residual:

The residual impact from the operation of the project on the susceptibility to erosion is considered low.

Impact: *Soil Pollution*

Nature: Potential spills and leaks from maintenance vehicles and equipment and waste generation on site can result in soil pollution. Also, any spillages around the workshop area or damaged infrastructure, such as inverters and transformers, can be a source of soil pollution.

	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Low (4)	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: » Maintenance must be undertaken regularly on all vehicles and maintenance machinery to prevent hydrocarbon spills; » No domestic and other waste must be left at the site and must be transported with the maintenance vehicles to an authorised waste dumping area; and » Regularly monitor areas alongside the roads, parking area and workshop for any signs of oil, grease and fuel spillage or the presence of waste.		
Residual: The residual impact from the operation of the proposed project will be low to negligible.		

Decommissioning phase

The decommissioning phase will have the same impacts as the construction phase i.e. soil erosion, soil compaction and soil pollution. It is anticipated that the risk of soil erosion will especially remain until the vegetation growth has re-established in the area where the project infrastructure was decommissioned.

7.4.4 Conclusion

From the outcomes of the studies undertaken, it is concluded that

- No highly sensitive features (after mitigation) and "No-Go" areas were identified.
- The entire development area has low sensitivity. The soil forms present within the development footprint consist mostly of Sepane soil form which has a Low-Moderate (06) land capability. All soils are assigned Low sensitivity to the development due to absence of any rainfed or irrigated crop production within the development footprint.

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Harmony Joel Solar PV Facility is expected to have a Low impact on soils and agricultural potential. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed and impacts on soils managed by taking the following into consideration:

- Limit vegetation clearance to only the areas where the surface infrastructure will be constructed
- Avoid parking of vehicles and equipment outside of designated parking areas.
- Plan vegetation clearance activities for dry seasons (late autumn, winter and early spring).
- Design and implement a Stormwater Management System where run-off from surfaced areas is expected.
- Re-establish vegetation along the access road to reduce the impact of run-off from the road surface.
- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills.
- Any waste generated during construction must be stored in designated containers and removed from the site by the construction teams.
- Any left-over construction materials must be removed from site.

7.5. Assessment of Impacts on Heritage Resources

Negative impacts on heritage resources will be due to loss of archaeological and palaeontological resources during construction activities of the Harmony Joel Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix G**).

7.5.1 Results of the Heritage Impact Assessment (including archaeology and palaeontology)

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. As such, the results of the survey only identified two sites of scientific cultural value – JL2, graded IIIC and JL5 graded IIIB within the development area proposed for the Harmony Joel Solar PV Facility.

The identified sites of archaeological significance have the potential to provide scientific insight into the past and as such, it is recommended that these areas are not impacted by the proposed development. It is therefore recommended that no-go development buffers as per the recommendations below are implemented. Further, it is recommended that these sites are mapped on all relevant SDPs and that on-going conservation measures are put in place in the EMPrs for the developments.

Furthermore, no impacts to significant palaeontological heritage are anticipated on condition that a Fossil Chance Find Protocol is implemented and no impacts to the cultural landscape are anticipated.

Table 7.1: Heritage resources identified within the Harmony Joel Solar PV development area

Site No.	Site Name	Description	Co-ordinates		Grading	Mitigation
JL1	Joel 1	Isolated dolerite artefact: bi-directional core, heavily reduced	-28.24715199	26.82775296	NCW	NA
JL2	Joel 2	Concentration of artefacts: Anvil, flake fragment, chert outcrop with exploitation evidence	-28.24704403	26.83083197	IIIC	20m Buffer
JL3	Joel 3	Isolated quartzite artefacts: poorly preserved core - heavily weathered and rolled, rolled flake	-28.25327799	26.83493399	NCW	NA
JL4	Joel 4	Isolated chert artefact: flake potentially associated with bladelet production	-28.24908201	26.82736899	NCW	NA
JL5	Joel 5	Concentration of artefacts in a datable context: 1) single platform chert core; 2) chert flake; 3) chert core; 4) point; 5) silcrete retouched point on a blade; 6) miniature quartz flake; 6) dolorite big flake; 7) silcrete flake; 8) silcrete fragment	-28.2505380	26.82795304	IIIB	50m Buffer
JL6	Joel 6	Isolated chert artefacts: two chert cores	-28.24558499	26.83130203	NCW	NA

Archaeology

All archaeological finds at Joel were documented in what appear to be ex-situ surface contexts. However, the absence of evidence for trampling of artefacts, particularly at JL5, suggests that post-depositional effects on surface stone scatters may be marginal, and artefacts may have been exposed relatively recently. Further, the presence of artefacts that are currently eroding out of quaternary sediments at JL5 suggests that there may be sub-surface archaeological occurrences within the footprint. The potential for finding a preserved and dateable in-situ archaeological horizon based on surface observations and based on the availability of current dating techniques (luminescence would be the only set of applicable methods to this context), however, is low based on the absence of dateable organic materials and the bioturbated nature of sediments partially encompassing some of the artefacts (JL5). This site is graded IIIB for its potential to contribute to the body of scientific knowledge.

Based on the surface observations outlined above, the presence of sub-surface contextualised materials at Joel cannot be excluded as a possibility. Excavation associated with the development should therefore be aware of the potential for sub-surface Stone Age materials. As such, it is recommended that a no-development area of 50m is implemented around site JL5.

JL2 represents a site that accumulated because of the chert raw-material source nearby, so flakes are largely primary. JL2 also has a hammerstone with visible pitting associated with percussion activities – probably knapping. This site has been graded IIIC and it is recommended that a no-development area of 30m is implemented around this site to ensure that it is conserved.

The documented archaeology at Joel is classified as scientifically low significance, apart from the site at JL5 which is classified as moderate significance.

Concerning the Stone Age archaeology at Joel, there are no objections to the authorisation of the development provided that the monitoring recommendations are adhered to, and provided that if any evidence of human remains are exposed during excavation, that development activities cease in the area of the identified remains.

Palaeontology

According to the Desktop Palaeontology Assessment, "Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sandstones, shales and sands are typical for the country and might contain trapped fossils. The sands of the Quaternary period would not preserve fossils. The area has been disturbed from farming and mining so no fossils would be present on the surface. No vertebrates or plants have been recorded so the lithology and assemblage zone can only be extrapolated."

Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age to contain fossils but are covered by soils. Furthermore, the material to be excavated are soils and this does not preserve fossils. Since there is a small chance that vertebrate fossils typical of the *Daptocephalus* Assemblage Zone or plant or bone fragments were trapped in pans that might occur below the soils and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low.

Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying sands and soils of the Quaternary. Vertebrate fossils may

occur, but there is no outcrop. Nonetheless, a Fossil Chance Find Protocol should be implemented as a mitigation measure.

7.5.2 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)

Impact: *Disturbance or altering archaeological resources*

Nature:
It is possible that buried archaeological resources may be impacted by the development in the preferred location

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Limited to the development footprint (1)	Limited to the development footprint (1)
Duration	Where manifest, the impact will be permanent (5)	Where manifest, the impact will be permanent. (5)
Magnitude	One archaeological resource of significance was identified within the development area (6)	One archaeological resource of significance was identified within the development area (6)
Probability	It is likely that significant resources will be impacted (5)	It is unlikely that significant resources will be impacted (1)
Significance	**High (60)**	**Low (12)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Likely	Not Likely
Can impacts be mitigated?	Yes	

Mitigation:

» A no-impact buffer of 30m is implemented around Site JL2 and a 50m buffer around site JL5.
» archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.

Residual Impacts:
None

Impact: *Disturbance or altering palaeontological resources*

Nature:
It is possible that buried palaeontological resources may be impacted by the proposed development in the preferred location

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Limited to the development footprint (1)	Limited to the development footprint (1)
Duration	Where manifest, the impact will be permanent (5)	Where manifest, the impact will be permanent. (5)
Magnitude	According to the SAHRIS Palaeosensitivity Map, the area proposed for development of the PV facilities is underlain by sediments that have moderate and very high palaeontological sensitivity. (8)	According to the SAHRIS Palaeosensitivity Map, the area proposed for development of the PV facilities is underlain by sediments that have moderate and very high palaeontological sensitivity. (8)

Probability	It is unlikely that significant fossils will be impacted (1)	It is unlikely that significant fossils will be impacted (1)
Significance	**Low (14)**	**Low (14)**
Status (positive or negative)	Negative	Negative
Reversibility	Any impacts to heritage resources that do occur are irreversible	Any impacts to heritage resources that do occur are irreversible
Irreplaceable loss of resources?	Unlikely	Not Likely
Can impacts be mitigated?	Yes	
Mitigation: » A Chance Fossil Finds Procedure (**Appendix G)** must be implemented for the duration of construction activities » Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.		
Residual Impacts: None		

7.5.3 Conclusion

From the outcomes of the studies undertaken, it is concluded that

- The 30m no-go buffer area recommended around site JL2 is recommended. However, the optimised layout avoids this buffer entirely.
- The 50m no-go buffer area recommended around site JL5 is recommended. However, the optimised layout avoids this buffer entirely.

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Harmony Joel Solar PV Facility will be low. From the outcomes of the studies undertaken, it is concluded that the PV facility can be developed. Although there were no other archaeological or heritage resources identified during the project survey; some archaeological material, including artefacts and graves can be buried underground and as such, may not have been identified during the initial survey and site visits. In the case where the proposed development activities bring these materials to the surface, work must cease and SAHRA must be contacted immediately to determine a way forward.

7.6. Assessment of Visual Impacts

Negative impacts on visual receptors will occur during the undertaking of construction activities and the operation of the Harmony Joel Solar PV Facility. Potential impacts and the relative significance of the impacts are summarised below (refer to **Appendix H**).

7.6.1 Results of the Visual Impact Assessment

The construction and operation of the Harmony Joel Solar PV Facility and its associated infrastructure may have a visual impact on the area surrounding the project site, especially within (but not restricted to) a 3km radius of the facility. The visual impact will differ amongst places, depending on the distance from the facility.

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. The proposed Harmony Joel Solar PV Facility

is located approximately 26km north of the closest airfield and relatively close to a decommissioned helicopter landing pad.

Land use activities within the broader region are predominantly described as maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The mining activities intensify further north (beyond the study area boundary), towards Virginia and Welkom, where predominantly gold and uranium are mined. Farm settlements or residences occur at irregular intervals throughout the study area. Some of these, in close proximity to the proposed development site. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use.

Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of rural homesteads and settlements (refer to **Figure 7.10**).

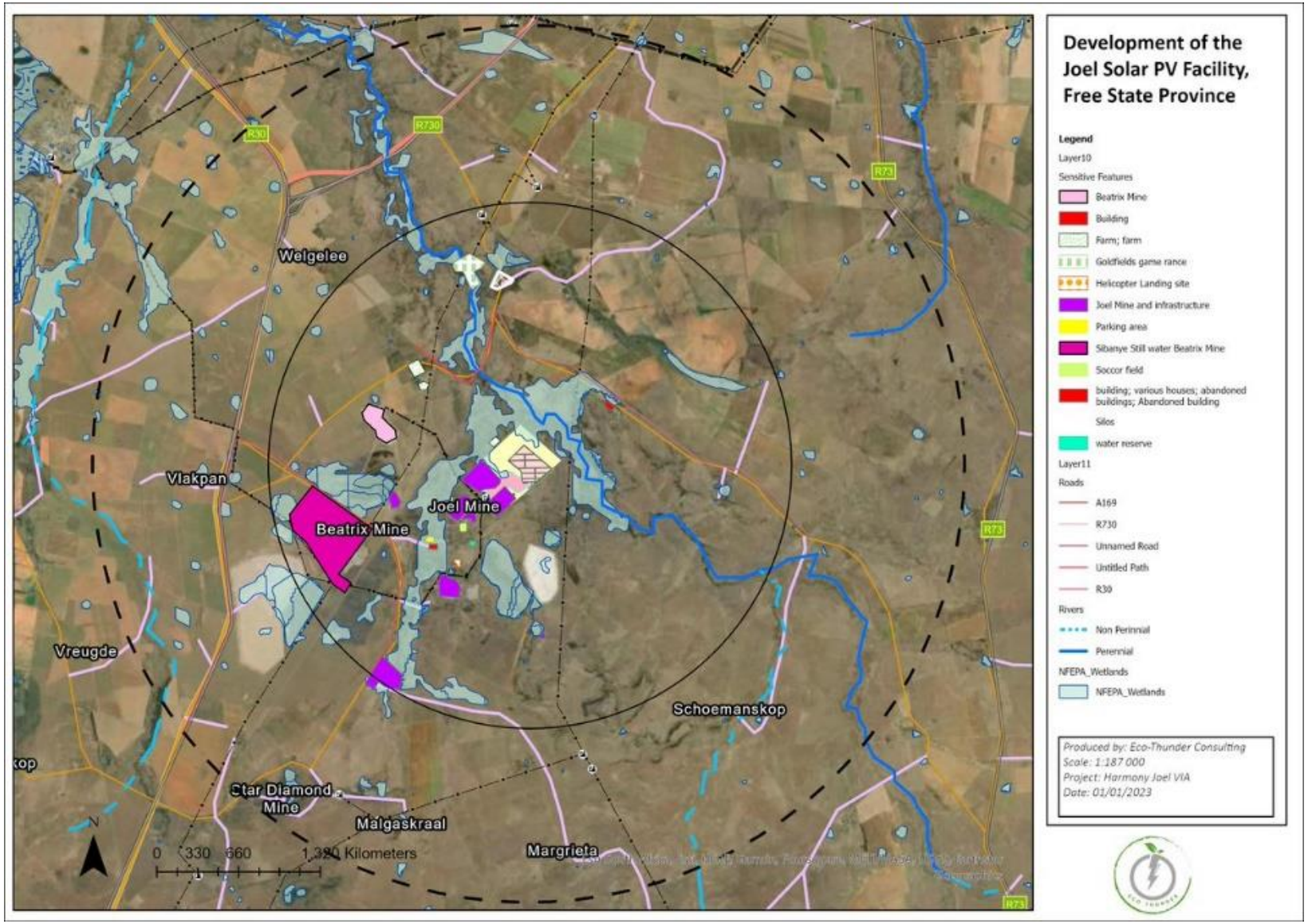


Figure 7.10: Potentially sensitive visual receptors in the area surrounding the site for the Harmony Joel Solar PV Facility.

7.6.2 Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)

The combined results of the visual exposure, viewer perception and visual distance of the solar PV facility are used to determine the impacts to the surrounding landscape. Typically, a location with close proximity to the proposed facility, a high viewer incidence, a predominantly negative perception and high visual exposure would have a high value on the index, thereby signifying a high visual impact.

The identification and assessment of environmental impacts is a multi-faceted process, using a combination of quantitative and qualitative descriptions and evaluations. It involves applying scientific measurements and professional judgement to determine the significance of environmental impacts associated with the proposed project. The process involves consideration of, inter alia: the purpose and need for the Project; views and concerns of interested and affected parties (I&APs); social and political norms, and the public's interest.

The following tables summarise the consequence and significance of the visual impact of the facility. These results are based on worst-case scenario when the impacts of all aspects of the Project are taken together (PV facilities and grid connection). Consequence of impact is a function of intensity, duration, and spatial extent (SLR 2020).

Construction Phase Impacts

Impact: *Impact on landscape character and sense of place due to the removal of vegetation and the construction of the PV structures and associated infrastructure.*

Nature: Solar PV Facilities and associated powerlines and substations are generally experienced as having a negative impact on landscape aesthetics as it will introduce an industrial aspect to a landscape. This area is however dominated by mining activities and has industrial features present, thus the visual intrusion of the proposed solar PV facility will be moderately low after mitigation.

It is important to note that renewable energy structures are becoming increasingly important features in the South African landscapes and an important source of electricity for the growing population of South Africa.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Short Distance (3)	Short Distance (3)
Duration	Short (2)	Short (2)
Magnitude	Moderate (5)	Moderate (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Low (27)**

Mitigation:

» Avoid complete clearing of parts of the construction site that will be cleared of vegetation, and only clear vegetation in a phased manner.
» Regular dust suppression must be applied on the construction site where earth is exposed, and along unsurfaced access roads to the construction site.
» Construction vehicle speed limits must be strictly adhered to avoid the creation of excessive dust.
» Retain and maintain natural vegetation immediately adjacent to the development footprint.
» Plan the placement of laydown areas and temporary construction equipment camps in order to minimise

vegetation clearing (i.e., in already disturbed areas) where possible.
» Restrict the activities and movement of construction workers and vehicles to the immediate construction site and existing access roads.
» Reduce construction activities between 07:00 and 18:00, where possible, in order to reduce the impacts of construction lighting.
» Rehabilitate all disturbed areas (if present / if required) immediately after the completion of construction works.

Residual Impacts:
» Land will no longer be able to be utilized for agricultural purposes.

Impact: *Impact of PV facility on the Roads in Close Proximity*

Nature: The Harmony Joel PV has two unnamed roads which is in close proximity to the development and will be a major visual receptor if constructed. These roads are however expected to be frequented primarily by local users going about their daily business (i.e., not sight-seeing), These roads are predominantly used by the mine as it grants access to the Target Facility therefore potentially lessening the probability of the impact significance as the power generation is a benefit for the mining development.

Traffic on the outer roads such as the R30 and other access roads may also be impacted by traffic, however these roads are often utilized by the mine for transporting of goods or large vehicles, this may add to the deterioration of the roads and increased upkeep.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Local (3)	Local (2)
Duration	Long term (4)	Long term (4)
Magnitude	High (8)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (45)**	**Medium (30)**

Mitigation:
Planning:
» Retain and maintain natural vegetation in all areas outside of the development footprint.
Operations:
» Maintain the general appearance of the facility as a whole.
Decommissioning:
» Remove infrastructure not required for the post-decommissioning use of the
» facility.
» Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
» Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Residual Impacts:
The visual impact will be removed after decommissioning, provided the development infrastructure is removed and the site is rehabilitated to its original (current) status. Failing this, the visual impact will remain.

Impact: *Visual Impact on Impact on Businesses, homes or facilities in close proximity*

Nature: The proposed land use is not expected to create high levels of discord between the project and its surroundings, since various mining activities, disturbed areas, infrastructure development and powerlines are already present in the region. The perceived overall compatibility of the proposed project with the surrounding land uses and existing infrastructure is therefore considered to be acceptable.

Considering the above it must be noted that some places of high sensitive receptors were identified during the visual analysis within the 1 to 6km observation zone.

In addition to physical infrastructure, impacts from clearing of vegetation, potential erosion as a result of bare soils, maintenance activities and the alteration of local topography will also create contrast in the landscape and may be visible to receptors. It is however important to note, that although the long term, operational visual impact of the Project is unlikely to be highly significant due to power lines being common features of South African landscapes.

These impacts associated may achieve lower moderate significance levels through the implementation of mitigation measures and provided that progressive revegetation of impacted areas take place.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Local (3)	Local (4)
Duration	Long term (5)	Long term (4)
Magnitude	Moderate (7)	Moderate (5)
Probability	Probable (3)	Probable (3)
Significance	**Medium (45)**	**Medium (39)**

Mitigation:

General mitigation/management:

Planning:

- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the facility as a whole.

Decommissioning:

- Remove infrastructure not required for the post-decommissioning use of the facility.
- Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications.
- Monitor rehabilitated areas post-decommissioning and implement remedial actions.

Site specific mitigation measures:

- Plant vegetation barriers along the western borders of the PV development in order to shield the structures from observers residing at the above-mentioned homesteads and residential settlements (The lifestyle farm).

Residual Impacts:

Some businesses may draw a negative connotation with the development of Solar PV facilities.

Operation Phase Impacts

Impact: *Glint and Glare / Night and Daytime lighting*

Nature: The visual impact of glint and glare relates to the potential it has to negatively affect sensitive visual receptors in relatively close proximity to the source (e.g., residents of neighbouring properties), or aviation safety risk for pilots (especially where the source interferes with the approach angle to the runway).

Lighting associated with the proposed project may be visible during both day and night, with lighting being more likely to have a visual impact during the night-time. Lighting may be visible for some distance and can be associated with indirect lighting impacts, such as sky glow (the scattering of light in the sky).

It is however important to note that the development area is situated within a suburban region and adjacent to the Harmony Joel, thus the area is currently already impacted by night-time lighting and although some level of cumulative impact is likely, the impact will not be highly significant.

With improved technology and design techniques, PV facilities are no longer associated with glare, however PV facilities can create increased visibility and contrast through the creation of geometric patterns of reflected light caused by simultaneous reflection of sunlight from regularly spaced metal surfaces in the collector array. The reflected light may not necessarily cause discomfort to the viewer, during the daytime, and may change dramatically as the observer moves.

It should be noted that the PV panels will not contribute to night-time light pollution in the area, since no reflection of the sun occurs at night.

No impacts are predicted towards pilots along any of the assessed approach paths and no ATC Tower was identified.

The potential visual impact related to solar glint and glare as an air / road travel hazard is expected to be of low significance. No mitigation of this impact is required since the PV facility is not expected to interfere with aircraft operations or impact the safety of road users.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Very short distance (4)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (24)**	N/A
Mitigation: N/A		
Residual Impacts: N/A		

Impact: *Visual Exposure*

Nature: Visual exposure is determined by qualifying the visibility of an object, with a distance rating to indicate the degree of intrusion and visual acuity. As distance between the viewer and the object increases, the visual perception of the object reduces.

Since the Mines in the area has significantly altered the landscape of the area and is visible from various receptors in the surrounding region, it will aid in absorbing the impact on the visual environment caused by the proposed Harmony Joel PV.

Visual exposure to public roads including the unnamed road next to the site, and local roads generally servicing the farms, towns and mines throughout the study area.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Local (4)	Local (4)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Moderate (42)**	**Moderate (36)**

Mitigation:

Planning:

- Retain and maintain natural vegetation in all areas outside of the development footprint.

Operations:

- Maintain the general appearance of the facility as a whole.

Decommissioning: » Remove infrastructure not required for the post-decommissioning use of the facility. » Rehabilitate all areas. Consult an ecologist regarding rehabilitation specifications. » Monitor rehabilitated areas post-decommissioning and implement remedial actions.
Residual Impacts: N/A

Impact: *Sense of place*

Nature: Sense of place refers to a unique experience of an environment by a user, based on his or her cognitive experience of the place. Visual criteria, specifically the visual character of an area (informed by a combination of aspects such as topography, level of development, vegetation, noteworthy features, cultural / historical features, etc.), plays a significant role.

An impact on the sense of place is one that alters the visual landscape to such an extent that the user experiences the environment differently, and more specifically, in a less appealing or less positive light. The environment surrounding the proposed PV is predominantly developed by mining activities represents existing visual disturbances.

PV Layout (and associated infrastructure)	**Without mitigation**	**With mitigation**
Extent	Regional (3)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (22)**	N/A
Mitigation: N/A		
Residual Impacts: The visual impact will be removed after decommissioning, provided the PV facility infrastructure is removed. Failing this, the visual impact will remain		

7.6.3 Conclusion

The objective of this study was to provide sufficient information on the visual environment of the area, in order for the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. Based on the findings of the visual assessment, the proposed project is expected to be moderately visually intrusive in portions of the surrounding environment.

The following is evident from the viewshed analyses:
0 – 1 km (**Very High sensitivity area**): The main project components are anticipated to fall within this area, the anticipated visual exposure of the facility is contained to a core area on the site itself and within a 1 km radius thereof. There are no residences within this zone, however some farming development appears to be located within this area. Some of the northern portion is within the river buffer zone. The Joel mine lays South-west of the proposed facility within this observation zone. There some small mine roads located to the west of the proposed development, which is utilized by the mine. Observers travelling along this road will be exposed to the project infrastructure.

1 – 3 km (**High Sensitivity**) This zone contains additional mining infrastructure and dumping facilities to the south. There are some abandoned buildings and recreational sport fields within this zone, which is theorized

to be used by the mine residence.

The majority of this area (towards the North and east) is agricultural or vacant land, very few residences reside within this area indicating fewer visual receptors. These features, farms, buildings, recreational facilities and mines can be considered one of the more sensitivity areas in terms of the visual receptors, however there are large number of trees, mining infrastructure and other infrastructure between the proposed development and the receptors which is anticipated to largely reduce the visual impact on the facility.

Additionally, there are some roads which are found within this observational area, such as the A169. It is expected that the PV facility would be clearly visible from these sections of road. There are some areas in which the topography is relatively flat with little to no tall vegetation. It is therefore recommended that in these areas the visual impact is mitigated from very high by use of things such as trees etc.

3 – 6km (**Moderate Sensitivity**)
Within this observation the visual exposure becomes very scattered and interrupted due to the undulating nature of the topography as well as the surrounding features (mine heaps, buildings, roads, vegetation, etc.). Some agricultural holdings exist to the east and north of the proposed development.

6 – 10 km (**Very Low Sensitivity**)
At distances exceeding 6km the intensity of visual exposure is expected to be very low and highly unlikely due to the distance between the object (development) and the observer.

It is clear that the relatively constrained dimensions of the PV facility would amount to a fairly limited area of potential visual exposure. The visual exposure would largely be contained within a 6km radius of the proposed development site, with the predominant exposure to the north and east of the development.

It is believed that renewable energy resources are essential to the environmental well- being of the country and planet (WESSA, 2012). Taking into account all positive factors of such a development including economic factors, social factors and sustainability factors, especially in an arid country, the visual impact of this proposed development will be insignificant and is suggested that the development commence, from a visual impact point of view.

The overall value and sense of place of the receiving environment is considered of low significance. It is the opinion of the specialist that the project be considered favourably from a visual resource management perspective, provided that the required mitigation and management measures be implemented and that it is ensured that the best long-term use of the resources in the project area will be made in support of the principle of sustainable development.

7.7. Assessment of Social Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Harmony Joel Solar PV Facility are summarised below (refer to **Appendix I**).

7.7.1 Results of the Social Impact Assessment

There are some vulnerable communities within the project area that may be affected by the development Harmony Joel Solar Facility and its associated infrastructure. Traditionally, the construction phase of a PV

solar development is associated with most 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. Several 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".

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, 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 site falls within existing mining development area and therefore falls within the mines social and economic processes and structures, things such as the socio-economic development and local economic development plans will take into consideration the development of the PV facilities.
- The development will introduce employment opportunities during the construction phase (temporary employment) and a limited number of permanent employment opportunities during 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 because 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 also represents an investment in infrastructure for the generation of non-polluting, Renewable Energy, which, when compared to energy generated because of burning polluting fossil fuels, represents a positive social benefit for society.
- When considering Harmony Joel Solar, it is also important to consider the cumulative social impacts that may arise with other proposed solar PV projects in the area.
- It should be noted that the perceived benefits associated with the project, which include RE generation and local economic and social development, outweigh the perceived impacts associated with the project.

The proposed mitigation measures should be implemented to limit the negative impacts and enhance the positive impacts associated with the project.

The proposed project and associated infrastructure are unlikely to result in permanent damaging social impacts. From a social perspective it is concluded that the project could be developed subject to the implementation of recommended mitigation measures and management actions identified for the project.

7.7.2 Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)

Construction Phase Impacts

The majority of social impacts associated with the project are anticipated to occur during the construction phase of the development and are typical of the type of social impacts generally associated with construction activities. These impacts will be temporary and short-term (~12 months) but could have long-term effects on the surrounding social environment if not planned or managed appropriately. It is therefore necessary that the detailed design phase be conducted in such a manner so as not to result in permanent social impacts associated with the ill-placement of project components or associated infrastructure or result in the mismanagement of the construction phase activities.

The positive and negative social impacts identified and assessed for the construction phase includes:

Potential positive impacts
- » Creation of employment and business opportunities
- » Contribution to the local economy
- » Skills Development
- » Growth of the local communities

Potential negative impacts
- » Impacts associated with the presence of construction workers on site
- » Threat to safety and security with the presence of construction workers on site
- » Impact of heavy vehicles, including damage to roads, safety, noise and dust
- » Increased pressure to local services

***Impact**: Employment opportunities and skills development*

Nature: Harmony Gold currently have social labour plans in place which meet the requirements of employment in terms of local employment and skills development, act. As per their current SLP. Harmony Joel Mining Operations will provide employment for 200 employees in mining, construction, management or other related activities.

As per the SLP, the Harmony Joel Human Resources Development (HRD) Strategy supports the company's business strategy and objectives, as well as the South African legislative and regulatory framework that seeks to address the general skills shortage within the country, as well as ensuring equitable representation in the workplace.
Part of these strategies include:
- » Adult Basic Education Training
- » Portable Skills Training plans
- » Trainee Programmes and Learnerships for Employees
- » Management Development Programs
- » Talent Pool Development
- » Community Human Resource Development Programme
- » Learnerships for the Community

It is the mine's intention to incorporate the development of the Harmony Joel Solar PV facility under the same principles as followed in the SLP, all be it on a smaller scale, relative to the size of the development of a 18MW solar PV facility.

	Without enhancement	**With enhancement**
Extent	Local – Regional (5)	Regional (4)
Duration	Short-term (1)	Short term (1)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Definite (5)
Significance	**Medium (30)**	**Medium (55)**
Status (positive or negative)	Positive	Positive

Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

To enhance the local employment, skills development and business opportunities associated with the construction phase, the following measures should be implemented:

- » It is recommended that the development be incorporated under the mines SLP, and the skills development processes and policies currently being implemented at the mine or associated infrastructure be incorporated in the development and operation of the Solar energy facility.
- » The strategies mentioned in the SLP (Adult Basic Education Training, Management Development Programs, Community Human Resource Development Programs, etc.) be specifically focused on mining and the renewable energy development sector.
- » Be commitment to involving and benefiting the communities neighbouring the mines, contributing to their development and growth, therefore it is recommended that particular attention be given to the needs of the people living near the mine in the Free State Province
- » It is recommended to conduct structured and proactive engagement sessions within the municipal district, to expose local small, micro and medium enterprises which will benefit from the proposed development
- » In terms of the MPRDA, REGULATION 46 (b) (v) states that: "The contents of a Social and Labour Plan must include a human resources development programme which must include the employment equity statistics which must be completed in the form of "Form S" contained in Annexure II and the mines plan to achieve the 10 percent women participating in mining and 40 percent historically disadvantaged South Africans (HDSA) participation in management within 5 years from the granting of the right or the conversion of the old order right" – It is recommended that the development of a solar facility be undertaken with the same equity goals, giving consideration to woman and previously disadvantaged individuals during the recruitment process.
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase.

Residual Impacts:

- » Initiatives to eliminate unfair discrimination in employment.
- » Recruit and select suitably qualified individuals from the designated groups.
- » Advance employees from designated groups who have been identified in the talent pool and to fast track them through focused training and development programmes.
- » Assist individual to acquire an initial vocational education and pre-qualification, in addition to further education and training, and which refreshes knowledge, skills, work and life competencies that are crucial for overall development.
- » Provide portable skills training to employees who show an interest in obtaining such training and with a special emphasis on employees who are incapacitated or retrenched in order to remain economically active, employable or self-sustaining within their communities.
- » Growth of talent is facilitated, thereby providing opportunities for all employees to contribute to their full potential.

***Impact**: Contributions to the local economy*

Nature: Harmony Gold Mine/ Harmony Joel Operations states that they are committed to the sustainable socio-economic development and the well-being of the communities in which they operate by contributing to community development that is sustainable long after mining operations have ceased.

Harmony's corporate social responsibility (CSR) policy for their South African operations recognises the need for socio-economic development in the country. This policy includes local economic development (LED) initiatives executed in terms of the Mining Charter, MPRDA regulations and codes of good practice for the minerals and mining industry.

	Without enhancement	**With enhancement**
Extent	Local – Regional (4)	Local – Regional (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)

Probability	Probable (3)	Definite (5)
Significance	**Medium (36)**	**Medium (60)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

It has to be noted that there currently are measures in place that speaks to economic development in terms of the mining operations:

- The Harmony tender policy was amended to give preference to BEE entity suppliers.
- BEE entities can win tenders even when their price is higher than that of non-BEE entity suppliers.
- Certain commodities are set aside and may only be purchased from BEE-entity suppliers and certain commodities may only be acquired from 100% black owned suppliers through the Harmony business development centers.
- BEE-entities get a second chance to revise their tender price, should they not win a tender.
- Preference is given to suppliers that are local to the operation where the service will be consumed.

The following measures must also be considered when constructing the solar PV facility

- Establishing liaison and communication structures with the district and local government structures
- Liaises with the local governmental structures and municipal authorities in the labour- sending communities to ensure that group development initiatives are integrated into the economic and development plans of those areas.
- The continuous review of the economic development of the project during the implementation process will ensure that the project does not become static but are revised in terms of changing needs and to ensure sustainability.
- It is recommended that a local procurement policy be adopted by the developer to maximise the benefit to the local economy, where feasible.
- Through the development of the Solar Facility create employment opportunities, boost local economies through supporting business activities and contributing to the government tax revenues.
- The Developer of the Solar Facility should establish a database of local companies, specifically Historically Disadvantaged (HD) companies, which qualify as potential service providers (e.g., construction companies, catering companies, waste collection companies, security companies etc.) prior to the commencement of the procurement of construction contractors. These companies should be notified of the tender process and invited to bid for project-related work where applicable.
- Engage with local authorities and business organisations to investigate the possibility of procurement of construction materials, goods and products from local suppliers, where feasible.

Residual Impacts:

- Improved local service sector, growth in local business.
- Community development and stimulation of the local economy
- Growth in the local markets

Impact*: Safety and security*

Nature: Temporary increase in safety and security concerns associated with the influx of people during the construction phase.

The Solar PV Development will fall in line with the Harmony Joel's occupational safety and health policies and related management frameworks which are aligned with the Mine Health and Safety Act in South Africa. A co-operative approach is undertaken, involving all stakeholders, ensuring that the necessary infrastructure and systems are in place – including relevant planning, communication and training.

	Without enhancement	**With enhancement**

Extent	Local – Regional (3)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Low (27)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

» Stopping significant unwanted events by focusing on critical control management.
» Safety awareness and training as well as positive behavior reinforcement.
» Improving system monitoring and analysis to improve risk management.
» Encourage employees to stop working when a workplace is considered unsafe and/or to prevent unsafe actions.
» Focus on critical control management (as per International Council on Mining and Metals guidelines).
» Education, Training and Development Services must be implemented.
» Access in and out of the construction area should be strictly controlled by a security company.
» The contractor must provide adequate firefighting equipment on site and provide firefighting training to selected construction staff.
» Have clear rules and regulations for access to the proposed site to control loitering.
» A comprehensive employee induction programme would cover land access protocols, fire management and road safety must be prepared.
» A Community Liaison Officer should be appointed.
» A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.

Residual Impacts:
None anticipated.

Impact*: Disruption of daily living and movement patterns*

Nature: Temporary increase in traffic disruptions and movement patterns during the construction phase, Transport of equipment, material and staff to site will lead to congestion.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Highly probable (4)	Improbable (2)
Significance	**Medium (40)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

» Implement standard dust control measures on gravel roads, including periodic spraying (frequency will depend on many factors including weather conditions, soil composition and traffic intensity and must thus be adapted on an on-going basis) of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
» Stagger component delivery to site.
» Reduce the construction period.

- » Make use of mobile batch plants and quarries in close proximity to the site.
- » 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 worthiness.
- » Provision of adequate and strategically placed traffic warning signs, that have to be maintained for the duration of the construction phase, and control measures along the R30, R730 and various unnamed roads to warn road users of the construction activities taking place for the duration of the construction phase. Warning signs must be always visible, especially at night.
- » Implement penalties for reckless driving to enforce compliance to traffic rules.
- » Avoid heavy vehicle activity during "peak" hours (when children are taken to school, or people are driving to work).
- » Ensure that all fencing along access roads is maintained in the present condition or repaired if disturbed due to construction activities.
- » The Contractor must ensure that damage/wear and tear caused by construction related traffic to the access roads is repaired before the completion of the construction phase.
- » Method of communication must be implemented whereby procedures to lodge complaints are set out for the local community to express any complaints or grievances with the construction process.

Residual Impacts:
None anticipated.

***Impact**: Increased pressure on local services/resources*

Nature: Added pressure on economic and social infrastructure during construction as a result of in-migration of people.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

- » A Community Liaison Officer should be appointed. A method of communication should be implemented whereby procedures to lodge complaints are set out in order for the local community to express any complaints or grievances with the construction process.
- » Current procurement channels set up by the mine should be utilized to reduce any complications which may arise from the development.

Residual Impacts:
Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.

***Impact**: Increased pressure on local services/resources*

Nature: Added pressure on economic and social infrastructure during construction as a result of in-migration of people.

	Without enhancement	**With enhancement**
Extent	Local (2)	Local (2)
Duration	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Low (4)
Probability	Probable (3)	Improbable (2)
Significance	**Medium (30)**	**Low (16)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

» It is necessary to appoint a Community Liaison Officer. A method of communication should be implemented, with procedures for filing complaints outlined, so that the local community can express any complaints or grievances about the construction process.

» Current procurement channels set up by the mine should be utilized to reduce any complications which may arise from the development.

Residual Impacts:

Possibility of outside workers remaining in the area after construction is completed and subsequent pressures on local infrastructure.

***Impact**: Nuisance impacts (noise& dust)*

Nature: Construction activities will result in the generation of noise and dust over a period of months. However, the development is located directly adjacent to mining sites. The noise and dust impacts are therefore insignificant in comparison to the noise and dust generated by the mine and will only be temporary in nature.

	Without enhancement	**With enhancement**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	High (8)	Moderate (6)
Probability	Highly Probable (4)	Improbable (2)
Significance	**Medium (44)**	**Low (18)**
Status (positive or negative)	Negative	Negative
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

» The development of the Solar PV facility will be on owned and operated by the Harmony Joel mine, the employees of the mine are subjected to:
- Annual audiometric testing at occupational health hubs during medical examinations.
- Awareness drives to ensure employees are aware of the benefits of wearing personalized hearing protection.
- Monitoring programs to measure actual compliance in the workplace.
- Compliance monitoring is undertaken during routine occupational hygiene inspections and ad hoc audits are also conducted.

» It is furthermore predicted that the current dust levels generated by the mining activities in the area far exceed that which will be generated by the construction of the PV facility. The Harmony Joel mine currently has standardized dust control measures in place which will allow the monitoring of the dust generation by the PV facility, these include:
- leading practices as advocated by the Mining Industry Occupational Safety and Health (MOSH)
- Multi-stage dust filtration systems

- Training and awareness programmes address dust control in stopes and all development ends are equipped with water blasts to settle dust directly after a blast.

The following ''Generic'' Noise and Dust suppression must be implemented where not covered by current mining processes.

» During construction care should be taken to ensure that noise from construction vehicles and plant equipment does not intrude on the surrounding residential areas. Plant equipment such as generators, compressors, concrete mixers as well as vehicles should be kept in good operating order and where appropriate have effective exhaust mufflers
» The movement of construction vehicles on the site should be confined to agreed access road/s.
» The movement of heavy vehicles associated with the construction phase should be timed (where possible) to avoid times days of the week, such as weekends, when the volume of traffic travelling along the access roads may be higher.
» Dust suppression measures should be implemented, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.

Residual Impacts:
Noise and Dust generation will remain an issue irrespective of the Solar PV development

Operation Phase Impacts

The operational phase is associated with the following key potential positive and negative social issues.
Potential positive impacts:

» Creation of employment and business opportunities.
» Social benefits associated with being a mining related development
» If realised contributing to the tourism and recreational development of the area
» Benefits associated with the additional funding available for socio-economic and/or enterprise development measures;
» Benefits associated with the establishment of a legal entity representing allocated beneficiary community (such as a community trust);
» Impact on tourism;
» The establishment of renewable energy infrastructure.

Potential negative impacts:

» The visual impacts and associated impact on sense of place;
» Potential impact on tourism;
» Influx of job seekers to the area;

***Impact**: Job creation during operation*

Nature: Harmony Gold currently have social labour plans in place which meet the requirements of employment in terms of local employment and skills development, act. As per their current SLP. Harmony Joel Mining Operations will provide employment for 2000 employees in mining, construction, management or other related activities.

As per the SLP, the Harmony Joel Human Resources Development (HRD) Strategy supports the company's business strategy and objectives, as well as the South African legislative and regulatory framework that seeks to address the general skills shortage within the country, as well as ensuring equitable representation in the workplace.

Part of these strategies include:

» Adult Basic Education Training
» Portable Skills Training plans

- » Trainee Programmes and Learnerships for Employees
- » Management Development Programs
- » Talent Pool Development
- » Community Human Resource Development Programme
- » Learnerships for the Community

It is the Mine's intention to incorporate the development of the Harmony Joel Solar PV facility under the same principles as followed in the SLP, all be it on a smaller scale, relative to the size of the development of a 18MW solar PV facility.

	Without enhancement	**With enhancement**
Extent	Regional (3)	Regional (3)
Duration	Long term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	High Probable (4)
Significance	**Medium (33)**	**Medium (44)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	

Enhancement measures:

To enhance the local employment, skills development and business opportunities associated with the construction phase, the following measures should be implemented:

- » It is recommended that the development be incorporated under the mines SLP and the skills development processes and policies currently being implemented at the mine or associated infrastructure be incorporated in the development and operation of the Solar PV facility.
- » The strategies mentioned in the SLP (Adult Basic Education Training, Management Development Programs, Community Human Resource Development Programs, etc.) be specifically focused on mining and the renewable energy development sector.
- » Be commitment to involving and benefing the communities neighbouring the mines, contributing to their development and growth, therefore it is recommended that particular attention be given to the needs of the people living near the mine in the Free State Province
- » It is recommended to conduct structured and proactive engagement sessions within the municipal district, to expose local small, micro and medium enterprises which will benefit from the proposed development
- » In terms of the MPRDA, REGULATION 46 (b) (v) states that: "The contents of a Social and Labour Plan must include a human resources development programme which must include the employment equity statistics which must be completed in the form of "Form S" contained in Annexure II and the mines plan to achieve the 10 percent women participating in mining and 40 percent historically disadvantaged South Africans (HDSA) participation in management within 5 years from the granting of the right or the conversion of the old order right" – It is recommended that the development of a solar facility be undertaken with the same equity goals, giving consideration to woman and previously disadvantaged individuals during the requirutment process.
- » Training and skills development programmes should be initiated prior to the commencement of the construction phase.

Residual Impacts:

Improved pool of skills and experience in the local area

- » Recruit and select suitably qualified individuals from the designated groups;
- » Advance employees from designated groups who have been identified in the talent pool and to fast track them through focused training and development programmes..
- » Assist individual to acquire an initial vocational education and pre-qualification, in addition to further education and training, and which refreshes knowledge, skills, work and life competencies that are crucial for overall development.

» provide portable skills training to employees who show an interest in obtaining such training and with a special emphasis on employees who are incapacitated or retrenched in order to remain economically active, employable or self-sustaining within their communities

***Impact**: Development of solar PV facility under existing mining guidelines and policies*

Nature: Mines are long standing institutions that in theory should have the capital, resources, and means to ensure that positive social benefits are realized, through the utilization of their existing policies and procedures, furthermore, developing on mine owned property results in the better utilization of the environment in a less 'evasive' and harmful way. Resulting in an overall positive social gain.

	Without enhancement	**With enhancement**
Extent	Local – Regional -National (4)	National (4)
Duration	Long term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	High Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement measures: The use of existing policies and procedures be implemented		
Residual Impacts: None anticipated		

***Impact**: Development of clean, renewable energy infrastructure*

Nature: The primary goal of the proposed project is to improve energy security in South Africa by generating additional energy. The proposed Solar PV Facility also reduces the carbon footprint associated with energy generation. The project should therefore be viewed within the context of the South Africa's current reliance on coal powered energy to meet the majority of its energy needs.

	Without enhancement	**With enhancement**
Extent	Local – Regional -National (4)	National (4)
Duration	Long term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly Probable (4)	High Probable (4)
Significance	**Medium (48)**	**Medium (48)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement measures: None anticipated		
Residual Impacts: » Reduce carbon emissions through the use of renewable energy and contribute to reducing global warming. » The renewable energy infrastructure places this project at the heart of the national strategy to increase power supply as well as reduce power generation impacts on climate. » The PV facility's location also uniquely connects the local community to skills for this sector, thus improving their employability.		

Impact: *Visual impacts and impacts on sense of place* **Nature:** Visual impacts and sense of place impacts associated with the operation phase of the project. Due to the number of mines in the area, the scenic quality of the region is low, further construction and operation of the Solar PV Facility in the area is likely to have a negative impact.		
	Without enhancement	**With enhancement**
Extent	Local (1)	N/A
Duration	Long term (4)	N/A
Magnitude	Low (4)	N/A
Probability	Improbable (2)	N/A
Significance	**Low (18)**	N/A
Status (positive or negative)	Negative	N/A
Reversibility	N/A	N/A
Irreplaceable loss of resources?	No	No
Can impacts be enhanced?	Yes	
Enhancement measures: None anticipated		
Residual Impacts: None anticipated if the visual impact will be removed after decommissioning, provided the solar PV facility infrastructure is removed and the site is rehabilitated to its original (current) status		

Decommissioning Phase Impacts

The social impact of decommissioning the Harmony Joel PV project is likely to be significant. While the relatively small number of people employed during the operational phase (15), the associated funding available for community projects and benefits are significant and expected to end with decommissioning of the facility. With mitigation however, the impacts are assessed to be low.

The proponent should inform and discuss the stakeholder and wider community involved and affected in the governance, management and implementation of community funds about the decommissioning of the energy project. This communication needs to be timed well in advance of the decommissioning, allowing all relevant parties to prepare. Further consideration is required to develop strategies for rehabilitation of the land.

7.7.3 Conclusion

From a social perspective it is concluded that the project is supported, but that mitigation measures should be implemented and adhered to. Positive and negative social impacts have been identified. The assessment of the key issues indicated that there are no negative impacts that can be classified as fatal flaws, and which are of such significance that it cannot be successfully mitigated. Positive impacts could be enhanced by implementing appropriate enhancement measures and through careful planning. Based on the social 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 focused on the construction of PV facilities (these relate to

influx of non-local workforce and jobseekers, intrusion and disturbance impacts, safety, and security) and could be reduced with the implementation of the mitigation measures proposed.

- » Employment opportunities will be created in the construction and operation phase and the impact is rated as positive even if only a small number of individuals benefit in this regard.
- » The proposed project could assist the local economy in creating entrepreneurial development, especially if local business could be involved in the provision of general material and services during the construction and operational phases.
- » Capacity building and skills training among employees are critical and would be highly beneficial to those involved, especially if they receive portable skills to enable them to also find work elsewhere and in other sectors.
- » The proposed development also represents an investment in infrastructure for the generation of clean, renewable energy, which, given the challenges created by climate change, represents a positive social benefit for society.

7.8. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Harmony Joel Solar PV Facility. 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.

In terms of value creation through sustainability it is estimated that the Harmony Gold suite of solar PV projects (of which the Harmony Joel Solar PV Facility is one) will offset the liabilities of anticipated costs pending Scope 2 carbon taxes, against the backdrop of deregulation of the energy sector in South Africa, represents a big step forward for mining and private power industries in South Africa.

The construction of the solar energy plants will be a watershed moment for Harmony, as not only will these transactions help deliver on the Mine's environmental and social obligations and undertakings, but they will also de-risk the business and deliver many socio-economic benefits, including ensuring that investors and other stakeholders continue to derive value and positive returns in a global climate of energy uncertainty.

It is anticipated that this emission profile will decline over time, in line with Harmony Gold production profile, as well as when the renewable energy mix increases in the national electricity grid. However, a number of active decarbonisation measures are currently under way ahead of that amelioration.

a) Land use and mining

Mining and livestock grazing are viable long-term land uses of the site as long as the field quality is maintained by never exceeding the grazing capacity. Another viable land use would be tourist attraction related to the H.J. Joel Private Nature Reserve adjacent to the project site.

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current grazing, mining and tourist activities, losing out on the opportunity to generate renewable energy from solar energy as additive thereto (i.e. current 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.

The 'do nothing' alternative would result in a lost opportunity for the Mine (in terms of implementing a compatible land use option, while still retaining the current land use) 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:

Potential negative social impacts associated with the construction and operation of the project include the following:

- Potential influx of job seekers and an associated change in population and increase in pressure on basic services.
- Potential safety and security impacts.
- Potential impacts on daily living and movement patterns.
- Potential nuisance impacts (noise and dust).
- Potential visual impact and impact on the sense of place.

Potential positive social impacts associated with the construction and operation of the project include the following:

- Potential direct and indirect employment opportunities.
- Skills development and training
- Development of Renewable energy facilities
- Potential economic multiplier effect.

The impacts of pursuing the "no-go" alternative can therefore be summarised as follows:

- The benefits would be that there is no disruption from nuisance impacts (noise and dust during construction), visual impacts and safety and security impacts. The impact is therefore neutral.
- There would also be an opportunity loss in terms of limited job creation, skills development, community upliftment and associated economic business opportunities for the local economy. This impact is considered to be negative.
- The opportunity to strengthen the grid connection within the municipal area would be lost which will have a negative impact on economic growth and development and therefore result in negative social impacts.

The No-Development option would mean that the electricity generated through renewable sources, in this case solar energy, is not generated and available for own use by the Mine, with any excess electricity to be wheeled to the national grid. In the given and described policy context, this would represent a negative social and environmental cost.

In addition, the employment opportunities associated with the construction and operation phase, as well as the benefits associated with the additional funding for socio-economic and enterprise development measures and the established local ownership entity representing beneficiary communities would be forgone.

c) Conclusion

As the project site experiences ample solar resource and optimal grid connection opportunities are available, not developing the Harmony Joel Solar PV Facility 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 is not considered significant. 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 the Harmony Joel Solar PV Facility. 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.

The 'do-nothing' alternative will result in lost opportunities to develop the site in a meaningful way. The site is currently under-utilised. The 'do nothing' alternative is therefore not preferred and not proposed to be implemented for the development of the Harmony Joel Solar PV Facility.

CHAPTER 8: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS

As identified and assessed in Chapter 7, a PV facility and the associated infrastructure may have effects (positive and negative) on the natural and social environments and on the people living in a project area. The preceding impact assessment chapter has reported on the assessment of the impacts associated with the Harmony Joel Solar PV Facility largely in isolation (from other similar developments).

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.

8.1 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 the Harmony Joel Solar PV Facility 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 avifauna through habitat loss, displacement, collision and interaction with power 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.

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 8.1 indicates the location of the Harmony Joel Solar PV Facility in relation to all other known and viable PV facilities (i.e. projects with a valid Environmental Authorisation) located within a radius of 30km from the project site. These projects were identified using the Department of Forestry, Fisheries and the Environment Renewable Energy Database and current knowledge of projects being proposed in the area. In the case of the Harmony Joel Solar PV Facility, there are four (4) authorised PV facilities located within a 30km radius of the project site (refer to **Figure 8.1** and **Table 8.1**). The potential for cumulative impacts is summarised in the sections that follow and has been considered within the specialist studies (refer to **Appendices D – I**).

Table 8.1: PV facilities located within the broader area (within a 30km radius) of the Harmony Joel Solar PV Facility

Project Name	DEA Reference Number(s)	Approximate distance from the Harmony Joel Solar PV Facility	Project Status
Beatrix Mine Shaft 4 Solar PV (20MW)	12/12/20/2666/A	~ 9 km north-west	Environmental Authorisation issued
Beatrix Mine Shaft 2 Solar PV (19.9MW)	12/12/20/2668	~ 3.8 km west	Environmental Authorisation issued
Co-Generation at Beatrix Mine Solar PV (4MW)	14/12/16/3/3/2/328	~ 11.6 km north-west	Environmental Authorisation issued
Sonvanger Solar PV Facility (84MW)	14/12/16/3/3/2/672	~ 24 km south-west	Environmental Authorisation issued

Several of the projects are also associated with Mine sites, and/or are mainly intended for own use. This is a positive position for mining and industry in this area. 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 (DFFE, DMRE, 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 the Harmony Joel Solar PV Facility are therefore qualitatively assessed in this Chapter. The following potential impacts are considered:

- Cumulative Impacts on ecology and wetlands
- Cumulative Impacts on avifauna
- Cumulative Impacts on land use, soil and agricultural potential
- Cumulative Impacts on heritage resources
- Cumulative visual impacts
- Cumulative socio-economic impacts

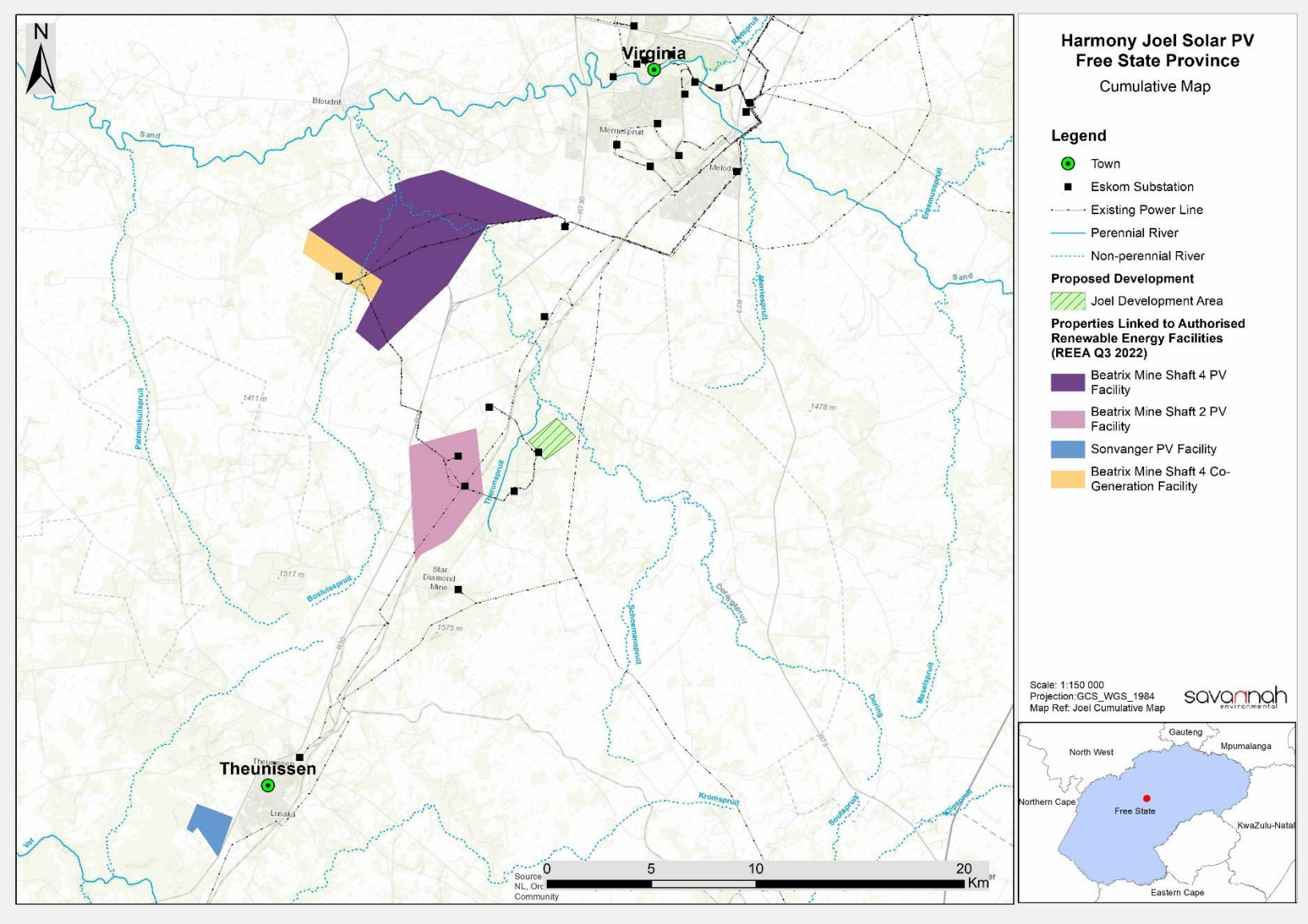


Figure 8.1: Identified PV facility projects located within a 30km radius of the Harmony Joel Solar PV Facility that are considered as part of the cumulative impact assessment for the Harmony Joel Solar PV project (refer to **Appendix L**).

8.2 Cumulative Impacts on Ecology and Wetlands

Cumulative impacts associated with the Harmony Joel Solar PV Facility and associated infrastructure have been identified by the ecological specialist (refer to **Appendix D**). These impacts include the following:

- The loss of vegetation types on a cumulative basis from the broad area may impact the Country's ability to meet its conservation targets.
- Transformation of intact, sensitive habitats could compromise the ecological functioning of these habitats and may 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.
- The loss of biodiversity may be exacerbated.
- Invasion of exotics and invasive species into the broader area may also potentially be exacerbated.

Cumulative impacts from an ecological perspective include the loss of unprotected vegetation types on a cumulative basis and loss of habitat. Minimal transformation of intact, sensitive habitats. These impacts could compromise the ecological functioning of these habitats and may contribute to the further 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.

Impact: *Cumulative impact as a result of development encroachment on natural areas*
Nature: The areas surrounding the site does still contain fairly extensive natural portions though mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation. The proposed solar development would therefore not result in a high cumulative impact though would certainly contribute toward the overall cumulative transformation of the area.

The impact ratings below assumes that the other projects are not within transformed areas.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Regional (3)
Duration	Permanent (5)	Long-Term (4)
Magnitude	Medium (6)	High (8)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Moderate (52)**	**High (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources?	No	Yes
Can impacts be mitigated?	Yes – but limited	

Mitigation:

- The cumulative impact is unlikely to be easily mitigated. Decreasing the total development footprint should allow for a decrease in the cumulative impact though the cumulative impact is still anticipated to remain significant.

8.3 Cumulative Impacts on Avifauna

Cumulative impacts from an avifauna perspective include exacerbated displacement and loss of habitat. In addition, the grid connection (via power lines) of these facilities with high voltage lines will increase the probability of bird strikes with power lines and avian mortalities due to collision and electrocution.

The cumulative avifauna impacts, considering the development of the Harmony Joel Solar PV Facility and the PV facilities within the surrounding area will be of a low to medium significance, depending on the impact being considered.

Impact: *Cumulative impact as a result of habitat loss.* ***Nature:*** *T*he development of the Harmony Joel Solar PV Facility and the other PV facilities will cause regional losses of natural habitat, as well as the subsequent displacement of birds.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	**Medium (48)**	**Medium (52)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	To some extent	
Mitigation: » It is difficult to mitigate against the loss of habitat without considering alternative sites. The best practicable mitigation will be to consolidate infrastructure (e.g. proposed powerline) to areas where existing impacts occur (e.g. placing the proposed powerline alongside existing powerlines) and to concentrate infrastructure on land with a low biodiversity conservation value.		

Impact: *Cumulative impact as a result of the avian collision with PV panels* ***Nature:*** Avian collision impacts (i.e. collision impacts with the PV panels) are expected during the operation phase of the Harmony Joel Solar PV Facility and other PV facilities.		
	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 (3)	Local and immediate surroundings (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Moderate (6)	High (8)
Probability	Probable (3)	Highly Probable (4)
Significance	**Medium (39)**	**Medium (60)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes, potential loss of waterfowl and certain shorebird taxa species.
Can impacts be mitigated?	Yes, to some extent	
Mitigation: » Apply bird deterrent devices to the panels for birds that may mistake the panels for open water and to prevent them from landing on the panels. » To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to employ video cameras to document any bird mortalities and to conduct direct observations and carcass searches on a regular and systematic basis. » Apply appropriate buffer zones to water features and wetlands.		

Impact: *Cumulative impact as a result of the avian collision with grid infrastructure*
Nature: Avian collision impacts (i.e. collision impacts with the overhead power lines) are expected during the operation phase of the Harmony Joel Solar PV Facility and other PV facilities owing to the increase in the number of grid line connections which would be required for multiple projects in one area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes
Can impacts be mitigated?	Yes, to some extent	

Mitigation:
» Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures.
» Allow for construction of new powerlines parallel to existing lines.
» To aid post-construction monitoring and/or monitoring of bird mortality rates, it is advised to conduct direct observations and carcass searches on a regular and systematic basis.
» As a priority, all new power lines should be marked with bird diverters.

Impact: *Cumulative impact as a result of electrocution*
Nature: During the operation phase of the Harmony Joel Solar PV Facility and other PV facilities in the area, avian electrocution related to the overhead power lines is expected to occur owing to the increase in the number of grid line connections which would be required for multiple projects in one area.

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local (2)	Local (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Low (24)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes, potential loss of waterfowl and certain shorebird taxa species.	Yes.
Can impacts be mitigated?	Yes, to some extent	

Mitigation:
» Apply bird deterrent devices to the power line and make use of "bird-friendly" pylon structures.
» As a priority, all new power lines should be marked with bird diverters.
» Make use of bird-friendly pylons and bird guards.
» Position electrical infrastructure in close proximity to existing infrastructure.

8.4 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 and cultivation, as well as an increased risk of erosion. These impacts can be reduced by keeping the footprints of the PV 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.

Impact: *Decrease in areas with suitable land capability for cattle farming.*
Nature: With the development of the Harmony Joel Solar PV Facility and other PV facilities in the area, the decrease in land capability for livestock is expected to occur, due to construction and operational activities of the PV facility.

	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	Short duration (2)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Highly likely (4)	Highly likely (4)
Significance	**Low (28)**	**Medium (40)**
Status (positive or negative)	Negative	Negative
Reversibility	High	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:

» The only mitigation measure for this impact is to keep the footprints of all renewable energy facilities as small as possible and to manage the soil quality by avoiding far-reaching soil degradation such as erosion.

Impact: *Cumulative impact areas susceptible to soil erosion.*
Nature: During construction Harmony Joel Solar PV Facility and other PV facilities in the area will be highly vulnerable to soil erosion due to the disturbances that will be created.

	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	Medium-term (3)	Medium-term (3)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (33)**
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:

» The area around the development footprint must regularly be monitored to detect early signs of soil erosion on-set.

» If soil erosion is detected, the area must be stabilised by the use of geo-textiles and facilitated re-vegetation.t

Impact: *Cumulative impact areas susceptible to soil compaction.*
Nature: During construction Harmony Joel Solar PV Facility and other PV facilities in the area will be highly vulnerable to soil compaction due to the movement of heavy construction vehicles.

	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	Medium-term (3)	Medium-term (3)
Magnitude	Low (4)	Low (4)
Probability	Improbable (2)	Probable (3)
Significance	**Low (16)**	**Low (27)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	Yes

Mitigation:
Each of the projects should adhere to the highest standards for soil compaction prevention and management:

- Vehicles and equipment must travel within demarcated areas and not outside of the construction footprint;
- Unnecessary land clearance must be avoided;
- Materials must be off-loaded and stored in designated laydown areas;
- Where possible, conduct the construction activities outside of the rainy season; and
- Vehicles and equipment must park in designated parking areas.

Impact: *Cumulative impact on increased risk of soil pollution*
Nature: During construction of the Harmony Joel Solar PV Facility and other PV facilities in the area will be vulnerable to soil pollution due to activities such as spills from fuel storage tanks, pollution from concreate mixing and spills from vehicles transporting workers and construction equipment.

	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	Short-term (2)	Short-term (2)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Low (27)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	No

Mitigation:
Each of the projects should adhere to the highest standards for soil pollution prevention and management:

- Maintenance must be undertaken regularly on all vehicles and construction/maintenance machinery to prevent hydrocarbon spills;
- Any waste generated during construction must be stored into designated containers and removed from the site by the construction teams;
- Any left-over construction materials must be removed from site;
- The construction site must be monitored by the Environmental Control Officer (ECO) to detect any early signs of fuel and oil spills and waste dumping.

8.5 Cumulative Impacts on Heritage (including archaeology and palaeontology)

The location of the proposed PV facility within an area with existing mining activities may lend itself to cumulative impacts. However, in terms of cumulative impacts to heritage resources, it is preferable that industrial-type infrastructure is clustered within an area in order to prevent the sprawl of industrial development across otherwise sensitive cultural landscapes.

No significant heritage resources are noted to occur in this area. As such, it is not anticipated that the proposed development will have a negative cumulative impact on significant heritage resources.

8.6 Cumulative Visual Impacts

Cumulative landscape and visual effects (impacts) result from additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments (associated with or separate to it), or actions that occurred in the past, present or are likely to occur in the foreseeable future. They may also affect how the landscape is experienced. Cumulative effects may be positive or negative. Where they comprise a range of benefits, they may be considered to form part of the mitigation measures.

Cumulative effects can also arise from the intervisibility of a range of developments and /or the combined effects of individual components of the proposed development occurring in different locations or over some time. The separate effects of such individual components or developments may not be significant, but together they may create an unacceptable degree of adverse effect on visual receptors within their combined visual envelopes. Intervisibility depends upon general topography, aspect, tree cover or other visual obstruction, elevation, and distance as this affects visual acuity, which is also influenced by weather and light conditions (LI-IEMA (2013)).

The anticipated cumulative visual impact is expected to be of medium significance, which is considered to be acceptable from a visual perspective.

Impact: *The potential cumulative visual impact of the PV facility on the visual quality of the landscape.* ***Nature:*** The proposed Harmony Joel PV will increase the cumulative impact of electricity related infrastructure within the region. The cumulative impact of additional traffic on the local and regional roads as well as combined impacts from potential night-time lighting will also affect the sense of place of the larger region. The Development will however shift the development trend of away from mining creating different landscape features.		
	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Very short distance (4)	Medium to longer distance (2)
Duration	Long term (4)	Long term (4)
Magnitude	Moderate (6)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (42)**	**Medium (36)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible (1)	Reversible (1)
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	No, only best practise measures can be implemented.	
Mitigation: <u>Planning:</u> » Retain/re-establish and maintain natural vegetation (if present) immediately adjacent to the development footprint where possible.		

Operations:
» Maintain the general appearance of the facility as a whole.
Decommissioning:
» Remove infrastructure not required for the post-decommissioning use.
» Rehabilitate all affected areas. Consult an ecologist regarding rehabilitation specifications.

8.7 Cumulative Social Impacts

The potential cumulative impacts on the areas sense of place will be largely linked to potential visual impacts, and include:

» Combined visibility (whether two or more facilities will be visible from one location).
» Sequential visibility (e.g. the effect of seeing two or more facilities along a single journey, e.g. road or walking trail).
» Visual compatibility of different facilities in the same vicinity.
» Perceived or actual change in land use across a character type or region.
» Loss of a characteristic element (e.g. viewing type or feature) across a character type caused by developments across that character type.

Cumulative impacts need to be considered in relation to dynamic as well as static viewpoints. The experience of driving along a tourist road, for example, needs to be considered as a dynamic sequence of views and visual impacts, not just as the cumulative impact of several developments on one location. The viewer may only see one renewable energy facility and the associated infrastructure at a time, but if each successive stretch of the road is dominated by views of renewable energy facilities, then that can be argued to be a cumulative visual impact.

The potential impact of the proposed facility and associated infrastructure on the sense of place is likely to be negligible. The cumulative impacts are also considered to be very low.

Positive cumulative impacts have been considered, and the facility has the potential to result in significant positive cumulative impacts; specifically relating to reduced pressure of the Eskom grid, creation of a number of socio-economic opportunities for the area and within the Local Municipality, which in turn, will result in a positive social benefit. The positive cumulative impacts include creation of employment, skills development and training opportunities, and downstream business opportunities. Benefits to the local, regional and national economy through employment and procurement of services could be substantial should many renewable energy facilities proceed. This benefit will increase significantly should critical mass be reached that allows local companies to develop the necessary skills to support construction and maintenance activities and that allows for components of the renewable energy facilities to be manufactured in South Africa. Furthermore, at municipal level, the cumulative impact could be positive and could incentivize operation and maintenance companies to centralize and expand their activities towards education and training.

Impact: *An increase in employment opportunities, skills development and business opportunities with the establishment of a solar PV facility*
Nature: During the construction and operation phase the establishment of a number of solar power projects in the area has the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities

	Overall impact of the proposed project considered in isolation	**Cumulative impact of the project and other projects in the area**
Extent	Local -regional (3)	Local-regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Moderate (6)
Probability	Probable (3)	Probable (3)
Significance	**Medium (33)**	**Medium (39)**
Status (positive or negative)	Positive	Positive
Reversibility	N/A	N/A
Irreplaceable loss of resources?	N/A	N/A
Can impacts be enhanced?	Yes	
Enhancement measures:		
» The establishment of a number of solar energy facilities in the area does have the potential to have a positive cumulative impact on the area in the form of employment opportunities, skills development and business opportunities. The positive benefits will be enhanced if local employment policies are adopted, and local services providers are utilised by the developers to maximise the project opportunities available to the local community.		

Impact: *Cumulative impact with large-scale in-migration of people* ***Nature:*** Negative impacts and change to the local economy with an in-migration of labourers, businesses and jobseekers to 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-regional (3)
Duration	Long-term (4)	Long-term (4)
Magnitude	Minor (2)	Low (4)
Probability	Very improbable (1)	Improbable (2)
Significance	**Low (7)**	**Low (22)**
Status (positive or negative)	Negative	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
» Develop a recruitment policy / process (to be implemented by contractors), which will ensure the sourcing of labour locally, where available. » Work together with government agencies to ensure that service provision is in line with the development needs of the local area. » Form joint ventures with community organisations, through Trusts, which can provide local communities with benefits, such as employment opportunities and services. » Develop and implement a recruitment protocol in consultation with the municipality and local community leaders. Ensure that the procedures for applications for employment are clearly communicated.		

8.8 Conclusion regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Harmony Joel Solar PV Facility throughout all phases of the project life cycle and within all areas of study considered as part of this EIA Report. The main aim for the assessment of cumulative impacts considering the Harmony Joel Solar PV Facility 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 following conclusions can be drawn regarding the cumulative impacts associated with the project:

- The areas surrounding the site does still contain fairly extensive natural portions though mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation. The proposed solar development would therefore not result in a high cumulative impact though would certainly contribute toward the overall cumulative transformation of the area. The cumulative impact is therefore acceptable.
- There will be no unacceptable risk to avifauna with the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding area, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of land capability due to the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding areas, provided recommended mitigation measures are implemented. The cumulative impact is therefore acceptable.
- There will be no unacceptable loss of heritage resources associated with the development of the Harmony Joel Solar PV Facility and other renewable energy projects within the surrounding areas. The cumulative impact is therefore acceptable.
- Change to the sense of place and character of the area is expected with the development of renewable energy facilities. However, the change is not considered to be significant.
- No unacceptable socio-economic impacts are expected to occur. The cumulative impact is therefore acceptable.

A summary of the cumulative impacts is included in **Table 8.2** below.

Table 8.2: Summary of the cumulative impact significance for the Harmony Joel Solar PV Facility

Specialist assessment	Cumulative significance of impact of the project and other projects in the area (without Mitigation)	Cumulative significance of impact of the project and other projects in the area (with Mitigation)
Ecology	Medium	High
Avifauna	Low to Medium (depending on the impact being considered)	Medium
Land use, soil and agricultural potential	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)
Heritage (archaeology and palaeontology)	Low	Low
Visual	Medium	Medium
Socio-Economic	Low to Medium (depending on the impact being considered)	Low to Medium (depending on the impact being considered)

Based on the specialist cumulative assessment and findings, the development of the Harmony Joel Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Harmony Joel Solar PV Facility cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to ecological impacts due to the extent of development encroachment on natural areas[25]. It was concluded that the development of the 18MW Harmony Joel Solar PV Facility will not contribute significantly toward the cumulative impacts in this

[25] The assumption is that all of the other projects are not located on transformed land.

area due to the proposed location being adjacent to an active mining site. The cumulative impact attributed to this facility is therefore acceptable.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

Freegold Harmony (Pty) (a subsidiary of Harmony Gold Mining Company Ltd) is looking to supplement its energy supply by implementing photovoltaic (PV) generation at their Mine site, aiding their transition to a more sustainable and environmentally friendly energy mix at the existing Harmony Joel Mine. A solar PV facility with a generating capacity of 18MW is proposed in close proximity to the Harmony Joel Gold Plant mining operations. The site is located 900m north east of the Harmony Joel operations, approximately ~20km north east of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Joel Solar PV Facility, will comprise of several arrays of PV panels and associated infrastructure. The project site is located on Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but located outside of the mining area (the project would not impact on mining activities).

A project site considered to be technically suitable for the development of the solar PV facility, with an extent of 1000ha has been identified by Freegold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~220ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities. A development footprint of ~47ha has been identified within the project site and assessed for the construction of the facility and its associated infrastructure. The optimal position for the PV facility was determined taking into consideration the environmental sensitivities identified through the Scoping Study. The PV infrastructure has been appropriately placed to optimise the energy generating potential of the solar resource while also minimising impacts on environmental sensitivities.

The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching substation to be connected via a power line to the existing Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint). The grid connection infrastructure is located within an assessment corridor of 300m wide and traverses Portion 0 of the Farm Leeuwbult 580.

The Harmony Joel Solar PV Facility will have a contracted capacity of up to 18MW and will include specific infrastructure, namely:

» PV modules and mounting structures
» Inverters and transformers a SCADA room, and maintenance room
» Cabling between the project components, to be laid underground where practical
» Access roads, internal roads and fencing around the development area.
» Temporary and permanent laydown areas and O&M buildings.
» Grid connection solution within a 300m wide corridor, including:
  - cabling between the project components and the facility substation
  - on-site facility substation
  - switching substation
  - overhead power line between the switching station and the point of connection at the Shafts 1 & 2 HJ Joel Mining Substation (located ~830m south west of the development footprint)

From a local perspective, the Mine site within the greater Virginia area is considered favourable for the development of a solar energy facility by virtue of prevailing climatic conditions, relief, aspect, the availability of a grid connection, and the availability of land on which the development can take place.

The construction of a dedicated solar PV facility at the Harmony Joel Mine is proposed in order to reduce the Mine's consumption of grid-supplied power by using solar power. This would provide cost savings to the Mine, and allow the mining operation to operate efficiently with uninterrupted power supply, while reducing the demand on the national grid. The Applicant, Freegold Harmony (Pty) Ltd will fund and own the PV plant which will generate energy for on-site consumption by the mining operations.

As the project has the potential to impact on the environment, an Environmental Impact Assessment process is required to be completed in support of an application for Environmental Authorisation prior to the commencement of construction and operation.

9.1 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an EIA Report

This chapter of the scoping report includes the following information required in terms of Appendix 3: Scope of Assessment and Content of the Environmental Impact Assessment Report:

Requirement	Relevant Section
3(k) where applicable, a summary of the findings and impact management measures identified in 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 report	A summary of the findings of the specialist studies undertaken for Harmony Joel Solar PV Facility has been included in section 9.2
3(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 site indicating any areas that should be avoided, including buffers and (iii) a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives.	An environmental impact statement containing the key findings of the environmental impacts of Harmony Joel Solar PV Facility has been included as section 9.5. Sensitive environmental features located within the study area and development area, overlain with the proposed development footprint have been identified and are shown in **Figure 9.1.**
3(p) 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.	A reasoned opinion as to whether the Harmony Joel Solar PV Facility should be authorised has been included in section 9.6.
3(n) 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.	All conditions required to be included in the Environmental Authorisation of the Harmony Joel Solar PV Facility have been included in section 9.7.

9.2 Evaluation of the Harmony Joel Solar PV Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-I** provide a detailed assessment of the potential impacts that may result from the development of the proposed Harmony Joel Solar PV Facility. This chapter concludes the environmental assessment by providing a summary of the results and conclusions of the assessment of the development area, and specifically the development footprint/facility layout. 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 sensitive features within the development footprint.

The potential environmental impacts associated with the Harmony Joel Solar PV Facility assessed through the EIA process include:

» Impacts on terrestrial ecology (flora and fauna)
» Impacts on wetlands
» Impacts on avifauna.
» Impacts on soils and agricultural potential.
» Impacts on heritage resources, including archaeology, palaeontology and the cultural landscape.
» Visual impacts on the area imposed by the components of the facility.
» Positive and negative social impacts.

The environmental sensitivities identified by the relevant specialists for the project site as discussed in the following sections are illustrated in **Figure 9.1.** The development footprint, as assessed in the EIA report, has been overlain with the relevant environmental sensitivities.

9.2.1 Impacts on Terrestrial Ecology (including flora, fauna and wetlands)

The site falls within the Central Free State Grassland (LC) and Highveld Alluvial vegetation types. The development will result in the loss of natural vegetation but which is considered to have only a moderate conservation value. The areas surrounding the site does contain fairly extensive natural areas, although mining operations and agricultural transformation does contribute toward a moderate degree of cumulative transformation.

The Terrestrial Ecology Assessment (**Appendix D**) undertaken determined that while the assessment and significance rating consider the full extent of the development area, the implementation of avoidance of sensitive areas as a mitigation strategy has been adopted. The northern and eastern portions of the development area (comprising of the Doring River and its tributaries including the Theronspruit river to the west) has been excluded entirely from the development footprint and the necessary mitigation implemented to ensure no indirect impacts affect the identified sensitive habitats.

The site for the proposed solar development is listed as being an Ecological Support Areas 1 & 2 (ESA1 and ESA2). This indicates that the area is not essential to meeting conservation targets, but forms part of the

functioning of the Doring River adjacent to the site, and as a result does provide important functions in the support of this system.

The majority of this area has previously been transformed by urban development, mining operations and livestock grazing. Subsequently those portions of previous grazing have now re-established grassland, but which is of secondary establishment while portions of previous residential areas had also been rehabilitated but is evidently still quite degraded. Despite the largely transformed condition of the site, fairly large areas of remaining natural grassland are also still present, and these areas clearly have a moderate conservation value.

Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Joel Solar PV Facility project that cannot be reduced to a medium significance. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Mitigation measures must be implemented to mitigate any impacts.

9.2.2 *Impacts on Avifauna*

The Avifauna Impact Assessment (**Appendix E**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate to low after mitigation (depending on the type of impact).

Three avifaunal habitat types were identified on the study site and surroundings, consisting of open grassland with bush clump mosaics, the Doring River system with riverine woodland, and transformed units (ranging from build-up land and mining infrastructure). The study site was also surrounded by slimes dams and the Doring River system, which provided additional habitat for waterbird and shorebird taxa. Approximately 162 bird species are expected to occur in the wider study area, of which 91 species were observed in the study area (during two independent surveys). The expected richness included four threatened or near threatened species, 15 southern African endemics and 19 near-endemic species. However, the occurrence of threatened and near threatened bird species was predicted to be low, although the natural broad-scale habitat units provided foraging habitat for the occasional occurrence of the vulnerable Lanner Falcon (*Falco biarmicus*) and endangered Secretarybird (*Sagittarius serpentarius*). Eleven southern African endemics and 13 near-endemic species were confirmed on the study site. In addition, a total of 50 collision-prone bird species have been recorded from the study area, of which 29 species were waterbird and shorebird taxa, and another 11 species were birds of prey.

The main impacts associated with the proposed PV solar facility included the following:

- The loss of habitat and subsequent displacement of bird species due to the ecological footprint required during construction.
- Direct interaction (collision trauma) by birds with the surface infrastructure (photovoltaic panels) caused by polarised light pollution and/or colliding with the panels (as they are mistaken for waterbodies).
- Collision with associated infrastructure (mainly overhead power lines).

The risk for risk for certain waterbirds (mainly large-bodied waterfowl such as the South African Shelduck *Tadorna cana* and Egyptian Goose *Alopochen aegyptiacus*) colliding with the PV infrastructure remained eminent due to the presence of wetland-associated features and the nearby Doring River system (including the Theronspruit river to the west). Waterbird interactions with the PV infrastructure was predicted as persistent due to the spatial location of the proposed footprint site (surrounded by water features of which

some sustain large numbers of birds). It is recommended that the proposed mitigation measures and monitoring protocols be implemented during the construction and operation phase of the project (including the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds).

The most significant potential impact associated with the Solar PV development relates to habitat destruction and disturbance/displacement. The area currently experiences high levels of existing impacts such as highly modified areas used for mining and grazing as well as high levels of disturbance associated with the mining activities. The avifaunal community, even in the remnant patches of natural or near-natural vegetation scattered amongst the agricultural fields, is likely accustomed to the ongoing habitat disturbance and movement of large machinery. The solar PV facility is therefore unlikely to pose a significant negative impact on the avifaunal community of the receiving environment.

No fatal flaws were identified during the assessment of the PV Facility. It is recommended by the specialist that the proposed mitigation measures and monitoring protocols (additional with pre- and post-construction monitoring) be implemented during the construction and operational phase of the project.

9.2.3 Impacts on Soil and Agricultural Potential

The Agricultural Agro-Ecosystem Assessment found that the area consists of four different natural soil forms, i.e. Glen horizon, Glenrosa, Sepane and Swartland. The areas with existing soil disturbance are classified as Technosols. The largest part of the total area assessed, has Low-Moderate land capability (143.79ha).

All soils are assigned Low sensitivity to the proposed development due to absence of any rainfed or irrigated crop production within the development footprint. There is also no irrigation infrastructure, such as centre pivots or drip irrigation, present within the project area. The grazing capacity (according to DALRRD, 2018), is 6ha/LSU, indicating that the proposed development area of 220ha has forage to feed 36 head of cattle.

It is anticipated that the construction and operation of the Harmony Joel Solar PV and associated grid connection corridor facility will have low impacts on soils and agricultural potential.

Considering that the infrastructure components, will be placed in close proximity to each other, the specialist can confirm that all reasonable measures have been taken to avoid or minimize fragmentation and disturbance of agricultural activities, provided that the mitigation measures provided in this report are implemented.

9.2.4 Impacts on Heritage Resources (archaeological and paleontological)

The Heritage Impact Assessment identified that all impacts associated with the development of the Harmony Joel Solar PV Facility will be of high and low significance before mitigation (depending on the impact considered), and can be mitigated to an acceptable level of impact (i.e., low significance). The impacts rated to be of high significance pre-mitigation are not considered as fatal flaws, provided the prescribed mitigation measures are implemented.

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. The results of the survey only identified two sites of scientific cultural value – JL2, graded IIIC and JL5 graded IIIB within the development area proposed for the Harmony Joel Solar PV Facility.

Based on the experience of the palaeontologist and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the loose sands of the Quaternary. No fossils were seen during the site survey and there were no rocky outcrops present.

The heritage specialists have no objection to the proposed development of the Harmony Joel Solar PV facility on condition that the respective no-go buffers be implemented around sites JL2 and JL5, and a Chance Finds Fossil Procedure be implemented for the duration of the construction phase of the project. From a heritage and paleontological perspective, the facility layout and grid line route are considered acceptable.

9.2.5 Visual Impacts

Besides the large number of mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines. Land use activities within the broader region are predominantly described as maize farming, with some mining activity evident towards the west (BEISA mine) of the proposed site. The proposed development is compatible with the surrounding land uses and does not present a conflicting land use.

Overall, the significance of the visual impacts is expected to range from moderate to low as a result of the generally undeveloped character of the landscape. The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads and residents of rural homesteads and settlements.

Subject to the recommended mitigation measures being implemented, from a Landscape and Visual Impact perspective, it is the specialist's opinion that there is no reason why the proposed layout should not be authorised.

9.2.6 Social Impacts

The social impacts identified (including all positive and negative impacts) will be either of a low or medium significance. No negative impacts with a high significance rating have been identified to be associated with the development of the Harmony Joel Solar PV Facility and associated infrastructure. All negative social impacts are within acceptable limits with no impacts considered as unacceptable from a social perspective. The site falls within existing mining development area and therefore falls within the Mine's social and economic processes and structures, with the socio-economic development and local economic development plans taking the PV facility into consideration. The recommendations proposed for the project are appropriate and suitable for the mitigation of the negative impacts and the enhancement of the positive impacts. Harmony Joel Solar PV Facility and its associated grid connection is supported at a national, provincial, and local level, and that the proposed project will contribute positively towards a number of targets and policy aims.

Based on the findings of the SIA the proposed establishment of the Harmony Joel Solar PV Facility is supported.

9.2.7 Assessment of Cumulative Impacts

The main aim for the assessment of cumulative impacts considering the Harmony Joel Solar PV Facility 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.

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 and within the surrounding areas of the development area. 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 Energy Response Plan 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.

Based on the specialist cumulative assessment and findings, the development of the Harmony Joel Solar PV Facility and its contribution to the overall impact of all renewable energy facilities to be developed within a 30km radius, it can be concluded that the Harmony Joel Solar PV Facility cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to ecological impacts due to the extent of development encroachment on natural areas. It was concluded that the development of the 18MW Harmony Joel Solar PV Facility will not contribute significantly toward the cumulative impacts in this area due to the location within the mining area. The cumulative impact attributed to this facility is therefore acceptable.

9.3 Environmental Sensitivity Mapping

The facility layout/development footprint assessed within this EIA Report was designed in order to respond to and avoid the sensitive environmental and social features located within the project site, which were identified by the specialists during the Scoping Phase of the EIA process. This approach ensured the application of the mitigation hierarchy (i.e., avoid, minimise, mitigate, and offset) to the proposed project, which ultimately ensures that the development is appropriate from an environmental perspective and is suitable for development within the project site.

As part of the specialist investigations undertaken within the project development area, which includes the development area, specific environmental features and areas were identified which will be impacted by the placement of Harmony Joel Solar PV Facility. The current condition of the features identified (i.e. intact or disturbed) will inform the sensitivity of the environmental features and its capacity for disturbance and change associated with the proposed development.

The environmental features identified within and directly adjacent to the project site and development footprint are illustrated in **Figure 9.1**. The sensitive features identified and indicated on the sensitivity map to be avoided/buffered relate to heritage resources, and ecological and avifauna sensitivities/features. The following provides a description of the sensitivities identified within the development footprint:

- **Ecological features:**
  - High Ecological Sensitivity:

- The areas demarcated as delineated wetland areas and riparian zones associated with the Doring river and its tributaries (located outside of the development footprint)
-
- **Avifauna:**
  - High Avifauna Sensitivity:
    - River (500m buffer) associated with the Doring river and its tributaries (outside of the development footprint)

- **Soils:**
  The project area is located on areas of low sensitivity.

- **Heritage resources:**
  A number of archaeological resources/structures were identified within and beyond the development area. For site JL5 within the development area, a no-development buffer of 50m is recommended around the site. For site JL2 within the development area, a no-development buffer of 30m is recommended around the site. These heritage sites and their respective no-go buffers are entirely avoided by the development footprint.

- **Visual and social:**
  The facility would be visible within an area that incorporates certain sensitive visual receptors who would consider visual exposure to this type of infrastructure to be intrusive. Such visual receptors include people travelling along roads, lifestyle and recreational areas, and residents. No no-go areas have been identified and no buffers have been recommended.

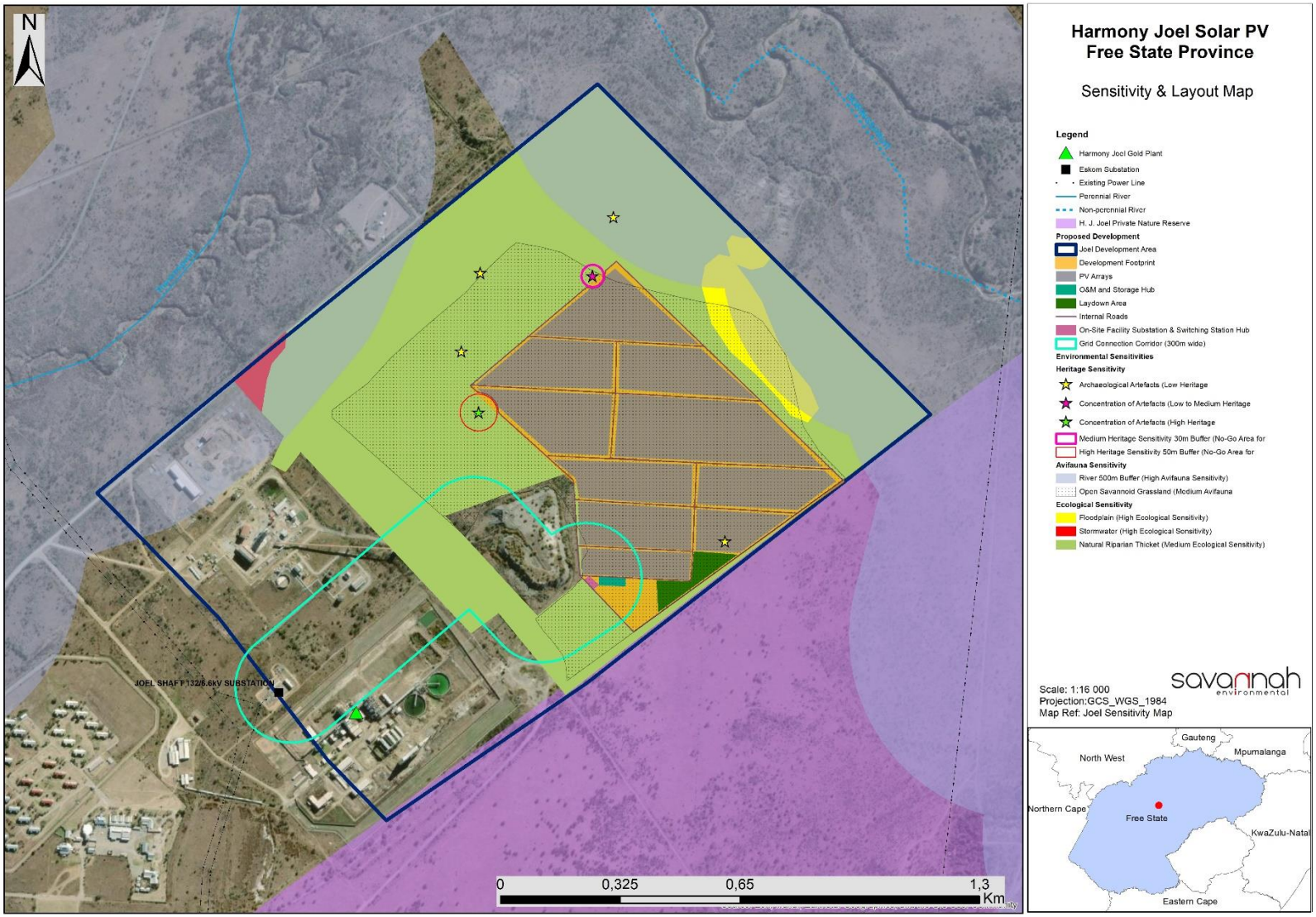


Figure 9.1: Facility layout and sensitivity map of the preferred development footprint and grid connection corridor for the Harmony Joel Solar PV Facility, as was assessed as part of the EIA process (A3 map is included in **Appendix L**).

9.4 Environmental Costs of the Solar PV Facility and its associated grid connection versus Benefits of the Solar 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 has been minimised/avoided through the implementation of recommendations provided by the specialist. The 500m regulated buffer around the Doring River is avoided by the PV facility. The CBA2 are avoided by the PV facility. The resulting impact is considered to be acceptable.
- Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable without any impact of high significance.
- Heritage impacts associated with the PV facility. The heritage resources are avoided by the optimised layout, and two features has a 30m (for JL2) and 50m (for JL5) no-go buffer respectively which is required to be adhered to. Mitigation measures that have been recommended will reduce the anticipated impacts.
- Loss of land for agriculture. The development will remove areas available for agricultural activities. However, based on the low sensitivity of the soils within the development footprint of the PV Facility, this will not be significant.
- Visual impacts associated with the PV facility. It is envisaged that the structures where visible from shorter distances, and where sensitive visual receptors may find themselves within this zone, may constitute a high visual prominence. General mitigations have been recommended to minimise the impact.
- Impacts on the social environment. Socio-economic impacts include impacts on the sense of place and the effect on social and economic infrastructure, and crime and social conflicts in the area that could be created during only the construction phase. These impacts though will only affect local communities either temporarily or over the long term. These impacts are not highly significant and can be traded off for the net positive impact created by the project. The project is for use by the Mine, with any excess electricity to be wheeled to the national grid, primarily to reduce the reliance on Eskom as an energy provider.

Benefits of the Harmony Joel Solar PV Facility include the following:

- The project will result in important economic benefits at the local and regional scale through job creation, income and other associated downstream economic development. These will persist during all stages of the project.
- The project provides an opportunity for a new land use on the affected properties which is considered as a more efficient use of the land and provides an opportunity for financial benefits to the current land use.
- Reliable and cost-effective energy, sourced and generated through private or internal arrangements eliminates the possibility of unexpected power outages and unreliable grid power from government-owned entities such as Eskom. The additional energy supply helps reduce the burden on such entities and reduces the need for energy management alternatives such as load shedding.
- In terms of value creation through sustainability it is estimated that the Harmony Gold suite of solar PV projects (of which the Harmony Joel Solar PV Facility is one) will offset the liabilities of anticipated costs

pending Scope 2 carbon taxes, against the backdrop of deregulation of the energy sector in South Africa, represents a big step forward for mining and private power industries in South Africa.

» The construction of the solar energy plants will be a watershed moment for Harmony, as not only will these transactions help deliver on the Mine's environmental and social obligations and undertakings, but they will also de-risk the business and deliver many socio-economic benefits, including ensuring that investors and other stakeholders continue to derive value and positive returns in a global climate of energy uncertainty.
» The project serves to diversify the economy and electricity generation mix of South Africa through the addition of solar energy.
» The water requirement for a solar 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. The Harmony Joel Solar PV Facility will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Harmony Joel Solar PV Facility 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility.

9.5 Overall Conclusion (Impact Statement)

The preferred activity was determined by Freegold Harmony (Pty) Ltd to be the development of a renewable energy facility on site using solar irradiation as the preferred technology, due to the availability of a suitable solar resource. Independent specialists appointed to undertake the assessment of potential impacts associated with the project assessed a larger area in order to inform the best location for the solar facility infrastructure. The Specialists considered desktop data, results from field work, existing literature and the National Web-based Environmental Screening Tool to inform the identification of sensitivities. A proposed layout was designed after provision of sensitivity data by the specialists with the aim of avoiding sensitive areas identified.

Based on the specialist investigations of the larger area, a technically viable development footprint was proposed by the developer and assessed as part of the EIA process. The findings of the assessment of the development footprint undertaken by independent specialists have informed the results of this report. The specialist findings have indicated that there are no identified fatal flaws associated with the implementation of the project within the project site.

From a review of the relevant policy and planning framework, it was concluded that the project is well aligned with the policy framework, and a clear need for the project is seen by Harmony Gold, who intend to use the power for their Harmony Joel operations, as well as from a policy perspective at a local, provincial and National level. The project development footprint is located outside of any protected area and outside of any Critical Biodiversity Areas (CBAs) as defined in the Provincial Conservation Plan. When considering biodiversity and socio-economic benefits and impacts on the affected and surrounding areas, the following is concluded from the specialist studies undertaken within this EIA process.

From a biodiversity perspective, the site is not located within a protected area. Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Joel Solar PV facility that cannot be reduced to a moderate or low significance. There are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding. Identified avifauna sensitivities were identified and avoided by the development footprint, and the layout proposed ensures that the heritage resource is avoided and recommended buffers are honoured. This approach is in line with the application of the mitigation hierarchy, where all the sensitive areas which could be impacted by the development have been avoided (i.e. tier 1 of the mitigation hierarchy). Where impacts could not be avoided, appropriate mitigation has been proposed to minimise impacts. It follows therefore that the project does not adversely impact on the ecological integrity of the area.

The Social Impact Assessment has identified short-term (construction related) impact indicators and operational related socio-economic impact indicators. The assessment of the proposed facility, and its net effect from a socio-economic perspective, indicates that the project would generate greater socio-economic benefits during both the construction and operational phases than the potential losses that could occur as a result of its establishment.

As detailed in the cost-benefit analysis, the benefits of the Harmony Joel Solar PV facility 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 lower sensitive areas through the avoidance of features and areas considered to be sensitive, the benefits of the project are expected to partially offset the localised environmental costs of the PV facility. From an economic perspective, both positive and negative impacts are expected.

Based on the conclusions of the specialist studies undertaken, it can be concluded that the development of the Harmony Joel Solar PV facility based on the current layout as provided by the Applicant will not result in unacceptable environmental impacts (subject to the implementation of the recommended mitigation measures).

9.6 Overall Recommendation

Considering the findings of the independent specialist studies, the impacts identified, the development footprint proposed by the developer within the development site, the avoidance of the sensitive environmental features within the project development area, 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 Harmony Joel Solar PV facility is acceptable within the landscape and can reasonably be authorised. The proposed layout as provided by the Applicant (**Figure 9.1**) is considered to be appropriate from an environmental perspective, with micro-siting of panels and roads required to ensure that the layout avoids all identified sensitivities and recommended buffer areas.

The following infrastructure would be included within an authorisation issued for the project:

18MW Solar PV facility: Harmony Joel Solar PV facility located within the project site located on the Portion 0 of the Farm Leeuwbult 580, which is owned by the Mine but outside of the mining area. The grid connection infrastructure is located within a 300m wide assessment corridor and traverses Portion 0 of the Farm Leeuwbult 580.

The following key conditions would be required to be included within an authorisation issued for the Harmony Joel Solar PV Facility:

- All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to I** are to be implemented.
- The EMPr as contained within **Appendix J** of this EIA report should form part of the contract with the Contractors appointed to construct and maintain the solar facility in order to ensure compliance with environmental specifications and management measures. The implementation of this EMPr for all life cycle phases of the Harmony Joel Solar PV facility is considered key in achieving the appropriate environmental management standards as detailed for this project.
- Exclude all areas of Very High Sensitivity from the PV facility development footprint.
- Following the final design of the Harmony Joel Solar PV facility, a revised layout must be submitted for review and approval prior to commencing with construction. No development is permitted within the identified no-go areas as detailed in **Figure 9.1.**
- A pre-construction walk-through of the final layout, including roads and underground cables, should be undertaken before construction commences and adjusted where required to reduce impacts on species of conservation concern and habitats of concern.
- 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 national and provincial authorities, must be obtained before the individuals are disturbed.
- A detailed site-specific eradication and management programme for alien invasive plants must be developed and implemented.
- Implement a chance finds procedure for the rescuing of any fossils or heritage resources discovered during construction.
- If any archaeological material or human burials are uncovered during construction activities, work in the immediate area should be halted, the find reported to the heritage authorities and inspected by an archaeologist. Such heritage is the property of the State and may require excavation and curation in an approved institution.
- Maintain vegetation cover (i.e. either natural or cultivated) immediately adjacent to the actual development footprint, both during construction and operation of the proposed facility.
- Monitor all rehabilitated areas for one year following decommissioning and implement remedial actions as and when required.

A validity period of 10 years of the Environmental Authorisation is requested, should the project obtain approval from DESTEA.

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120259	PIA Desktop	Barry Millsteed		Desktop Palaeontological Heritage Impact Assessment Report for the Oryx Solar Energy Facility
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124729	Heritage Scoping	Jaco van der Walt	08/05/2013	Archaeological Scoping Report for the Proposed Oryx Energy Facility
136650	Archaeological Specialist Reports	Jaco van der Walt	30/08/2013	Archaeological Impact Assessment report for the Oryx Solar Energy Facility
138939	Heritage Impact Assessment Specialist Reports	Karen Van Ryneveld, Gideon Groenewald	17/10/2013	Phase 1 Archaeological Impact Assessment & Palaeontological Assessment Lebone Solar Farm The Remaining Extent of the Farm Onverwag No. 728 and Portion 2 of the Farm Vaalkranz Np. 220, Welkom, Free State Province

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