

HARMONY TARGET 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)(ee), 10 (b) (ee) (hh), 12(b) (i),
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savannah
environmental

t +27 (0)11 656 3237

f +27 (0)86 684 0547

e info@savannahsa.com

w www.savannahsa.com

Prepared for:

Avgold (Pty) Ltd

Randfontein Office Park

Cnr Main Reef Road and Ward Avenue, Randfontein,
P O Box 2, Randfontein, 1760 Johannesburg, South Africa,

Prepared by:

savannah
environmental

PROJECT DETAILS

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Title	:	Environmental Impact Assessment Process: Harmony Target Solar PV Facility, Free State Province
Authors	:	Savannah Environmental (Pty) Ltd Chantelle Geyer Karen Jodas Nicolene Venter Jo-Anne Thomas
Client	:	Avgold (Pty) Ltd
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PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT

Avgold (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 Target 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 Target Solar PV Facility project and the environmental impact assessment.
- » **Chapter 2** provides a project description of the Harmony Target 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 Target 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 **16 January 2023** to **15 February 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 be 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 15 February 2023 to the contact person below.

Please submit your comments by 15 February 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

Avgold (Pty) Ltd (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 Target Mine. A solar PV facility with a generating capacity of 30MW is proposed in close proximity to the Harmony Gold Target Plant mining operations. The site is located 550m south of the Harmony Gold Target Plant operations, approximately ~1km south of the town of Allanridge within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Target 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 Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are owned by the Mine but 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 approximately 500ha, was identified by Avgold (Pty) Ltd. A development area of ~245ha was demarcated within this project site for the construction and operation of the Harmony Target 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 (~105ha) for the installation of a solar PV facility with a contracted capacity of up to 30MW, 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 station to be connected to the existing Avgold Substation via overhead power line (located ~400m north east of the site). The grid connection infrastructure is to be located within an assessment corridor of 300m wide. Three alternative corridors have been assessed, and traverse Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227.

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 Allanridge 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 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 Target Solar PV Facility project site

Province	Mpumalanga Province
District Municipality	Lejweleputswa District Municipality
Local Municipality	Matjhabeng Local Municipality
Ward Number (s)	Ward 36
Nearest town(s)	Allanridge (14km north of the site)
Affected Properties:	Portion 0 of Farm Kromdraai 386 Portion 0 of Farm Aandenk 227

The Harmony Target Solar PV Facility will have a contracted capacity of up to 30MW 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, switching station, to be connected to the Avgold Substation via an overhead power line (located ~400m north east of the site).

Three alternative grid corridors (300m in width) have been assessed.

The overarching objective for the Harmony Target 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 will be 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; this will serve to inform and optimise the design of the solar PV facility.

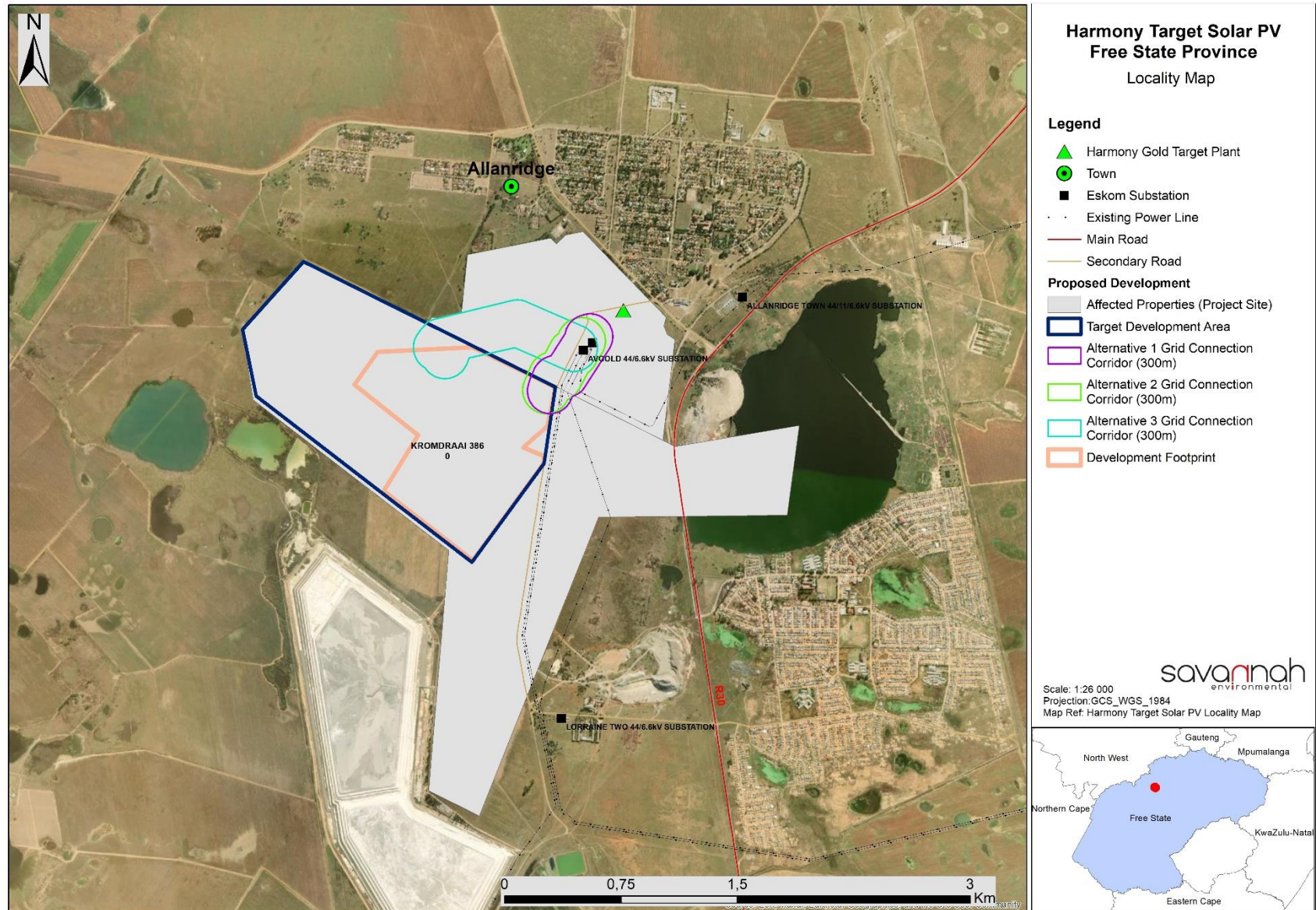


Figure 1: Locality map of the development area and footprint within which the Harmony Target Solar PV Facility is proposed to be developed

1. Environmental Permitting Requirements

The Harmony Target 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 (DESTE) 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 Target Solar PV Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-J** provide a detailed assessment of the potential impacts that may result from the development of the proposed Harmony Target 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 Target Solar PV Facility and associated grid connection corridor 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 development footprint, as assessed in the EIA Report is presented in **Figure 2**.

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

The site falls within the Vaal-Vet Sandy Grassland vegetation type. Much of the vegetation unit is transformed, being prime agricultural land, with remnant patches comprising natural and near natural (sometimes secondary) remaining.

The Terrestrial Ecology Assessment (**Appendix D**) undertaken identified areas of sensitivity, and the implementation of avoidance of sensitive areas as a mitigation strategy has been adopted. The majority of the site development area that was assessed is not considered as being remaining habitat (i.e., it has been transformed at some point either historically, or recently, and based on land cover and transformation analyses). The entire PV development footprint is situated within transformed or secondary vegetation, including currently or recently cultivated lands and a small area of old lands (<10 years).

The entire PV development footprint is located within a ESA 2 designated area and has been designed to avoid CBA 1 and ESA 1 areas. The site falls almost entirely within an ESA 2 designated area, with a small patch of CBA 1 within the site, as well as adjacent to an ESA 1 designated area, both on the north-western corner.

The majority of this area has previously been completely transformed or severely degraded, and can be considered to have a low conservation status, especially where there is very dense alien infestation. Loss

of these areas will not significantly compromise the current conservation status of the vegetation unit at a regional level, nor is its loss likely to compromise the ecological functioning of surrounding areas. Despite the largely transformed condition of the site, small areas of remaining natural grassland are also still present, and these areas clearly have a high conservation value. The development footprint of the Harmony Target Solar PV Facility avoids this identified area entirely.

Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Target Solar PV Facility and associated grid connection corridor. All impacts on terrestrial ecology were rated to be of low significance before and after mitigation. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

1.2. Impacts on Wetlands

The Wetland Impact Assessment (**Appendix E**) undertaken determined that there are no impacts associated with the Harmony Target Solar PV Facility and associated grid connection corridor that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable.

According to the national web-based environmental screening tool, the site has a Low sensitivity for Aquatic Biodiversity. During the field survey it was confirmed that the site has a Low sensitivity from a wetland and aquatic biodiversity perspective. The wetlands in the project area have been ploughed and planted with agricultural crops. It was also evident that no planting had occurred within the preceding year, and weeds and declared invader plant species has grown. Some of the wetlands outside of the development area are of a higher sensitivity, but they will not be directly impacted by the development footprint.

The wetlands inside the development area are classified as endorheic depression wetlands. The PV development footprint and associated grid connection corridor has been designed to avoid the wetland areas and associated buffers. All impacts on wetlands were rated to be of low significance before and after mitigation. As such, there are no fatal flaws associated with the development and no considerations that should prevent it from proceeding.

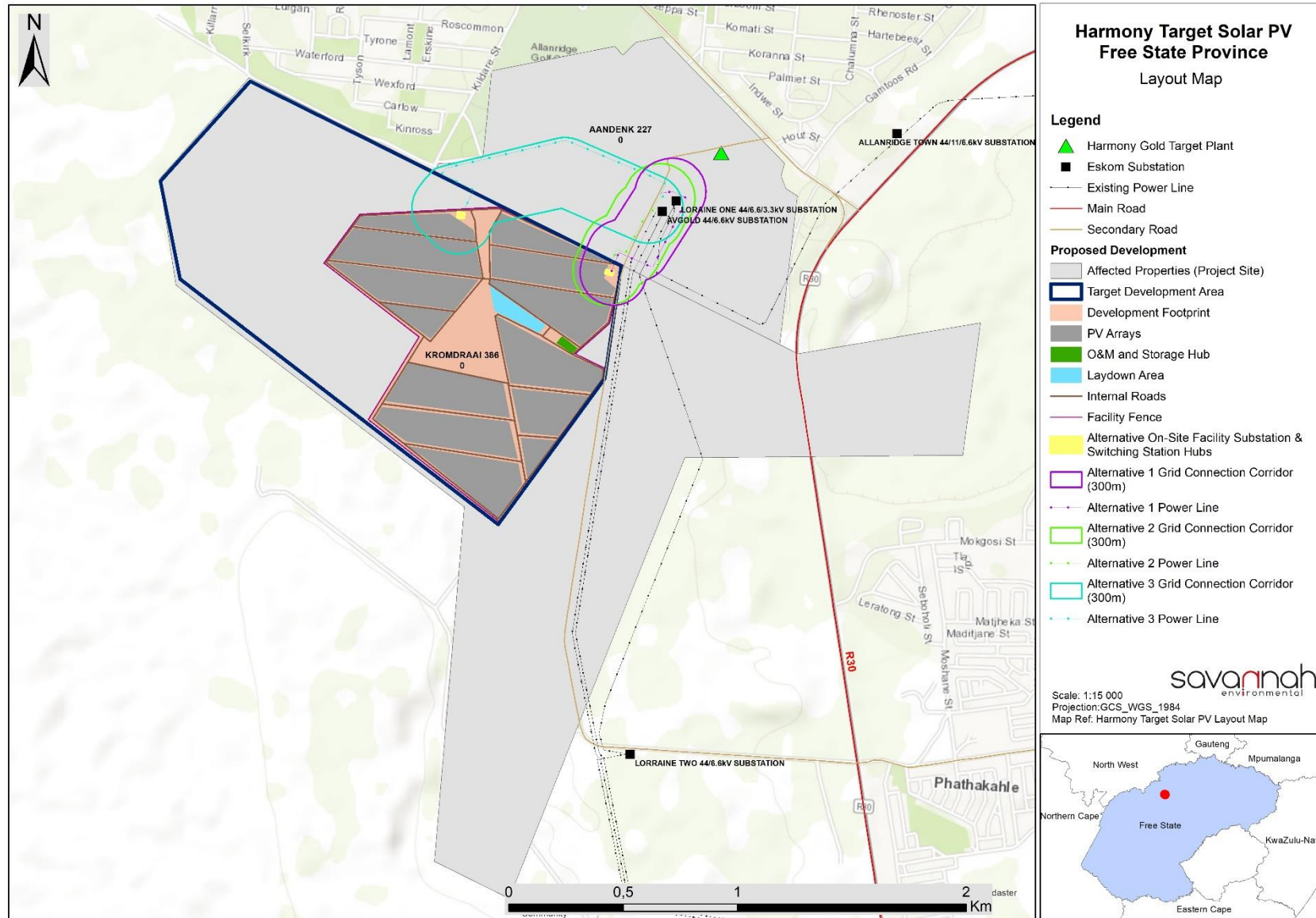


Figure 2: Development footprint (~105ha) and layout assessed within this EIA Report for the Harmony Target Solar PV Facility

1.3. Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix F**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate-high to low after mitigation (depending on the type of impact), and the potential for birds to collide with the associated power line being low after mitigation.

Three broad-scale avifaunal habitat types were identified on the study site and surroundings, ranging from secondary grassland, depressions to transformed and landscape/manicured areas, including cultivated land. The study site was also surrounded by a number of pans and Stinkpan, which provided habitat for a large number of waterbird taxa. A total of 130 bird species have been recorded within the study area, including five Red listed species (threatened and near threatened species). In addition, a total of 59 collision-prone bird species have been recorded from the study area, of which 46 species were waterbird and shorebird taxa and another seven species were birds of prey. These also included the near threatened Greater Flamingo (*Phoenicopterus roseus*) and Lesser Flamingo (*Phoeniconaias minor*) and the globally endangered Maccoa Duck (*Oxyura maccoa*) which were regular foraging visitors to the nearby Stinkpan.

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).

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was predicted to be moderate-high to low after mitigation (depending on the type of impact). However, the risk for waterbirds and shorebirds (including flamingo taxa) colliding with the PV infrastructure remained eminent due to the presence of inundated pans and dams in the study area and dispersal routes coinciding with the study area. 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 was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post-construction monitoring) be implemented during the construction and operation phase of the project (e.g. the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds).

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.

1.4. Impacts on Soils and Agricultural Potential

The Agricultural Agro-Ecosystem Assessment found that the area consists of four different natural soil forms, i.e. Avalon, Bainsvlei, Clovelly, and Ermelo. The areas with existing soil disturbance are classified as Technosols. The entire development area largely consists of land with Moderate-High (Class 09) land capability. Moderate (Class 08) land capability is found in the middle of the study area, while a small patch of Low-Moderate (Class 07) land capability is found in middle parts. Within the development area, the areas where soil has been disturbed by activities associated with the nearby mining infrastructure, and that

has been classified as Technosols, have Very low (Class 02) land capability. The areas are no longer suitable for rainfed crop production and has limited suitability for livestock farming because of the uneven terrain in these areas.

The land capability of the natural soil forms mainly depended whether the soil was found on cultivated land. All soil forms had a Moderate (Class 08) land capability on non-cultivated areas and Moderate-High (Class 09) on cultivated land. The Technosol soil had a Very low (Class 02) land capability

The soils on cultivated land are better suited to rainfed crop production because of the soft plinthic horizon that underlies the deep apedal B1 subsoil-horizons. The soft plinthic horizon retains soil moisture and this is available for crop roots during periods of water stress. The Ermelo (only found on cultivated land) is freely drained, thus making it better suited for irrigation as the water will freely drain through the soil.xxx

The extent of the development encroaching on areas of Moderate-High land capability, has resulted in a higher significance rating.

It is anticipated that the construction and operation of the Harmony Target Solar PV and associated grid connection corridor facility will have impacts that range from high to low impacts on soils and agricultural potential, depending on which impact is being considered. These impacts can be reduced by keeping the footprints 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.

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.

1.5. Impacts on Heritage Resources (archaeology, palaeontology and cultural landscape)

The Heritage Impact Assessment identified that all impacts associated with the development of the Harmony Target Solar PV Facility and associated grid connection corridor will be of low significance before and after mitigation measures are implemented.

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. No archaeological resources of scientific cultural value were identified within the area proposed for the Target PV Facility and its grid connection and as such, no impact to significant archaeological heritage resources is anticipated. Only one site (TG1) of heritage significance was identified within the grid corridor development area. However, the PV footprint as well as two of the grid corridors considered (alternative 1 and 2) avoid this heritage site.

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 at all.

The heritage specialists have no objection to the proposed development of the Harmony Target Solar PV facility and associated grid connection corridor on condition that a Chance Fossil Finds 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 alternatives are considered acceptable.

1.6. Visual Impacts

Besides the mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines.

A 10km radius from the project area was evaluated. The largest portion of the area selected and regarded suitable for the development was previously cultivated, then left fallow before being ripped and sown with a mixture of grass species and is currently used for cattle grazing. The surrounding farms are overall used for mixed agriculture, consisting of cultivated areas and grazing areas. Land use activities within the broader region are predominantly described as maize and wheat farming, with some mining activity evident towards the north (Allanridge) and the south (Odendaalsrus). 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 mitigation measures being undertaken, mitigation measures arising and the recommended mitigation measures, 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.

1.7. Socio-Economic 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 Target Solar PV Facility and associated grid connection corridor. 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 Target Solar PV Facility and its associated grid connection alternatives 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 Target Solar PV Facility and associated grid connection corridor is supported.

1.8. Assessment of Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Harmony Target 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 Target 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:

- » Transformation of natural areas has occurred as a result of widespread development. Cumulative impacts on ecological aspects (vegetation types, species and ecological processes) are negligible. Since transformation is already so extensive, this proposed development has the opportunity to make use of these transformed areas, and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area. The cumulative impact is therefore acceptable.
- » There will be no unacceptable risk to avifauna with the development of the Harmony Target 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 Target 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 Target 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 Target 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)
Terrestrial Ecology	Low	Low
Wetlands	Low	Low
Avifauna	Low to High (depending on the impact being considered)	Medium to High (depending on the impact being considered)
Land use, soil and agricultural potential	Medium to High (depending on the impact being considered)	Medium
Heritage (archaeology and palaeontology)	Low	Low
Visual	Medium	Medium
Social	Medium to Low	Medium to Low

Based on the specialist cumulative assessment and findings, the development of the Harmony Target 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 cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to decrease in land capability for rainfed crops due to the extent of development encroachment on areas of high land capability. It was concluded that the development of the 30MW Harmony Target 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.

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 EMP 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. All CBA1 and natural grassland areas are avoided by the PV facility. The facility is planned to be located on transformed/disturbed areas. The resulting impact is considered to be acceptable.
- » Impacts on wetlands. All wetland features are avoided by the PV facility.
- » Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable with the implementation of the recommended mitigation measure.
- » The heritage resource identified is located outside of the PV facility development footprint. 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. It is anticipated that the construction and operation of the Harmony Target Solar PV facility will have impacts that range from high to low. Through the consistent implementation of the recommendation mitigation measures, most of the impacts can all be reduced to low.
- » 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 the Mine's own use, primarily to reduce the reliance on Eskom as an energy provider.

Benefits of the Harmony Target Solar PV Facility and associated grid connection corridor 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 the 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 Target Solar PV Facility and associated grid connection corridor 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 Gold, 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 Target Solar PV Facility and associated grid connection corridor will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Harmony Target 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 the developer 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 design of the facility layout has ensured that all identified environmental features are avoided by the PV facility. The preferred grid route alternative was identified as Alternative 2 from an environmental perspective (refer to **Figure 2**). 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 Target operations, as well as from a policy perspective at a local, provincial and National level. The project development footprint for the PV facility is located outside of any protected area and outside of the Critical Biodiversity Area 1 (CBA1) 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 Target Solar PV facility and associated grid connection corridor 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. 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 are not able to 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 Target Solar PV facility and associated grid connection corridor 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 Target 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 Target Solar PV facility and associated grid connection corridor 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. It is recommended that the alternative 2 grid line should be constructed based on having the lowest environmental impact.

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

30MW Solar PV facility: Harmony Target Solar PV facility located within the project site located on Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are owned by the Mine but outside of the mining area. The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching station to be connected to the existing Avgold Substation via a power line. Grid Connection Corridor Alternative 2 is the preferred alternative.

The following key conditions would be required to be included within an authorisation issued for the Harmony Target Solar PV Facility and associated grid connection corridor:

- » All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to J** are to be implemented.
- » The EMPr as contained within **Appendix K** of this 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 Target Solar PV facility and associated grid connection corridor 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. The power line corridor is an exception.
- » Following the final design of the Harmony Target Solar PV facility and associated grid connection corridor, 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 from an avifauna specialist (during peak wet season), 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.

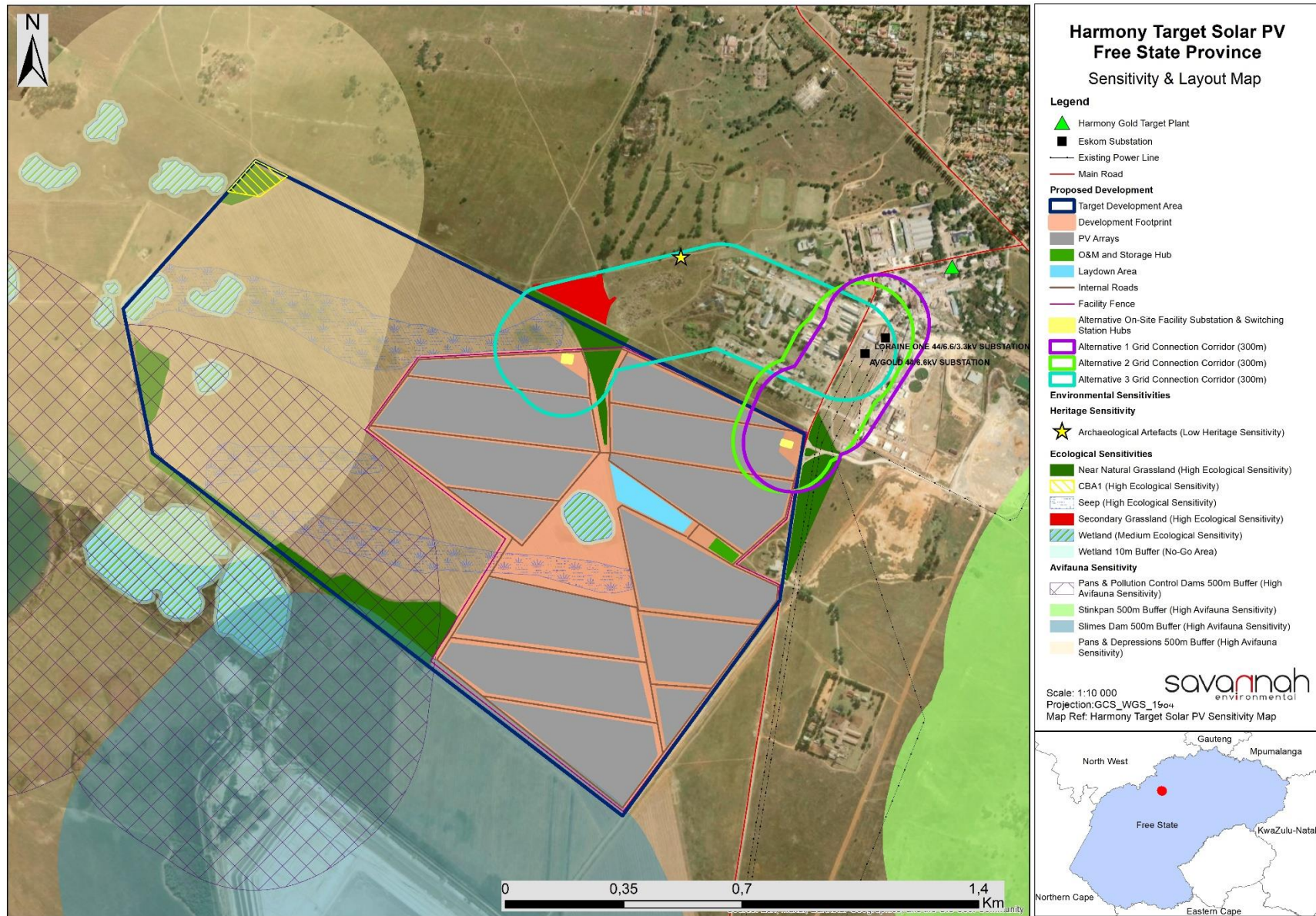


Figure 3: Environmental sensitivity and layout map from the results of the impact assessment of the Harmony Target Solar PV Facility.

DEFINITIONS AND TERMINOLOGY¹

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 Target 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 Target 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.

¹ 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 500ha, within which the Harmony Target 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.

TABLE OF CONTENTS

PROJECT DETAILS	i
PURPOSE OF THE EIA REPORT AND INVITATION TO COMMENT	ii
EXECUTIVE SUMMARY	iii
DEFINITIONS AND TERMINOLOGY	xix
TABLE OF CONTENTS	xxiii
APPENDICES LIST.....	xxvii
CHAPTER 1: INTRODUCTION	28
1.1 Project Overview	30
1.2 Requirement for an Environmental Impact Assessment Process.....	32
1.3 Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an Environmental Impact Assessment Report.....	32
1.4 Overview of this Environmental Impact Assessment (EIA) Process	33
1.5 Appointment of an Independent Environmental Assessment Practitioner (EAP)	34
1.6 Details of the Independent Specialist Team.....	36
CHAPTER 2: PROJECT DESCRIPTION	37
2.1. Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report.....	37
2.2. Nature and Extent of the Harmony Target Solar PV Facility	37
2.2.1 Overview of the Project Site and Planned Infrastructure	37
2.2.2 Components of the Harmony Target Solar PV Facility	38
2.3 Technology considered for the Solar Energy Facility and the Generation of Electricity	43
2.4 Activities during the Project Development Stages	45
2.4.1 Design and Pre-Construction Phase	45
2.4.2 Construction Phase	46
2.4.3 Operation Phase.....	51
2.4.4 Decommissioning Phase	52
CHAPTER 3: POLICY AND LEGISLATIVE CONTEXT	54
3.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report.....	54
3.2 Strategic Electricity Planning in South Africa.....	54
3.3 Policy and Planning Considerations on International, National, Provincial and Local Levels	56
3.3.1 Policy and planning on an International Level	56
3.3.2 Policy and planning on a National Level	58
3.3.3 Policy and planning at a Provincial Level	67
3.3.4 Policy and planning at a Local Level.....	69
CHAPTER 4: NEED AND DESIRABILITY & ALTERNATIVES	71
4.1 Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report.....	71
4.2 Need and Desirability of the Harmony Target Solar PV Facility	71
4.2.1 Need for the Harmony Target Solar PV Facility	73
4.2.2 Receptiveness of the proposed development area for the establishment of the Harmony Target Solar PV Facility	74
4.2.3 Benefits of Renewable Energy and the Need and Desirability in the South African Context	75
4.3 Alternatives Considered during the EIA Process.....	77

4.3.1	<i>Consideration of Fundamentally Different Alternatives</i>	78
4.3.2	<i>Consideration of Incrementally Different Alternatives</i>	78
4.4	Conclusion	85
	CHAPTER 5: APPROACH TO UNDERTAKING THE SCOPING/EIA PROCESS	86
5.1	Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report	86
5.2	Relevant legislative permitting requirements	87
5.2.1	<i>National Environmental Management Act (No. 107 of 1998) (NEMA)</i>	87
5.2.2	<i>National Water Act (No. 36 of 1998) (NWA)</i>	91
5.2.3	<i>National Heritage Resources Act (No. 25 of 1999) (NHRA)</i>	92
5.3	Overview of the Scoping Phase	93
5.4	Overview of the EIA Phase	93
5.4.1	<i>Authority Consultation and Application for Authorisation in terms of the 2014 EIA Regulations (as amended)</i>	94
5.4.2	<i>Public Participation Process</i>	95
5.5	Outcomes of the DFFE Web-Based Screening Tool	102
5.6	Assumptions and Limitations of the EIA Process	108
5.7	Legislation and Guidelines that have informed the preparation of this EIA Report	108
5.7.1	<i>Best Practice Guidelines Birds & Solar Energy (2017)</i>	121
5.7.2	<i>The IFC Environmental Health and Safety (EHS) Guidelines</i>	122
5.7.3	<i>IFC’s Project Developer’s Guide to Utility-Scale Solar Photovoltaic Power Plants (2015)</i>	124
	CHAPTER 6: DESCRIPTION OF THE RECEIVING ENVIRONMENT	129
6.1	Legal Requirements as per the EIA Regulations, 2014 (as amended), for the undertaking of an Impact Assessment Report	129
6.2	Regional Setting	130
6.3	Climatic Conditions	133
6.4	Biophysical Characteristics of the Development Area	134
6.4.1	<i>Topographical profile</i>	135
6.4.2	<i>Geology, Soils and Agricultural Potential</i>	135
6.4.3	<i>Land Use</i>	138
6.4.4	<i>Ecological Profile of the Study Area and the Development Area</i>	139
6.4.5	<i>Avifauna profile for the area</i>	148
6.5	Integrated Heritage including Archaeology, Palaeontology and the Cultural Landscape	155
6.5.1	<i>State of the Site</i>	155
6.5.2	<i>Archaeology</i>	156
6.5.3	<i>Palaeontology</i>	156
6.6	Visual Quality	156
6.7	Social Context	159
6.7.1	<i>Profile of the Broader Area</i>	159
	CHAPTER 7: ASSESSMENT OF IMPACTS	163
7.1	Quantification of Areas of Disturbance on the Site	165
7.2	Potential Impacts on Terrestrial Ecology	166
7.2.1	<i>Results of the Terrestrial Ecology Impact Assessment</i>	166
7.2.2	<i>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)</i>	170
7.2.3	<i>Conclusion</i>	173
7.3	Potential Impacts on Wetlands	174

7.3.1	Results of the Wetland Impact Assessment	174
7.3.2	Impact tables summarising the significance of impacts on wetlands related to the PV facility, substations and the grid line during construction and operation (with and without mitigation)	174
7.3.3	Conclusion	177
7.4.	Potential Impacts on Avifauna	177
7.4.1	Results of the Avifauna Impact Assessment	177
7.4.2	Description of Avifaunal Impacts	179
7.4.3	Impact tables summarising the significance of impacts on avifauna related to the proposed PV facility and associated infrastructure.	183
7.4.4	Conclusion	185
7.5.	Assessment of Impacts on Land Use, Soil and Agricultural Potential	186
7.5.1	Results of the Land Use, Soil and Agricultural Potential Study	186
7.5.2	Description of Land Use, Soil and Agricultural Potential Impacts	194
7.5.3	Impact tables summarising the significance of impacts on Land Use, Soil and Agricultural Potential during construction and operation (with and without mitigation)	194
7.5.4	Conclusion	198
7.6.	Assessment of Impacts on Heritage Resources	198
7.6.1	Results of the Heritage Impact Assessment (including archaeology and palaeontology)	199
7.6.2	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)	201
7.6.3	Conclusion	203
7.7.	Assessment of Visual Impacts	203
7.7.1	Results of the Visual Impact Assessment	203
7.7.2	Impact table summarising the significance of visual impacts during construction and operation (with and without mitigation)	206
7.7.3	Conclusion	212
7.8.	Assessment of Social Impacts	213
7.8.1	Results of the Social Impact Assessment	213
7.8.2	Impact tables summarising the significance of social impacts during construction and operation (with and without mitigation measures)	214
7.8.3	Conclusion	223
7.9.	Assessment of the 'Do Nothing' Alternative	224
CHAPTER 8: ASSESSMENT OF POTENTIAL CUMULATIVE IMPACTS		226
8.1	Approach taken to Assess Cumulative Impacts	226
8.2	Cumulative Impacts on Terrestrial Ecology	229
8.3	Cumulative Impacts on Wetlands	229
8.4	Cumulative Impacts on Avifauna	231
8.5	Cumulative Impacts on Land Use, Soil and Agricultural Potential	234
8.6	Cumulative Impacts on Heritage (including archaeology and palaeontology)	235
8.7	Cumulative Visual Impacts	236
8.8	Cumulative Social Impacts	237
8.9	Conclusion Regarding Cumulative Impacts	238
CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS		241
9.1	Legal Requirements as per the EIA Regulations, 2014 (as amended) for the undertaking of an EIA Report	242
9.2	Evaluation of the Harmony Target Solar PV Facility	243
9.2.1	Impacts on Terrestrial Ecology (including flora and fauna)	244

9.2.2	Impacts on Wetlands	244
9.2.3	Impacts on Avifauna.....	245
9.2.4	Impacts on Soil and Agricultural Potential	246
9.2.5	Impacts on Heritage Resources (archaeological and paleontological).....	246
9.2.6	Visual Impacts	247
9.2.7	Social Impacts	247
9.2.8	Assessment of Cumulative Impacts.....	248
9.3	Environmental Sensitivity Mapping.....	248
9.4	Consideration of Alternatives.....	251
9.5	Environmental Costs of the Solar PV Facility and its associated grid connection versus Benefits of the Solar PV Facility.....	252
9.6	Overall Conclusion (Impact Statement).....	253
9.7	Overall Recommendation	256
CHAPTER 10:	References	258

APPENDICES LIST

Appendix A:	EIA Project Consulting Team CVs
Appendix B:	Authority Correspondence
Appendix C:	Public Participation Process
<i>Appendix C1:</i>	<i>I&AP Database</i>
<i>Appendix C2:</i>	<i>Site Notices and Newspaper Advertisements</i>
<i>Appendix C3:</i>	<i>Background Information Document</i>
<i>Appendix C4:</i>	<i>Organs of State Correspondence</i>
<i>Appendix C5:</i>	<i>Stakeholder Correspondence</i>
<i>Appendix C6:</i>	<i>Minutes of Meetings</i>
<i>Appendix C7:</i>	<i>Comments Received</i>
<i>Appendix C8:</i>	<i>Comments and Responses Report</i>
Appendix D:	Terrestrial Ecology Impact Assessment
Appendix E:	Wetland Impact Assessment
Appendix F:	Avifauna Impact Assessment
Appendix G:	Soils and Agricultural Impact Assessment
Appendix H:	Heritage Impact Assessment
Appendix I:	Visual Impact Assessment
Appendix J:	Socio-Economic Impact Assessment
Appendix K:	Environmental Management Programmes
Appendix L:	DFFE Screening Report
Appendix M:	Maps (A3)
Appendix N:	EAP Declaration of Independence and Affirmation
Appendix O:	Specialist Declarations

CHAPTER 1: INTRODUCTION

Avgold (Pty) Ltd (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 Target Mine. A solar PV facility with a generating capacity of 30MW is proposed in close proximity to the Harmony Gold Target Plant mining operations. The site is located 550m south of the Harmony Gold Target Plant operations, approximately ~1km south of the town of Allanridge within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Target 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 Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are owned by the Mine but 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 approximately 500ha, was identified by Avgold (Pty) Ltd. A development area of ~245ha was demarcated within this project site for the construction and operation of the Harmony Target 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 (~105ha) for the installation of a solar PV facility with a contracted capacity of up to 30MW, 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 station to be connected to the existing Avgold Substation via overhead power line (located ~400m north east of the site). The grid connection infrastructure is to be located within an assessment corridor of 300m wide. Alternative corridors have been assessed, and traverse Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227.

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

From a local perspective, the Mine site within the greater Allanridge 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 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.

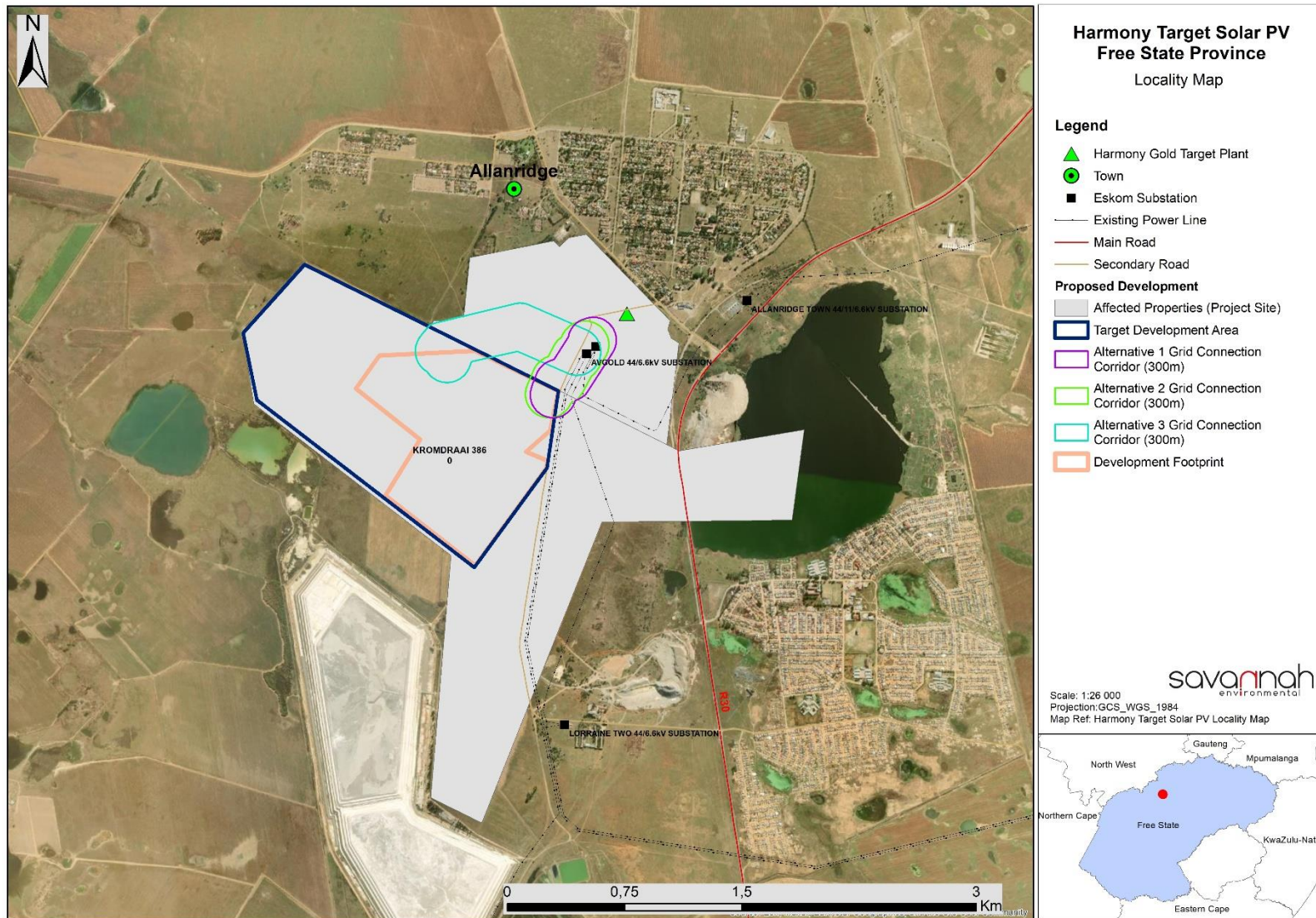


Figure 1.1: Locality map illustrating the location of the Harmony Target Solar PV Facility project site and associated infrastructure (refer to **Appendix M**).

1.1 Project Overview

The construction of a dedicated Solar PV facility at the Harmony Gold Target 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, Avgold (Pty) Ltd will fund and own the PV plant which will generate energy for on-site consumption by the mining operations.

The project site² 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 area³ of approximately 245 ha has been identified within the project site for the development of the Harmony Target 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 development area 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 footprint⁴ (~105ha in extent) within the project site where the PV arrays and other associated infrastructure for the Harmony Target Solar PV Facility is planned to be constructed. Since the development area 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 36
Nearest town(s)	Allanridge (1km north of the site)
Farm Portion(s), Name(s) and Number(s) associated with the PV Facility	Portion 0 of Farm Kromdraai 386 Portion 0 of Farm Aandenk 227
SG 21 Digit Code (s) for all properties	Portion 0 of Farm Kromdraai 386 – F02400000000038600000 Portion 0 of Farm Aandenk 227 – F02400000000022700000
Current zoning	Mining

² The project site comprises the affected properties 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 BA process, within which direct effects of the proposed project may occur. The project site is ~500ha in extent.

³ The development area is that identified area where the 30MW 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 ~245ha in extent.

⁴ The development footprint is the defined area (105ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Target Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

Current land use	Grazing (mainly cattle)		
Site Extent (Study Area)	~500ha		
PV Development Area	~245ha		
PV Development Footprint	~105ha		
Site Coordinates (project site)		Latitude:	Longitude:
	Northern point	27°45'33.20"S	26°37'14.31"E
	Eastern point	27°45'45.18"S	26°38'23.95"E
	Southern point	27°46'31.52"S	26°37'56.87"E
	Western point	27°46'1.42"S	26°37'4.75"E
	Centre point	27°45'56.85"S	26°37'43.79"E

The Harmony Target Solar PV Facility will have a contracted capacity of up to 30MW 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, switching station, to be connected to the Avgold Substation via an overhead power line (located ~400m north east of the site).

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the south side of the Avgold Substation (located directly south west of the Loraine One Substation).

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the south side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. at the junction with the secondary road, the route turns south to access the south side of the Avgold Substation.

The site is accessible via the R30 and an unnamed secondary road/mine access road.

The overarching objective for the Harmony Target 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 will be 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; this will serve 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 Target Solar PV Facility are listed as activities that may have a detrimental impact on the environment. The primary listed activity triggered by Harmony Target Solar PV Facility is Activity 1 of Listing Notice 2 (GN R325) which relates to the development of facilities or infrastructure for the generation of electricity from a renewable resource where the generating capacity is 20MW or more. The Harmony Target Solar PV Facility will have a contracted capacity of 30MW.

The Harmony Target 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 Target Mining Plant. 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 (DESTE) 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)	The location of the Harmony Target 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 .

Requirement	Relevant Section
is not available, the coordinates of the boundary of the property or properties.	
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 Target 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 Target Solar PV Facility project and the environmental impact assessment.
- » **Chapter 2** provides a project description of the Harmony Target 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 Target 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.

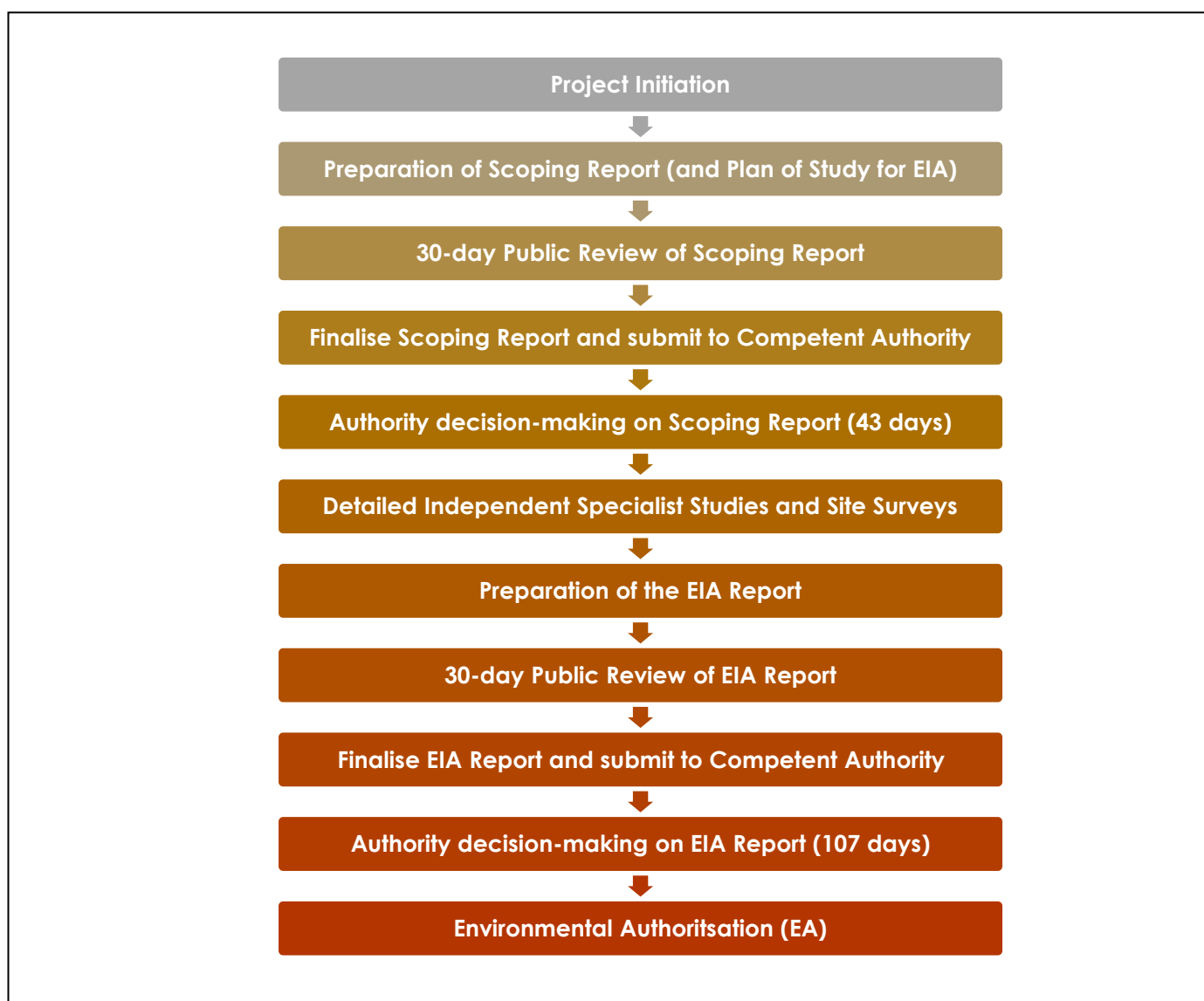


Figure 1.2: Regulated timeframe of an EIA Process

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 a Director at Savannah Environmental (Pty) Ltd and 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
Jamie Pote	Terrestrial Ecology	Jamie Pote
Biosphere Enviro Solutions	Wetlands	Mari Van der Westhuizen Justin Bezuidenhout
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	Brogan Geldenhuys

CHAPTER 2: PROJECT DESCRIPTION

This Chapter provides an overview of the Harmony Target 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 .
3(1)(c) a plan which locates the proposed activity or activities applied for at an appropriate scale, or, if it is	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 Target Solar PV Facility

Avgold (Pty) Ltd is looking to supplement its energy supply by implementing 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 550m south of the Harmony Gold Target Plant operations, approximately ~1km south of the town of Allanridge within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The project site is located on Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are 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 station to be connected to the existing Avgold Substation via overhead power line (located ~400m north east of the site). The grid connection infrastructure is to be located within an assessment corridor of 300m wide. Alternative corridors have been assessed, and traverse Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227.

A technically feasible project site, with an extent of 500ha has been identified by Avgold (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~245ha 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 30MW, while allowing for the avoidance of environmental site sensitivities. A development footprint of ~105ha 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 Target 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, switching station, to be connected to the Avgold Substation via an overhead power line (located ~400m north east of the site).

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the south side of the Avgold Substation (located directly south west of the Loraine One Substation).

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the south side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. at the junction with the secondary road, the route turns south to access the south side of the Avgold Substation.

The site is accessible via the R30 and an unnamed secondary road/mine access road.

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 Target Solar PV Facility assessed as part of this EIA report.

Table 2.1 provides the details of the Harmony Target 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 Target Solar PV Facility and associated infrastructure

Component	Description / Dimensions
Contracted capacity of the facility	30MW
Total extent of the Affected Properties, also referred to as the project site ⁵	~ 500ha
Total extent of the PV Development Area ⁶	~ 245ha
Total extent of the PV Development Footprint ⁷	~ 105ha
Technology	» Monofacial or Bifacial PV panels, mounted on either fixed-tilt, or single-axis tracking systems
PV panels	» Height: ~5m from ground level (installed)
On-Site Facility Substation & Switching Substation Hubs	» On-site facility substation and switching substations hubs located on Portion 0 of Farm Aandenk 227 and Portion 0 of Farm Kromdraai 386. » Approximately 2ha in extent (2ha per substation)
Grid Connection	» Facility substation located within grid corridor/s » Cabling connecting PV array to facility substation » A 300m wide grid connection corridor within which the grid connection infrastructure will be constructed and operated. » Three alternative corridors assessed » Corridor/s traverse Portion 0 of Farm Aandenk 227 and Portion 0 of Farm Kromdraai 386.
Site and internal access	» The site is accessible via the R30 and is traversed by 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 area » O&M and Storage Hub » Operations and Management Building » Control centre

⁵ The project site comprises the affected properties 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 BA process, within which direct effects of the proposed project may occur. The project site is ~500ha in extent.

⁶ The development area is that identified area where the 30MW 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 ~245ha in extent.

⁷ The development footprint is the defined area (105ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Target Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.



» Warehouse/ workshop

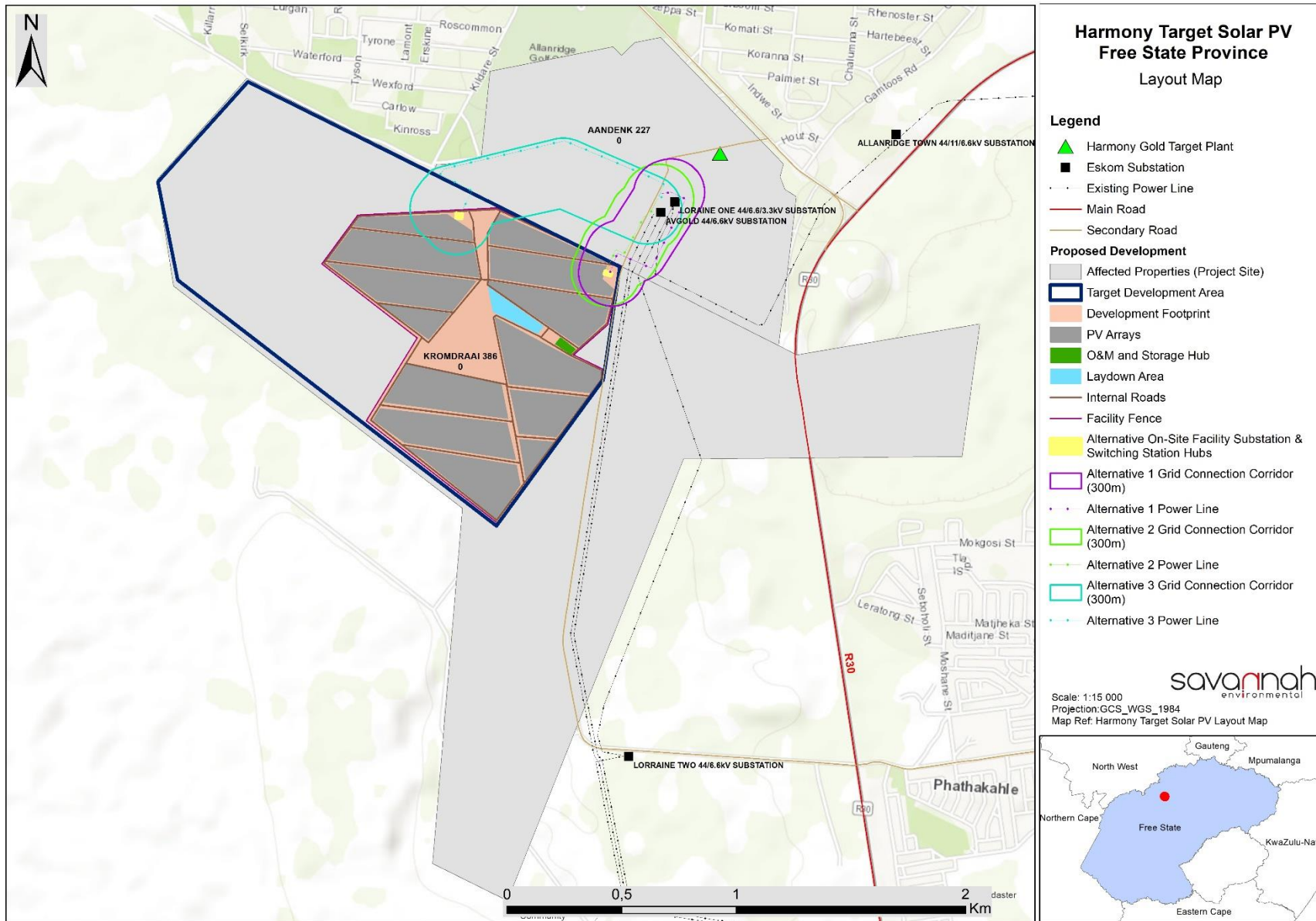


Figure 2.1: Development footprint (~105ha) assessed within this EIA Report for the Harmony Target Solar PV Facility.

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.

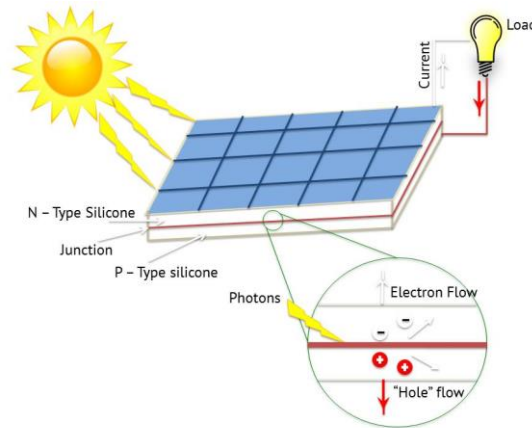


Figure 2.2: Diagram illustrating the Photovoltaic Effect (Source: Centre for Sustainable Energy)

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 (DC⁸) to alternating current (AC⁹). The electricity is then stepped up to a higher voltage via a transformer before being evacuated into the national grid via a power line.

⁸ 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://whatistechtarget.com/definition/DC-direct-current/>).

⁹ 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://whatistechtarget.com/definition/alternating-current-AC/>).

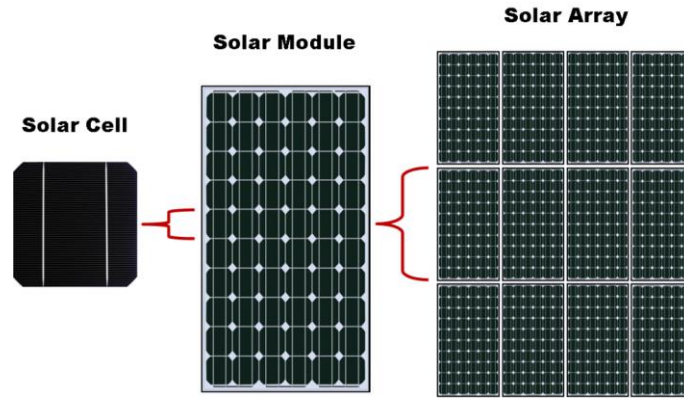


Figure 2.3: Overview of a PV cell, module and array / panel (Source: pveducation.com)

Bifacial Solar Panel Technology

Avgold (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.

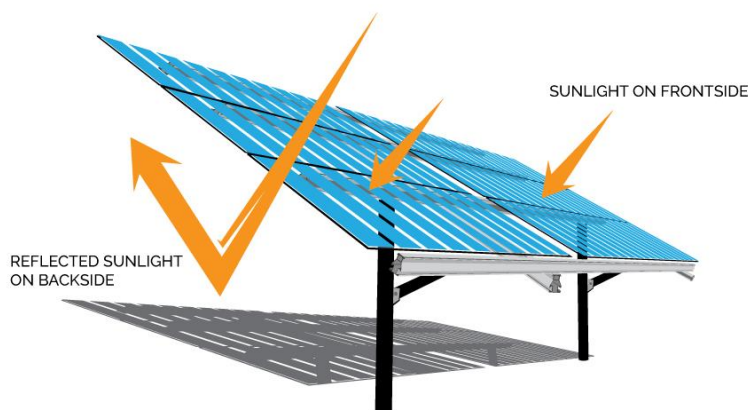


Figure 2.4: Diagram showing how bifacial Solar PV panels work (Source: <https://sinovoltaics.com/learning-center/solar-cells/bifacial-solar-modules/>)

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.

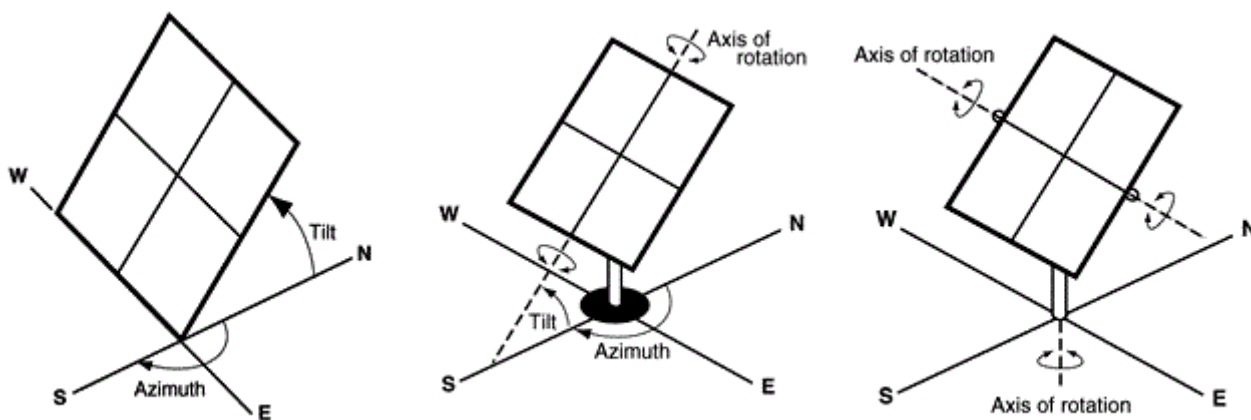


Figure 2.5: Overview of different PV tracking systems (from left to right: fixed-tilt, single-axis tracking, and double-axis tracking (Source: pveducation.com)).

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 Target 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	<ul style="list-style-type: none"> » Project requires an Environmental Authorisation from the DESTEA and a generating authorisation issued by NERSA. » 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. Up to 100-120 employment opportunities will be created. » No on-site labour camps. Employees to be accommodated in the nearby towns such as Allanridge 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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.

	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » PV arrays to be connected to the on-site substation via underground electrical cables.

	<ul style="list-style-type: none"> » Excavation of trenches is required for the installation of the cables. Trenches will be approximately 1.5m deep. » Underground cables are planned to follow the internal access roads, as far as possible. » On-site substation to be connected to the collector substation via underground cables.
Establishment of ancillary infrastructure	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » A power line will run from the on-site substation and the switching station and tie into the Avgold Substation.
Undertake site rehabilitation	<ul style="list-style-type: none"> » 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 east of the proposed site and there are various unnamed roads, one of which is located directly adjacent to the development area. 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.





Figure 2.7: Photographs of the construction phase of a solar facility similar to the Harmony Target 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 Target 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	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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 Target 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	<ul style="list-style-type: none"> » Decommissioning of the Harmony Target 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., agriculture) once the Harmony Target facility has reached the end of its economic life and all infrastructure has been decommissioned.
Activities to be undertaken	
Site preparation	<ul style="list-style-type: none"> » 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	<ul style="list-style-type: none"> » 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 Target 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 Target 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.

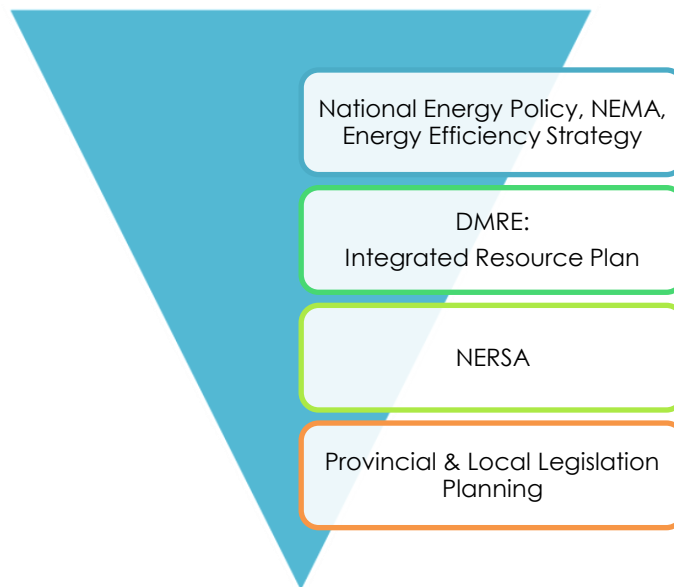


Figure 3.1: Hierarchy of electricity and planning documents

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 Matjhabeng 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 Target Solar PV facility aligns with the thinking or commitments of these agreements. The Harmony Target 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 Target Solar PV Facility

Relevant policy	Relevance to the Harmony Target Solar PV Facility
<p>United Nations Framework Convention on Climate Change (UNFCCC) and Conference of the Party (COP)</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>

Relevant policy	Relevance to the Harmony Target Solar PV Facility
	<p>Glasgow Climate Pact to keep 1.5°C alive and finalise the outstanding elements of the Paris Agreement.</p> <p>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.</p> <p>The policy provides support for the Harmony Target 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.</p>
<p>The Equator Principles IV (October 2020)</p>	<p>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 Target Solar PV Facility) and apply globally to all industry sectors.</p> <p>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 Target 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.</p> <p>The Harmony Target 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.</p>
<p>International Finance Corporation (IFC) Performance Standards and Environmental and Social Sustainability (January 2012)</p>	<p>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.</p> <p>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.</p>

Relevant policy	Relevance to the Harmony Target Solar PV Facility
	Given the nature of the Harmony Target 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 Target 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 Target Solar PV Facility

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
Constitution of the Republic of South Africa, 1996	<p>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.</p> <p>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.</p>
National Environmental Management Act (No. 107 of 1998) (NEMA)	<p>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.</p> <p>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.</p> <p>The need for responsible and informed decision-making by government on the acceptability of environmental impacts is therefore enshrined within NEMA.</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
<p>National Energy Act (No. 34 of 2008)</p>	<p>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.</p> <p>The Act provides the legal framework which supports the development of power generation facilities.</p>
<p>White Paper on the Energy Policy of the Republic of South Africa (1998)</p>	<p>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.</p> <p>The policy states that the advantages of Renewable Energy include:</p> <ul style="list-style-type: none"> » minimal environmental impacts during operation in comparison with traditional supply technologies, » generally lower running costs, and high labour intensities. <p>Disadvantages include:</p> <ul style="list-style-type: none"> » 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. <p>Nonetheless, renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future.</p>
<p>White Paper on the Renewable Energy Policy of the Republic of South Africa (2003)</p>	<p>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.</p> <p>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.</p> <p>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.</p>
<p>The Electricity Regulation Act (No. of 2006)</p>	<p>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</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>amended, with the exception of Section 5B, which provides funds for the energy regulator for the purpose of regulating the electricity industry.</p> <p>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.</p> <p>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).</p>
<p>National Development Plan 2030</p>	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> » 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. <p>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.</p> <p>The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Harmony Target 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.</p>
<p>Integrated Energy Plan (IEP), 2016</p>	<p>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:</p> <ul style="list-style-type: none"> » 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 Target Solar PV Facility
	<ul style="list-style-type: none"> » 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. <p>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.</p> <p>The 8 key objectives of the integrated energy planning process are as follows:</p> <ul style="list-style-type: none"> » 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.
<p>Integrated Resource Plan for Electricity (IRP) 2010-2030</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>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</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>the grid. IPPs have commissioned 1005MW from two (2) Open Cycle Gas Turbines (OCGT) peaking plants.</p> <p>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.</p> <p>Provision has been made for the following new capacity by 2030:</p> <ul style="list-style-type: none"> » 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 <p>Of relevance to the proposed project is the provision for distributed generation capacity for own use. Therefore, the development of the Harmony Target Solar PV Facility is supported by the IRP 2019.</p>
<p>New Growth Path (NGP) Framework, 23 November 2010</p>	<p>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.</p> <p>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.</p>
<p>National Development Plan 2030</p>	<p>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.</p> <p>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:</p> <ul style="list-style-type: none"> » 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. <p>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,</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>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.</p> <p>The NDP aims to provide a supportive environment for growth and development, while promoting a more labour-absorbing economy. The development of Harmony Target 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.</p>
<p>National Climate Change Response Policy, 2011</p>	<p>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.</p> <p>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.</p> <p>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.</p> <p>The policy provides support for Harmony Target 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.</p>
<p>Climate Change Bill, 2018</p>	<p>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.</p> <p>Harmony Target Solar PV Facility comprises a renewable energy generation facility and would not result in the generation or release of emissions during its operation.</p>
	<p>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.</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
<p>National Climate Change Response Strategy for South Africa, 2004</p>	<p>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.</p> <p>A number of principles and factors guided the conception of the strategy and are required to be implemented. These are:</p> <ul style="list-style-type: none"> » 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. <p>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.</p>
<p>Infrastructure Development Act (2014) regarding Strategic Integrated Projects (SIPs)</p>	<p>The Presidential Infrastructure Coordinating Commission (PICC) is integrating and phasing investment plans across the 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.</p> <ul style="list-style-type: none"> » SIP 8 of the energy SIPs supports the development of RE projects as follows: <i>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.</i>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>» SIP 20: Energy (gazetted in GG 43547 on 24 July 2020). Includes 3 sub-projects;</p> <ul style="list-style-type: none"> 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 <p>The Embedded Generation Investment Programme (EGIP) forms part of the Energy Strategic Integrated Project No. 20c. The development of Harmony Target 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.</p> <p>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).</p>
<p>National Protected Area Expansion Strategy (2010)</p>	<p>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.</p>
<p>National Biodiversity Economy Strategy (NBES) (March 2016)</p>	<p>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.</p> <p>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.</p> <p>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</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>is therefore characterised by an interesting combination of agriculture, eco-tourism, and conservation characteristics.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>To address these transformation NBES imperatives, NBES has the principles of:</p> <ul style="list-style-type: none"> » 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. <p>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</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>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.</p>
<p>Free State Provincial Growth and Development Strategy (FSGDS), Revised October 2013</p>	<p>The revised FSGDS refers to specific imperatives which sets the tone and pace for shared growth and development in the Province. These include:</p> <ul style="list-style-type: none"> » 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. <p>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.</p>
<p>Free State Provincial Spatial Development Framework (PSDF) 2013 - Executive Summary (Inception Report)</p>	<p>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.</p> <p>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 needs of the present generation without compromising the ability of future generations to meet their own needs.</p> <p>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.</p>

Relevant legislation or policy	Relevance to Harmony Target Solar PV Facility
	<p>The Harmony Target Solar PV Facility will contribute to sustainable and economic development goals of the Free State PSDF, once completed and formally adopted.</p>
<p>Free State Green Economy Strategy (2014)</p>	<p>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).</p> <p>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.</p> <p>The Harmony Target 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.</p>
<p>Free State Investment Prospectus (2019)</p>	<p>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.</p> <p>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.</p> <p>Considering the future opportunities available for the development of renewable energy facilities (including solar PV facilities) the development of the Harmony Target Solar PV Facility is considered to be in-line with the Investment Prospectus of the Province.</p>

3.3.4 Policy and planning at a Local Level

The local tiers of government relevant to the Harmony Target Solar PV Facility project are the **Matjhabeng 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 Target 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 Target Solar PV Facility

Relevant policy	Relevance to the Harmony Target Solar PV facility
<p>Integrated Development Plan (IDP) of the Lejweleputswa District (2021/2022)</p>	<p>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 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</p>

Relevant policy	Relevance to the Harmony Target Solar PV facility
	<p>Plan for Lejweleputswa District Municipality was commissioned and finally adopted in 2002 in terms of the Municipal Systems Act No. 32 of 2000.</p>
<p>Integrated Development Plan (IDP) of the Matjhabeng local Municipality (2020/2021)</p>	<p>The following strategic objectives have been set to deliver on the above stated key performance areas:</p> <ul style="list-style-type: none"> » Ensuring access to basic services for all residents; » Developing and sustaining spatial, natural and built environments; » Providing integrated and sustainable human settlements; » Addressing the challenges of poverty, unemployment and social inequality; » Fostering a safe, secure and healthy environment for employees and communities; » Developing a prosperous and diverse economy; » Accelerating service delivery through the acquisition and retention of competent and efficient human capital; » Ensuring sound financial management and viability. <p>The IDP seeks to achieve sustainable development within Matjhabeng. To this end, there is a balanced approach to economic, environmental and social development: the overarching pillars of sustainable development. In pursuit of economic growth and the provision of services to its citizens, the Municipality cannot compromise its responsibility for protecting the natural and built environment. It is committed to adhere to good governance principles (participation, efficiency, effectiveness, accountability, transparency, equity, fairness and the rule of law) and Batho Pele 4 principles (courtesy and people first, consultation, service excellence, access, information, openness and transparency, redress and value for money) in the provision of services to residents.</p>

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 Target 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 Target 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 Target 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 Target 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 Target 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 Target 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 Target 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 Target mine. The Harmony Target 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 Target 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 Target 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 Target 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 Target 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 Target 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 Target Mine:** The development area is located in close proximity to the Harmony Target Mine, which will be the exclusive user of the generated power and is therefore preferred for development of the proposed PV Facility. Furthermore, there are existing available infrastructure that are considered as possibly forming part of the grid connection points in order to be able to evacuate the generated power from the PV facility to the Harmony Target mine. The grid will tie-in behind the meter of the Harmony customer substation.
- » **Land suitability and land use activities** – The properties included in the project site were identified considering the feasible solar resource and are deemed technically feasible by the project developer for such development to take place. The project site is currently owned by the Harmony Gold and has an extent of 500ha, which was considered by the developer as sufficient for the development of a 30MW Solar PV facility. The proposed development 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 and agricultural activities (grazing). The areas identified for the PV facility although on mining land will not impact on the mining activities. The land is currently not actively farmed. 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 Allanridge and Odendaalsrus 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 Target 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 Target 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 (CO₂) 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 137MW 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 five 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, Welkom, 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 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 Target 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 Target 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 Target Solar PV Facility, a solar energy facility with capacity of up to 30MW 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)¹⁰, 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.

¹⁰ 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 Target Solar PV facility is located 550m south of the Harmony Gold Target operations, approximately ~1km south of the town of Allanridge. 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 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:** 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 ~1972 - 2118 kWh/m²/annum, which is considered favourable for the development of a solar PV facility.
- » **Topography:** Sites that facilitate easy construction conditions, (i.e., relatively flat topography, lack of major rock outcrops, limited watercourse crossings, etc.) are favoured during the site selection process. The topography of the study area is described as slightly undulating plains with an even (flat) slope and a gradual drop (approximately 90m) from the south to the Vaal River to the north-west. The proposed development site itself is located at an average elevation of 1 310m above sea level and has an even slope to the north. The topography or terrain morphology of the region is broadly described as plains and pans of the Central Interior Plain. The slope of the entire study area is even (flat) with a very gradual drop (less than 70m) from the south-east (near the R30) to the north-west of the study area. This non-perennial river, pans and farm dams account for the dominant hydrological features within this region. The flat topography of the project area is considered beneficial in terms of the construction activities that will be required. Based on the suitable and preferable topography, no location alternatives are considered for the development.

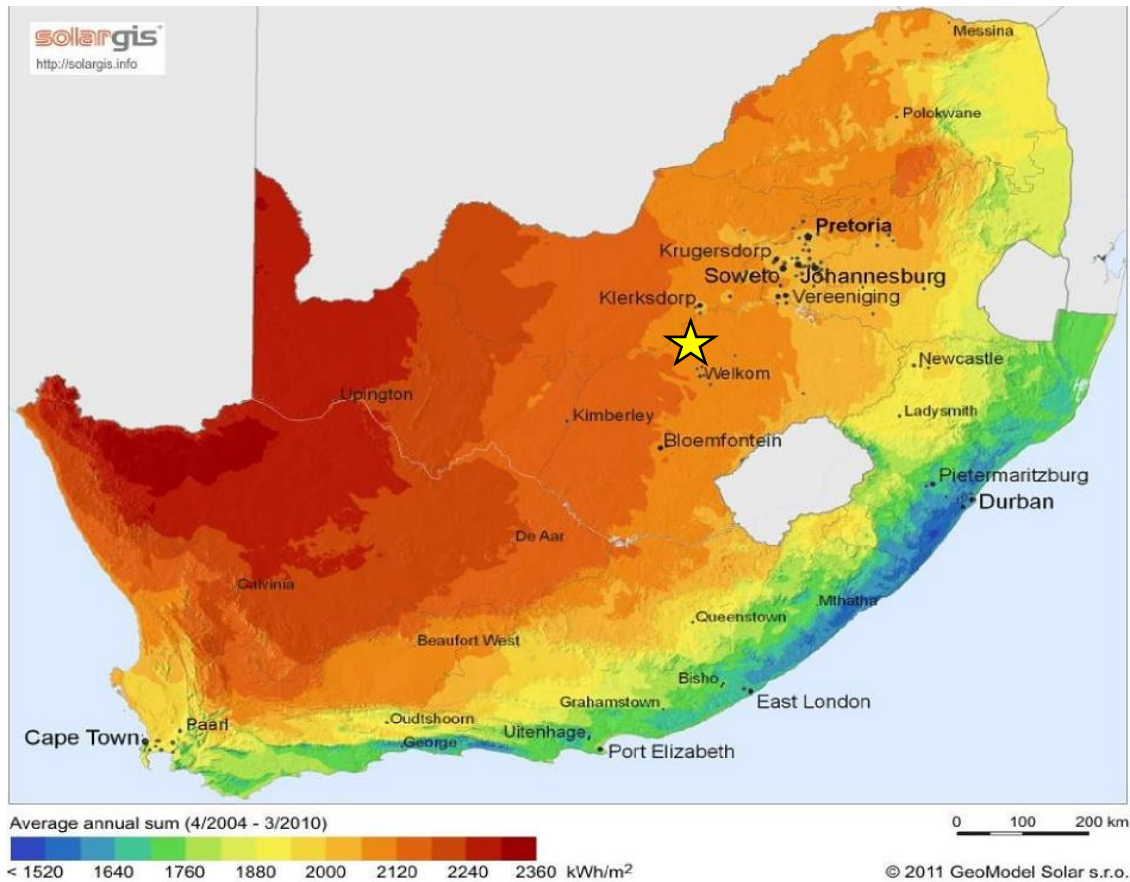


Figure 4.1: Solar irradiation map for South Africa. The approximate location of Harmony Target Solar PV Facility site is indicated by the yellow star. (Source: adapted from GeoModel Solar, 2011).

- » **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 30MW facility. The development area, within which the project development footprint will be located, is 245ha. This area is considered to be sufficient for the planned 30MW 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 Farm Kromdraai 386 and Portion 0 of Farm Aandenk 227, which are owned by the Mine but outside of the mining area (the project would not impact on mining activities).

Land use: The current land use of the development area is an important consideration in site selection in terms of limiting disruption to existing land use practices. The area surrounding the development footprint can be classified as a mix between agricultural activities such as grazing, and crop production and activities associated with mining. Towards the northern, and southern boundaries of the site, pre-existing mining infrastructure and buildings are clearly visible. In addition, residential areas are located outside of the northern and eastern boundaries of the project site. The project site is located within a cultivated crop region where a few maize stalks from the previous harvest is evident. A few pivot irrigation fields are located outside the development area, mostly north-west. Large fields with rainfed crops and/or planted pastures are located to the north, west and south of the development area, with old fields to the north and west.

- » **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 Target Solar PV facility will be the Avgold Substation located 400m to the north east 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 eastern side of the development site, there are various unnamed roads, one of which is directly adjacent to the development area. The project site can be readily accessed via the main roads and unnamed secondary road/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.

Taking into consideration the solar resource, grid access, land suitability, landowner support, access to road infrastructure, the current land use of the project site and development area, the Harmony Target 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 Target Solar PV Facility in the area will be determined through the EIA process being undertaken for the facility. The findings of the specialist impact assessments assisted 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 properties (i.e. 500ha in which development area (~245ha) and facility footprint (~105ha) is located, 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 Target 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.

» Grid Connection Alternatives

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the south side of the Avgold Substation (located directly south west of the Loraine One Substation).

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the south side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. at the junction with the secondary road, the route turns south to access the south side of the Avgold Substation.'

All three alternatives are considered and assessed in this EIA report (refer to Chapter 7) in order to determine the most optimal grid connection option from an environmental perspective.

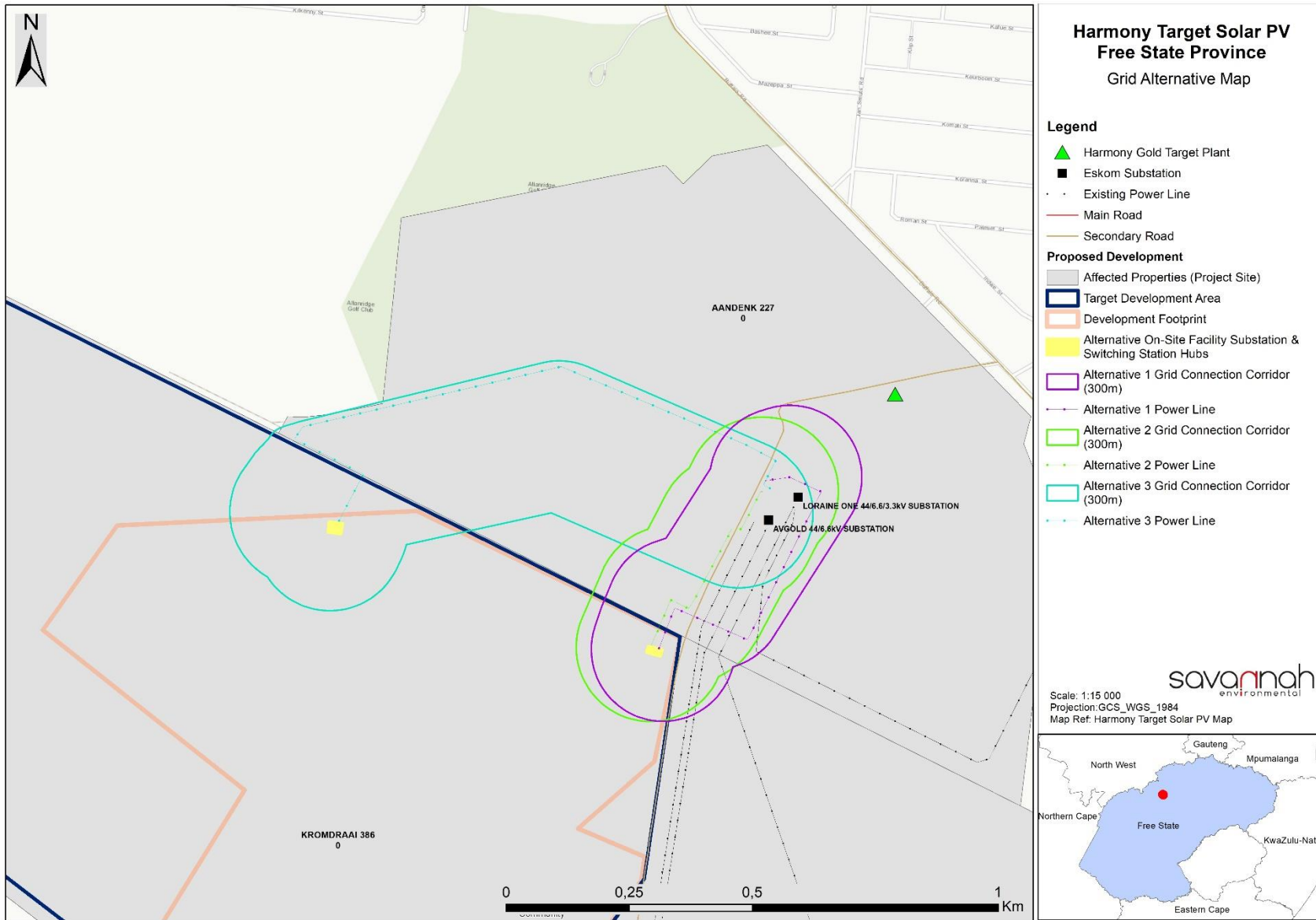


Figure 4.2: Figure indicating the Harmony Target Solar PV Facility Development area. Three grid connection corridor alternatives are considered during the EIA Phase of the project

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

Avgold (Pty) Ltd is a renewable energy project developer and as such is only considering renewable energy technologies for the generation of up to 30MW of electricity. The project site is located near the town of Allanridge 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 remain 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.

Once environmental constraining factors have been determined through the Scoping and EIA process, Avgold (Pty) Ltd, the preferred technology option will be informed by efficiency as well as environmental impact and constraints (such as sensitive biophysical features). The PV panels proposed, will comprise solar panels which once installed, 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' Alternative**

The 'do-nothing' alternative is the option of not constructing the Harmony Target 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 Target 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

Three grid connection corridor alternatives were considered by Avgold (Pty) Ltd within the proposed project site of 500ha. All three alternatives are considered and assessed in this EIA report (refer to Chapter 7) in order to determine the most optimal grid connection option from an environmental perspective.

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 Target 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 contracted capacity of the facility being 30MW and Activity 1 of Listing Notice 2 (GNR 325) being 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.

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 Target 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 C8).
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 Target 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 Target 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 Target 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 Avgold Substation and will consist of an on-site substation, switching station 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 and seeps have been identified within the development area. 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 where such storage will occur inside containers with a combined capacity exceeding 80 cubic meters but not exceeding 500 cubic meters.
Listing Notice 1 (GNR 327)	19 (i)	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

Notice Number	Activity Number	Description of listed activity
08 December 2014 (as amended)		(i)watercourse. The development area is in close proximity to watercourses 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 Target Solar PV Facility will be constructed and operated on land which has been used for agriculture. The development footprint considered for the establishment of the PV facility is ~105ha in extent and is located outside an urban area.
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	1	The development of facilities or infrastructure for the generation of electricity from a renewable resource where the electricity output is 20MW or more. The project is a renewable energy generation facility, which will utilise solar power technology and will have a generating capacity of up to 30MW.
Listing Notice 2 (GNR 325) 08 December 2014 (as amended)	15	The clearance of an area of 20ha or more of indigenous vegetation ¹¹ . 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.
Listing Notice 3 (GNR 985) 08 December 2014 (as amended)	4(b)(i)(ee)	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: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; The development of Harmony Target 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 of an urban area. A small fragment of CBA 1 is located in the north-western corner of the development area. The remainder of the development area is located within an ESA2 as identified in bioregional plans.

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.

Notice Number	Activity Number	Description of listed activity
Listing Notice 3 (GNR 985) 08 December 2014 (as amended)	10(b)(i)(gg)(hh)	<p>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.</p> <p>b. Free State</p> <p>i. Outside urban areas: (ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (gg) Areas within a watercourse or wetlands; or within 100 metres from the edge of a watercourse or wetland.</p> <p>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 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.</p> <p>A small fragment of CBA 1 is located in the north-western corner of the development area. The remainder of the development area is located within an ESA2 as identified in bioregional plans.</p> <p>Wetlands and seeps have been identified within the development area.</p>
Listing Notice 3 (GNR 985) 08 December 2014 (as amended)	12(b)(ii)(iv)	<p>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.</p> <p>b. Free State</p> <p>ii. Within critical biodiversity areas identified in bioregional plans; iv. Areas within a watercourse or wetlands; or within 100 metres from the edge of a watercourse or wetland.</p> <p>The project will require the clearing of indigenous vegetation (natural areas) that exceeds 300 m² and occurs within designated critical biodiversity areas or within 100 m of a watercourse or wetland.</p> <p>A small fragment of CBA 1 is located in the north-western corner of the development area. The remainder of the development area is located within an ESA2 as identified in bioregional plans.</p> <p>Wetlands and seeps have been identified within the development area.</p>
Listing Notice 3 (GNR 985) 08 December 2014 (as amended)	14(ii)((a)(b)(i)(hh)	<p>The development of –</p> <p>(ii) infrastructure or structures with a physical footprint of 10 square meters or more; where such development occurs –</p> <p>(a) within a watercourse; or</p>

Notice Number	Activity Number	Description of listed activity
		<p>(c) if no development setback exists, within 32 meters of a watercourse, measured from the edge of a watercourse.</p> <p>b. Free State</p> <p>i. Outside urban areas:</p> <p>(ee) Critical biodiversity areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;</p> <p>Wetlands and seeps have been identified within the development area. 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.</p> <p>The development footprint of the PV facility will be up to ~105ha in extent.</p> <p>The site is located in the Free State Province, outside an urban area. A small fragment of CBA 1 is located in the north-western corner of the development area. The remainder of the development area is located within an ESA2 as identified in bioregional plans.</p>

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, four (4) wetlands or watercourse features are located within the extent of the larger project area. Areas classified as wetlands and seeps are extensive throughout the project site and surrounding area and the project 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)	<p>Impeding or diverting the flow of water in a watercourse</p> <p>The development area considered for the establishment of the Harmony Target Solar PV Facility has some wetlands located within the extent of the</p>

Notice No.	Activity No.	Description of Water Use
		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 Target Solar PV Facility has some 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 30MW for the Harmony Target 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 (DESTE A) 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 DESTE A 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 B**).
- » Submission of the Application for Environmental Authorisation to the DESTE A (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 EIA 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 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 Target 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 Ltd
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
Independent Communications Authority of South Africa (ICASA)
Provincial Government Departments
Free State Department: Agriculture and Rural Development
Free State Department of Economic Development, Tourism and Environmental Affairs
Free State Department of Public Works & Infrastructure
Free State Heritage Resources Authority (FSHRA)
Local Government Departments
Lejweleputswa District Municipality
Matjhabeng Local Municipality - including the Ward Councillor and ward committee 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 names¹² of:

- » 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 informing registered parties of the Acceptance of Scoping Report and Approval of the EIA Plan of Study received from DESTEA and the notifying them of the availability of the EIA Report for review and comments distributed on **13 January 2023**.
- » 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 **16 January 2023**. The tearsheet of the newspaper advert is included in **Appendix C2** of the EIA Report.
- » The EIA Report will be made available for review by I&APs for a 30-day review and comment period from **16 January 2023** to **15 February 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 **16 January 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. Public Involvement and Consultation

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 **16 January 2023** to **15 February 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) was with affected and adjacent landowners, and any other stakeholder group identified or requested a virtual FGM.

¹² 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).

- * Virtual Key Stakeholder Workshop was 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 Target 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.	24 August 2022
The BID and electronic reply form was also made available on the online stakeholder engagement platform.	
Placement of site notices.	18 August 2022
Announcement of the EIA process in one local newspaper: The Volksblad Newspaper	24 August 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.	24 August 2022
30-day review and comment period of the Scoping Report.	24 August 2022 – 23 September 2022
Virtual and in person meetings through the use of virtual platforms as determined through discussions with the relevant stakeholder group: » 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), key stakeholder groups and registered I&APs on the project database.	13 January 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	16 January 2022

30-day review and comment period of the EIA Report	16 January 2023 to 15 February 2023
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-target-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 L** of the EIA Report) for the Harmony Target 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 Target 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	<p>Screening tool: High Sensitivity</p> <p>Required an agricultural impact assessment (in accordance with the protocol prescribed in GNR 320).</p> <p>Verified Sensitivity by Specialist: High to Low Sensitivity</p>	<p>The largest portion of the development footprint has land with Moderate-High (Class 09) land capability that is suitable for dryland crop production with the climate being the limiting factor. Areas not on cultivated land have Moderate (Class 08) land capabilities, while the areas with existing disturbance, have Very low (Class 02) land capability.</p> <p>It is anticipated that the construction and operation of the Harmony Target Solar PV facility will have impacts that range from high to low.</p> <p>Since the area around the development footprint will be fenced off, it is not anticipated that the impact on livestock grazing and rainfed crops within the crop field, can be mitigated as this area will now be excluded from agricultural practises.</p> <p>Through the consistent implementation of the recommendation mitigation measures, most of the impacts can all be reduced to low.</p> <p>The Soils and Agricultural Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as Appendix G.</p>
Landscape/Visual Impact Assessment	<p>Screening tool: Very High Sensitivity</p> <p>(General Assessment Protocols)</p>	<p>The findings of the Visual Impact Assessment undertaken for the proposed 30MW PV facility is that the visual environment surrounding the site, especially within a 1 - 6km radius, may be visually impacted during the anticipated operational lifespan of the facility (i.e., a minimum of 25 years).</p>

	<p>Verified Sensitivity by Specialist: Medium to low sensitivity</p>	<p>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.</p> <p>A Visual Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as Appendix I.</p>
<p>Archaeological and Cultural Heritage Impact Assessment</p>	<p>Screening tool: Very High Sensitivity</p> <p>Required an archaeological & cultural impact assessments (No specific protocol- consider general requirements (GG 45421 of 10/05/2019)_DRAFT))</p> <p>Verified Sensitivity by Specialist: Low Sensitivity</p>	<p>The Archaeological Impact Assessment (included as an Appendix to the HIA) determined that the potential for finding a dateable in-situ archaeological horizon at Target based on current surface observations outlined above appears to be low. The documented archaeology at the Target site is therefore classified as scientifically Low Significance.</p> <p>Concerning the archaeology observed during the survey of the potentially affected area at the Target site, there are no objections to the authorization of the proposed development, provided that if any evidence of buried human remains are exposed during excavation, that development activities cease in the area of the identified remains. No impacts to significant heritage resources are anticipated</p> <p>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 H.</p>
<p>Palaeontology Impact Assessment</p>	<p>Screening tool: Medium Sensitivity</p> <p>Verified Sensitivity by Specialist: Low Sensitivity</p>	<p>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.</p> <p>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</p> <p>Since there is a small chance that fossils 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.</p> <p>A Heritage Impact Assessment (which includes a palaeontological assessment of the project site) is included in this EIA Report as Appendix H.</p>
<p>Terrestrial Biodiversity Impact Assessment</p>	<p>Screening tool: Very High Sensitivity</p> <p>Required a terrestrial biodiversity impact assessment and a plant</p>	<p>The ecological impact assessment identified that the majority of the site is located within ESA2, which corresponds to transformed, secondary vegetation (old lands) and/or cultivated lands within an Endangered and significantly transformed vegetation unit. The entire PV development footprint is within ESA2. A small fragment of CBA1 on the north-</p>

	<p>species assessment (Terrestrial Biodiversity Assessment Protocols)</p> <p>Verified Sensitivity by Specialist: Very Low Sensitivity</p>	<p>western corner of the site, which is outside of the project footprint and will not be affected directly or indirectly.</p> <p>While the terrestrial biodiversity screening tool designated the site and project footprint as having an Ecological Support Area 2 designation, the significant current cultivation, historical disturbances and secondary nature of most of the vegetation as well as likely persistent ongoing cultivation of the site under status quo conditions implies that it is unlikely to provide any conservation value of significance, despite the fact that the vegetation unit has an Endangered status regionally. This designation is likely associated with broader landscape level ecological processes to retain ecological connectivity between scattered remnant patches of the endangered vegetation unit and the site development plan will accommodate such connectivity.</p> <p>The minimal footprint within an already highly disturbed landscape comprising transformed, secondary vegetation (old lands) and/or cultivated lands is unlikely to result in any significant impacts or threats to ecological processes associated with the current ESA2 designation, as the alternative land use will most likely be ongoing cultivation on the site. It is the specialist's opinion based on a field survey that the overall sensitivity of the area is of Very Low significance after mitigation measures are implemented.</p> <p>An Ecological Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as Appendix D.</p>
<p>Aquatic Biodiversity Impact Assessment</p>	<p>Screening tool: Low Sensitivity</p> <p>Required an Aquatic Biodiversity impact assessment (in accordance with the protocol prescribed in GNR 320, Aquatic Biodiversity Assessment Protocols).</p> <p>Verified Sensitivity by Specialist: Low Sensitivity</p>	<p>It was confirmed through a field survey that the site has a Low sensitivity from an Aquatic biodiversity perspective. The wetlands in the project area has been ploughed and planted with agricultural crops. It was not planted this year and weeds and declared invader plant species have grown and dominate the wetland feature. Some of the wetlands outside of the development area have a higher sensitivity, but they will not be significantly impacted by the development and will not be impacted by the PV development footprint.</p> <p>A Wetland Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as Appendix E.</p>
<p>Avian Impact Assessment</p>	<p>Screening tool: Low Sensitivity</p> <p>Verified Sensitivity by Specialist: High-Medium to Low (depending on the impact considered)</p>	<p>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 secondary grassland, pans, depressions, pollution control dams and Stinkpan, and transformed, landscaped (manicured) areas and cultivation.</p>

				<p>An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was moderate-high to low after mitigation (depending on the type of impact). However, the risk for certain waterbirds and shorebirds (mainly flamingo taxa) colliding with the PV infrastructure remained eminent due to the presence of the nearby wetlands. 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.</p> <p>An Avifauna Impact Assessment has been undertaken for the Harmony Target Solar PV Facility and is included as Appendix F of the BA Report. The assessment has been undertaken in accordance with the requirements of the BirdLife SA Best Practice Guidelines for Solar Developments.</p>
Civil Aviation Assessment	Screening tool: Low Sensitivity	Verified Sensitivity: Low Sensitivity		<p>No major aerodromes or small airfields are known to occur in the larger area. The Civil Aviation Authority (CAA) and Air Traffic Navigation Services (ATNS) will be consulted throughout the S&EIA process to obtain input. Further assessment of the potential impacts is not required.</p> <p>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.</p>
Defence Assessment	Screening tool: Low Sensitivity			<p>A defence or military base is not located within close proximity to the PV facility. Further consultation is not required.</p>
RFI Assessment	Screening tool: Low Sensitivity	Verified Sensitivity: Low		<p>The project site under consideration for the development of the Harmony Target Solar PV Facility is located within an area that is classified as having low sensitivity for telecommunication.</p>
Plant Species Assessment	Screening tool: Low Sensitivity			<p>The ecological impact assessment identified that the majority of the site is located within ESA2, which corresponds to transformed, secondary vegetation (old lands) and/or cultivated lands within an Endangered and significantly transformed vegetation unit. The entire PV development footprint is within ESA2. A small fragment of CBA1 on the north-western corner of the site, which is outside of the project footprint and will not be affected directly or indirectly.</p> <p>While the terrestrial biodiversity screening tool designated the site and project footprint as having an Ecological Support Area 2 designation, the significant current cultivation, historical disturbances and secondary nature of most of the vegetation as well as likely persistent ongoing cultivation of the site under status quo conditions implies that it is unlikely to provide any conservation value of significance, despite the fact that the vegetation unit has an Endangered status regionally. This designation is likely associated with broader landscape level ecological processes to retain ecological connectivity between scattered remnant patches of the endangered</p>
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	

		<p>vegetation unit and the site development plan will accommodate such connectivity.</p> <p>The National Environmental Screening Tool flagged no flora species. Further screening of species on the site concluded that no species of conservation concern having an elevated status and/or limited distribution range are confirmed present. Species protected in terms of the Free State Nature Conservation Ordinance were found but are all widespread species; however, a FSNCO permit would none the less be required should they require removal during construction.</p> <p>A single bird is listed in the screening tool, which is unlikely to be present, as it is mostly associated with the nearby waterbodies and the specific site is unlikely to provide irreplaceable habitat, bearing in mind the elevated baseline levels of disturbance on the site and in the surrounding area.</p> <p>The minimal footprint within an already highly disturbed landscape comprising transformed, secondary vegetation (old lands) and/or cultivated lands is unlikely to result in any significant impacts or threats to ecological processes associated with the current ESA 2 designation, as the alternative land use will most likely be ongoing cultivation on the site. It is the specialist's opinion based on a field survey that the overall sensitivity of the area is of Very Low significance after mitigation measures are implemented.</p> <p>An Ecological Impact Assessment has been undertaken for the proposed project and is included in this EIA Report as Appendix D.</p>
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5.7 Assessment of Issues Identified through the EIA Process

Issues (both direct and indirect environmental impacts) associated with the Harmony Target 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
Jamie Pote	Ecology (Terrestrial)	Appendix D
Justin Bezuidenhout and Mari Van der Westhuizen of Biosphere Enviro Solutions	Wetlands	Appendix E
Lukas Niemand of Pachnoda Consulting	Avifauna	Appendix F
Marine Pienaar of TerraAfrica	Soils & Agricultural Potential	Appendix G
Jenna Lavin of CTS Heritage	Heritage (including archaeology, cultural landscape and palaeontology)	Appendix H
Brogan Geldenhuys of Eco-Thunder Consulting	Visual	Appendix I
Marti Le Roux of Eco-Thunder Consulting	Social	Appendix J

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 Target 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 Target Solar 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-J** 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 Target Solar PV Facility

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Legislation			
Constitution of the Republic of South Africa (No. 108 of 1996)	<p>In terms of Section 24, the State has an obligation to give effect to the environmental right. The environmental right states that:</p> <p><i>“Everyone has the right –</i></p> <ul style="list-style-type: none"> » <i>To an environment that is not harmful to their health or well-being, and</i> » <i>To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:</i> <ul style="list-style-type: none"> * <i>Prevent pollution and ecological degradation,</i> * <i>Promote conservation, and</i> * <i>Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.”</i> 	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)	<p>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).</p> <p>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.</p>	Free State DESTEA – Competent Authority	<p>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.</p> <p>Considering the capacity of the Harmony Target Solar PV facility project (i.e. contracted capacity of 30MW) and the triggering of Activity 1 of Listing Notice 2 (GNR 325) a full Scoping and EIA process is required in support of the Application for EA.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
National Environmental Management Act (No 107 of 1998) (NEMA)	<p>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.</p> <p>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.</p>	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)	<p>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.</p> <p>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.</p> <p>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).</p>	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	A Wetland Impact Assessment has been undertaken for the PV facility and is included as Appendix E of the EIA Report. The wetlands inside the development area are classified as endorheic depression wetlands.

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>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.</p> <p>Consumptive water uses may include taking water from a water resource (Section 21(a)) and storing water (Section 21(b)).</p> <p>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)).</p>		<p>Wetlands in the development area and 500m buffer around the development area were assessed.</p> <p>A Water Use License will be required for Section 21 (c) & 21(i). A WUL application has been initiated with the Department of Water and Sanitation, and a RAM is being prepared to consider the risk of infrastructure within 500m of any water resource.</p>
<p>Minerals and Petroleum Resources Development Act (No. 28 of 2002) (MPRDA)</p>	<p>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.</p> <p>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.</p>	<p>Department of Mineral Resources and Energy (DMRE)</p>	<p>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.</p> <p>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.</p>
<p>National Environmental Management: Air Quality Act (No. 39 of 2004) (NEM:AQA)</p>	<p>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.</p>	<p>Free State DESTE Lejweleputswa District Municipality</p>	<p>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</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>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.</p> <p>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.</p>		<p>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.</p>
<p>National Heritage Resources Act (No. 25 of 1999) (NHRA)</p>	<p>Section 07 of the NHRA stipulates assessment criteria and categories of heritage resources according to their significance.</p> <p>Section 35 of the NHRA provides for the protection of all archaeological and palaeontological sites, and meteorites.</p> <p>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.</p> <p>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.</p> <p>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.</p>	<p>South African Heritage Resources Agency (SAHRA)</p> <p>Free State Provincial Heritage Resources Agency (FS PHRA)</p>	<p>A full Heritage Impact Assessment (HIA) (with field work) has been undertaken as part of the EIA process (refer to Appendix H of this EIA Report). No archaeological resources of scientific cultural value were identified within the area proposed for the Target PV Facility and its grid connection and as such, no impact to significant archaeological heritage resources is anticipated.</p> <p>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).</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
<p>National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)</p>	<p>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.</p> <p>Three government notices have been published in terms of Section 56(1) of NEM:BA as follows:</p> <ul style="list-style-type: none"> » Commencement of TOPS Regulations, 2007 (GNR 150). » Lists of critically endangered, vulnerable and protected species (GNR 151). » TOPS Regulations (GNR 152). <p>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).</p>	<p>DFFE Free State DESTEA</p>	<p>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.</p> <p>During the survey no plant SCC was recorded (refer to the Ecological Impact Assessment Report (Appendix D)).</p> <p>National Environmental Screening Tool flagged no flora species. Further screening of species on the site concluded that no species of conservation concern having an elevated status and/or limited distribution range are confirmed present.</p>
<p>National Environmental Management: Biodiversity Act (No. 10 of 2004) (NEM:BA)</p>	<p>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.</p> <p>Applicable, and exempted alien and invasive species are contained within the Alien and Invasive Species List (GNR 864).</p>	<p>DFFE Free State DESTEA</p>	<p>Twelve (12) alien and invasive spp were identified within the project site: Sisal (<i>Agave sisalana</i>); Mexican Poppy (<i>Argemone mexicana</i>); Scotch Thistle (<i>Cirsium vulgare</i>); Thorn Apple (<i>Datura spp.</i>); Gum tree (<i>Eucalyptus spp</i>); Syringa (<i>Melia azedarach</i>); Prickly Pear (<i>Opuntia ficus-indica</i>); Kikuyu (<i>Pennisetum clandestinum</i>); Bugweed (<i>Solanum mauritianum</i>) and Wild tomato (<i>Solanum sisymbriifolium</i>).</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
<p>Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA)</p>	<p>Section 05 of CARA provides for the prohibition of the spreading of weeds.</p> <p>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.</p> <p>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.</p>	<p>Department of Agriculture, Rural Development, and Land Reform (DARDLR)</p>	<p>An Ecological Impact Assessment has been undertaken for the PV facility and grid connection and is included as Appendix D of the EIA Report.</p> <p>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.</p> <p>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:</p> <ul style="list-style-type: none"> » 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

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
			<p>concerned, subject to the provisions of sub-regulation 4.</p> <p>» 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.</p>
<p>National Forests Act (No. 84 of 1998) (NFA)</p>	<p>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.</p> <p>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”.</p>	<p>DFFE</p>	<p>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.</p> <p>An Ecological Impact Assessment has been undertaken for the PV facility and is included as Appendix D of the EIA Report.</p>
<p>National Veld and Forest Fire Act (No. 101 of 1998) (NVFFA)</p>	<p>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.</p>	<p>DFFE</p>	<p>While no permitting or licensing requirements arise from this legislation, this Act will be applicable during the construction and operation of Harmony Target 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.</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>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.</p>		
<p>Hazardous Substances Act (No. 15 of 1973) (HAS)</p>	<p>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.</p> <ul style="list-style-type: none"> » 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. <p>The use, conveyance, or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.</p>	<p>Department of Health (DoH)</p>	<p>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.</p>
<p>National Environmental Management: Waste Act (No. 59 of 2008) (NEM:WA)</p>	<p>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.</p>	<p>DFFE – Hazardous Waste</p>	<p>No waste listed activities are triggered by Harmony Target Solar PV Facility; therefore, no Waste Management License is required to be</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>The Minister may amend the list by –</p> <ul style="list-style-type: none"> » Adding other waste management activities to the list. » Removing waste management activities from the list. » Making other changes to the particulars on the list. <p>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.</p> <p>Any person who stores waste must at least take steps, unless otherwise provided by this Act, to ensure that:</p> <ul style="list-style-type: none"> » The containers in which any waste is stored, are intact and not corroded or in » Any other way rendered unfit 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. 	<p>Free State DESTEA – General Waste</p>	<p>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.</p>
<p>National Road Traffic Act (No. 93 of 1996) (NRTA)</p>	<p>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.</p>	<p>South African National Roads Agency (SANRAL) – national roads</p> <p>North West Department of Public Works and Roads (NWDPWR)</p>	<p>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</p>

Legislation	Applicable Requirements	Relevant Authority	Compliance Requirements
	<p>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.</p> <p>The general conditions, limitations, and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution, and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.</p>		<p>of the on-site substation and BESS components may not meet specified dimensional limitations (height and width) which will require a permit.</p>
Provincial Policies / Legislation			
<p>Bophuthatswana Nature Conservation Act. No. 3 of 1973.</p>	<p>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:</p> <ul style="list-style-type: none"> » 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; <p>The Act provides lists of protected species for the Province.</p>	<p>Free State DESTEА</p>	<p>A collection/destruction permit must be obtained from Free State (DESTEА) for the removal of any protected plant or animal species found on site.</p> <p>Species protected in terms of the Free State Nature Conservation Ordinance were found but are all widespread species; however, a FSNCO permit would none the less be required should they require removal during construction.</p> <p>Four (4) plant species were identified namely <i>Lessertia phillipsiana</i>; <i>Boophone disticha</i>; <i>Bulbine narcissifolia</i>; and <i>Ledebouria marginata</i>.</p> <p>Refer to the Ecological Impact Assessment Report (Appendix D).</p>

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 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 Target Solar PV Facility. The dry season survey has already been conducted in August 2021; 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 Target 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 Target 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 Target 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 Target 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 Target Solar PV Facility have been assessed as part of the Ecology Impact Assessment (refer to **Appendix D**) and Avifauna Impact Assessment (refer to **Appendix F**) 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 Target Solar PV Facility have been assessed as part of the Heritage Impact Assessment conducted as part of the EIA process (refer to **Appendix H**), 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) (NRTA) 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 EMP_r prepared for the project and attached as **Appendix K** to 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, Harmony Target 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.	<p>The environmental attributes associated with the development of Harmony Target Solar PV facility is included as a whole within this chapter. The environmental attributes that are assessed within this chapter includes the following:</p> <ul style="list-style-type: none"> » The regional setting of the broader study area indicates the geographical aspects associated with Harmony Target Solar PV facility. This is included in Section 6.2. » The climatic conditions for the Allanridge 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 broader 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 J** of this EIA report.

6.2. Regional Setting

The Harmony Target Plant is located near Allanridge, in the northern region of the Free State Goldfields.. The planned PV facility is located 550m south of the Harmony Target Plant.

The Matjhabeng Local Municipality includes Allanridge, Odendaalsrus, Virginia, Hennenman, Welkom and Ventersburg with a combined population of 406 461 people. The economy of the Matjhabeng Municipality area centres around the mining activities located in and around Allanridge, Odendaalsrus, Welkom and Virginia. In terms of economic contribution, the Matjhabeng Local Municipality is the most important Local Municipality in the district. accounting for almost 72% of the District's economic output. 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.

The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture to the south-west and broader south and western area. Agricultural activities include the production of maize, wheat, and sunflower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

Access to the development area is afforded by a secondary (local) road that joins the R30 at Odendaalsrus, to the south, or the R30 near Allanridge to the west.

The topography or terrain morphology of the region is broadly described as plains and pans of the Central Interior Plain. The slope of the entire study area is even (flat) with a very gradual drop (less than 70m) from the south-east (near the R30) to the north-west of the study area.

The region consists of slight undulating plains. The slope gradient of the region is low with no hills, ridgelines, spurs or steep slopes. For these reasons the facility would only be visible from short distances. High points such as ridges and hills are visible from greater distances and determine the horizon effect. These features are more prominent and visible from greater distances. The area does not contain any prominent topographic features or other scenic features such as scenic routes, protected areas or game farms.

Farm settlements or residences occur at irregular intervals near the study area. The population density of the region is indicated as approximately 173 people per km², predominantly concentrated within the built-up centres. Existing Eskom power lines runs along the eastern boundary of the farm portion and the Avgold substation, into which the grid connection will tie-in, is located to the north east of the site, on Portion 0 of Farm Aandenk 227.

Province	Free State Province
District Municipality	Lejweleputswa District Municipality
Local Municipality	Matjhabeng Local Municipality
Ward number(s)	36
Nearest town(s)	Allanridge (1km north of the site)
Current Zoning	Mining
Current land use	Grazing (mainly cattle)

Access	The site can be readily accessed via an existing gravel access road (Unnamed Rd connecting with the Target Gold Mine located north of the site)
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The Free State

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. Manufacturing also features in the provincial economic profile. This sector makes up 14% of the provincial output, with petrochemicals (via Sasol) accounting for more than 85% of the output.

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

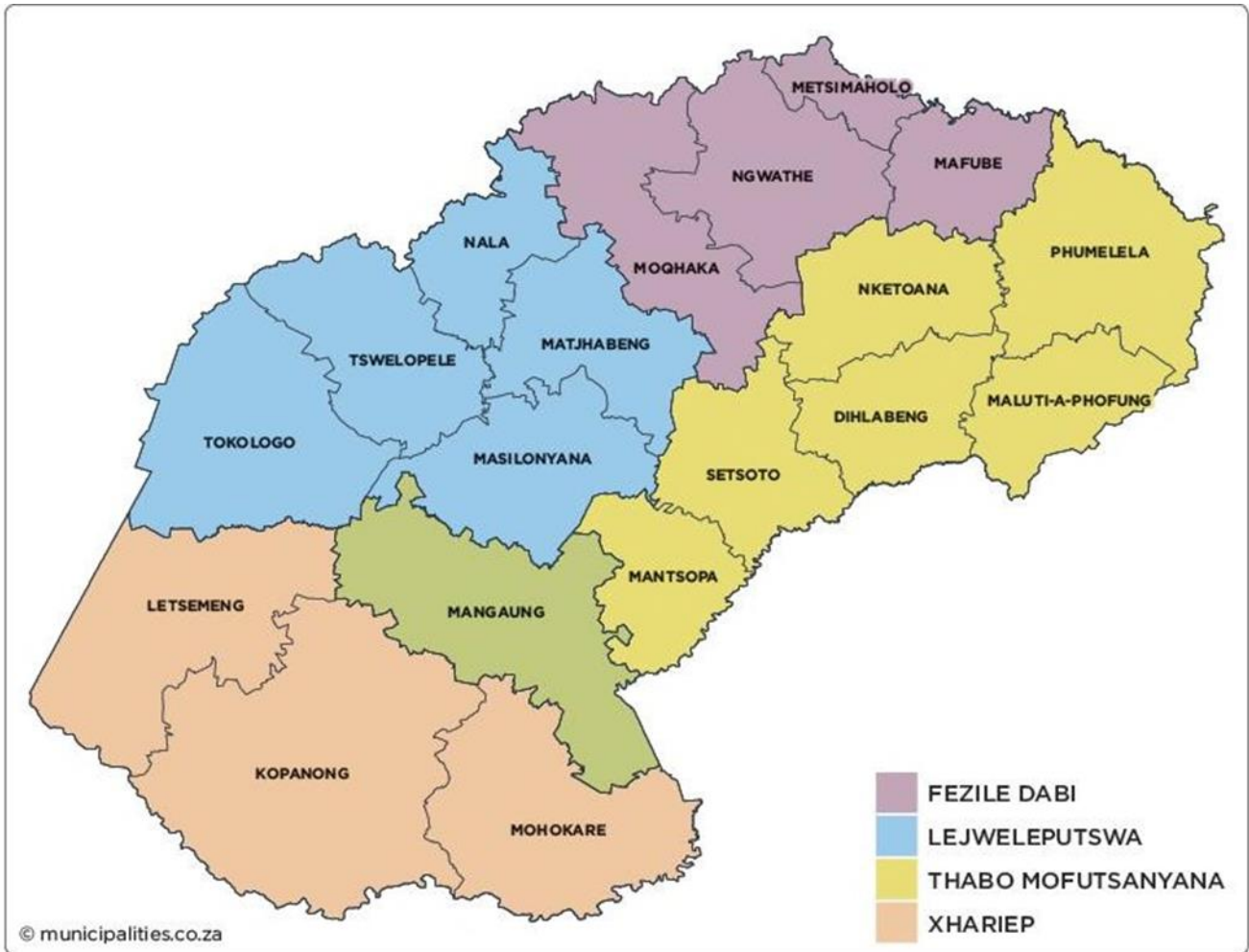


Figure 6.1: District municipalities of the Free State Province (Source: Municipalities of South Africa).

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 930km² (*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 Free State province's population (*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)

Matjhabeng Local Municipality

Matjhabeng is the largest municipality in the district, and it contains most of the mining activities, especially gold mining, followed by Masilonyana with some of the gold mining and diamond mining. Recently the mining sector has been on a downward trend as a result of the closure of many of the shafts due to of high costs of production, among others, and the need for deep mining. The recent decline in world commodity prices, has aggravated the situation in general with many businesses that have traditionally been dependent on the mining sector, either have closed or are in the process of closing down. Other municipalities primary sector relies heavily on agriculture.

In terms of economic contribution, the Matjhabeng Local Municipality (MLM) is the most important LM in District. The MLM accounts for ~72% of the district's economic output, followed by the Masilonyana LM with around 10.8%. The statistics show that the economies of Welkom (53%), Odendaalsrus (38%) and Virginia (78%) are dominated by mining. The total area percentages show a combined figure of 58% dominance by the mining sector. Approximately 98% of mining activities take place in Matjhabeng and Masilonyana LMs, while ~65% of agricultural output in the District comes from Tswelopele and Nala LMs. Approximately 84.8% of all manufacturing output is produced in Matjhabeng LM. A large percentage of the manufacturing is linked to the mining sector. In terms of future economic development, there is likely to be a decline in the role played by mining, which will also impact negatively on employment in the Province.

6.3. Climatic Conditions

Allanridge is located at an elevation of approximately 1 324m above sea level and is influenced by the local steppe climate with rainfall mainly occurring during summer. The climate is strongly seasonal and semi-arid, rainfall for the Allanridge area is given as 584mm per annum (South African Rain Atlas, Water Research Commission, updated). Local thunderstorms and showers are responsible for most of the precipitation during the summer, from October to March and peaking in January. Hail is sometimes associated with the thunderstorms and mainly occurs in the early summer from October to January with its highest frequency in December.

The summers are hot and wet, with summer temperatures ranging typically between 17-31°C. The winters are cold and dry, with wintertime temperatures ranging typically between 1 to 19°C. An average of 36 frost days occurs each winter. The soils are perpetually moisture stressed, with mean annual evaporation of 2,507mm.

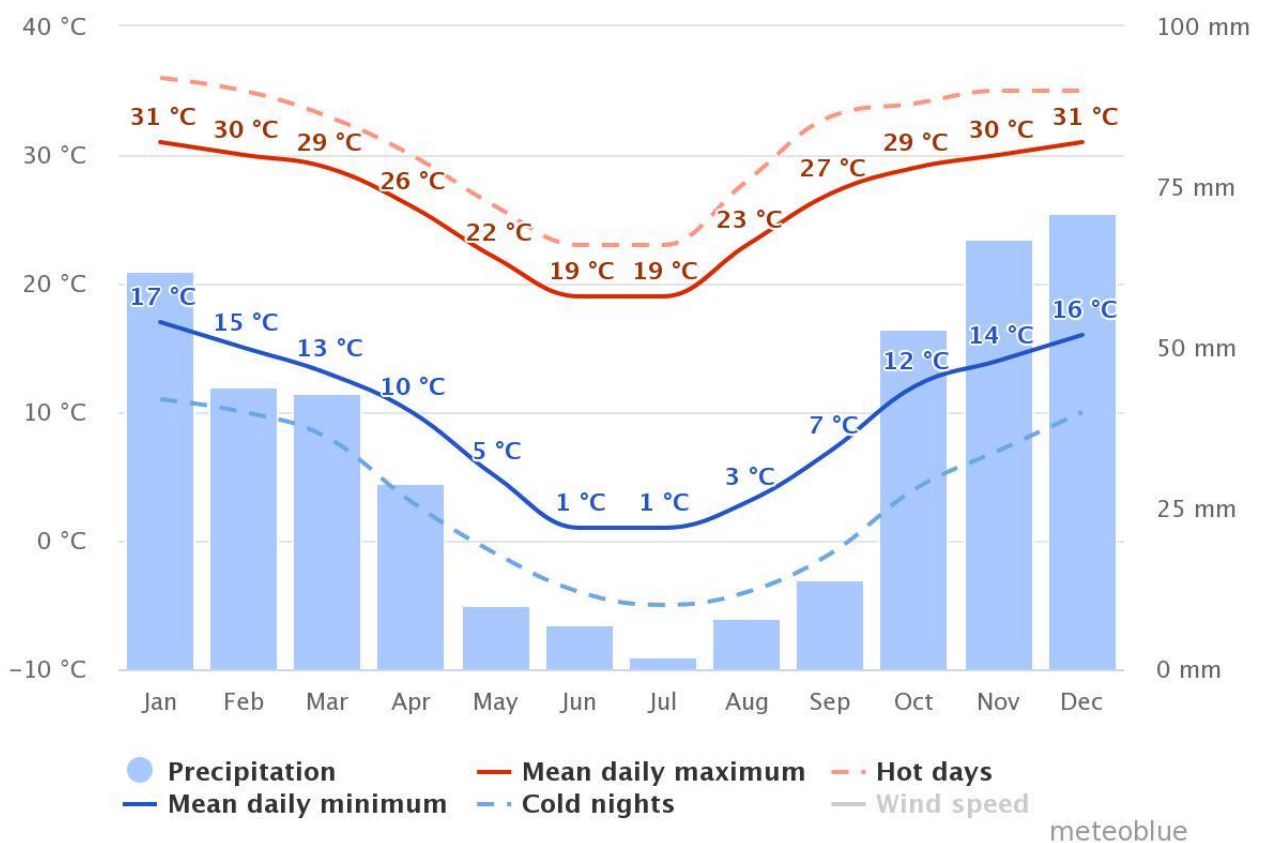


Figure 6.3: Climate graph for the Allanridge area, Free State Province within which the project site is located (source: Meteoblue 2022)

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-J**) undertaken for this EIA Report.

6.4.1. Topographical profile

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 Harmony Target Solar PV site has an elevation of approximately 1261m. The topography of the area is relatively flat, with the area surrounding Allanridge characterised by rolling plains and low hills. The rolling plain elevations range from 1 250m above mean sea level (amsl) to 1 460m amsl. 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%.

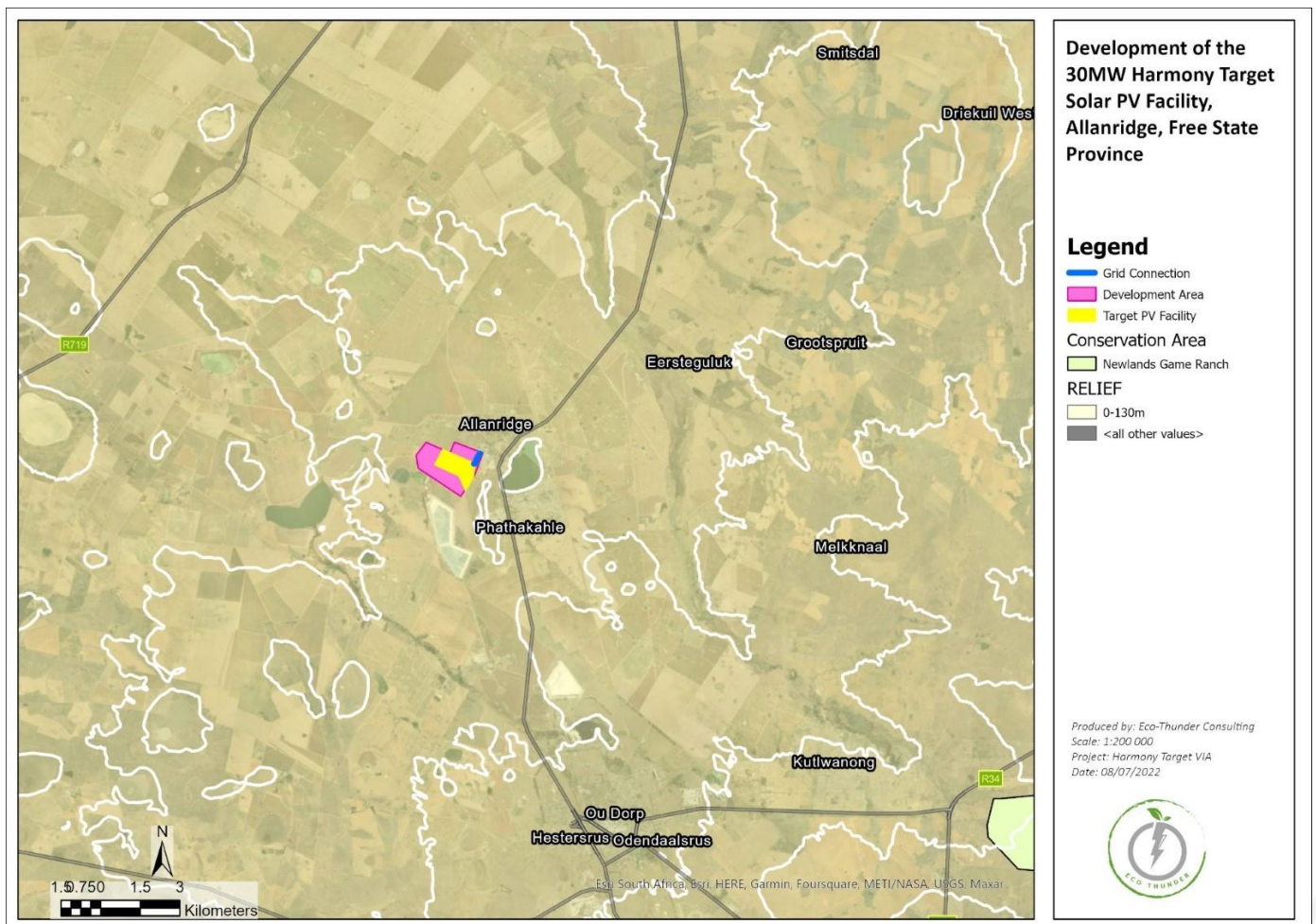


Figure 6.4: Topography for the Allanridge area, in the Free State Province

6.4.2. Geology, Soils and Agricultural Potential

The sedimentary rocks underlying the survey area are made up of grey to black silty shale with thin, usually bioturbated, siltstone and sandstone lenses and beds of the Upper Ecca Volksrust Formation. It is generally accepted to be Middle Permian in age. The formation is a predominately argillaceous unit which interfingers

with the overlying Beaufort Group and underlying Vryheid Formation (Ecca Group). It represents a transgressive sequence consisting largely of mud deposited from suspension when large, swampy deltas were formed after Gondwana started to drift from the Antarctic region and rivers flowing into the inland Karoo Sea deposited large amounts of sediment along its shorelines.

The study area contains three soil forms. These are the Valsrivier (Va), Sepane (Se) and Clovelly (Cv) soil forms. The Valsrivier soil form occurs over the majority of the site and comprises an orthic A-horizon that overlies a pedocutanic B-horizon and unconsolidated material without signs of wetness. The Sepane soil form only occurs near the seasonal stream on the property and only marginally forms part of the proposed site. It comprises an orthic A-horizon that overlies a pedocutanic B-horizon and unconsolidated material with signs of wetness as a result of the proximity to the seasonal stream. The Clovelly soil form only occurs in a small portion of the site in the south western corner of the site. It comprises an orthic A-horizon that overlies a yellow brown apedal B-horizon and unspecified material. The soils of the area are defined by the pedocutanic B-horizon. These poorly permeable layers impede water infiltration, internal drainage and flow out of the profile. Plant available water is low and plant root development is inhibited by the high clay content and compaction of the soils. The Harmony Target Solar PV development area includes three different land capability classes according to the land capability data (DALRRD, 2017). **Figure 6.5** indicates the position of the different classes within the farm portions that form the proposed development area. The entire development area largely consists of land with Moderate (Class 8) to Moderate High (Class 9) land capability. Smaller patches in the northeast consist of land with Low- Moderate (Classes 06) land capability. Classes 08 and 09 have potential to produce specific crops under rainfed conditions while classes 06 and 07 are likely to be very marginal arable land that is more suitable for livestock grazing.

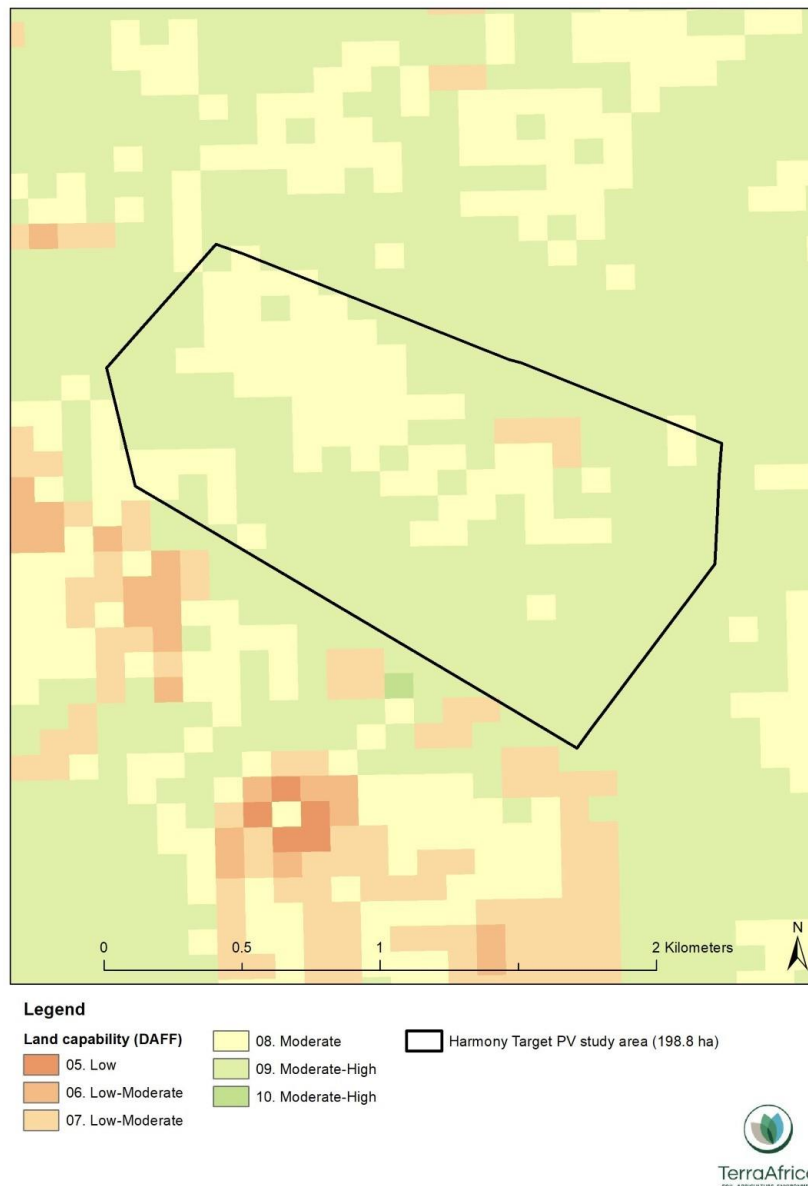


Figure 6.5: Illustration of the land capability classification (Source: TerraAfrica)

The development area consists of Land Type Ae40, as illustrated in **Figure 6.6**. Land Type Ae40 consists of three terrain units and the landscape can be described as slightly undulating with slopes ranging between 1% and 2%. The soil formed from sandstone, mudstone and shale. The toe-slope (Terrain unit 4) is dominated by deep Clovelly and Hutton soil forms (>1.2m). Terrain unit 4 (toe-slopes) forms 92% of land type Ae40. The valley bottom consists of deep Katspruit and Rensburg soil forms (0.5m-0.9m).

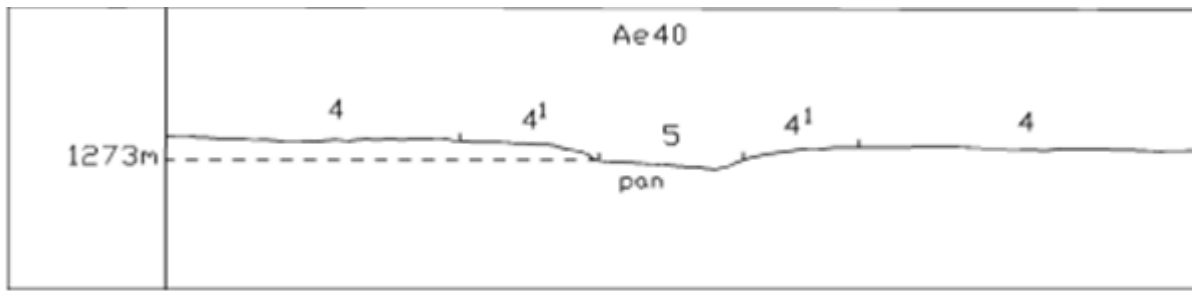


Figure 6.6: Illustration of land type (Land Type Survey Staff, 1972 - 2006)

6.4.3. Land Use

The proposed development is approximately 14km south Allanridge and 16km north of the town Odendaalsrus. The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture to the south-west and broader south and western area. Agricultural activities include the production of maize, wheat, and sunflower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

The proposed development is also located in an area which are noted to have various bodies of water on either side of the development. Additionally, to the north, both the existing target mine and the town of Allanridge is in close proximity to the development. To the South East of the development the small settlement of Nyakallong can be found. To the west of the development the area is predominantly un developed or used for agricultural practices.

The R30 road provides access to the region and is the main connecting route in between Klerksdorp and Welkom. The proposed PV facility sites is accessible from various Target Mine access roads running directly adjacent to the site.

Besides the mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines

The extent of the development area consists of rainfed agriculture (maize fields), mining activities and the populated or built-up land.

- » The project site was previously utilised by Harmony Gold for mining activities.
- » Most of the study area is covered by cultivated land and historically ploughed land which consists currently of secondary grassland. However, the north-eastern part of the study area is mainly transformed and consists of mining infrastructure (e.g. the Harmony Target plant) and build-up land which contain manicured parks.
- » The study site is also surrounded by numerous endorheic pans, as well as pollution control dams and the large Stinkpan (east of the study site). These pan basins, when inundated provides foraging, roosting and breeding habitat for large congregations of waterbird and shorebird species, including species that are globally and regionally threatened and near threatened.

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

i. Vegetation Type

The study area is situated south and on the outskirts of the town of Allanridge and to the east of the Stinkpan waterbody. The development area is fairly large but is dominated by grassland plains without prominent slopes and has an approximate extent of 100ha. The majority of this area has previously been transformed by urban development, mining operations and agricultural crop fields. Subsequently those portions of previous cultivation 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.

The Vaal-Vet Sandy Grassland occurs in the Free State and North West provinces, where it extends from Lichtenburg and Ventersdorp southwards to Klerksdorp, Leeudoringstad, Bothaville and the Brandfort area north of Bloemfontein. It occurs at an altitude of 1 220-1 560 m and is mainly confined to aeolian and colluvial sand overlying shales and mudstones. The floristic structure of the Vaal-Vet Sandy Grassland is mainly a low tussocky grassland with many karroid elements. In its untransformed condition, *Themeda triandra* is an important dominant graminoid, while intense grazing and erratic rainfall is responsible for an increase of *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta*.

The Vaal-Vet Sandy Grassland is a threatened (**Endangered**) ecosystem with only a few remaining patches of untransformed grassland being statutorily conserved (c. 0.3 % at Bloemhof Dam, Schoonspruit, Sandveld, Faan Meintjies, Wolwespruit and Soetdoring Nature Reserves). In addition, the Vaal-Vet Sandy Grassland is a Critically Endangered Ecosystem (as per Section 52 of National Environmental Management Biodiversity Act, (Act No. 10 of 2004)) and a Critical Biodiversity Area as per the Free State Conservation Plan (DESTE, 2015). More than 63 % of this grassland type is already transformed by intense livestock grazing and mining activities. The borders of these natural areas have also been refined by the current site survey.

The National Vegetation Map, as depicted in **Figure 6.7** in the preceding section, designates the project area to have Vaal-Vet Sandy Grassland (NBA, 2019), having an Endangered status (NBA, 2019). Much of the vegetation unit is transformed, being prime agricultural land, with remnant patches comprising natural and near natural (sometimes secondary) remaining.

Project : Harmony Target PV Layout - Vegetation and Status (National)

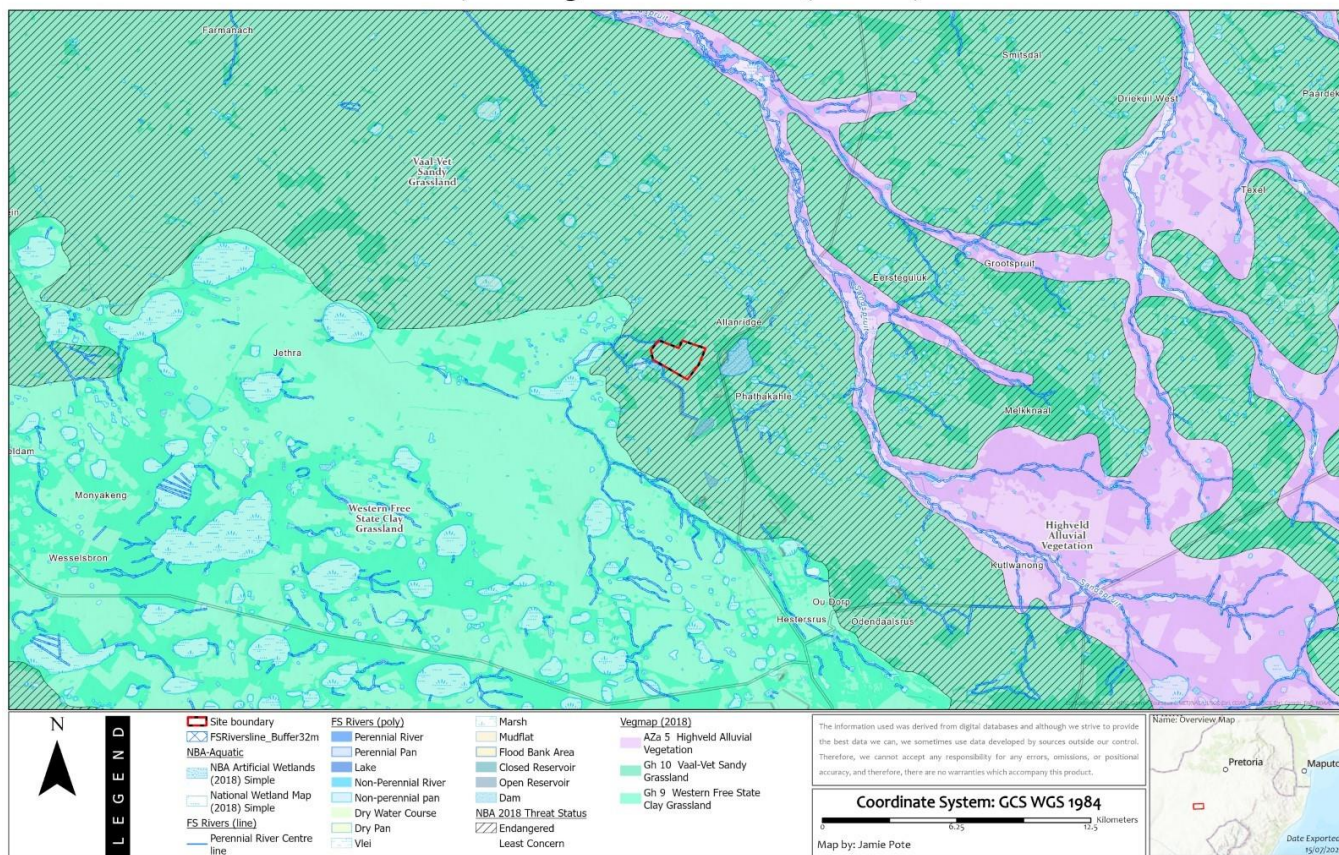


Figure 6.7: Vegetation map of the project site showing the Harmony Target Solar PV facility

The following plant species have been identified in the development area:

- » **Grasses:** *Antheophora pubescens* (d), *Aristida congesta* (d), *Chloris virgata* (d), *Cymbopogon caesius* (d), *Cynodon dactylon* (d), *Digitaria argyrograpta* (d), *Elionurus muticus* (d), *Eragrostis chloromelas* (d), *E. lehmanniana* (d), *E. plana* (d), *E. trichophora* (d), *Heteropogon contortus* (d), *Panicum gilvum* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Tragus berteronianus* (d), *Brachiaria serrata*, *Cymbopogon pospischilii*, *Digitaria eriantha*, *Eragrostis curvula*, *E. obtusa*, *E. superba*, *Panicum coloratum*, *Pogonarthria squarrosa*, *Trichoneura grandiglumis*, *Triraphis andropogonoides*.
- » **Herbs:** *Stachys spathulata* (d), *Barleria macrostegia*, *Berkheya onopordifolia* var. *onopordifolia*, *Chamaesyce inaequilatera*, *Geigeria aspera* var. *aspera*, *Helichrysum caespitium*, *Hermannia depressa*, *Hibiscus pusillus*, *Monsonia burkeana*, *Rhynchosia adenodes*, *Selago densiflora*, *Vernonia oligocephala*.
- » **Low shrubs:** *Felicia muricata* (d), *Pentzia globosa* (d), *Anthospermum rigidum* subsp. *pumilum*, *Helichrysum dregeanum*, *H. paronychioides*, *Ziziphus zeyheriana*.
- » **Geophytic Herbs:** *Bulbine narcissifolia*, *Ledebouria marginata*.
- » **Succulent Herbs:** *Tripteris aghillana* var. *integrifolia*.
- » **Endemic Taxa:** *Lessertia phillipsiana* (herb)

ii. Red Listed, Endemic and Protected Flora

National Environmental Screening Tool flagged no flora species. Further screening of species on the site concluded that no species of conservation concern having an elevated status and/or limited distribution range are confirmed present. Species protected in terms of the Free State Nature Conservation Ordinance were found but are all widespread species; however, a FSNCO permit would none the less be required should they require removal during construction.

iii. Regional Planning Risk Assessment Mapping

A summary of these risks and issues is provided below, to be read in conjunction with the map in **Figures 6.8:**

- » **Critical Biodiversity Area 1 (CBA 1)** – CBA 1 designated areas are those that have been identified as priority areas to be retained in order to meet conservation targets. The land use guidelines for CBA 1 designated areas recommend no further development. The designation may not necessarily be based on the condition of the habitat, species composition, ecological connectivity or overall ecological value since it is largely based on a statistical analysis process, which will be assessed during the assessment phase, based on the proposed layout. A CBA1 area is located peripheral to the site and development footprint, in the western corner of the project site.
- » **Critical Biodiversity Area 2 (CBA 2)** – As for above, however these areas are deemed to be degraded but deemed priority areas. The land use recommendations for CBA 2 designated areas are broadly speaking restore and maintain to meet conservation targets. None flagged.
- » **Ecological Support Area 1 (ESA 1)** – not essential for meeting biodiversity targets, maintain in a functional, near-natural state. Some loss is acceptable as long as it does not compromise landscape ecological functioning and connectivity. None flagged.
- » **Ecological Support Area 2 (ESA 2)** - not essential for meeting biodiversity targets, maintain in a functional, near-natural state and/or restore where transformed or degraded. Some loss is acceptable as long as it does not compromise landscape ecological functioning and connectivity. The bulk of the development footprint is located within a ESA2
- » **Endangered Ecosystem** - Vaal-Vet Sandy Grassland currently has an Endangered conservation status, meaning that is under threat and further avoidable loss of intact vegetation is not advisable.
- » **Aquatic CBA and/or Freshwater Ecosystem Priority Areas** – None flagged in desktop assessment.
- » **National Protected Area Expansion Strategy Areas (NPAES)** – No National PAES areas overlay with the site, nor are in vicinity.
- » **Watercourses, Rivers, and Wetlands** – None flagged during the desktop phase, site assessment confirms presence of several watercourse and wetland features.
- » **Rocky Dolerite Hills, Ridges, and Outcrops** – None present.

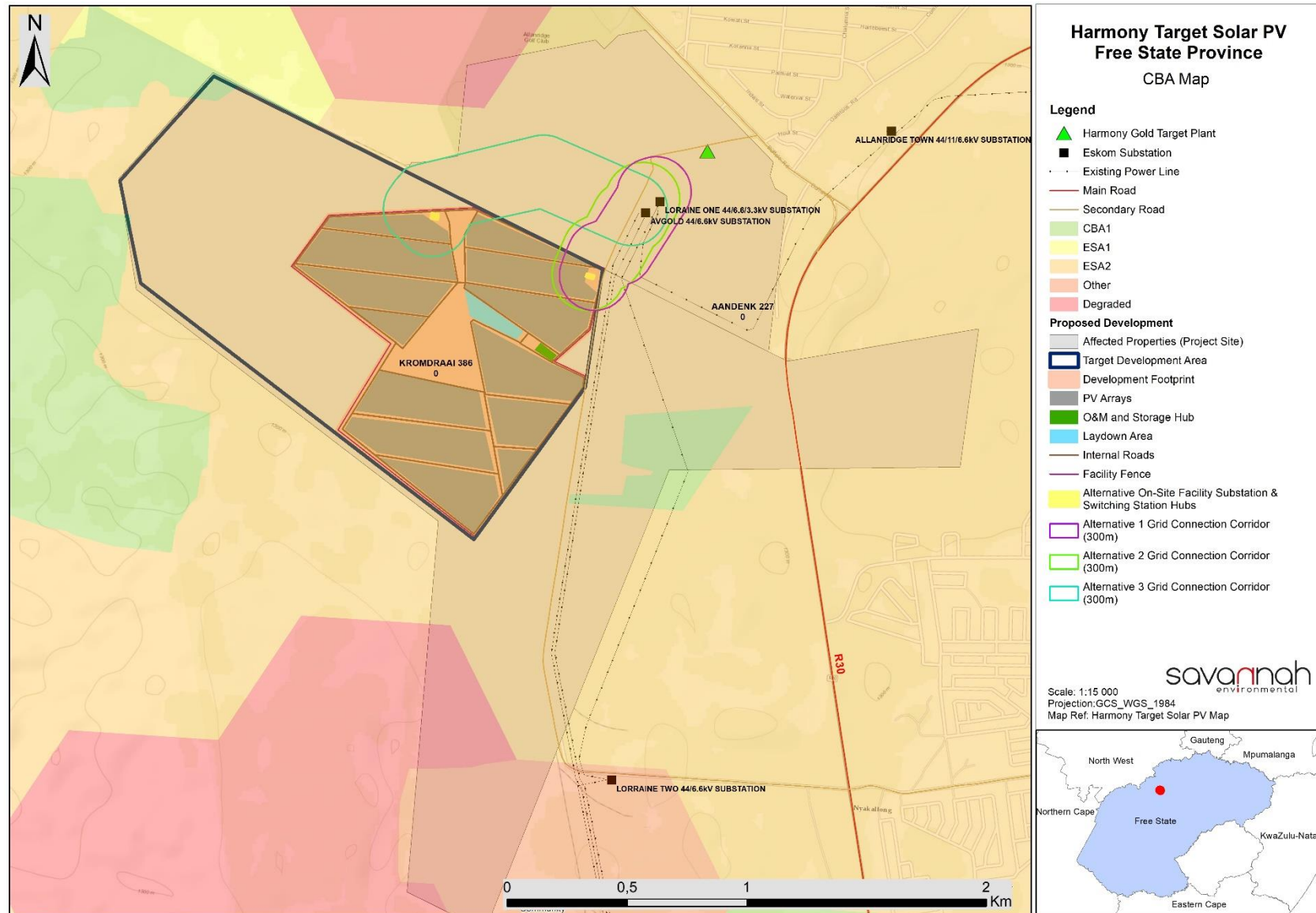


Figure 6.8 shows the project area superimposed on the Terrestrial CBA maps

iv. Wetlands and Freshwater Resources

There are four wetlands inside the project area, but there are nine more within 500m of the project area (refer to **Figure 6.9**). All of the wetlands are depression wetlands, some natural and others artificial.

The wetlands inside the development area are in a poor condition as they were ploughed in the past for agricultural crops. Some were not ploughed recently and have had some time to recover, but all are still dominated by weeds.

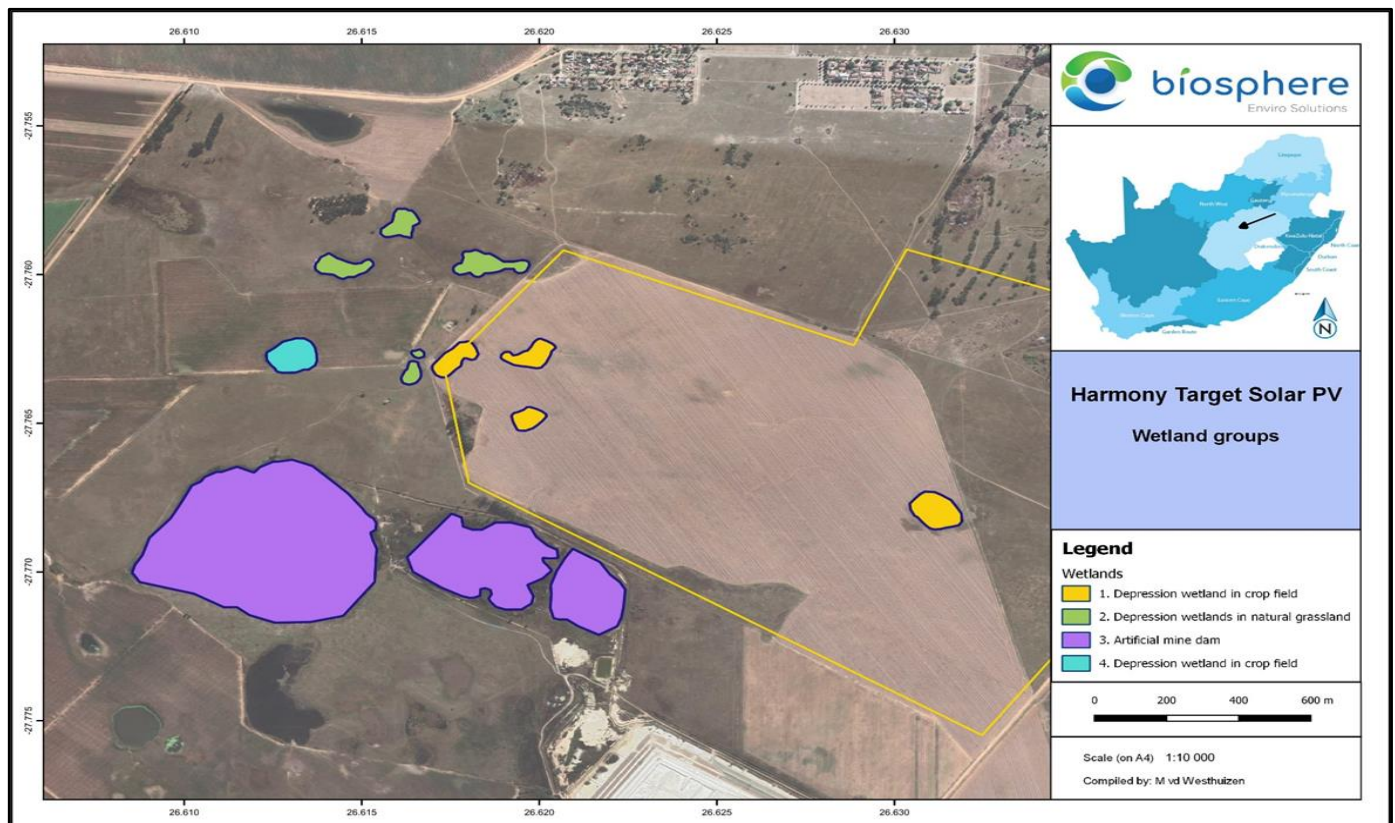


Figure 6.9: Wetland delineation map for the Harmony Target Solar PV site

Table 6.1: Description of the identified wetland areas on site

Feature	1. Endorheic Depression Wetlands in agricultural crop fields (in project area)	2. Endorheic depression wetlands in natural grassland (outside project area)	3. Exorheic Depression Wetlands south of project area (Mine dams)	4. Endorheic depression wetlands in agricultural crop fields (outside project area)
Catchment Features and Current Impacts	The catchment area of this assessed wetlands consists mostly of cultivated crops (that has not been planted this season and now consists of weeds), natural veld used for cattle grazing and gold mining activities.	The catchment area of this assessed wetlands consists mostly of natural veld used for cattle grazing and cultivated crops.	The catchment area of the assessed wetlands consists mostly of disturbed grassland, gold mining activities and cultivated crops.	The catchment area of this assessed wetlands consists mostly of cultivated crops and natural veld used for cattle grazing.
Wetland Type	Endorheic Depression Wetland	Endorheic Depression Wetland	Exorheic Depression Wetland	Endorheic Depression Wetland
Downstream Features	None – there is no outflow from the wetland	None – there is no outflow from the wetland	Agricultural crops, disturbed grassland, dams, mining activities	None – there is no outflow from the wetland
Vegetation Characteristics	Vegetation consists of weeds (<i>Conyza bonariensis</i> , <i>Pseudognaphalium luteo-album</i> , <i>Lobelia erinus</i>) and sedges (<i>Schoenoplectus</i> spp., <i>Cyperus</i> spp.)	Hydrophilic vegetation such as sedges (<i>Cyperus</i> & <i>Schoenoplectus</i> spp.), <i>Potamogeton schweinfurthii</i> and grasses	Vegetation consists of the tree <i>Eucalyptus camaldulensis</i> , grasses, weeds (<i>Tagetes minuta</i> , <i>Opuntia</i> sp.) and sedges	Hydrophilic vegetation such as sedges (<i>Cyperus</i> & <i>Schoenoplectus</i> spp.), and grasses
Algae Presence	No, no standing water during site visit	Yes	Yes	Yes
Aquatic Faunal Impacts	No	Disturbance by cattle	Water pollution by mining activities	Disturbance by cattle
Depth Characteristics	No water	Up to 50cm	Deep, not measured	Up to 50cm
Flow Conditions	No flow	No flow	Slow flow	No flow
Water Clarity	N/A	Moderate turbidity	High turbidity	Moderate turbidity
Water Odour	None detected	None detected	None detected	None detected

Erosion Impacts	Low erosion potential as the wetland vegetation is moderately dense.	Low erosion potential as the wetland vegetation is moderately dense.	Low erosion potential as the wetland vegetation is quite dense.	High erosion potential as the catchment of this wetland is cultivated and vegetation is sparse
Soil characteristics	Mottling is present between 40 and 50cm	Gleying and mottling present	Gleying	Gleying and mottling present



Figure 6.10: Group 1 Depression wetland in project area dominated by weeds



Figure 6.11: Group 2 depression wetland in natural grassland



Figure 6.12: Group 3 exorheic wetlands (mine dams)



Figure 6.13: Group 4 endorheic depression wetland in crop field outside project area

6.4.5. Avifauna profile for the area

Regional Vegetation Description

From an avifaunal 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.

Conservation Areas, Protected Areas and Important Bird Areas

The study site does not coincide with any formal conservation area or Important Bird and Biodiversity Area (IBA). The nearest legal conservation area to the proposed study site is the Sandveld and Bloemhof Dam Nature Reserves, which is located 45 km north-west of the study site. The Sandveld and Bloemhof Dam Nature Reserves are also a recognised IBA (SA039).

Annotations on the National Web-Based Environmental Screening Tool

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 **low** avian theme sensitivity.



Figure 6.14: The relative avian sensitivity of the study site and immediate surroundings according to the Screening Tool.

Preliminary avifaunal habitat types

Apart from the regional vegetation type, the local composition and distribution of the vegetation associations on the study site and immediate surroundings are a consequence of a combination of factors simulated by geomorphology, presence of wetland features and past land use practice which have culminated in a number of habitat types that deserve further discussion¹ (**Figure 6.15**):

- » **Secondary grassland:** This unit is prominent on the eastern part of the study site of which most were historically under cultivation in the past. It represents a grassland sere with a secondary graminoid composition that is dominated by *Cynodon dactylon* and graminoid species of the genus *Eragrostis*. The expected bird composition is represented by widespread cryptic grassland species. Typical bird species expected to be present include Desert Cisticola (*Cisticola aridulus*), Red-capped Lark (*Calandrella cinerea*), Ant-eating Chat (*Myrmecocichla formicivora*) and Double-banded Courser (*Rhinoptilus africanus*). It also provides foraging and breeding habitat for the collision-prone species, the Northern Black Korhaan (*Afrotis afraoides*).
- » **Pans, depressions, pollution control dams and Stinkpan:** These habitat features include a number of mainly endorheic pan basins which becomes seasonally inundated during the austral wet season. They provide foraging, roosting and also breeding habitat for a diversity of waterbird species, of which the richness is proportional to the surface area and depth of the pans. Thereby, large, shallow pans are more likely to sustain larger congregations of waterbird numbers and waterbird species. Most of these pans occur along the periphery of the study site, but are regarded as an "inter-connected" system of pans,

meaning that none of the pans within the local catchment are similar to each, thereby providing a continuous supply of resources for waterbirds which tend to commute on a daily basis over the study site. Furthermore, the large and nearby Stinkpan also provides important foraging habitat for two near threatened flamingo species as well as the globally engendered Maccoa Duck (*Oxyura maccoa*) (pers. obs.).

- Most of the basins of depressions on the study site is colonised by moist grassland, and these are more likely to provide habitat for a unique bird composition represented by smaller wetland-associated passerine species, such as Zitting Cisticola (*C. juncidis*), Levillant's Cisticola (*C. tinniens*) and Quailfinch (*Ortygospiza atricollis*).
 - A series of pollution control dams are located near the south-western boundary of the study site and these also provide ephemeral habitat for a variety of waterbird species, most notably Cape Teal (*Anas capensis*), Black-winged Stilt (*Himantopus himantopus*), Cape Shoveller (*A. smithii*), Red-billed Teal (*A. erythrorhyncha*) and Black-necked Grebe (*Podiceps nigricollis*).
- » **Transformed, landscaped (manicured) areas and cultivation:** These areas are represented by build-up land and landscaped areas as well as areas under active commercial cultivation. The manicured park is earmarked by a distinct tree dominated by *Searsia lancea* which was artificially planted. These "parks" area colonised by a high number of bird species which favour the vertical heterogeneity provided by the tree canopy. The bird composition is expected to be represented by a "bushveld" composition which is often present in semi-urban landscaped (manicured) gardens and parks (c. *Ring-necked Dove Streptopelia capicola*, *Rattling Cisticola Cisticola cheniana*, *Red-eyed Dove S. semitorquata*, *Cape Starling Lamprotornis nitens*), *Chestnut-vented Warbler (Curruca subcaerulea)*, *Blue Waxbill (Uraeginthus angolensis)* and *Green Wood-hoopoe (Phoeniculus purpureus)*.

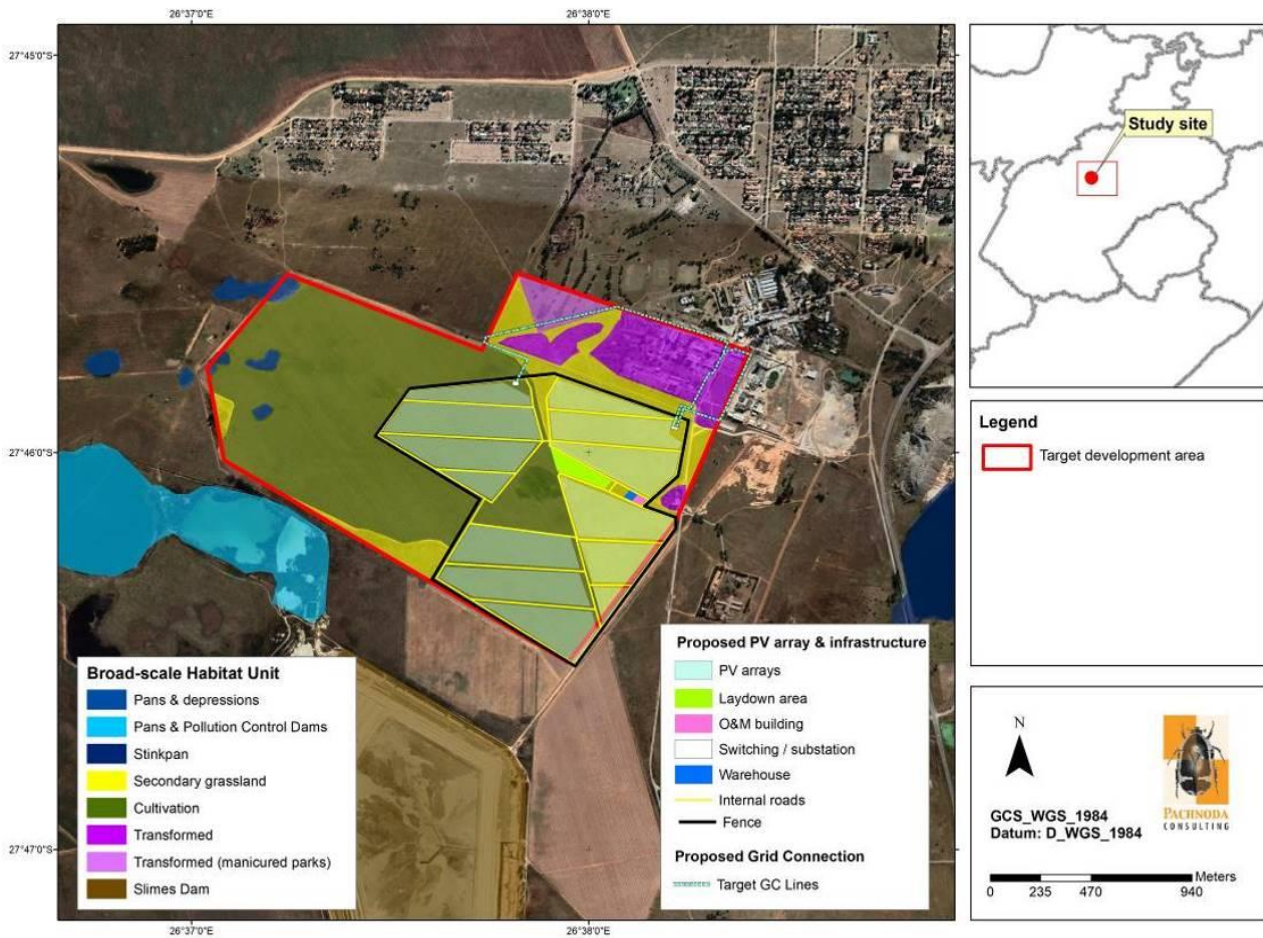


Figure 6.15: A broad-scale habitat map illustrating the avifaunal habitat types on the study area and immediate surroundings. It is evident from **Figure 6.15** that the majority of development footprint is transformed as a result of cultivation.

Species Richness and Predicted summary statistics

Approximately ~132 bird species have been recorded within the study area, although it is more likely that between 50-70 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) (Harrison et al., 1997; www.sabap2.birdmap.africa) and the presence of suitable habitat in the study area. This equates to 13 % of the approximate 990 species listed for the southern African subregion (and approximately 15 % of the 871 species recorded within South Africa). However, an average number of 48 species for each full protocol card submitted, were recorded for the pentad grid 2745_2635 corresponding to the study area (for observations of two hours or more; range= 1 - 78 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 African Wattled Lapwing (*Vanellus senegallus*), Double-banded Courser (*Rhinoptilus africanus*) and the Green-winged Pytilia (*Pytilia melba*).

According to **Table 6.2**, biome-restricted species remained to be absent on the study area and the local endemic and near-endemic bird richness were extremely low. It also a low diversity of regional endemics,

with 9% of the endemic species present in the subregion. In addition, a large percentage of the species recorded in the study area is represented by waterbirds and shorebird taxa (ca. 38% of the total number of recorded bird species, sensu SABAP2).

Table 6.2: 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
Total number of species*	132 (13 %)
Number of Red Listed species*	5 (3.6 %)
Number of biome-restricted species – Zambezi and Kalahari-Highveld Biomes)	0 (0 %)
Number of local endemics (BirdLife SA, 2022)*	1 (3 %)
Number of local near-endemics (BirdLife SA, 2022)*	3 (10 %)
Number of regional endemics (Hockey et al., 2005)**	10 (9 %)
Number of regional near-endemics (Hockey et al., 2005)**	7 (11 %)

* only species in the geographic boundaries of South Africa (including Lesotho and eSwatini) were considered.

** only species in the geographic boundaries of southern Africa (including Namibia, Botswana, Zimbabwe and Mozambique south of the Zambezi River) were considered

*** Percentage values in brackets refer to totals compared against the South African avifauna (sensu BirdLife SA, 2022)

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**, a total of five species could occur on the study area which includes one globally threatened species, one globally near threatened species, two regionally threatened species and one regionally near-threatened species.

It is evident from **Table 6.3** that the highest reporting rates (>50%) were observed for the globally near threatened Lesser Flamingo (*Phoeniconaias minor*) and regionally near threatened Greater Flamingo (*Phoenicopterus roseus*). These two species are regarded as regular foraging visitors to the nearby pans (including the pollution control dams) and Stinkpan which is located adjacent to the study area. At least 10 individuals of Greater Flamingo and 50 individuals of Lesser flamingo were counted on Stinkpan during the July survey. However, these species are probably absent on the physical study site due to the absence of any suitable habitat on the study site. Nevertheless, birds dispersing or commuting between the nearby pans and Stinkpan, will have to fly over the study area and could potentially interact (collide) with the PV panels and associated electrical infrastructure. In addition, the close proximity of these water features to the study site will also increase the risk of these species interacting with the PV infrastructure.

The remaining species have low reporting rates (<20%) and are regarded as irregular foraging visitors to the study site with the exception of the globally endangered Maccoa Duck (*Oxyura maccoa*). The latter species was probably overlooked in the past and is regarded as regular foraging visitors (and probably also breeding visitors) to the nearby Stinkpan. At least four individuals were observed on Stinkpan during the July survey .

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
<i>Circus ranivorus</i> (African Marsh Harrier)	-	Endangered	16.67	Restricted permanent wetlands with extensive reedbeds.	Probably absent from the study site, although it could occur along the well-vegetated margins of the nearby Stinkpan. Only known from a single observation during 2011 in the study region. (sensu SABAP2).
<i>Oxyura maccoa</i> (Maccoa Duck)	Endangered	Vulnerable	16.67	Large saline pans and shallow impoundments.	A regular foraging visitor and possibly also breeding visitor to the pans and impounds adjacent to the study site. It was observed on Stinkpan (July 2022; pers. obs.). Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between pans could potentially fly over the site and may interact with the PV panels and electrical infrastructure.
<i>Mycteria ibis</i> (Yellow-billed Stork)	-	Endangered	16.67	Wetlands, pans and flooded grassland.	Probably an irregular foraging visitor to the pans in the region. It is currently only known from a single recent record obtained during 03 March 2022 (sensu SABAP2). Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between pans could potentially fly over the site and may interact with the PV panels and electrical infrastructure.
<i>Phoeniconaias Minor</i> (Lesser Flamingo)	Near-threatened	Near-threatened	66.67	Restricted to large saline pans and other inland water bodies containing cyanobacteria.	A regular foraging visitor to the shallow margins of Stinkpan (pers. obs.) and probably also the nearby smaller pans. Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between the pans and dams in the area could potentially fly over the site and may interact with the PV panels and electrical infrastructure.

<p><i>Phoenicopterus roseus</i> (Greater Flamingo)</p>	<p>-</p>	<p>Near-threatened</p>	<p>83.33</p>	<p>Restricted to large saline pans and other inland water bodies.</p>	<p>A highly regular foraging visitor to the shallow margins of Stinkpan (pers. obs.) and probably also the nearby smaller pans. Probably absent on the physical study site due to the absence of suitable habitat. Birds dispersing between the pans and dams in the area could potentially fly over the site and may interact with the PV panels and electrical infrastructure.</p>
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The proposed PV facility corresponds to the Grassland Biome and more particularly to the Dry Highveld Grassland Bioregion as defined by Mucina & Rutherford (2006). It comprehends an ecological type known as Vaal-Vet Sandy Grassland (Mucina & Rutherford, 2006)

From an avifaunal 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.

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

6.5.1. State of the Site

The potentially affected area associated with the proposed PV facility is located in the Target mining area, in the Free State province of South Africa. The footprint for potential development is largely flat, and characterised - over substantial portions - by ploughed agricultural camps in the western most two-thirds. The upper sediments in the agriculturally affected regions (western portion) have thus been extensively disturbed through agricultural processes, and the original quaternary deposits have been reworked or removed to depths in excess of ~0.5m in several places, as a consequence of agriculture and/or mining related clearing (TG1).

Local bedrock outcrops ephemerally at several points east of the affected area. This bedrock is comprised largely of shales and indurated siltstones (Ecca Group), whereas the upper sediments covering these host rocks, and the footprint itself, likely derive from the in-situ weathering of local parent formations. The upper sediments were fluviially deposited across much of the area (as evidenced by sub-angular edges and rounding of lithic inclusions), and potentially relate in depositional origin to summer flooding of the drainages to the south and west.

In the eastern portion of the affected property, where natural landscape is primarily retained (i.e. unaffected by modern activity), grassland and semi-arid shrubland is evident with shale and some evidence for sub-volcanic rock in the form of small secondary colluvial nodules (<5cm in maximum diameter) in several locations.

The western portion of the affected property is interspersed with vehicle tracks where grass has been trampled and/or removed, probably to facilitate vehicle manoeuvrability between agricultural infrastructure and to facilitate movement associated with prospecting. Indigenous fowl including francolin and guineafowl were observed on the affected property, in addition to abundant traces of burrowing rodents (predominantly hares), which may well affect any potential sub-surface archaeology (though no sub-surface remains were documented).

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)." Archaeological sites spanning the Earlier, Middle and Later Stone Age have been found in the region despite the extensive agricultural and mining transformation of the area.

The Stone Age archaeological footprint in the region is largely represented by the occurrence of open-site, Middle Stone Age (MSA) and Later Stone Age (LSA) assemblages that are mainly located near river drainages. Interestingly, a large number of MSA artifacts were found 2m below the surface at the Allanridge railway siding in 1953. There are no records of rock engravings known from the area. The ruins of a large complex of Late Iron Age settlements (OXF 1, Maggs 1976) are found at Strydfontein between Hennenman and Ventersburg. However, it is noted that the affected area is situated outside the western periphery of distribution of Late Iron Age settlements below the Vals River in the Free State (Maggs 1976)." In Rossouw's assessment, he found no evidence of in situ Stone Age or Iron Age archaeological material. He noted no indications of prehistoric structures or rock engravings, historical buildings or structures older than 60 years. Two small graveyards were also recorded during the survey. Despite the high number of heritage impact assessments completed in the broader area, only one archaeological site of significance have been identified in close proximity to the proposed development area. This is likely due to the extreme transformation of the area as a result of historic and ongoing gold mining activities.

6.5.3. Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate fossil sensitivity consisting of caenozoic regolith according to the extract from the CGS 2726 Kroonstad Geology Map. According to a Palaeontological assessment completed by Groenewald (2013) for a development located nearby in similar sediments, "No fossils have been described from the quaternary aeolian deposits in the study area, although fossil finds have been recorded from similar aged sediments, for example: the Cornelia Formation in the north-eastern Free State (Johnson et al, 2006)." It is possible that sensitive sediments of the Adelaide Subgroup underly the Quaternary Sands. According to Groenewald (2013), "The Permian Adelaide Subgroup is interpreted as a meandering river deposit grading upwards into a lacustrine environment and is well-known for containing fossils (Johnson et al, 2006). Although difficult to correlate the study area directly with more well-known outcrops of the lower part of the Adelaide Subgroup to the east, the subgroup is known to contain very good examples of Glossopteris flora as well as numerous remains of vertebrate fossils associated with the Dicynodon Assemblage Zone in the north-eastern part of the Karoo Basin (Groenewald, 1989 and 1996)." Groenewald (2013) concludes that "There is a possibility that fossils could be encountered during excavation into both the quaternary sand deposits and the Adelaide Subgroup sediments within the development footprint. The study area has been extensively modified through agricultural development and it is unlikely that fossils will be exposed in these developed areas."

6.6 Visual Quality

The regional topography or terrain morphology of the region is broadly described as plains and pans of the Central Interior Plain. The slope of the entire study area is even (flat) with a very gradual drop (less than 70m) from the south-east (near the R30) to the north-west of the study area.

The most prominent (and visible) land use within the region is the mining activities, mining infrastructure and mine dumps. Interspersed with these mining activities are agricultural land uses, ranging from irrigated agriculture to the south-west and broader south and western area. Agricultural activities include the production of maize, wheat, and sunflower crops, as well as cattle farming. The farmers working these fields predominantly reside at homesteads or farm residences scattered throughout the study area.

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

- » Allanridge
- » Welkom
- » Bronville
- » Naudeville
- » Bedelia
- » Silwerstraat
- » Bloudrif
- » Virginia
- » Meloding
- » Whites
- » Riebeekstad
- » Odendaalsrus

The R30 road provides access to the region and is the main connecting route in between Klerksdorp and Welkom. The proposed PV facility sites is accessible from various Target Mine access roads running directly adjacent to the site.

Besides the mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines

The site where the facility is to be constructed consists of natural grassland. However, the surrounding environment consists of extensive cultivated fields (extensive maize cultivation) and natural areas are rare. The area cannot be said to consist of extensive natural areas of natural vegetation or recreational areas and therefore the sense of place is not regarded as sensitive. The area surrounding the proposed solar farm contains several dirt roads belonging to the mine facility. These roads service the farming properties as well as the Target mine consequently the amount of road users is low.

Figure 6.16 – 6.18 Of the Visual setting of proposed PV facility



Figure 6.16. Southern View of Proposed PV Facility



Figure 6.17. R30 Road View of development



Figure 6.18. View of Target from the west

6.7 Social Context

6.7.1 Profile of the Broader Area

The Matjhabeng Local Municipality is situated in the Lejweleputswa District in the Free State. According to Statistics South Africa the following towns occur within the municipality's border: Allanridge, Blaauwdrift, Hani Park, Henneman, Kutloanong, Matjhabeng NU, Meloding, Mmamahabane, Odendaalsrus, Phathakahle, Phomolong, Riebeeckstad, Thabong, Tswelangpele, Ventersburg, Virginia, Virginia Mine, Welkom and Whites (STATS SA, 2017). The key social statistics for the area are as follows (STATS SA, 2017)

Description	Number or Percentage
Total Population	406, 461
Youth (0-14)	27.3%
Working Age (15-64)	68.1%
Elderly (65+)	4.7%
Dependency Ratio ²	46.9
Sex Ratio ³	98.3
Growth Rate	-0.04% (measured from 2001 to 2011)
Population Density	79 persons/km ²
Unemployment Rate	37%
Youth Unemployment Rate	49.7%
No Schooling Aged 20+	4.6%
Higher Education Aged 20+	9%
Matric Aged 20+	28%
Number of Households	123.195

Number of Agricultural Households	16.810
Average Household Size	3.1
Female Headed Households	39.8%
Formal Dwellings	78.5%
Housing owned / paying off	58.5%
Flush Toilet connected to Sewerage	81.1%
Weekly Refuse Removal	86.3%
Piped Water Inside Dwelling	54.8%
Electricity for Lighting	91.1%

It is evident that young people within the community struggle with unemployment. The growth rate indicated negative during 2011. The area is reliant on mining and agricultural farming which displayed minimal growth during the last few years. Few economic opportunities are available which resulted in people moving away to larger economic nodes with more work opportunities.

According to the Matjhabeng Local Municipality Integrated Development Plan the second-generation local government was mandated to improve levels of sanitation (Matjhabeng Local Municipality, 2017). The mandates were fulfilled but some of the challenges related to planning and execution of the projects which led to some households not be able to use the proper sanitation (Matjhabeng Local Municipality, 2017). A significant portion of the reticulation system is old and 37.5% proportion of the households uses other forms of toilet facilities (Matjhabeng Local Municipality, 2017).

The Matjhabeng Local Municipality has a total population of 406 461 people of which 87.7% are black, 9.6% are white and 2.1% are coloured.

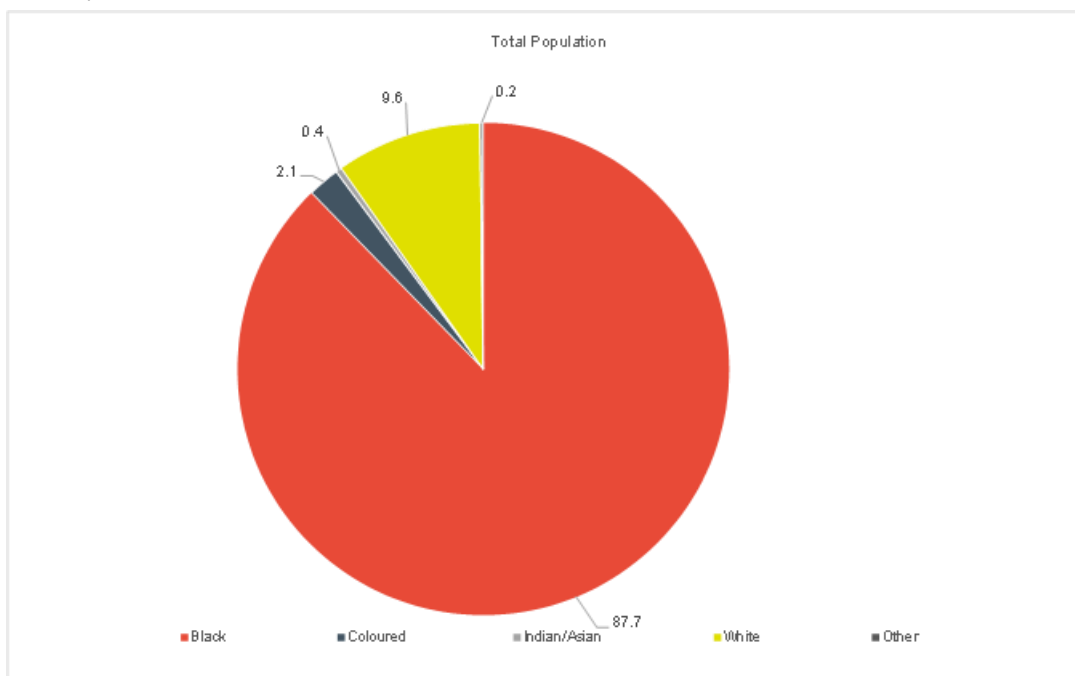


Figure 6.19: Total population percentages for the Matjhabeng Local Municipality

The Matjhabeng Local Municipality has a growth rate of -0.04% which, according to the IDP for the Lejweleputswa District Municipality, is due to the mining sector restructuring and retrenching staff especially unskilled mine workers. The IDP also refers to the increase in petrol price having a detrimental effect on the

growth rate of the municipality as well as employment opportunities. **Figure 6. 20** show the number of people within the Matjhabeng local Municipality who are employed, unemployed, discouraged and not economically active.

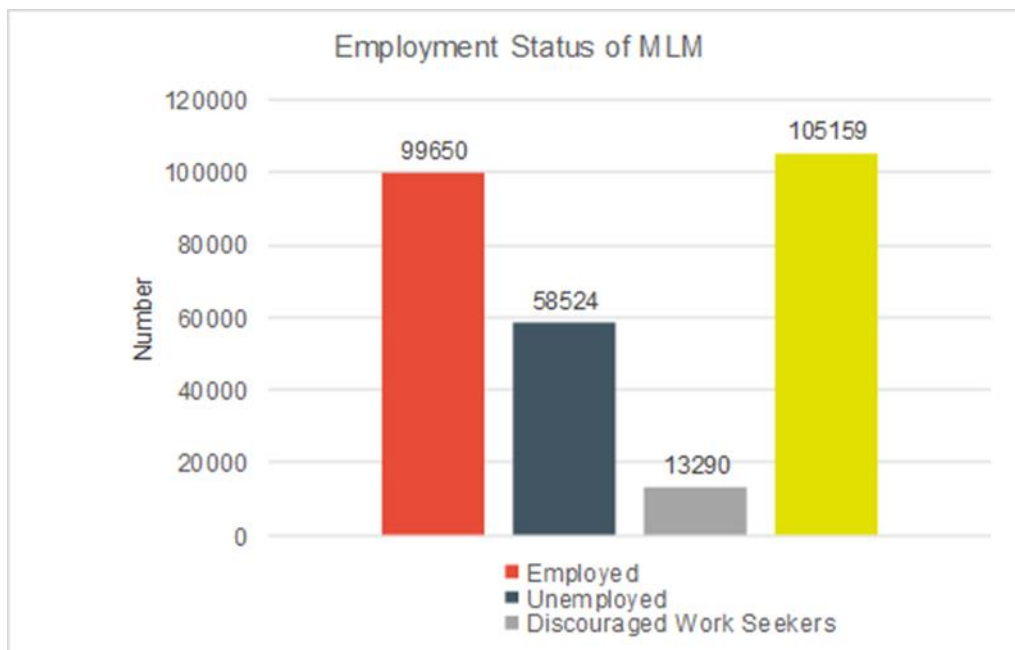


Figure 6.20: Employment status within the MLM

The unemployment rate within the MLM is 37% with 49,7% of that being youth unemployment (between the age of 15-34). Within the Matjhabeng Local Municipality 16,3% of the population does not earn an income. The MLM education levels range from no schooling to higher education. **Figure 6.21** indicates the percentage of the population which attended the various education levels.

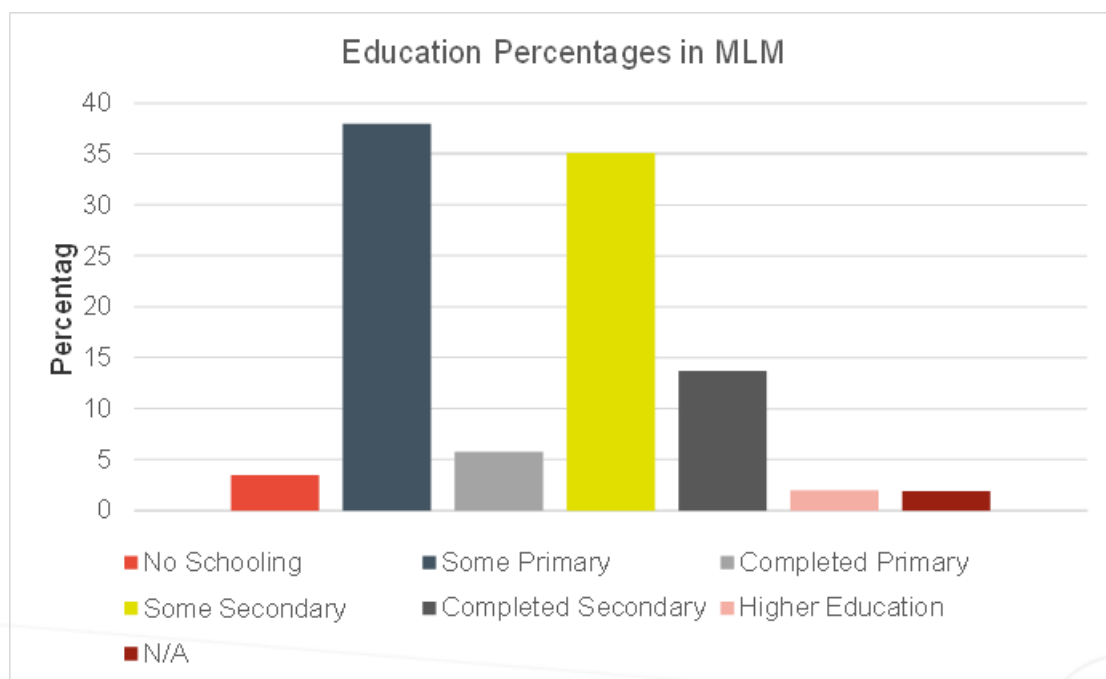


Figure 6.21: Education percentages for the MLM

According to the Census data from 2011 (most recent census), 81.1% of the population within the MLM have access to flushing toilets connected to a sewer line while the rest vary from pit toilets and bucket toilets.

Language

Sesotho is the dominant home language in most of the province. The Free State is the only province in South Africa with a Sesotho majority. Afrikaans is widely spoken throughout the province, as a first language for the majority of whites and coloureds and as a second or third language by Sesotho, Setswana and isiZulu speakers.

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 Target 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 30MW with a development footprint (~105ha)¹³. The infrastructure associated with the 30MW solar PV facility 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, switching station, to be connected to the Avgold Substation via an overhead power line (located ~400m north east of the site).

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the western side of the Avgold Substation (located directly south west of the Loraine One Substation).

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the western side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. at the junction with the secondary road, the route turns south to access the western side of the Avgold Substation.

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 Target Solar PV development area, including the grid connection infrastructure.

¹³ The development footprint is the defined area (105ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Target Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

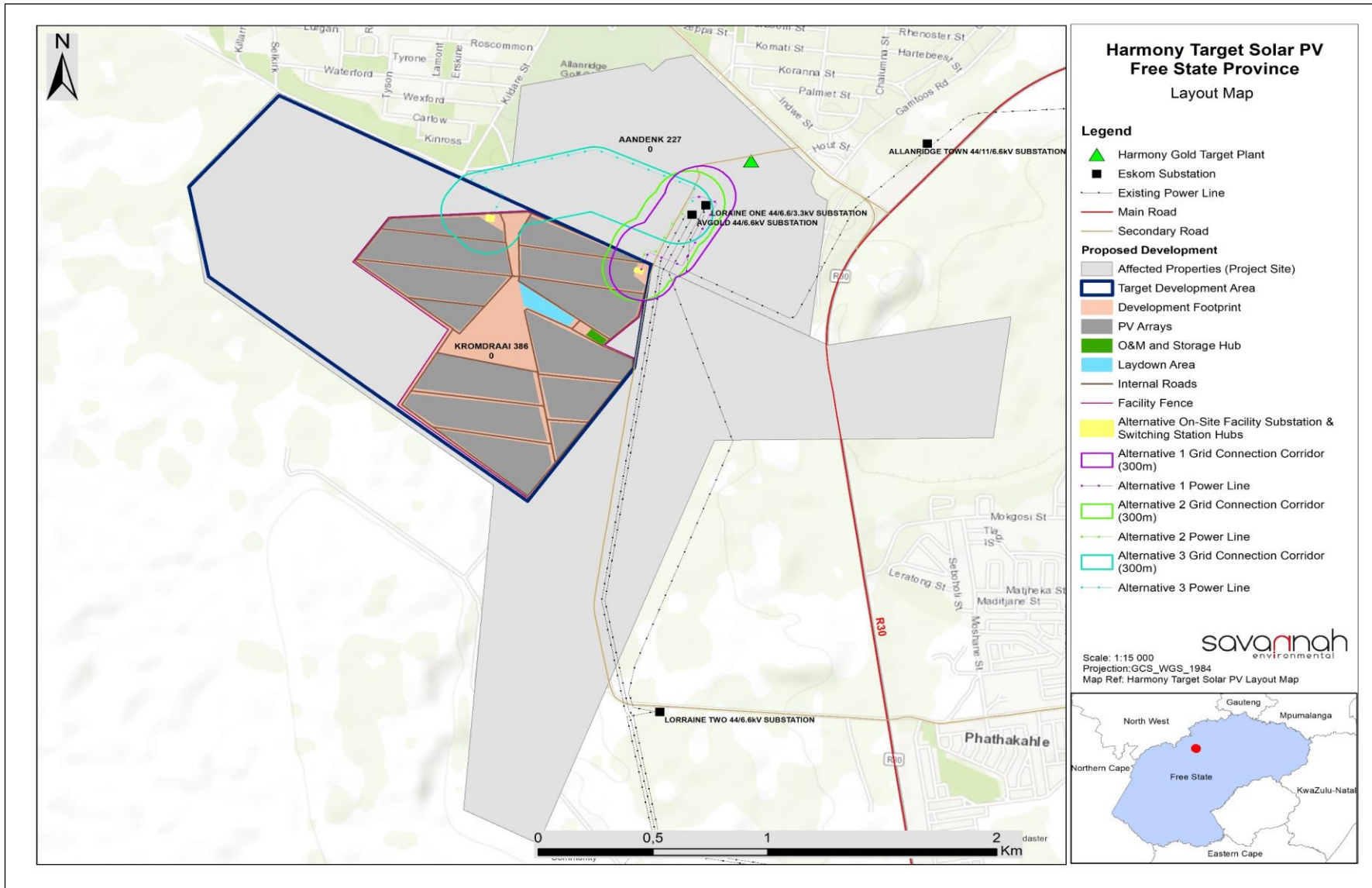


Figure 7.1: Map of the Harmony Target Solar PV Facility development area, internal infrastructure and grid connection (refer to **Appendix M** for A3 map).

The development of the Harmony Target 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 availability of agricultural land, and nuisance from the movement of vehicles transporting equipment and materials.

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 Target 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 Target Solar PV Facility, it is necessary to understand the extent of the affected area.

- » The project site being assessed for the Harmony Target Solar PV Facility requires a development footprint area of approximately ~105ha. 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). Three alternative grid corridors (300m in width) have been assessed.

7.2. Potential Impacts on Terrestrial Ecology

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 expected with the development of the Harmony Target Solar PV Facility has been assessed as very low sensitivity, 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).

The relevant ecological sensitivities of the project site as determined are illustrated in **Figure 7.2**.

7.2.1 Results of the Terrestrial Ecology Impact Assessment

Flora

The project area is generally characterised by plains-dominated landscape with some scattered, slightly irregular undulating plains and hills. Mainly low-tussock grasslands with an abundant karroid element in natural remnant vegetation. Dominance of *Themeda triandra* is an important feature of this vegetation unit. Locally low cover of *T. triandra* and the associated increase in *Elionurus muticus*, *Cymbopogon pospischilii* and *Aristida congesta* is attributed to heavy grazing and/or erratic rainfall. Karroid elements tend to be absent within the footprint, most likely a result of secondary nature of the vegetation due to historical and recent cultivation.

The landscape is somewhat undulating and incised by several south and westward draining non-perennial drainage lines, with seeps and wetlands also prevalent, having a distinct riparian vegetation comprised of obligate aquatic species including several sedge species. The assessment area is situated across a level to slightly south-facing slope that is largely either cultivated or having secondary grassland vegetation (old lands). The undulating slope is bisected by seep areas and poorly defined drainage lines with several wetland areas. All drainage lines, wetlands and seeps have been historically cultivated (ploughed), although the wetlands have regenerated to some extent with no recent ploughing evident (within the last 2 – 5 years). All seep areas are within cultivated areas, but aerial photograph and on-site observations indicate elevated water content which does negatively influence crop growth to some extent. It is likely that the wetland areas are no longer cultivated due to presence of seasonal standing water which will affect crop growth, hence riparian elements have regenerated, and they are no longer ploughed or cultivated.

Recently cultivated areas contain no indigenous or natural vegetation other than indigenous weedy pioneer species and occasional grasses as well as several exotic weed species that are common to such agricultural areas in the region including Blackjack, Mexican Poppy, Thorn Apple and Kikuyu grass.

Several endemic and range restricted species are known from the surrounding area. None are likely to be present. Due to the localised nature of the impact, as well as the level of degradation of the site, the risk of a species suffering any significant loss is low.

Project : Harmony Target PV Layout - Vegetation & Sensitivity

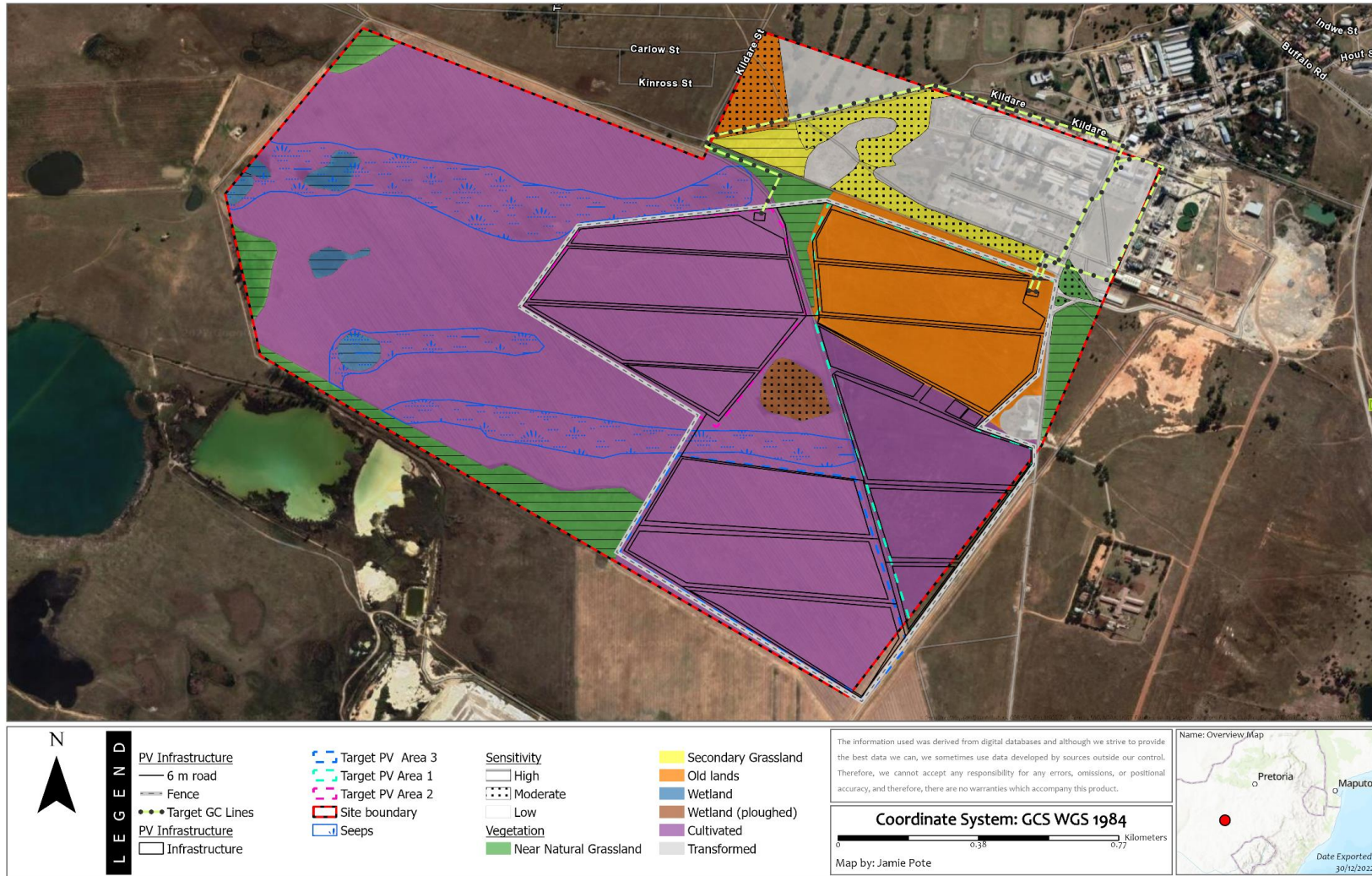


Figure 7.2: Overall ecological sensitivity map for the Harmony Target PV Facility

A few exotic invasive and other weed species were noted within the broader site, generally occurring as scattered individuals or localised clumps, mostly weedy species such as Mexican Poppy and Blackjack, being common and abundant in disturbed areas and around cultivated lands. Trees such as Gum trees, Syringa, Pine tree and Brazilian Peppers are likely planted for landscaping and/or shade purposes and only large trees were noted with minimal regeneration, all being outside of the proposed footprint area. A weed/alien invasive management programme will be required, including an after-care period (a two year after-care period is recommended) until such time as natural vegetation has become adequately re-established. Some species listed are not within the site but may be introduced during construction from the adjacent area.

The site falls almost entirely within an ESA 2 designated area, with a small patch of CBA 1 within the site, as well as adjacent to an ESA 1 designated area, both on the north-western corner. The site is broadly surrounded by a patchwork of CBA 1, ESA 1, and ESA 2. The entire PV development footprint is located within ESA 2 designated areas and has been designed to avoid CBA 1 and ESA 1 areas (refer to **Figure 7.3**) The minimal footprint within an already highly disturbed landscape comprising transformed, secondary vegetation (old lands) and/or cultivated lands is unlikely to result in any significant impacts or threats to ecological processes associated with the current ESA 2 designation, as the alternative land use will most likely be ongoing cultivation on the site

While the grid connection overhead powerlines will have a limited terrestrial biodiversity impact and the difference between the 3 alternatives is likely to be negligible, Alternative 2 (central) would have the least impact, being the most direct and shortest route passing through transformed areas, followed by Alternative 1 (east). Alternative 3 (west) would potentially have the greatest terrestrial biodiversity impact as it passes through more naturally vegetated areas and is considerably longer (i.e. more pylons) than the other alternatives. Regarding terrestrial biodiversity, it is recommended that Alternatives 1 and 2 are considered, while Alternative 3 should be avoided, unless technical or safety reasons preclude the other alternatives

Fauna

The habitats and microhabitats present on the project site are not unique and are widespread in the general area, hence the local impact associated with the footprint would be of low significance if mitigation measures are adhered to.

Larger mammal species are unlikely present due to proximity to human habitation, including the mine, however, the site could provide transient habitat for species such as Bush Duiker (*Sylvicapra grimmia*) and Common Warthog (*Phacochoerus africanus*). Should any be occasionally present, they are likely to be mobile species that would move away from disturbance during construction and with intact habitat available in the immediate surrounds are unlikely be negatively affected by the development.

Small mammals within the habitat are generally mobile and likely to be transient to the area. As with all construction sites there is a latent risk that there will be some accidental mortalities. Generally, these small mammals are mobile and will vacate the area once construction commences. This risk is unlikely to exceed current baseline risks associated with the nearby mine area and agriculture related disturbance. Burrowing small mammal species including the Ground squirrel (*Geosciurus inauris*) and Yellow Mongoose (*Cynictis penicillata*) are present on the site and/or in the surrounding area.

The assessment has also screened for any other fauna species including those that may require permits in terms of regional legislation for removal, none of significance were observed other than widespread species typical of the habitat and area. A single reptile species (Sungazer or Giant Girdled Lizard) was noted during public consultation as occurring in similar grassland habitat in the region. The site visit confirms that this species is not present and unlikely to occur under status quo conditions due to ongoing cultivation off the site. The site is also not within the expected distribution range of this species and is not flagged by the National Environmental Screening Tool.

Due to the limited footprint within a predominantly cultivated landscape, faunal species are unlikely to be significantly affected by the proposed activity.

Since the project footprint is surrounded by extensive outlying areas of natural habitat, any disturbance or displacement associated with increased activity or habitat destruction as a direct result of the activity during the construction phase is unlikely to pose a significant negative impact to faunal species.

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

- » Permanent or temporary loss of indigenous vegetation cover because of site clearing. Site clearing before construction will result in the blanket clearing of vegetation within the affected footprint.
- » Loss of flora species of special concern during pre-construction site clearing activities. Numerous species of special concern are potentially present within the affected area, which could be destroyed during site preparation.
- » Susceptibility of some areas to erosion because of construction related disturbances. Removal of vegetation cover and soil disturbance may result in some areas being susceptible to soil erosion after completion of the activity.
- » Susceptibility of post construction disturbed areas to invasion by exotic and alien invasive species and removal of exotic and alien invasive species during construction. Post construction disturbed areas having no vegetation cover are often susceptible to invasion by weedy and alien species, which can not only become invasive but also prevent natural flora from becoming established.
- » Disturbances to ecological processes. Activity may result in disturbances to ecological processes.
- » Aquatic and Riparian processes. Diversion and increased velocity of surface water flows – Changes to the hydrological regime and increased potential for erosion. Impact of changes to water quality. Loss of riparian vegetation / aquatic habitat. Loss of species of special concern.
- » Loss of Faunal Habitat: Activity will result in the loss of habitat for faunal species.
- » Loss of faunal SSC due to construction activities: Activities associated with bush clearing and ploughing, killing of perceived dangerous fauna, may lead to increased mortalities among faunal species.

7.2.2 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: <i>Permanent or temporary loss of indigenous vegetation cover as a result of the activity.</i>		
Impact Description: Site clearing before construction will result in the blanket clearing of vegetation within the affected footprint.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (0)
Probability	Definite (5)	Definite (5)
Significance	Medium (35)	Low (25)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: <ul style="list-style-type: none"> » Blanket clearing of vegetation must be limited to the site. No clearing outside of footprint to take place. » Topsoil must be striped and stockpiled separately during site preparation and replaced on completion where revegetation will take place. » Any site camps and laydown areas requiring clearing must be located within already disturbed areas away from watercourses. 		
Cumulative Impacts: Since most of the footprint is within currently cultivated lands and only a small portion is within old lands, cumulative impact to terrestrial biodiversity locally and regionally will be negligible. Furthermore, it is likely that vegetation regrowth within the PV footprint will occur after construction and these areas will not be cultivated for the duration of the project, hence cumulative impacts would be negligible.		
Residual Impacts: Residual risks include possible clearing of natural or near natural vegetation outside of the proposed footprint.		

Nature: <i>Loss of flora species of conservation concern during pre-construction site clearing activities.</i>		
Impact Description: Species of conservation concern are present within the larger area (old lands only), which could be destroyed during site clearing. All species are widespread species and removal will not result in any significant impact to any flora species or population.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (0)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation: <ul style="list-style-type: none"> » 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.
Cumulative Impacts: Since most of the footprint is within currently cultivated lands and only a small portion is within old lands, cumulative impact to flora species locally and regionally will be negligible. All species are widespread species and removal will not result in any significant impact to any flora species or population. Furthermore, it is likely that some flora species will regenerate within the footprint once construction is completed, hence cumulative impacts would be negligible. No species having an elevated conservation status were found to be present within the development footprint.
Residual Impacts: Residual risks include possible clearing of areas outside of the development footprint, or not relocating any species, but are likely to be negligible.

Nature: <i>Loss of fauna species of conservation concern and potential loss of faunal habitat.</i>		
Impact Description: Faunal species of conservation concern are present within the larger area (old lands only), which could be destroyed during site clearing. All species are widespread species and removal will not result in any significant impact to any flora species or population. Species may include transient fauna species. Activities associated with site preparation and killing of perceived dangerous fauna, may lead to increased mortalities among faunal species.		
	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (0)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none"> » Blanket clearing of vegetation must be limited to the footprint. » Small mammals within the habitat on and around the affected area are generally mobile and likely to be transient to the area. They will most likely vacate the area once construction commences. As with all construction sites there is a latent risk that there will be some accidental mortalities. Specific measures are made to reduce this risk. The risk of species of special concern is low, and it is unlikely that there will be any impact to populations of such species because of the activity. » Reptiles such as lizards are less mobile compared to mammals, and some mortalities could arise. It is recommended that a faunal search and rescue be conducted before construction commences, although experience has shown that there could still be some mortalities as these species are mobile and may thus move onto site once construction is underway. A reptile handler should be on call for such circumstances. » Should any amphibian migrations occur between wetland areas during construction, appropriate measures (including temporarily suspending works in the affected area) should be implemented. » A pre-construction walk-through survey is recommended, but not necessarily required. Respective permits to be obtained beforehand. » No animals are to be harmed or killed during the course of operations including use of snares. 		
Cumulative Impacts: Since most of the footprint is within currently cultivated lands and only a small portion is within old lands, cumulative impact to faunal species locally and regionally will be negligible. All fauna species are widespread species and removal will not result in any significant impact to any fauna species or population. Furthermore, it is likely that some fauna species will return to the project footprint once construction is completed, hence cumulative impacts would		

be negligible. No species having an elevated conservation status were found to be present within the project footprint.

Residual Impacts:

Residual risks include possible clearing of areas outside of the proposed footprint, killing of perceived harmful fauna during construction or not relocating any species, but are likely to be negligible.

Nature:

Invasion by exotic and alien invasive species could occur as a result of construction.

Impact Description:

Exotic (weed) and alien invasive species may proliferate during and after construction in disturbed areas. Areas disturbed during construction, having no vegetation cover, including temporary stockpile areas, are often susceptible to invasion by weedy and alien invasive species, which can not only become invasive but also prevent natural flora from becoming established.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (0)
Probability	Probable (3)	Probable (3)
Significance	Low (21)	Low (15)
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.

Cumulative Impacts:

Since most of the footprint is currently cultivated lands, these areas are generally subject to weed proliferation, hence it is unlikely that impacts or risks will exceed current conditions locally or regionally.

Residual Impacts:

Residual risks are primarily related to inadequate initial and ongoing implementation of the weed management plan.

Nature:

Disturbances to ecological processes may occur as a result of the activity.

Impact Description:

Activity may result in disturbances to ecological processes.

	Without mitigation	With mitigation
Extent	Local (1)	Local (1)
Duration	Long term (4)	Long term (4)
Magnitude	Low (2)	Low (0)
Probability	Improbable (2)	Improbable (2)
Significance	Low (14)	Low (10)

Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none"> » Blanket clearing of vegetation must be limited to the development footprint, and the area to be cleared must be demarcated before any clearing commences. » Rehabilitation or revegetation should be implemented on completion of construction. 		
Cumulative Impacts:		
<p>Since most of the footprint is within currently cultivated lands and only a small portion is within old lands, as well as being within an area already significantly fragmented, cumulative impact to ecological processes both locally and regionally will be negligible. Furthermore, it is likely that vegetation regrowth within the PV footprint will occur after construction and these areas will not be cultivated for the duration of the project, hence cumulative impacts would be negligible as ecological processes are likely to persist during operation.</p>		
Residual Impacts:		
Residual risks include possible clearing of natural or near natural vegetation outside of the proposed footprint.		

7.2.3 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 development footprint is located within a ESA2, which owing to the current state of the habitat and vegetation has been classified as low sensitivity (Low sensitivity areas include all portions of site that has been cultivated including cultivated areas and old lands as well as any other transformed or significantly disturbed areas where ecological functioning is substantially compromised) and are located across the development area as cultivated land with low sensitivity. The eastern block of PV arrays consists of old lands that were rated as low significance.
- » Areas of moderate sensitivity include near-natural but disturbed or secondary regenerated grassland vegetation in less disturbed areas. These areas are located in the centre of the development footprint which are avoided by the optimised layout.
- » High sensitivity terrestrial areas include wetlands and patches of remnant grassland vegetation that appears to have some near natural-to-natural elements. The development footprint avoids these areas entirely.

No significant terrestrial ecological flaws, that could pose a problem to the proposed PV Facility development, were identified during the EIA phase assessment. It is recommended that Alternatives 1 and 2 are considered, while Alternative 3 should be avoided, unless technical or safety reasons preclude the other alternatives

All impacts are assessed to be of **low significance after mitigation** and specific mitigation measures are outlined in this Chapter as well as in the Environmental Management Plan. Impacts are anticipated to be as follows:

- » Impacts relating to loss of vegetation and disruption to ecological processes are deemed to be **medium** before mitigation and **low** after mitigation.
- » Impacts relating to disturbance and displacement of faunal habitat and faunal species of conservation concern are deemed to be **medium** before mitigation and **low** after mitigation.
- » Impacts relating to disturbance of flora species of conservation concern located in the site will be **medium** before mitigation and **low** after mitigation.

- » All other impacts are assessed to be of **medium** significance before mitigation and can be reduced to **low** with the implementation of the mitigation measures.

It is likely that the construction of the PV facility, which will limit future agricultural use, may have positive impact in that it will allow natural successional revegetation of grassland within the footprint and without ongoing ploughing, in the long term, a more climax grassland vegetation may persist.

It is the conclusion of this terrestrial biodiversity assessment that the proposed PV development can be constructed within acceptable terrestrial biodiversity impact limits providing the recommended mitigation actions are adhered to.

The implementation of the management actions relating to flora and fauna as well erosion and stormwater management and post construction rehabilitation will minimise biodiversity impacts.

7.3. Potential Impacts on Wetlands

7.3.1 Results of the Wetland Impact Assessment

There are four wetlands inside the larger project area, with nine more within 500m of the project area. All of the wetlands are depression¹⁴ wetlands, some natural and others artificial.

The wetlands inside the development area are in a poor condition as they were ploughed in the past for agricultural crops. Some were not ploughed recently and have had some time to recover, but all are still dominated by weeds. There are no wetlands directly impacted by the facility layout.

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

Nature: <i>Compaction of soil caused by heavy machinery. Soil erosion because of cleared areas and increased runoff. Potential sedimentation of wetlands.</i>		
Impact Description: The use of heavy machinery during the construction process of the development will result in the compaction of soil, resulting in decreased infiltration of rainwater and increased surface run-off volumes and velocities leading to a greater erosion risk. The hardened surfaces of the road and compacted soils of the proposed development area will also lead to an increase in surface run-off during storms. This can lead to erosion in the cleared areas and sedimentation in the wetlands.		
	Without mitigation	With mitigation
Extent	Low (1)	Low (1)
Duration	Short-term (2)	Very short-term (1)
Magnitude	Minor (2)	Small (1)
Probability	Probable (3)	Improbable (2)

¹⁴ A depression is a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates (Ollis et al., 2013). An 'endorheic' depression is inward-draining, meaning it has no outflow (Ollis et al., 2013). An exorheic depression has an outflow.

Significance	Low (15)	Low (6)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none"> » Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). » Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. » Erosion control mechanisms must be established as soon as possible. » A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. » The indiscriminate use of machinery within the wetland area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled. » A buffer zone of 10 m should be implemented around the wetland as a no-go area, to prevent sediment changes. 		

Nature:		
<i>Soil and water pollution caused by spillages from construction vehicles.</i>		
Impact Description:		
Construction work will also carry a risk of soil and water pollution, with large construction vehicles contributing substantially due to oil and fuel spillages. If not promptly dealt with, spillages or accumulation of waste matter can contaminate the soil and surface- or groundwater, leading to potential medium/long-term impacts on fauna and flora.		
	Without mitigation	With mitigation
Extent	Medium-low (2)	Low (1)
Duration	Medium-term (3)	Short-term (2)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Improbable (2)
Significance	Low (27)	Low (10)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none"> » Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. » No dumping of waste should take place within the wetlands or their buffer zones. If any spills occur, they should be cleaned up immediately. » Contain all dirty water in the dirty water system and contain all dirty stormwater up to a 1:50 year flood line as a minimum. Ensure that all activities impacting on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. » Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. » Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Control Officer (ECO) should enforce this rule rigorously. » Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off. » Spill kits should be on-hand to deal with spills immediately. 		

- » All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier.
- » Implement standard dust control measures, 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) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
- » A speed limit (preferably 40 km/hour) should be enforced on dirt roads.
- » Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.

Nature: <i>Spread and establishment of alien invasive species.</i>		
Impact Description: The construction almost certainly carries by far the greatest risk of alien invasive species being imported to the site, and the high levels of habitat disturbance also provide the greatest opportunities for such species to establish themselves, since most indigenous species are less tolerant of disturbance. The biggest risk is that seeds of noxious plants may be carried onto the site along with materials that have been stockpiled elsewhere at already invaded sites. Continued movement of personnel and vehicles on and off the site, as well as occasional delivery of materials required for maintenance, will result in a risk of importation of alien species throughout the life of the project. Declared invader plant species such as <i>Argemone ochroleuca</i> (Mexican Poppy, Category 1b) are already present at the site. The spread of the alien invasive species through the area will be accelerated when seeds are carried by stormwater into the drainage features on the site that will cause environmental degradation and indigenous species to be displaced.		
	Without mitigation	With mitigation
Extent	Low (1)	Low (1)
Duration	Permanent (5)	Very short-term (1)
Magnitude	Low (4)	Small (1)
Probability	Probable (3)	Very improbable (1)
Significance	Low (24)	Low (3)
Status (positive or negative)	Negative	Negative
Can impacts be mitigated?	Yes, to a large extent	
Mitigation:		
<ul style="list-style-type: none"> » Alien and invader vegetation must not be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the project area. » Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. » Rehabilitate disturbed areas as quickly as possible. » Institute a monitoring programme to detect alien invasive species early. » Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species should also occur when seedlings are found. 		

7.3.3 Conclusion

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

- » The wetlands inside the development area are classified as endorheic depression wetlands¹⁵.
- » The development footprint avoids all wetland features, and there is no direct impact on these features
- » The project has been classified as low sensitivity, and
- » The development footprint is within 500m of wetland features, however, no significant impacts that could pose a risk were identified during the EIA phase assessment.
- » The proposed grid alternatives will have no direct impact on any wetland features.

According to the national web-based environmental screening tool in terms of National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), the site has a Low sensitivity for Aquatic Biodiversity. During the site visit, it was confirmed that the site has a Low sensitivity from an Aquatic biodiversity perspective. The wetlands in the project area have been ploughed and planted with agricultural crops. No planting was apparent in the past year, and weeds and declared invader plant species have grown. Some of the wetlands outside of the development area have a higher sensitivity, but they will not be directly impacted by the development.

The desktop survey indicated that there are some National Freshwater Ecosystem Priority Area (NFEPA) wetlands in the 500m buffer area surrounding the project area.

The wetlands inside the development area are classified as endorheic depression wetlands.

7.4. Potential Impacts on Avifauna

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

7.4.1 Results of the Avifauna Impact Assessment

From an avifaunal 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 132 species. Approximately 5 red-listed species is known to be present in the wider study area. Furthermore, 10 southern African endemics and 7 near-endemic species were confirmed on the study area and the immediate

¹⁵ An 'endorheic' depression is inward-draining, meaning it has no outflow.

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

It includes the pans, pollution control dams, and all the adjacent pans and buffer zones.

The pans have the potential to attract passerine bird species with high affinities for wetland-associated habitat units. It thereby contribute towards the local avian richness in supporting bird species that are otherwise absent from the surrounding terrestrial "dryland" grassland units.

Nevertheless, all the nearby pans, including Stinkpan and some of the pollution control dams support congregations of waterfowl and shorebirds taxa. These include globally and regionally threatened and near threatened species (e.g. flamingo taxa and Maccoa Duck). The pans are also important from a functional and dynamic perspective at the landscape level since they are part of an "inter-connected" system of "stepping stones" within the local catchment, meaning that environmental conditions at these pans (e.g. water levels, salinity, food availability, availability of shoreline habitat) are constantly changing. Therefore, none of the pans within catchment are similar to each, thereby providing a continuous supply of resources for waterbirds which tend to commute on a daily basis over the study site and along the edges of the slimes dams (which are often inundated). The placement of electrical infrastructure and PV panels in close proximity to these areas, as well as on areas where the frequency of fly-overs by waterbirds are high could elevate potential avian collisions with the infrastructure. Nevertheless, the pollution control dams are of artificial origin, and could be removed or relocated.

» Areas of low sensitivity

These habitat units are represented by transformed types and include the secondary grasslands, cultivated land, build-up areas and landscaped/manicured areas.

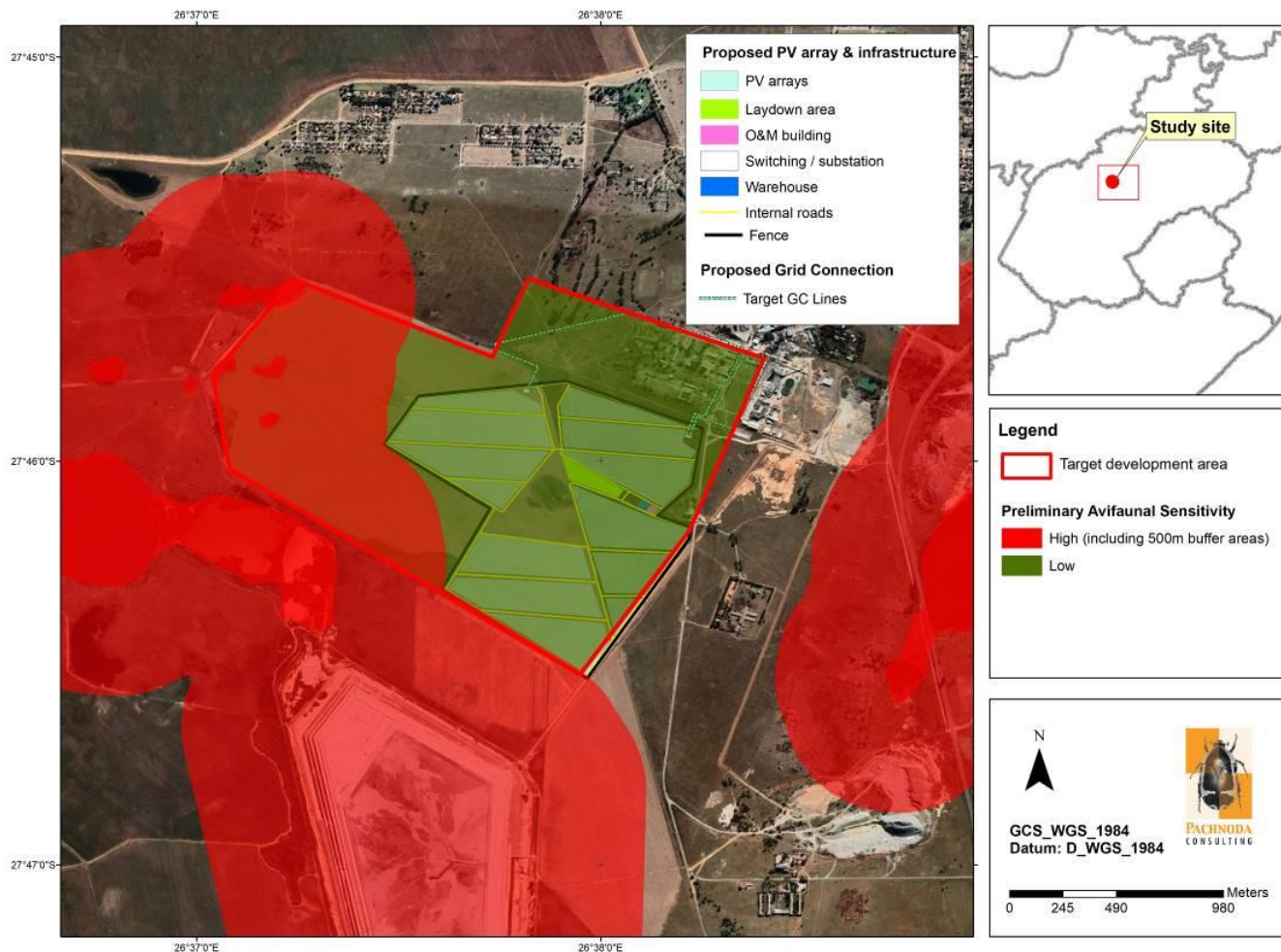


Figure 7.4: Avifaunal sensitivity map for the Harmony Target Solar PV Facility.

7.4.2 Description of Avifaunal Impacts

Negative avifauna impacts expected to occur with the development of the Harmony Target 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 106ha of the study site 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 7.05 species.ha-1 and 66.79 birds.ha-1 will become displaced should the activity occur (as per Jenkins et al., 2017). However, the predicted loss in bird densities is low and the number of endemic species that occur on the study area is also regarded as low. Nevertheless, at least five pairs of Northern Black Korhaan (*Afrotis afraoides*) may become displaced.

- » Cloud Cisticola (*Cisticola textrix*); and
- » 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 proximity of pans, inundated depressions and the large Stinkpan to the study site increases the risk of waterbirds and shorebird taxa interacting with the PV panels. A number of waterbird species are expected to occur with a high frequency of traversing the study site on a daily basis (bird dispersing between the water features) which could interact with the PV panels.

Appropriate application of bird deterrent devices are highly recommended, which may include a combination of rotating flashers/reflectors, including diverters which emit light during night time to increase the visibility of the infrastructure for birds such as flamingos which tend to disperse during the night. Post construction monitoring to quantify mortalities will be important during to early operational phase in order to determine "hotspot" areas which may require additional mitigation measures.

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*);
- » 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 Swamphehen (*Porphyrio madagascariensis*).

Interaction with overhead power lines and reticulation

At least three alternative 132kV overhead powerlines are proposed to tie-in to the Avgold (6.6/44 kV) substation. Almost the entire corridors of these will traverse transformed/manicured land occupied by mining infrastructure. Birds are impacted in three ways by means of overhead powerlines. It is however a common rule 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" (BFD) to increase the visibility of the lines. It is proposed that the overhead powerlines (including existing lines) considers the fitment of dynamic devices such as the "Viper live bird flapper" and nocturnal LED solar-charged bird diverters owing to the potential nocturnal flyovers by flamingo taxa.

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.

7.4.3 Impact tables summarising the significance of impacts on avifauna related to the proposed PV facility and associated 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	Low (4)	Minor (2)
Probability	Definite (5)	Probable (3)
Significance	Medium (50)	Low (24)
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 low sensitivity. 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).		
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 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 competitive bird species such as crows and increased fecundity rate for bird species that are adapted to anthropogenic activities. The impact is regarded as low.		

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Nature: Avian collision impacts related to the PV facility during the operation phase (collision with the PV panels) owing to the movement of birds between wetland features.		
PV Layout (and associated infrastructure)	Without mitigation	With mitigation
Extent	Site and immediate surroundings (4)	Site and immediate surroundings (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	High (8)	Medium (6)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	High (64)	Medium-High (56)
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: It is difficult to mitigate against the potential for waterbird species to collide with the PV infrastructure owing to the spatial location of the footprint area (being located in close proximity to a number of wetland features). 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 be placed at panels nearest (facing) to pans and other water features. Bird deterrent devices should also include light-emitting devices to increase the visibility of the PV infrastructure for waterbird species that migrate at night (e.g. flamingo species). Security/CCTV cameras may be installed to quantify mortalities (cameras are also installed along the perimeter fence for security measures and may also prove to be effective to quantify mortalities). Buffer pans/depressions by at least 500m (arrays should be positioned at least 500m away from pans). If post-construction monitoring predicts and/or confirms any 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 the overhead power 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, potential loss of waterfowl and certain shorebird taxa 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 corridor is 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 collision-prone waterbird species.	Yes (to some extent), owing to the potential loss of collision-prone 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 tailings facilities. 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		

7.4.4 Conclusion

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

- » No highly sensitive features (after mitigation) and "No-Go" areas were identified.
- » Areas of high sensitivity includes the pans, pollution control dams, and all the adjacent pans and buffer zones. These areas are located around the development footprint which are entirely avoided by the optimised layout.
- » The entire development footprint forms part of areas classified as low sensitivity which are represented by transformed types and include the secondary grasslands, cultivated land, build-up areas and landscaped/manicured areas.

- » Grid Alternative 3 is the least preferred alternative since it follows the longest route, thus increasing collision impacts. Alternatives 1 and 2 are considered as these are shorter grid routes and follows existing grid line, therefore reducing collision impacts.

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was predicted to be moderate-high to low after mitigation (depending on the type of impact). However, the risk for waterbirds and shorebirds (including flamingo taxa) colliding with the PV infrastructure remained eminent due to the presence of inundated pans and dams in the study area and dispersal routes coinciding with the study area. 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 was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post-construction monitoring) be implemented during the construction and operation phase of the project (e.g. the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds).

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

The impact of the Harmony Target 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 G** – Soils Impact Assessment for more details).

7.5.1 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 Target development area (see **Figure 7.5**). The area of each soil form as well as the horizon organisation and depths.

The Technosols is present at approximately 31.88 ha of the development area, located in only in the northern side of the study area. Technosols are defined as material from mining, industrial, construction or urban activities that supply parent materials for new anthropogenic soils (Soil Classification Working Group, 2018).

The Technosols are associated with existing mine infrastructure or previous disturbance to soil because of the mining activities. The nature of the disturbance in the areas of the Technosols is a mixture of transported materials, areas of previous excavation and areas previously compacted by temporary infrastructure. The scope of this assessment does not include analysis of samples for soil contamination; therefore, it is not known whether there are any chemically polluted Technosols present on site.

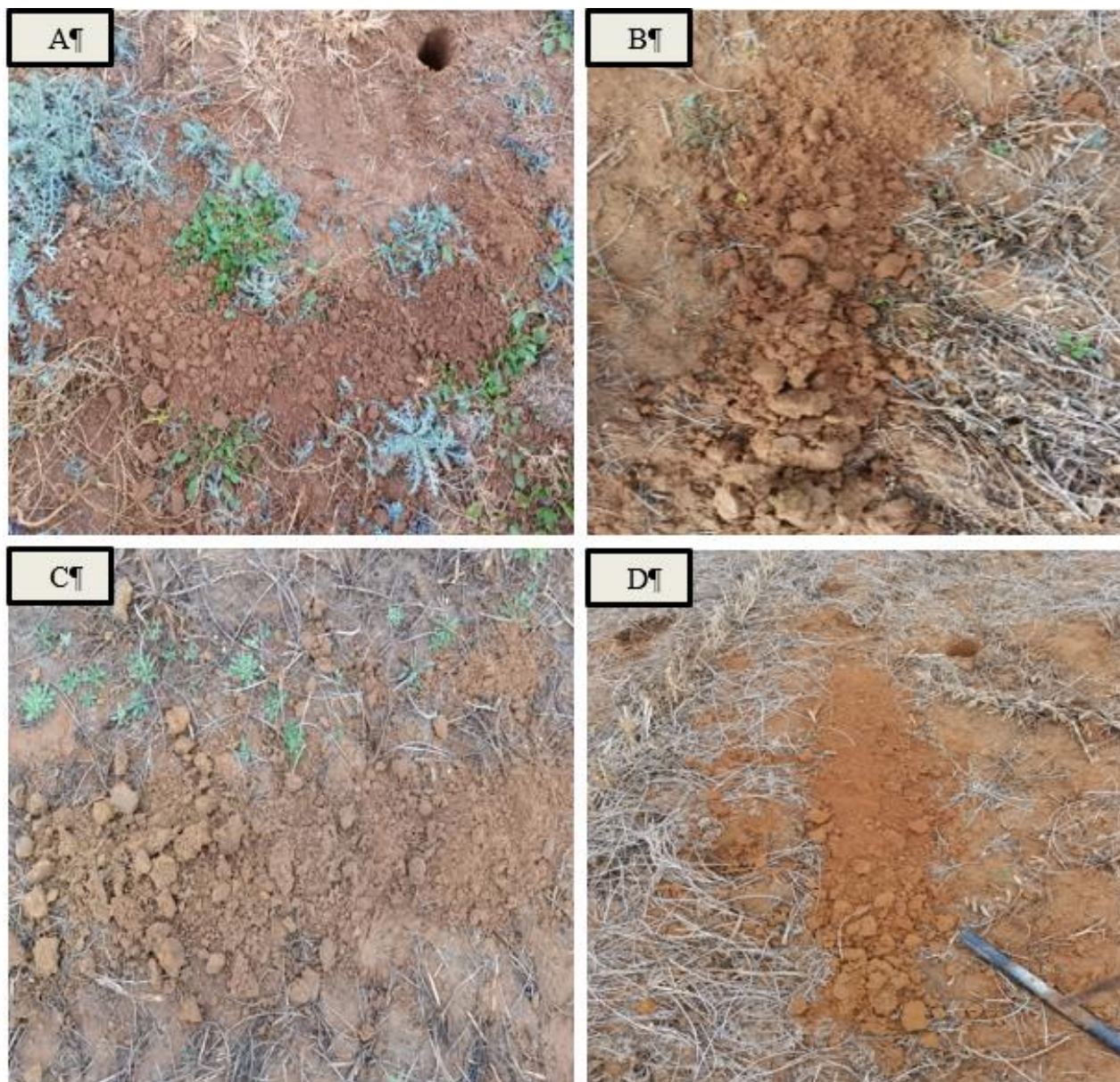
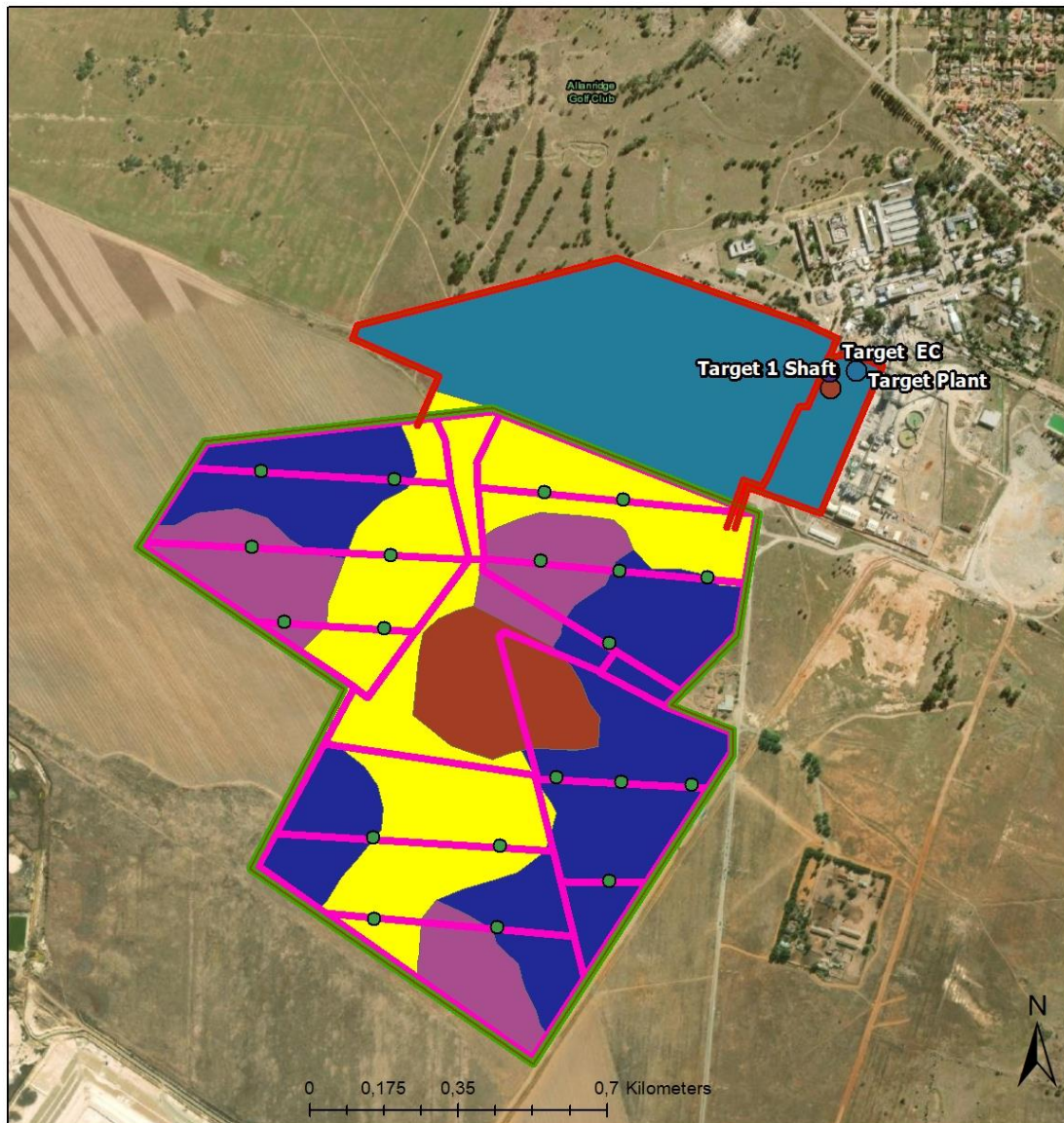


Figure 7.5: Example of the soil forms within the development area (A-Clovelly, B-Bainsvlei, C-Avalon, D-Ermelo).



Legend

Target	6 m road	Avalon (41.10 ha)
PTS	Fence	Bainsvlei (17.65 ha)
Target EC	Target GC Lines	Clovelly (8.71 ha)
Target 1 Shaft	Ermelo (38.56 ha)	Technosol (31.88 ha)
Target Plant		



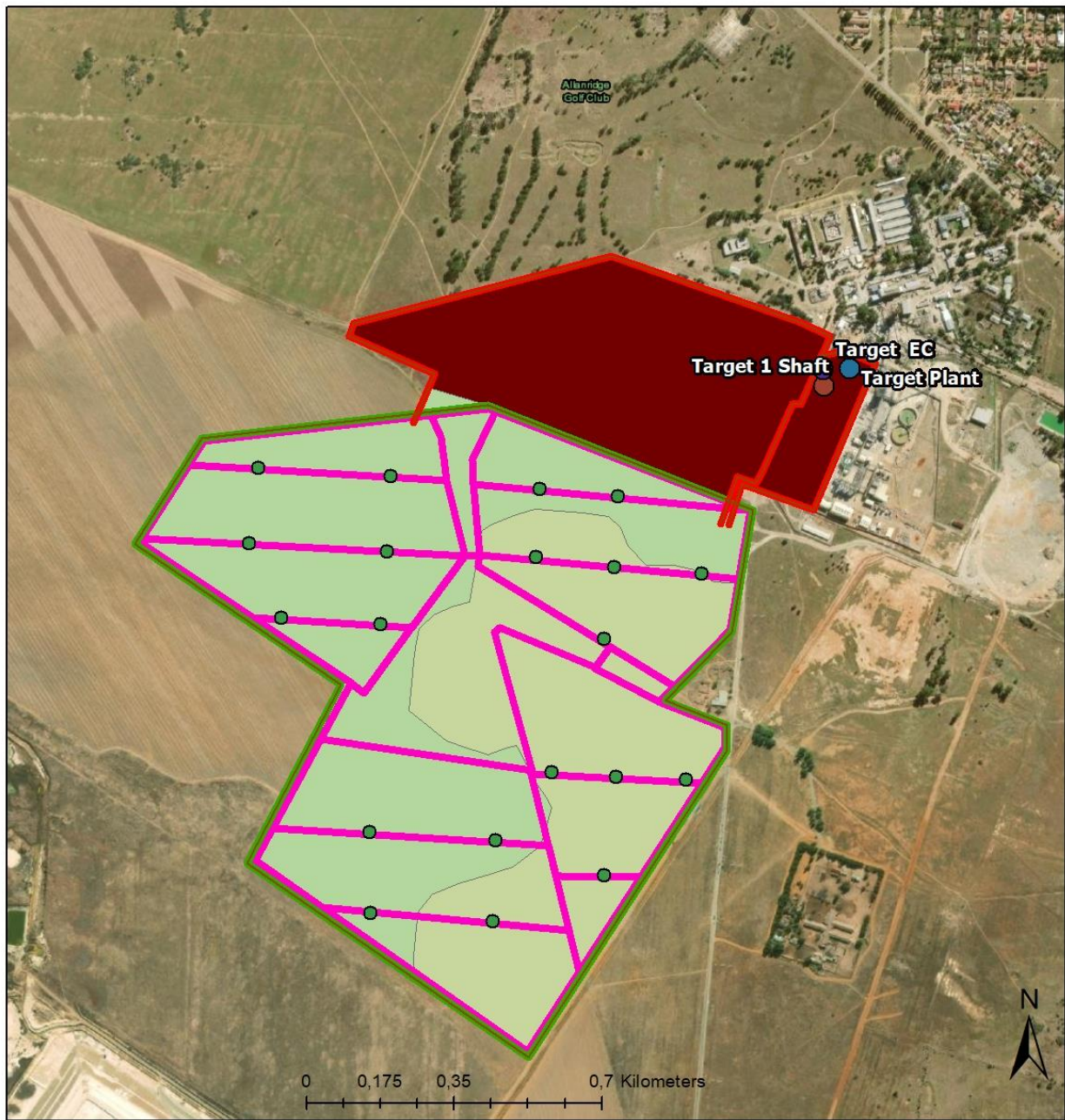
Figure 7.6: Soil map of the Harmony Target development area

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 Target Solar PV development area includes three different land capability classes according to the land capability data (DALRRD, 2016). **Figure 7.7** shows the position of the different classes within the farm portions that form the proposed development area. The entire development area largely consists of land with Moderate-High (Class 09) land capability. Moderate (Class 08) land capability is found in the middle of the study area, while a small patch of Low-Moderate (Class 07) land capability is found in middle parts.

Following the soil classification and the integration of the soil classification data with the terrain and climate capability of the development area, the confirmed land capabilities of the development area was determined. The delineation is shown in **Figure 7.7**.



Legend

- | | | |
|----------------|-----------------|----------------------------|
| Target | 6 m road | Very low (2)-31.88 ha |
| PTS | Fence | Moderate (8)-45.54 ha |
| Target EC | Target GC Lines | Moderate-High (9)-60.52 ha |
| Target 1 Shaft | | |
| Target Plant | | |



Figure 7.7: Verified land capability classification of the Harmony Target development area

Within the development area, the areas where soil has been disturbed by activities associated with the nearby mining infrastructure, and that has been classified as Technosols, have Very low (Class 02) land capability. The areas are no longer suitable for rainfed crop production and has limited suitability for livestock farming because of the uneven terrain in these areas.

The land capability of the natural soil forms mainly depended whether the soil was found on cultivated land. All soil forms had a Moderate (Class 08) land capability on non-cultivated areas and Moderate-High (Class 09) on cultivated land. The Technosol soil had a Very low (Class 02) land capability.

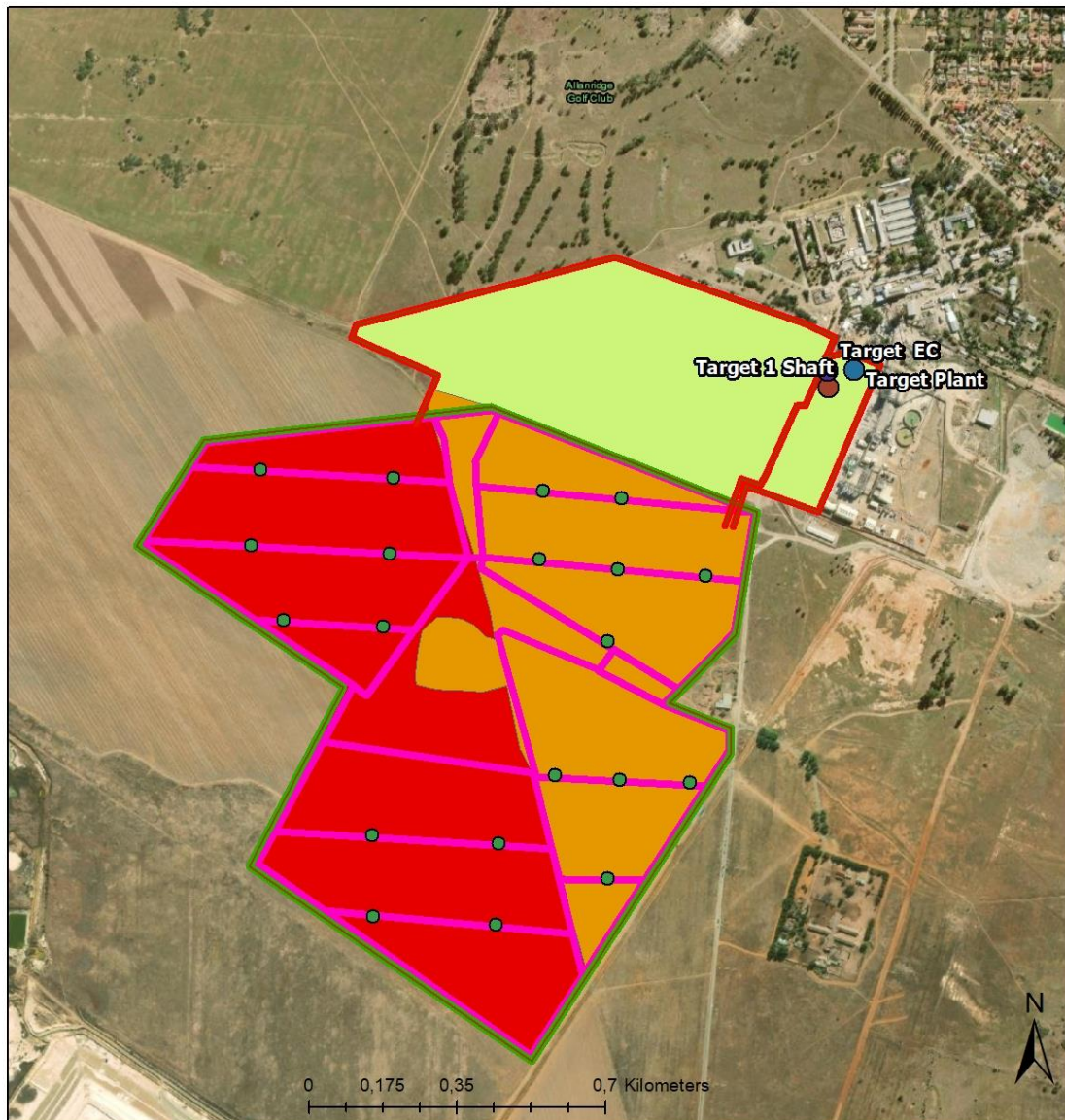
The soils on cultivated land are better suited to rainfed crop production because of the soft plinthic horizon that underlies the deep apedal B1 subsoil-horizons. The soft plinthic horizon retains soil moisture and this is available for crop roots during periods of water stress. The Ermelo soil classification (only found on cultivated land) is freely drained, therefore making it better suited for irrigation as the water will freely drain through the soil.

Sensitivity analysis

Following the consideration of all the baseline and desktop data, the Harmony Target Solar PV facility development area can be categorised as either High, Medium or Low sensitivity. The largest part of the development area has High sensitivity (60.84 ha), followed by Medium sensitivity (45.37 ha) and Low sensitivity (31.88 ha) (refer to **Figure 7.8**).

The development footprint considered is mostly located on land with High and Medium agricultural sensitivity with some areas falling in low agricultural sensitivity. Three alternatives were considered for the grid corridor. Due to Alternative 3 having a small area that falls within the high agricultural sensitive area, it was considered the least favourable, but not considered a No-go Alternative or a fatal flaw. The preferred alternatives are both Alternative 1 and Alternative 2 of the grid corridor as both fall entirely within areas of Low agricultural sensitivity where Technosols are present.

There will be no additional impacts on soil properties and the current soil quality will remain as it is, permitting that the livestock grazing does not result in soil degradation. However, there will also be no gain in employment and income generation opportunities as Harmony Gold does not plan to ever develop intensive agriculture or crop production within the development area.



Legend

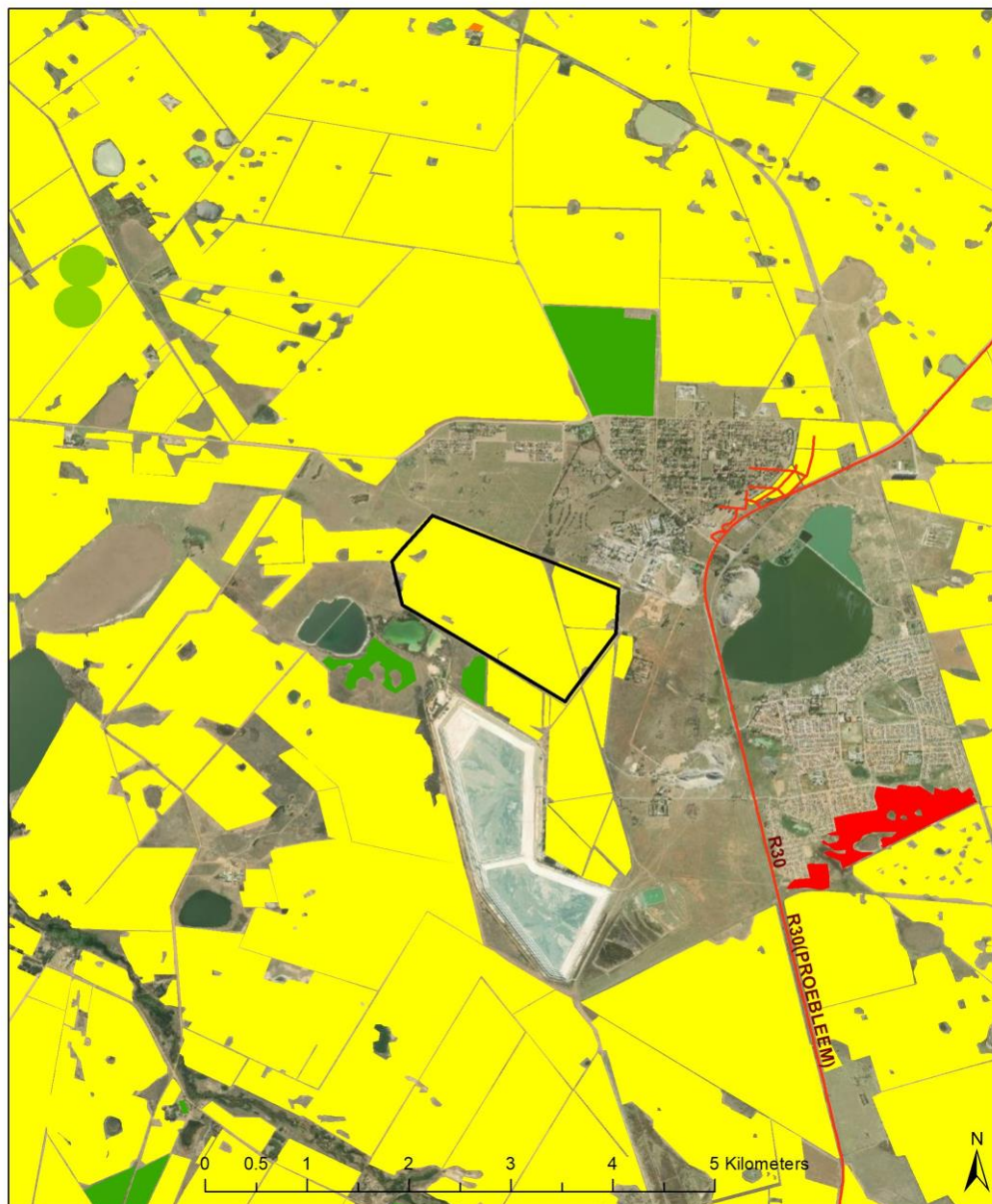
- | | | |
|----------------|-----------------|-------------------|
| Target | 6 m road | High (60.84 ha) |
| PTS | Fence | Medium (45.37 ha) |
| Target EC | Target GC Lines | Low (31.88 ha) |
| Target 1 Shaft | | |
| Target Plant | | |



Figure 7.8: Agricultural sensitivity of the Harmony Target development area

The development area is currently not fenced off and cultivation of the area were observed. Grazing of livestock after maize yield could also be possible. The field crop boundary delineations of the Crop Estimates Consortium, confirms that the development area has rainfed field crops (see **Figure 7.9**).

The surrounding land uses include mining, residential and agriculture. The mining areas are located west, east and south of the site and are centred around the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227. The residential areas are located north and east of the development area and includes the towns of Alanridge. The agricultural areas consist of crop fields, old field and grazing areas with livestock, located south, southwest and west.



Legend

Field crops

- Old Fields
- Pivot Irrigation
- Rainfed Annual Crop Cultivation / Planted Pastures
- Shadenet
- Subsistence Farming 1

- Harmony Target PV study area (198.8 ha)
- Road



Figure 7.9: Locality of field crops around the development area of the Harmony Target Solar PV (source: DALRRD, 2019)

7.5.2 Description of Land Use, Soil and Agricultural Potential Impacts

The most significant impacts of the Harmony Target Solar PV facility project on soil and agricultural productivity will occur during the construction phase when the vegetation is removed and the soil surface is prepared for infrastructure commissioning. During the operations phase, the risk remains that soil will be polluted by the waste generated during the operations phase or affected by soil erosion in areas where vegetation has not re-established after the construction phase. During the decommissioning phase, soil will be prone to erosion when the infrastructure is removed from the soil surface.

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

Construction phase

<i>Impact: <u>Change in land use from livestock farming to energy generation</u></i>		
<i>Nature: Prior to construction of the PV plant, the 105ha development footprint will be fenced off. The area where infrastructure will be constructed will be stripped of vegetation and will no longer be suitable for livestock grazing. As there is currently rainfed crop farming within the development footprint, there will be negative impacts on crop production.</i>		
	Without mitigation	With mitigation
<i>Extent</i>	Local (1)	Local (1)
<i>Duration</i>	Medium duration (3)	Medium duration (3)
<i>Magnitude</i>	Low (4)	Low (4)
<i>Probability</i>	Definite (4)	Definite (4)
<i>Significance</i>	Medium (32)	Medium (28)
<i>Status (positive or negative)</i>	Negative	Negative
<i>Reversibility</i>	Moderate	Moderate
<i>Irreplaceable loss of resources?</i>	Yes	Yes
<i>Can impacts be mitigated?</i>	No	
<i>Mitigation:</i>		
<ul style="list-style-type: none"> » 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. » No fences of neighbouring crop fields and farming areas must be damaged during the construction phase. 		
<i>Residual:</i>		
The residual impact from the construction and operation of the Harmony Target Solar PV facility is considered negligible.		

<i>Impact: <u>Change in land use from rainfed crops to energy generation</u></i>		
<i>Nature: Prior to construction of the PV plant, the 105ha development footprint will be fenced off. The area where infrastructure will be constructed will be disturbed and will no longer be suitable for rainfed crops.</i>		
	Without mitigation	With mitigation
<i>Extent</i>	Local (1)	Local (1)
<i>Duration</i>	Long term duration (4)	Long term duration (4)

Magnitude	High (8)	High (8)
Probability	Definite (5)	Definite (5)
Significance	High (65)	High (65)
Status (positive or negative)	Negative	Negative
Reversibility	Moderate	Moderate
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
<p>Mitigation:</p> <ul style="list-style-type: none"> » Soil disturbance must be restricted to areas where infrastructure is constructed. » No materials removed from development area must be allowed to be dumped in rainfed crop 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. » No fences of neighbouring crop fields and farming areas must be damaged during the construction phase. 		
<p>Residual:</p> <p>The residual impact from the construction and operation of the Harmony Target Solar PV facility is considered negligible.</p>		

<p>Impact: <u>Soil Erosion</u></p> <p>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. This includes the areas where internal access roads will be constructed. Both wind and water erosion are a risk, especially when there are heavy rainstorms during the summer months.</p>		
	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	
<p>Mitigation:</p> <ul style="list-style-type: none"> » 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 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. 		
<p>Residual:</p> <p>The residual impact from the construction and operation of the proposed Harmony Target Solar PV facility on the susceptibility to erosion is considered low.</p>		

<p>Impact: <u>Soil Compaction</u></p>
--

The clearing and levelling of land where required for the PV facility's infrastructure, will result in soil compaction. In the area where internal roads will be constructed, topsoil will be removed and the remaining soil material will be deliberately compacted to ensure a stable road surface.

	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;
- » 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 proposed Harmony Target Solar PV facility 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 PV plant and grid connection. Both potential spills and leaks from construction vehicles and equipment as well as 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.

Residual:

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

Operations phase

Impact: Soil Erosion

During the operational phase, staff and maintenance personnel will access the Harmony Target Solar PV facility daily. This phase will have no additional impact on the rainfed crops and livestock farming potential of the area. The following impacts on soil is expected for this phase:

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 Target Solar PV facility.

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

Mitigation:

- » The area around the development footprint must regularly be monitored to detect early signs of soil erosion onset.
- » If soil erosion is detected, the area must be stabilised by the use of geo-textiles and facilitated re-vegetation.

Residual:

The residual impact from the operation of the proposed Harmony Target Solar PV facility on the susceptibility to erosion is considered low.

Impact: Soil Pollution

Nature: During the operational phase, potential spills and leaks from maintenance vehicles and equipment as well as waste generation on site, can result in soil pollution.

	Without mitigation	With mitigation
<i>Extent</i>	Local (1)	Local (1)
<i>Duration</i>	Short-term (2)	Short-term (2)
<i>Magnitude</i>	Moderate (6)	Low (4)
<i>Probability</i>	Low (4)	Improbable (2)
<i>Significance</i>	Medium (36)	Low (14)
<i>Status (positive or negative)</i>	Negative	Negative

Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	No
Can impacts be mitigated?	Yes	
<p><i>Mitigation:</i></p> <ul style="list-style-type: none"> » 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. 		
<p><i>Residual:</i></p> <p>The residual impact from the operation of the proposed project will be low to negligible.</p>		

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 especially the risk of soil erosion will remain until the vegetation growth has re-established in the area where the Harmony Target Solar PV facility will be decommissioned.

7.5.4 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 largest part of the development area has high sensitivity. Areas of high sensitivity includes areas that consists of rainfed crops or the potential for the production thereof.
- » Areas of moderate sensitivity include areas which are not cultivated. These areas are located in the eastern half of the development footprint which are traversed by the optimised layout.
- » A small area of the development footprint is classified as very low sensitivity because of existing disturbances.
- » Due to Alternative 3 having a small area that falls within the high agricultural sensitive area, it was considered the least favourable, but not considered a No-go Alternative or a fatal flaw. The preferred alternatives are both Alternative 1 and Alternative 2 of the grid corridor as both fall entirely within areas of Low agricultural sensitivity where Technosols are present.

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Harmony Target Solar PV Facility is expected to have a High to Low impact on soils and agricultural potential, depending on which impact is being considered. These impacts can be reduced by keeping the footprints 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 site.

7.6. 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 Target 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 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. One heritage resource (refer to **Table 7.1** and **Figure 7.10**) has been identified within the development area; however, this site has been rated as having low scientific cultural value. Therefore, no archaeological resources of significant scientific cultural value were identified within the area proposed for the Target PV Facility and its grid connection and as such, the impact to significant archaeological heritage resources is anticipated as being of low significance.

Furthermore, no impacts to significant palaeontological heritage is anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

Table 7.1: Heritage resources identified within the Harmony Target Solar PV development area¹⁶

Site No.	Site Name	Description	Co-ordinates		Grading	Mitigation
TG1	Target 1	Isolated artefacts: two miniature cores associated with microlithic flake production	-27.7608890 4	26.6334529 9	NCW	NA

¹⁶ The alternatives assessed as part of this project have been mapped throughout the HIA. Based on the outcomes of this analysis, and other environmental constraints, a Final Layout has been developed that fits within the various environmental constraints identified. The development area identified as 'Alternative' is the preferred area for the Final Layout.

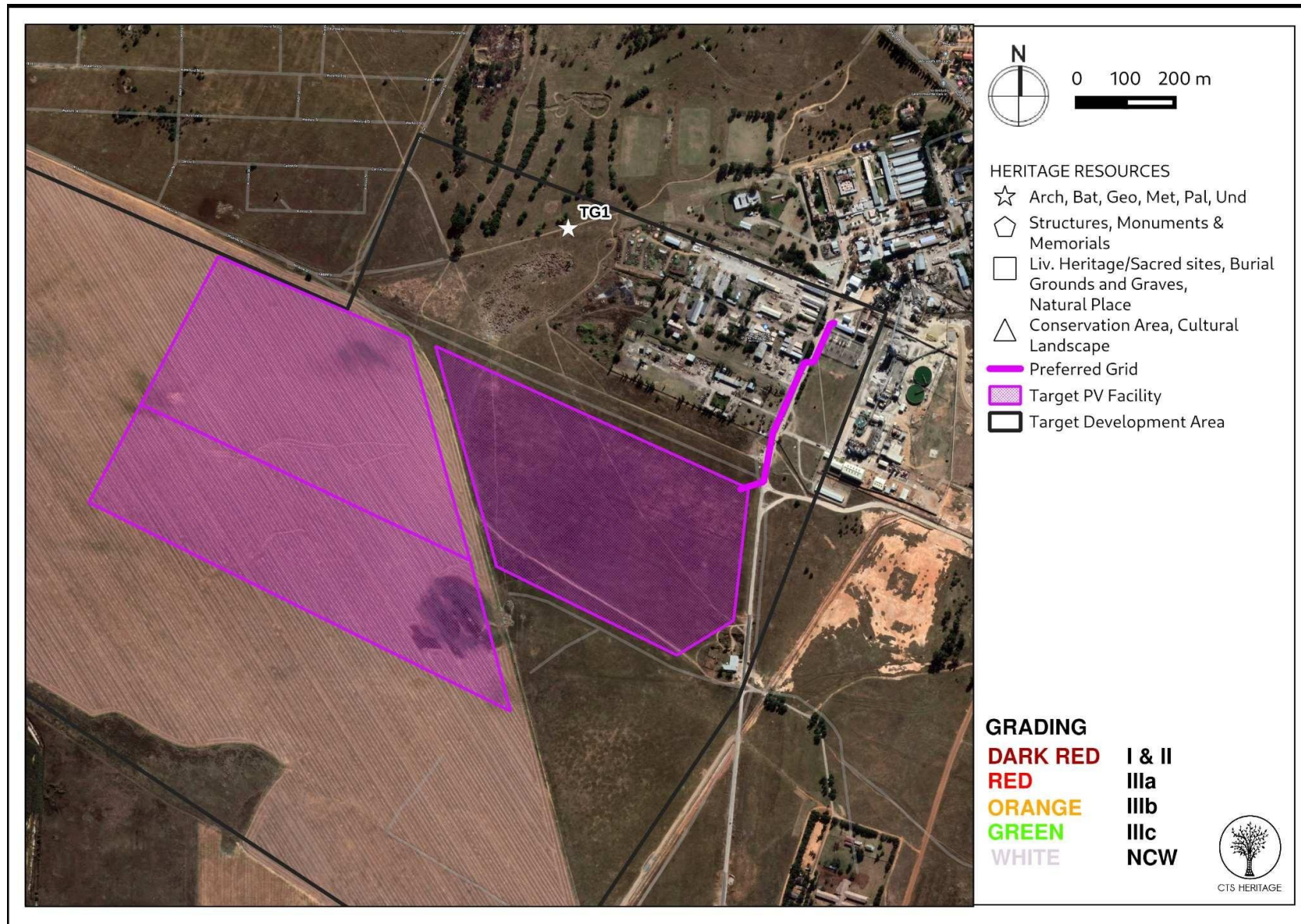


Figure 7.10: Map of heritage resources identified within the development area of the Harmony Target Solar PV Facility.

Archaeology

The potential for finding a dateable in-situ archaeological horizon at the Harmony Target Solar PV site is based on current surface observations outlined above, and is low. The documented archaeology at the Harmony Target Solar PV Facility is therefore classified as scientifically of low significance.

Concerning the archaeology (at TG1) observed during the survey of the potentially affected area at the Harmony Target Solar PV Facility, there are no objections to the authorization of the proposed development, provided that if any evidence of buried human remains are exposed during excavation, that development activities cease in the area of the identified remains.

No significant impacts to heritage resources are anticipated as a result of the PV facility or the grid line alternatives.

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."

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 fossils 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. There is a very small chance that fossils may occur in pans or springs but no such feature is visible in the satellite imagery. Nonetheless, a Fossil Chance Find Protocol is added to the EMPr.

7.6.2 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)

Nature: It is possible that buried archaeological 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	No archaeological resources of significance were identified within the development area (2)	No archaeological resources of significance were identified within the development area (2)
Probability	It is unlikely that significant heritage will be impacted (2)	It is unlikely that significant resources will be impacted (1)
Significance	Low (16)	Low (8)
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:		
<ul style="list-style-type: none"> » Should any previously unrecorded 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		

Nature:		
It is possible that buried palaeontological 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	According to the SAHRIS Palaeosensitivity Map, the area proposed for development of the PV facilities is underlain by sediments that have moderate palaeontological sensitivity (5)	According to the SAHRIS Palaeosensitivity Map, the area proposed for development of the PV facilities is underlain by sediments that have moderate palaeontological sensitivity (5)
Probability	It is unlikely that significant fossils will be impacted (1)	It is unlikely that significant fossils will be impacted (1)
Significance	Low (11)	Low (11)
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:		
<ul style="list-style-type: none"> » The Chance Fossil Finds Procedure attached to the HIA in Appendix H 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		

7.6.3 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 only isolated finds were two small probably Later Stone age cores (TG1), however, these cores were documented in the area of the footprint that is not currently earmarked for PV development.
- » Due to Alternative 3 traversing TG1, it was considered the least favourable, but not considered a No-go Alternative or a fatal flaw. The preferred alternatives are both Alternative 1 and Alternative 2 of the grid corridor as both fall entirely within areas of no archaeological significance.

With the implementation of mitigation measures by the developer, contractors, and operational staff, the significance of impacts of the Harmony Target 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 archaeological or heritage resources, other than TG1, 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.

7.7. Assessment of Visual Impacts

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

7.7.1 Results of the Visual Impact Assessment

The construction and operation of the Harmony Target 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 1-6km radius of the facility. The visual impact will differ amongst places, depending on the distance from the facility.

Towns or residences occur at irregular intervals throughout the area. Some of these in close proximity to the Harmony Target Solar PV Facility, include:

- » Allanridge
- » Nyakallong
- » Welkom
- » Bronville
- » Naudeville
- » Bedelia
- » Silwerstraat
- » Bloudrif
- » Virginia
- » Meloding
- » Whites

- » Riebeekstad
- » Odendaalsrus

The R30 road provides access to the region and is the main connecting route in between Klerksdorp and Welkom. The proposed PV facility sites is accessible from various Target Mine access roads running directly adjacent to the site.

Besides the mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines

A 10km radius from the project area was evaluated. The largest portion of the area selected and regarded suitable for the development was previously cultivated, then left fallow before being ripped and sown with a mixture of grass species and is currently used for cattle grazing. The surrounding farms are overall used for mixed agriculture, consisting of cultivated areas and grazing areas. Land use activities within the broader region are predominantly described as maize and wheat farming, with some mining activity evident towards the north (Allanridge) and the south (Odendaalsrus).

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 (**Figure 7.10**).

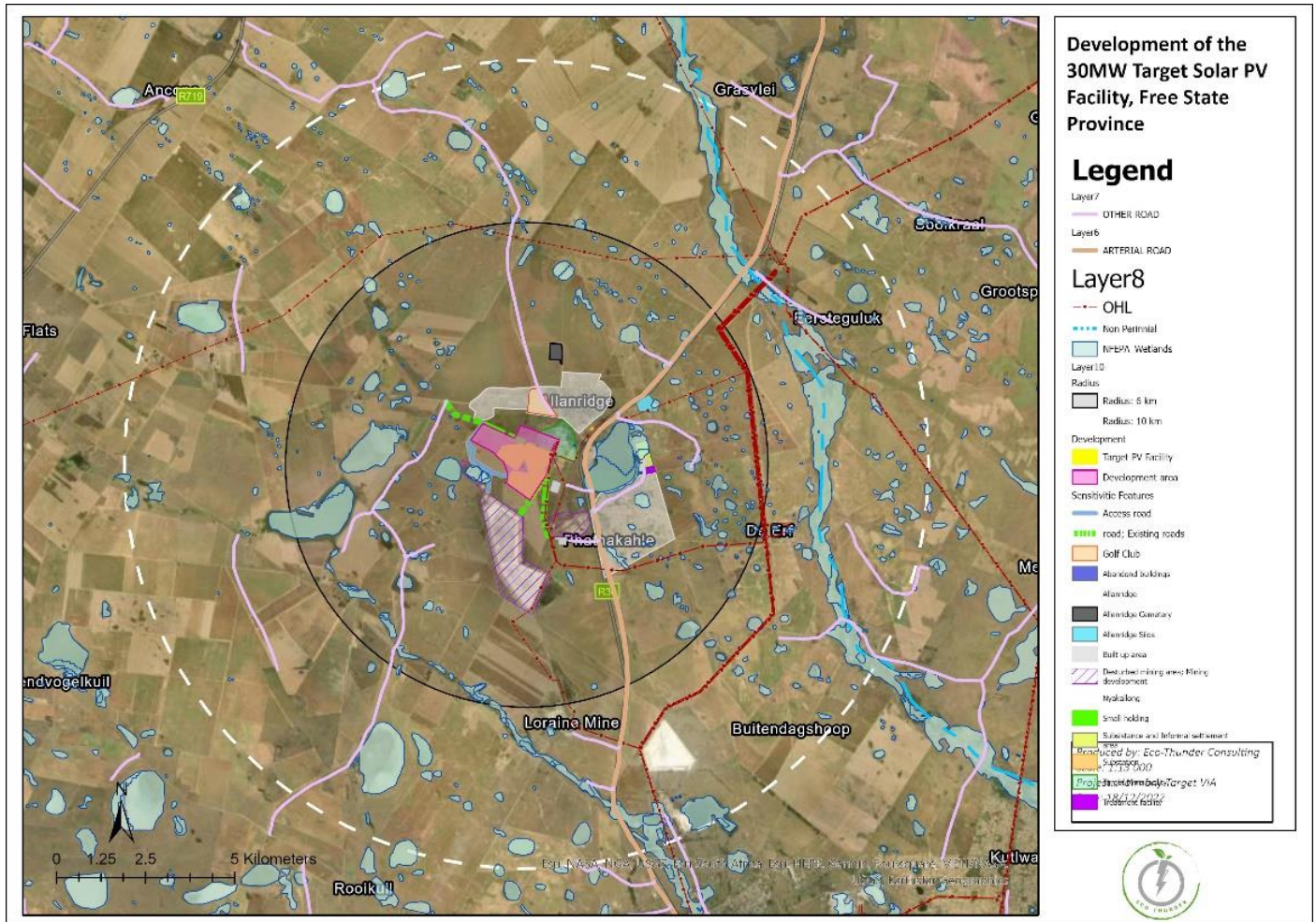


Figure 7.10: Potentially sensitive visual receptors in the area surrounding the site for the Harmony Target Solar PV Facility

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

During the construction phase, there may be a noticeable increase in heavy vehicles utilising the roads to the project site that may cause, at the very least, a visual nuisance to other road users and landowners in the area. Construction activities may potentially result in a moderate, temporary visual impact, that may be mitigated to low.

During the operation phase there will be a moderate visual impact on observers (residents and road users) located between a 1-6km radius of the PV facility structures. Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order to reduce/mitigate the potential visual impact.

Visual impacts during the operation phase will also include lighting impacts relating to glint and glare. It is possible that the Harmony Target Solar PV Facility may contribute to the effect of glint and glare within the environment which is currently undeveloped.

The tables below are applicable to all alternatives under consideration for the project infrastructure.

Construction Phase Impacts

Nature: Impact on landscape character and sense of place due to the removal of vegetation and the construction of the PV structures and associated infrastructure.		
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. The significance of the impact is assessed in the table below.		
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	Low (30)	Low (27)
Mitigation:		
<ul style="list-style-type: none"> » 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 		

<p>existing access roads.</p> <ul style="list-style-type: none"> » 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.
<p>Residual Impacts:</p> <ul style="list-style-type: none"> » Land will no longer be able to be utilized for agricultural purposes.

<p>Nature: <i>Impact of PV facility on the Roads in Close Proximity</i></p> <p>The Harmony Target PV has two unnamed road which runs directly adjacent to it (one directly to the north and another directly to the east) 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.</p> <p>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.</p>		
<p>PV Layout (and associated infrastructure)</p>	<p>Without mitigation</p>	<p>With mitigation</p>
<p>Extent</p>	<p>Local (3)</p>	<p>Local (2)</p>
<p>Duration</p>	<p>Long term (4)</p>	<p>Long term (4)</p>
<p>Magnitude</p>	<p>High (8)</p>	<p>Low (4)</p>
<p>Probability</p>	<p>Probable (3)</p>	<p>Probable (3)</p>
<p>Significance</p>	<p>Medium (45)</p>	<p>Low (30)</p>
<p>Mitigation:</p> <p>Mitigation of this impact is possible and both specific measures as well as general "best practice" measures are recommended in order ensure that a lower moderate impact is achieved.</p> <p>General mitigation / management:</p> <p>Planning:</p> <ul style="list-style-type: none"> » Retain and maintain natural vegetation in all areas outside of the development footprint. <p>Operations:</p> <ul style="list-style-type: none"> » Maintain the general appearance of the facility as a whole. <p>Decommissioning:</p> <ul style="list-style-type: none"> » 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. 		
<p>Residual Impacts:</p> <p>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.</p>		

<p>Nature: <i>Visual Impact on Impact on Businesses, homes or facilities in close proximity</i></p> <p>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.</p>
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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, most noticeably being Allanridge, the surrounding access roads, and Nayakallong settlement.

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.

Nature: Visual Impact of the OHL options.

The proposed development is considering three different alternatives, the gridlines are all in close proximity to one another and to the proposed development lines are all routed to connect into the Avgold Substation, therefore having a similar anticipated impact.

	Rating	Motivation		Significance
Prior to Mitigation				
	Alt A	Alt B	Alt C	
	From switching station, A to Avgold Sub via a 440m OHL	From switching station, A to Avgold Sub via an 750m OHL	From switching station, B to Avgold Sub via a 1.5km OHL	

Duration	Short (2)	Short (2)	Short (2)	Construction is estimated to last or 12 months	Alternative A and B Low (24) Alternative C Low (27)
Extent	Short Distance (2)	Short Distance (2)	Short Distance (3)	The visual intrusion will only potentially be experienced by receptors within the immediate vicinity and in areas with flat topography and little vegetation	
Magnitude	Moderate (4)	Moderate (4)	Moderate (4)	The visual environment during the construction phase, may lead to moderate levels of visual intrusion, this will however be a temporary impact as the proposed construction activities are estimated to be one year	
Probability	Probable (3)	Probable (3)	Probable (3)	If development is approved there is a high probability the landscape will be impacted	

Post Mitigation/Enhancement Measures

	Alt A	Alt B	Alt C		
Duration	Short (2)	Short (2)	Short (2)	Construction is estimated to last or 12-18 months	Alternatives A – C Low (21)
Extent	Short Distance (2)	Short Distance (2)	Short Distance (2)	The visual intrusion will only potentially be experienced by receptors within the immediate vicinity, however mitigation will serve as buffer to decrease the impact	
Magnitude	Moderate (3)	Moderate (3)	Moderate (3)	The visual environment during the construction phase, may lead to moderate levels of visual intrusion, this will however be a temporary impact as the proposed construction activities are estimated to be one year	
Probability	Probable (3)	Probable (3)	Probable (3)	If development is approved there is a high probability the landscape will be impacted	

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

<p>and existing access roads.</p> <ul style="list-style-type: none"> » 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.
<p>Residual Impacts: Some businesses may draw a negative connotation with the development of Solar PV facilities.</p>

Operations Phase Impacts

<p>Nature: <i>Glint and Glare / Night and Daytime lighting</i></p> <p>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).</p> <p>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).</p> <p>It is however important to note that the development area is situated within a suburban region and adjacent to the Harmony Free gold Mine, 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.</p> <p>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.</p> <p>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.</p> <p>No impacts are predicted towards pilots along any of the assessed approach paths and no ATC Tower was identified.</p> <p>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.</p>		
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
<p>Mitigation: N/A</p>		
<p>Residual Impacts: N/A</p>		

Nature: <i>Visual Exposure</i>		
<p>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.</p> <p>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 Target PV.</p> <p>The basic area of concern is:</p> <ul style="list-style-type: none"> » The 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)
<p>Mitigation:</p> <p>General mitigation/management:</p> <p>Planning:</p> <ul style="list-style-type: none"> » Retain and maintain natural vegetation in all areas outside of the development footprint. <p>Operations:</p> <ul style="list-style-type: none"> » Maintain the general appearance of the facility as a whole. <p>Decommissioning:</p> <ul style="list-style-type: none"> » 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		

Nature: <i>Sense of place</i>		
<p>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.</p> <p>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.</p>		
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.		

7.7.3 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. There are no residences within this zone, however two existing buildings are within this area which have largely been abandoned, it is speculated this was utilized by the mine. The Target Gold mine lays north of the proposed facility within this observation zone. There are two directly adjacent access roads (to the north and the east of the development). Observers travelling along this road will be exposed to the project infrastructure. There are also three existing 44kV Overhead lines to the east of the site across from the access road.

1 – 3 km (**High Sensitivity**)

Potential visual exposure is largely contained to the north (extending into the town of Allanridge) and to the east (Nayakallong). The western portion of the observation zone is largely more vacant land with fewer visual receptors.

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 West of the proposed development. Most of the eastern area is comprised of the small settlement of Nayakallong, beyond this town is a similar land use pattern to the west (mostly agriculture or vacant land) existing mine heaps or infrastructure which severely influences the characteristics of the landscape.

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 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.

7.8. Assessment of Social Impacts

Potential social impacts and the relative significance of the impacts associated with the development of the Harmony Target Solar PV Facility are summarised below (refer to **Appendix J**).

7.8.1 Results of the Social Impact Assessment

There are some vulnerable communities within the project area that may be affected by the development Harmony Target 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 Target 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.

7.8.2 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
- » Pressure to local services

Nature: Employment opportunities and skills development

Impact description: 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 the Harmony Target Mining Operations will provide employment for 7000 employees in mining, construction, management or other related activities.

As per the SLP, the Harmony Target 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 Target 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 30MW 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	Low (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	
<p><i>Enhancement measures:</i></p> <p>To enhance the local employment, skills development and business opportunities associated with the construction phase, the following measures should be implemented:</p> <ul style="list-style-type: none"> » 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. <p><i>Residual Impacts:</i></p> <ul style="list-style-type: none"> » 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. 		

Nature: Contributions to the local economy

Impact description: Harmony Gold Mine Harmony Target 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 centres;
- » 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 also 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

Nature: *Safety and security*

Impact description: 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 Target'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 behaviour 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.

Nature: *Disruption of daily living and movement patterns*

Impact description: 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:		
<ul style="list-style-type: none"> » 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.		

Nature: <u>Increased pressure on local services/resources</u>		
Impact description: 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:		
<ul style="list-style-type: none"> » 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.

Nature: *Nuisance impacts (noise & dust)*

Impact description: 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 impact is 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 Target 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 Target 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 realized 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;

Nature: Job creation during operation

Impact description: 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 the Harmony Target mining Operations will provide employment for 6 636 employees in mining, construction, management or other related activities.

As per the SLP, the Harmony Target 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 Target 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 30MW 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 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 requirement 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

Nature: *Development of solar PV facility under existing mining guidelines and policies*

Impact description: 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 an 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

Nature: Development of clean, renewable energy infrastructure

Impact description: Development of clean, renewable energy infrastructure

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 power plant's location also uniquely connects the local community to skills for this sector, thus improving their employability.

Nature: Visual impacts and impacts on sense of place

Impact description: 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 Target PV project is likely to be significant. While the relatively small number of people employed during the operational phase (20), 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.

7.8.3 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.
- » Grid alternative 3 is considered least preferred from a social perspective, due to this route cutting across Portion 0 of the Farm Aandenk 227. Grid alternatives 1 and 2 follow existing grid lines as well as farm roads and will, therefore have low impact.

7.9. Assessment of the 'Do Nothing' Alternative

The 'do-nothing' alternative (i.e. no-go alternative) is the option of not constructing the Harmony Target 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 Target 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, crop production and cattle grazing are viable long-term land uses of the site as long as the field quality is maintained by never exceeding the grazing and cultivation capacity.

There are currently rainfed crop activities within the development area. The area is likely grazed periodically by livestock of the local community, after maize has been harvested

The implementation of the 'do-nothing' alternative would leave the land-use restricted to the current agricultural activities, losing out on the opportunity to generate renewable energy from solar energy as additive thereto (i.e. current agricultural 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) 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

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 largest impact will be on the Mine, as the owner and user of the project. If the no-go alternative is followed and no PV Facility is developed, it will be the status quo of being reliant to power and the national grid will be strained.
- » 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 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. In the given and described policy context, this would represent a negative social and environmental cost.

c) Conclusion

As the project site experiences ample solar resource and optimal grid connection opportunities are available, not developing the Harmony Target Solar PV Facility would see such an opportunity being lost. 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 Target 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.
- » 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 Target 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 Target 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 Target 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 Target 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 Target Solar PV Facility, there are five(5) authorised PV facilities located within a 30km radius of the project site, as well as one(1) new PV solar energy facilities proposed for development (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 – J**).

Table 8.1: PV facilities located within the broader area (within a 30km radius) of the Harmony Target Solar PV Facility

Project Name	DEA Reference Number(s)	Approximate distance from the Harmony Target Solar PV Facility	Project Status
Grootspruit Solar PV (75MW)	14/12/16/3/3/2/376	~ 13.5 km north-east	Environmental Authorisation issued
Grootkop Solar PV (75MW)	14/12/16/3/3/2/515	~ 9 km west	Environmental Authorisation issued
Harmony Tshepong Solar PV (10MW)	14/12/16/3/3/1/1444	~ 12.5 km south-east	Environmental Authorisation issued
Farm Uitkyk 509 Solar PV (75MW)	14/12/16/3/3/2/581	~ 29 km south-east	Environmental Authorisation in process
Harmony Eland Solar PV (10MW)	14/12/16/3/3/1/1471/AM1	~ 16.5 km south	Environmental Authorisation issued
Harmony Nyala Solar PV (10MW)	14/12/16/3/3/1/1472	~ 14.6 km south	Environmental Authorisation issued

Several of the projects are also associated with Mine sites, and/or are 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 Target Solar PV Facility are therefore qualitatively assessed in this Chapter. The following potential impacts are considered:

- » Cumulative Impacts on Ecological
- » 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

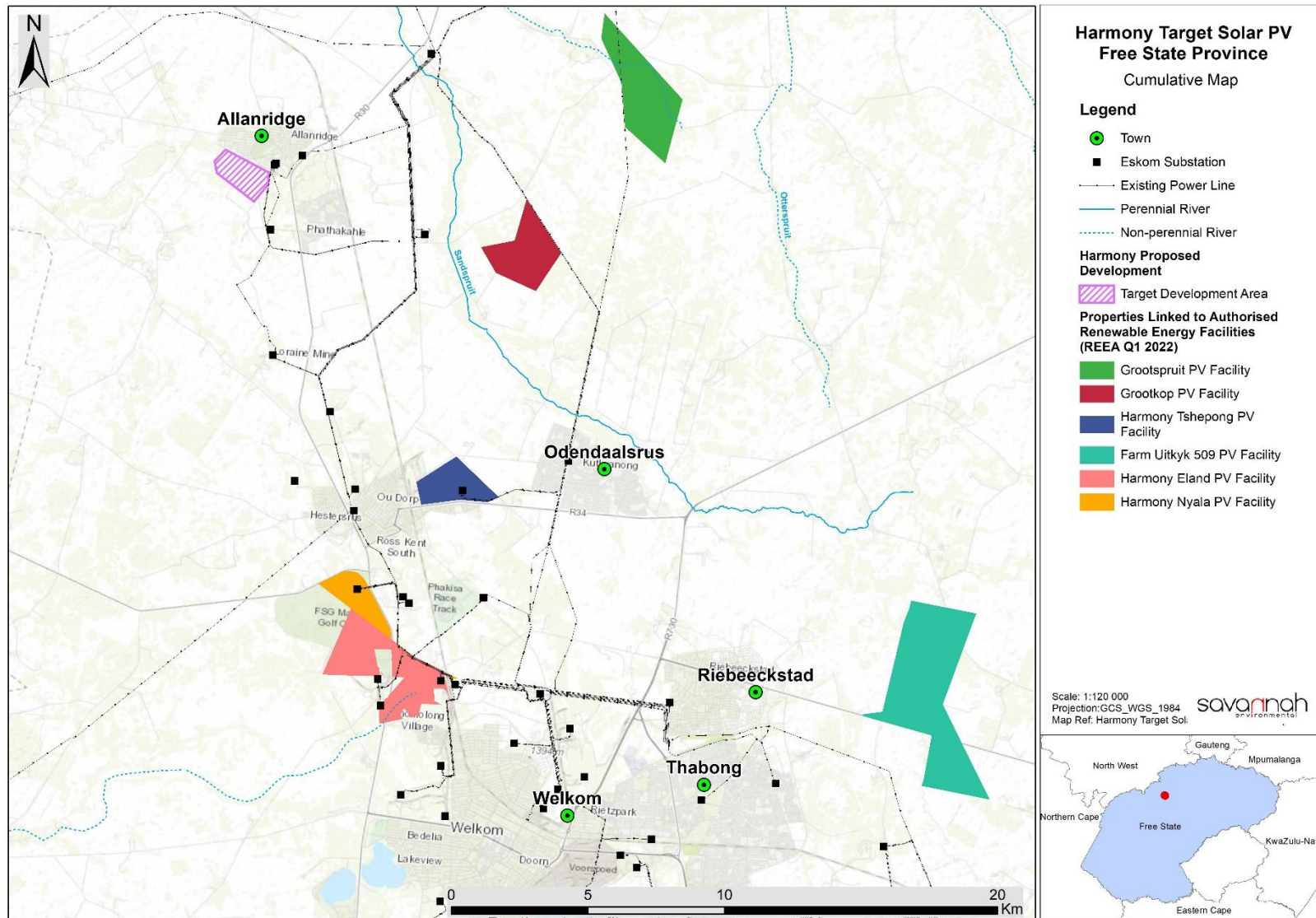


Figure 8.1: Identified PV facility projects located within a 30km radius of the Harmony Target Solar PV Facility that are considered as part of the cumulative impact assessment for the Harmony Target Solar PV project

8.2 Cumulative Impacts on Terrestrial Ecology

Cumulative impacts associated with the Harmony Target Solar PV Facility and associated infrastructure have been identified by the ecological specialist (refer to **Appendix D**).

The proposed activity will not result in any unacceptable loss or impact on the site or regionally, regardless of any other projects proposed in the area. Nature: <i>Activity may result in cumulative impacts to terrestrial ecology.</i>		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Low (1)	Low (1)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Minor (2)
Probability	Probable (3)	Probable (3)
Significance	Low (27)	Low (21)
Status (positive or negative)	Negative	Negative
Reversibility	High	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Blanket clearing of vegetation must be limited to the site. No clearing outside of footprint to take place. » Rehabilitation or revegetation should be implemented on completion of construction. » The habitats and microhabitats present on the project site are not unique and are widespread in the general area, hence the local impact associated with the footprint would be of low significance if mitigation measures are adhered to. » Small mammals within the habitat on and around the affected area are generally mobile and likely to be transient to the area. They will most likely vacate the area once construction commences. As with all construction sites there is a latent risk that there will be some accidental mortalities. Specific measures are made to reduce this risk. The risk of species of special concern is low, and it is unlikely that there will be any impact to populations of such species because of the activity. » Reptiles such as lizards are less mobile compared to mammals, and some mortalities could arise. It is recommended that a faunal search and rescue be conducted before construction commences, although experience has shown that there could still be some mortalities as these species are mobile and may thus move onto site once construction is underway. A reptile handler should be on call for such circumstances. » Should any amphibian migrations occur between wetland areas during construction, appropriate measures (including temporarily suspending works in the affected area) should be implemented. » A pre-commencement faunal search and rescue is recommended, but not necessarily required. Respective permits to be obtained beforehand. » No animals are to be harmed or killed during the course of operations including use of snares. 		

8.3 Cumulative Impacts on Wetlands

Cumulative impacts associated with the Harmony Target Solar PV Facility and associated infrastructure have been identified by the wetland specialist (refer to **Appendix E**).

The cumulative impacts to wetlands and water resources, considering the development of the Harmony Target Solar PV Facility and the PV facilities within the surrounding area will be of a low significance.

Nature: <i>Compaction, Soil Erosion and Sedimentation</i>		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area

Extent	Very short-term (1)	Short term (2)
Duration	Low (1)	Medium-low (2)
Magnitude	Small (1)	Minor (2)
Probability	Improbable (2)	Probable (3)
Significance	Low (6)	Low (18)
Status (positive or negative)	Negative	Negative
Reversibility	High	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Compaction of soils should be limited and / or avoided as far as possible. Compaction will reduce water infiltration and will result in increased runoff and erosion. Where any disturbance of the soil takes place (have taken place in the past), these areas must be stabilised and any alien plants which establish should be cleared and follow-up undertaken for at least 2 years thereafter and preferably longer. Where compaction becomes apparent, remedial measures must be taken (e.g., "ripping" the affected area). » Reseed any areas where earthworks have taken place with indigenous grasses to prevent further erosion. » Erosion control mechanisms must be established as soon as possible. » A stormwater plan must be developed with the aid of an engineer to ensure that water runoff is diverted off the site without pooling and stagnation or erosion. Financial provision for closure will include the estimated costs for erosion control post-construction and post-decommissioning. » The indiscriminate use of machinery within the wetland area will lead to compaction of soils and destruction of vegetation and must therefore be strictly controlled. » A buffer zone of 10 m should be implemented around the wetland as a no-go area, to prevent sediment changes. 		

Nature: <u>Soil and water pollution</u>		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Short-term (2)	Short term (2)
Duration	Low (1)	Medium (3)
Magnitude	Minor (2)	Low (4)
Probability	Improbable (2)	Improbable (2)
Significance	Low (10)	Low (18)
Status (positive or negative)	Negative	Negative
Reversibility	High	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. Regularly inspect all vehicles for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil. » No dumping of waste should take place within the wetlands or their buffer zones. If any spills occur, they should be cleaned up immediately. » Contain all dirty water in the dirty water system and contain all dirty stormwater up to a 1:50 year flood line as a minimum. Ensure that all activities impacting on groundwater resources of the subject property are managed according to the relevant DWS Licensing regulations and groundwater monitoring and management requirements. » Appropriate sanitary facilities must be provided for the duration of the proposed development and all waste removed to an appropriate waste facility. » Excess waste or chemicals should be removed from site and discarded in an environmentally friendly way. The Environmental Control Officer (ECO) should enforce this rule rigorously. » Hazardous chemicals to be stored on an impervious surface protected from rainfall and stormwater run-off. 		

- » Spill kits should be on-hand to deal with spills immediately.
- » All vehicles should be inspected for oil and fuel leaks on a regular basis. Vehicle maintenance yards on site should make provision for drip trays to capture spills. Drip trays should be emptied into a holding tank and returned to the supplier.
- » Implement standard dust control measures, 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) and chemical dust suppressants of construction areas and access roads, and ensure that these are continuously monitored to ensure effective implementation.
- » A speed limit (preferably 40 km/hour) should be enforced on dirt roads.
- » Limit pesticide use to non-persistent, immobile pesticides and apply in accordance with the label and application permit directions and stipulations for terrestrial and aquatic applications.

Nature: <i>Spread and establishment of alien invasive species in wetland areas</i>		
	Overall impact of the proposed project considered in isolation	Cumulative impact of the project and other projects in the area
Extent	Very short-term (1)	Short term (2)
Duration	Low (1)	Medium (3)
Magnitude	Small (1)	Low (4)
Probability	Very improbable (1)	Improbable (2)
Significance	Low (3)	Low (18)
Status (positive or negative)	Negative	Negative
Reversibility	High	Moderate
Irreplaceable loss of resources?	No	No
Can impacts be mitigated?	Yes	
Mitigation:		
<ul style="list-style-type: none"> » Alien and invader vegetation must not be allowed to colonise the area. Control involves killing alien invasive plants present, seedlings and establishing an alternative plant cover to limit re-growth. The use of indigenous plants must be encouraged in the rehabilitated areas (stormwater canals). Control should begin prior to construction phase considering small populations of invader plant species occur around the project area. » Institute strict control over materials brought onto site, which should be inspected for seeds and steps taken to eradicate these before transport to the site. The contractor is responsible for the control of weeds and invader plants. » Rehabilitate disturbed areas as quickly as possible. » Institute a monitoring programme to detect alien invasive species early. » Institute an eradication/control programme for early intervention if invasive species are detected. The use of indigenous plants must be encouraged in the rehabilitated areas. Active management and eradication of exotic / alien plant species should also occur when seedlings are found. » 		

8.4 Cumulative Impacts on Avifauna

Cumulative impacts from an avifauna perspective include exacerbated displacement and loss of habitat. In addition, the grid connection alternatives (via power lines) of this facility with high voltage lines north-west of the Harmony Target Solar PV Facility 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 Target Solar PV Facility and the PV facilities within the surrounding area will be of a low to high significance, depending on the impact being considered.

Nature: <i>Habitat loss</i>		
The development of the Harmony Target 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	Minor (2)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	Low (24)	Medium (33)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	No	
Mitigation:		
<ul style="list-style-type: none"> » 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. 		

Nature: <i>Collision – PV panels</i>		
Avian collision impacts (i.e. collision impacts with the PV panels) are expected during the operation phase of the Harmony Target 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 (4)	Site and immediate surroundings (4)
Duration	Long-term (4)	Long-term (4)
Magnitude	Medium (6)	High (8)
Probability	Highly Probable (4)	Highly Probable (4)
Significance	Medium-High (56)	High (64)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
Can impacts be mitigated?	Yes, to some extent	
Mitigation:		
<ul style="list-style-type: none"> » 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. 		

Nature: <i>Collision – Grid Infrastructure</i>

Avian collision impacts (i.e. collision impacts with the overhead power lines) are expected during the operation phase of the Harmony Target 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 (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
Can impacts be mitigated?	Yes, to some extent	
Mitigation:		
<ul style="list-style-type: none"> » 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. 		

Nature: Electrocution

During the operation phase of the Harmony Target 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 (to some extent), owing to the potential loss of waterbird taxa.	Yes (to some extent), owing to the potential loss of waterbird taxa and potential threatened and near threatened waterbird taxa
Can impacts be mitigated?	Yes, to some extent	
Mitigation:		
<ul style="list-style-type: none"> » 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. 		

8.5 Cumulative Impacts on Land Use, Soil and Agricultural Potential

Cumulative impacts from a soils perspective are related to an increase in the loss of agricultural land used for livestock farming 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.

The cumulative soils and land use impacts, considering the development of the Harmony Target Solar PV Facility and the PV facilities within the surrounding area will be of a medium significance, depending on the impact being considered.

Nature: <i>Decrease in areas with suitable land capability for cattle farming.</i>		
With the development of the Harmony Target 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	Medium duration (3)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Definite (4)	Highly likely (4)
Significance	Medium (32)	Medium (40)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	N/A	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.		

Nature: <i>Decrease in areas with suitable land capability for rainfed crops</i>		
With the development of the Harmony Target PV Facility and other PV facilities in the area, the decrease in land capability for rainfed 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	Long term duration (4)	Long-term (4)
Magnitude	High (8)	High (8)
Probability	Definite (5)	Highly likely (4)
Significance	High (65)	Medium (40)
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	N/A	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.		

Nature: *Cumulative impact areas susceptible to soil erosion.*

During construction Harmony Target 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.

Nature: *Cumulative impact on increased risk of soil pollution*

During construction the Harmony Target 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 concrete 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 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.

8.6 Cumulative Impacts on Heritage (including archaeology and palaeontology)

This application is for the proposed development of a solar energy facility and associated grid connection to facilitate operations at the Target Harmony Mine. The location of the 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. The cumulative impacts associated with the development and others in this area are unlikely to result in unacceptable risk or loss, or in a complete change to the sense of place of the area (and no impact table is required to reflect a no impact). The facility is not likely to result in an unacceptable increase in impact due to its location, considering it is one of many renewable energy facilities in this area, and its proximity to the existing mining operations.

The anticipated cumulative impact is expected to be of low significance, which is considered to be acceptable from a heritage perspective.

8.7 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-EMA (2013)).

The anticipated cumulative visual impact is expected to be of medium significance, which is considered to be acceptable from a visual perspective.

Nature: Potential cumulative visual impact on the visual quality of the landscape		
The proposed Harmony Target 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.

8.8 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.

Nature: *An increase in employment opportunities, skills development and business opportunities with the establishment of a solar PV facility*

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:		
<ul style="list-style-type: none"> » The establishment of a number of solar PV 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. 		

Nature: Cumulative impact with large-scale in-migration of people
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:		
<ul style="list-style-type: none"> » 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. 		

8.9 Conclusion Regarding Cumulative Impacts

Cumulative impacts are expected to occur with the development of the Harmony Target 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 Target 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:

- » Transformation of natural areas has occurred as a result of widespread development. Cumulative impacts on ecological aspects (vegetation types, species and ecological processes) are negligible. Since transformation is already so extensive, this proposed development has the opportunity to make use of these transformed areas, and should the development be able to remain within these transformed areas should therefore not contribute significantly toward the cumulative impacts in this area. The cumulative impact is therefore acceptable.
- » There will be no unacceptable risk to avifauna with the development of the Harmony Target 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 Target 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 Target 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 Target 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)
Terrestrial Ecology	Low	Low
Wetlands	Low	Low
Avifauna	Low to High (depending on the impact being considered)	Medium to High (depending on the impact being considered)
Land use, soil and agricultural potential	Medium to High (depending on the impact being considered)	Medium
Heritage (archaeology and palaeontology)	Low	Low
Visual	Medium	Medium
Social	Medium to Low	Medium to Low

Based on the specialist cumulative assessment and findings, the development of the Harmony Target 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 cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to decrease in land capability for rainfed crops due to the extent of development encroachment on areas of high land capability. It was concluded that the development of the 30MW Harmony Target 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.

CHAPTER 9: CONCLUSIONS AND RECOMMENDATIONS

Avgold (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 Target Mine. A solar PV facility with a generating capacity of 30MW is proposed in close proximity to the Harmony Target Plant mining operations. The site is located 550m south of the Harmony Target operations, approximately ~14km south of the town of Allanridge within the Matjhabeng Local Municipality and within the Lejweleputswa District Municipality, Free State Province.

The solar PV facility, known as Harmony Target 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 Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are owned by the Mine but outside of the mining area (the project would not impact on mining activities).

A project site¹⁷ considered to be technically suitable for the development of the solar PV facility, with an extent of approximately 500ha, was identified by Avgold (Pty) Ltd. A development area¹⁸ of ~245ha was demarcated within the project site for the construction and operation of the Harmony Target Solar PV Facility and associated grid connection corridor, and the full extent of this development area has been fully considered within this Scoping/EIA process and assessed in terms of its suitability from an environmental and social perspective within this EIA Report. The development area allows an adequate footprint¹⁹ (~105ha) for the installation of a solar PV facility with a contracted capacity of up to 30MW, 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 station to be connected to the existing Avgold Substation via a power line (located ~400m north east of the site). The corridor allows for the consolidation of linear infrastructure and runs parallel to existing power lines traversing the site, for most of its length.

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the western side of the Avgold Substation (located directly south west of the Loraine One Substation).

¹⁷ The project site comprises the affected properties 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 BA process, within which direct effects of the proposed project may occur. The project site is ~500ha in extent.

¹⁸ The development area is that identified area where the 30MW 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 ~245ha in extent.

¹⁹ The development footprint is the defined area (105ha) located within the development area) where the PV panel array and other associated infrastructure for the Harmony Target Solar PV facility is planned to be constructed. This includes the actual footprint of the facility, and the area which would be disturbed.

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the western side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. At the junction with the secondary road, the route turns south to access the western side of the Avgold Substation.

The Harmony Target Solar PV Facility will have a contracted capacity of up to 30MW 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, switching station, to be connected to the Avgold Substation via an overhead power line (located ~400m north east of the site).

From a local perspective, the Mine site within the greater Allanridge 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 Target 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, Avgold (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 EIA 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	A summary of the findings of the specialist studies undertaken for Harmony Target Solar PV Facility

Requirement	Relevant Section
indication as to how these findings and recommendations have been included in the final report	and associated grid connection corridor 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 Target Solar PV Facility and associated grid connection corridor 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 Target Solar PV Facility and associated grid connection corridor 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 Target Solar PV Facility and associated grid connection corridor have been included in section 9.7.

9.2 Evaluation of the Harmony Target Solar PV Facility

The preceding chapters of this report together with the specialist studies contained within **Appendices D-J** provide a detailed assessment of the potential impacts that may result from the development of the proposed Harmony Target 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 Target Solar PV Facility and associated grid connection corridor 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 and fauna)

The site falls within the Vaal-Vet Sandy Grassland vegetation type. Much of the vegetation unit is transformed, being prime agricultural land, with remnant patches comprising natural and near natural (sometimes secondary) remaining.

The Terrestrial Ecology Assessment (**Appendix D**) undertaken identified areas of sensitivity, and the implementation of avoidance of sensitive areas as a mitigation strategy has been adopted. The majority of the site development area that was assessed is not considered as being remaining habitat (i.e., it has been transformed at some point either historically, or recently, and based on land cover and transformation analyses). The entire PV development footprint is situated within transformed or secondary vegetation, including currently or recently cultivated lands and a small area of old lands (<10 years).

The entire PV development footprint is located within a ESA 2 designated area and has been designed to avoid CBA 1 and ESA 1 areas. The site falls almost entirely within an ESA 2 designated area, with a small patch of CBA 1 within the site, as well as adjacent to an ESA 1 designated area, both on the north-western corner.

The majority of this area has previously been completely transformed or severely degraded, and can be considered to have a low conservation status, especially where there is very dense alien infestation. Loss of these areas will not significantly compromise the current conservation status of the vegetation unit at a regional level, nor is its loss likely to compromise the ecological functioning of surrounding areas. Despite the largely transformed condition of the site, small areas of remaining natural grassland are also still present, and these areas clearly have a high conservation value. The development footprint of the Harmony Target Solar PV Facility avoids this identified area entirely.

Overall, there are no specific long-term impacts likely to be associated with the development of the Harmony Target Solar PV Facility and associated grid connection corridor. All impacts on terrestrial ecology were rated to be of low significance before and after mitigation. As such, there are no fatal flaws associated with the development and no terrestrial ecological considerations that should prevent it from proceeding.

9.2.2 Impacts on Wetlands

The Wetland Impact Assessment (**Appendix E**) undertaken determined that there are no impacts associated with the Harmony Target Solar PV Facility and associated grid connection corridor that cannot be mitigated to an acceptable level and as such, the assessed layout was considered acceptable.

According to the national web-based environmental screening tool, the site has a Low sensitivity for Aquatic Biodiversity. During the field survey it was confirmed that the site has a Low sensitivity from a wetland and aquatic biodiversity perspective. The wetlands in the project area have been ploughed and planted with agricultural crops. It was also evident that no planting had occurred within the preceding year, and weeds and declared invader plant species has grown. Some of the wetlands outside of the development area are of a higher sensitivity, but they will not be directly impacted by the development footprint.

The wetlands inside the development area are classified as endorheic depression wetlands. The PV development footprint and associated grid connection corridor has been designed to avoid the wetland areas and associated buffers. All impacts on wetlands were rated to be of low significance before and after mitigation. As such, there are no fatal flaws associated with the development and no considerations that should prevent it from proceeding.

9.2.3 Impacts on Avifauna

The Avifauna Impact Assessment (**Appendix F**), which considered the results of two seasons of pre-construction bird monitoring, determined the significance of potential avifauna impact to be moderate-high to low after mitigation (depending on the type of impact), and the potential for birds to collide with the associated power line being low after mitigation.

Three broad-scale avifaunal habitat types were identified on the study site and surroundings, ranging from secondary grassland, depressions to transformed and landscape/manicured areas, including cultivated land. The study site was also surrounded by a number of pans and Stinkpan, which provided habitat for a large number of waterbird taxa. A total of 130 bird species have been recorded within the study area, including five Red listed species (threatened and near threatened species). In addition, a total of 59 collision-prone bird species have been recorded from the study area, of which 46 species were waterbird and shorebird taxa and another seven species were birds of prey. These also included the near threatened Greater Flamingo (*Phoenicopterus roseus*) and Lesser Flamingo (*Phoeniconaias minor*) and the globally endangered Maccoa Duck (*Oxyura maccoa*) which were regular foraging visitors to the nearby Stinkpan.

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).

An evaluation of potential and likely impacts on the avifauna revealed that the impact significance was predicted to be moderate-high to low after mitigation (depending on the type of impact). However, the risk for waterbirds and shorebirds (including flamingo taxa) colliding with the PV infrastructure remained eminent due to the presence of inundated pans and dams in the study area and dispersal routes coinciding with the study area. 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 was strongly recommended that the proposed mitigation measures and monitoring protocols (e.g. post-construction monitoring) be implemented during the construction and operation phase of the project (e.g. the installation of appropriate bird diverters to minimise the potential risk of collision trauma in birds).

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.

9.2.4 Impacts on Soil and Agricultural Potential

The Agricultural Agro-Ecosystem Assessment found that the area consists of four different natural soil forms, i.e. Avalon, Bainsvlei, Clovelly, and Ermelo. The areas with existing soil disturbance are classified as Technosols. The entire development area largely consists of land with Moderate-High (Class 09) land capability. Moderate (Class 08) land capability is found in the middle of the study area, while a small patch of Low-Moderate (Class 07) land capability is found in middle parts. Within the development area, the areas where soil has been disturbed by activities associated with the nearby mining infrastructure, and that has been classified as Technosols, have Very low (Class 02) land capability. The areas are no longer suitable for rainfed crop production and has limited suitability for livestock farming because of the uneven terrain in these areas.

The land capability of the natural soil forms mainly depended whether the soil was found on cultivated land. All soil forms had a Moderate (Class 08) land capability on non-cultivated areas and Moderate-High (Class 09) on cultivated land. The Technosol soil had a Very low (Class 02) land capability

The soils on cultivated land are better suited to rainfed crop production because of the soft plinthic horizon that underlies the deep apedal B1 subsoil-horizons. The soft plinthic horizon retains soil moisture and this is available for crop roots during periods of water stress. The Ermelo (only found on cultivated land) is freely drained, thus making it better suited for irrigation as the water will freely drain through the soil.xxx

The extent of the development encroaching on areas of Moderate-High land capability, has resulted in a higher significance rating.

It is anticipated that the construction and operation of the Harmony Target Solar PV and associated grid connection corridor facility will have impacts that range from high to low impacts on soils and agricultural potential, depending on which impact is being considered. These impacts can be reduced by keeping the footprints 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.

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.

9.2.5 Impacts on Heritage Resources (archaeological and paleontological)

The Heritage Impact Assessment identified that all impacts associated with the development of the Harmony Target Solar PV Facility and associated grid connection corridor will be of low significance before and after mitigation measures are implemented.

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. No archaeological resources of scientific cultural value were identified within the area proposed for the Target PV Facility and its grid connection and as such, no impact to significant archaeological heritage resources is anticipated. Only one site (TG1) of heritage significance was identified

within the grid corridor development area. However, the PV footprint as well as two of the grid corridors considered (alternative 1 and 2) avoid this heritage site.

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 at all.

The heritage specialists have no objection to the proposed development of the Harmony Target Solar PV facility and associated grid connection corridor on condition that a Chance Fossil Finds 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 alternatives are considered acceptable.

9.2.6 Visual Impacts

Besides the mines and mining infrastructure within the study area, there are numerous power lines and substations, predominantly associated with the mines.

A 10km radius from the project area was evaluated. The largest portion of the area selected and regarded suitable for the development was previously cultivated, then left fallow before being ripped and sown with a mixture of grass species and is currently used for cattle grazing. The surrounding farms are overall used for mixed agriculture, consisting of cultivated areas and grazing areas. Land use activities within the broader region are predominantly described as maize and wheat farming, with some mining activity evident towards the north (Allanridge) and the south (Odendaalsrus). 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 mitigation measures being undertaken, mitigation measures arising and the recommended mitigation measures, 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.

9.2.7 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 Target Solar PV Facility and associated grid connection corridor. 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 Target Solar PV Facility and its associated grid connection alternatives 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 Target Solar PV Facility and associated grid connection corridor is supported.

9.2.8 Assessment of Cumulative Impacts

The main aim for the assessment of cumulative impacts considering the Harmony Target Solar PV Facility and associated grid connection corridor 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 Target Solar PV Facility and associated grid connection corridor 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 Target Solar PV Facility cumulative impacts will be of a medium to low significance, with impacts of a high significance relating to agricultural due to the extent of development encroachment on areas of high land capability for rainfed crops, and avifauna due to expected collision impacts of avian species. It was concluded that the development of the 30MW Harmony Target Solar PV Facility and associated grid connection corridor 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 Target Solar PV Facility and associated grid connection corridor. 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 wetlands and avifauna sensitivities/features. The following provides a description of the sensitivities identified within the development footprint:

» **Ecological features:**

- High Ecological Sensitivity:
- » The area demarcated as secondary grassland (grid corridor).
- » The areas demarcated as near natural grassland (PV footprint – however, the PV layout/infrastructure avoids this area).

» **Wetland features:**

- Medium Wetland Sensitivity:
Wetlands and the associated 10m buffer are required to be avoided as far as possible (PV footprint – however, the PV layout/infrastructure avoids this feature and buffer)

» **Soils:**

The project area is located on areas of moderate sensitivity and high sensitivity. However, none of these identified areas are required to be excluded from the proposed development footprint.

» **Heritage Resources:**

One site with archaeological resources/structures were identified within and beyond the development area. For site TG1, no no-go areas have been identified and no buffers have been recommended. There are no sites identified which are required to be excluded from the proposed development footprint. TG1 should be avoided by the grid line Alternative 3.

» **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.

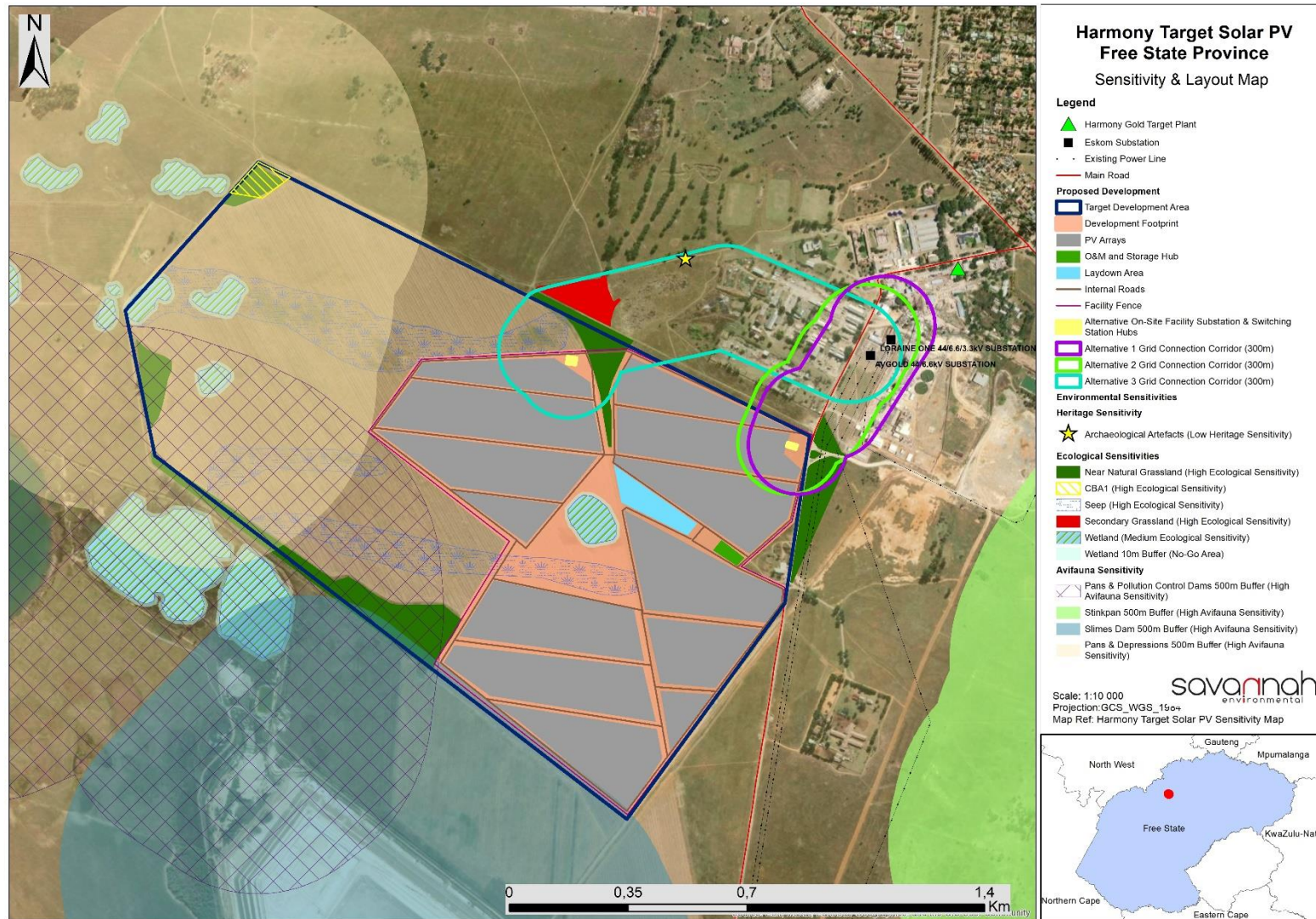


Figure 9.1: Facility layout and sensitivity map of the Harmony Target Solar PV Facility and associated grid connection corridor, as was assessed as part of the EIA process (A3 map is included in **Appendix M**).

9.4 Consideration of Alternatives

Three alternative grid corridors (300m in width) have been assessed. These are described as follows:

Alternative 1: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~750m in length). The corridor exits the facility from the north east corner of the development footprint, and follows existing Eskom power lines to the east of the development area as well as an unnamed mine access road. The route skirts around the Loraine One Substation to access the western side of the Avgold Substation (located directly south west of the Loraine One Substation).

Alternative 2: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~440m in length). The corridor exits the facility from the north east corner of the development footprint, and follows a secondary mine access road to access the western side of the Avgold Substation (located 400m north east of the site).

Alternative 3: A 300m wide corridor between the switching substation located on the Harmony Target Solar PV Facility and the Avgold Substation via an overhead power line (~1.5km in length). The corridor exits the facility from the north west corner of the development footprint, and follows the farm boundary for approximately 200m west before turning north and then east to follow an unnamed mine access road for approximately 570m. At the junction with the secondary road, the route turns south to access the western side of the Avgold Substation.

As part of specialist assessments all three alternative grid connection solutions were assessed, and these alternative corridors were determined to be acceptable from an environmental perspective. A summary of the assessment of impacts for the grid connection corridor and associated infrastructure alternatives are detailed below:

Aspect	Grid Connection Corridor Alternative 1	Grid Connection Corridor Alternative 2	Grid Connection Corridor Alternative 3
Ecology	Acceptable	Preferred & Acceptable	Least Preferred
Wetlands	Acceptable	Acceptable	Acceptable
Avifauna	Acceptable	Preferred & Acceptable	Least Preferred
Soil	Preferred & Acceptable	Preferred & Acceptable	Least Preferred
Heritage	Acceptable	Acceptable	Least Preferred
Visual	Acceptable	Preferred & Acceptable	Least Preferred
Social	Acceptable	Acceptable	Least Preferred

Although Grid Connection Corridor Alternative 2 is the preferred alternative from an ecological, avifauna, and visual perspective, it has been indicated by the respective specialists that all impacts on Grid Connection Corridor Alternative 1 can be mitigated to acceptable levels and therefore both alternatives are considered to be environmentally acceptable. However, Grid Connection Corridor Alternative 3 is the Least preferred by all specialist assessments. This route would potentially have the greatest terrestrial biodiversity impact as it passes through more naturally vegetated areas and is considerably longer than the other alternatives. It is therefore recommended that this alternative should be avoided, unless technical or safety reasons preclude the other alternatives.

Grid Connection Corridor Alternative 2 was identified by the developer as the preferred alternative from a technical feasibility perspective, due to its strategic location allowing it to connect to the substation via a

shorter grid line. This grid alternative has been fully considered and assessed within this EIA report, and is considered to be acceptable from an environmental perspective.

9.5 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 EMP 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. All CBA1 and natural grassland areas are avoided by the PV facility. The facility is planned to be located on transformed/disturbed areas. The resulting impact is considered to be acceptable.
- » Impacts on wetlands. All wetland features are avoided by the PV facility.
- » Impacts on birds. The development will result in a loss of habitat. The impact is however considered to be acceptable with the implementation of the recommended mitigation measure.
- » The heritage resource identified is located outside of the PV facility development footprint. 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. It is anticipated that the construction and operation of the Harmony Target Solar PV facility will have impacts that range from high to low. Through the consistent implementation of the recommendation mitigation measures, most of the impacts can all be reduced to low.
- » 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 the Mine's own use, primarily to reduce the reliance on Eskom as an energy provider.

Benefits of the Harmony Target Solar PV Facility and associated grid connection corridor 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 the 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 Target Solar PV Facility and associated grid connection corridor 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 Gold, 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 Target Solar PV Facility and associated grid connection corridor will contribute to achieving goals for implementation of renewable energy and sustaining a 'green' economy within South Africa.

The benefits of the Harmony Target 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.

9.6 Overall Conclusion (Impact Statement)

The preferred activity was determined by the developer 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 design of the facility layout has ensured that all identified environmental features are avoided by the PV facility. The preferred grid route alternative was identified as Alternative 2 from an environmental perspective (refer to **Figure 9.2**). 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 Target operations, as well as from a policy perspective at a local, provincial and National level. The project development footprint for the PV facility is located outside of any protected area and outside of the Critical Biodiversity Area 1 (CBA1) 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 Target Solar PV facility and associated grid connection corridor 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. 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 are not able to 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 Target Solar PV facility and associated grid connection corridor 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 Target 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).

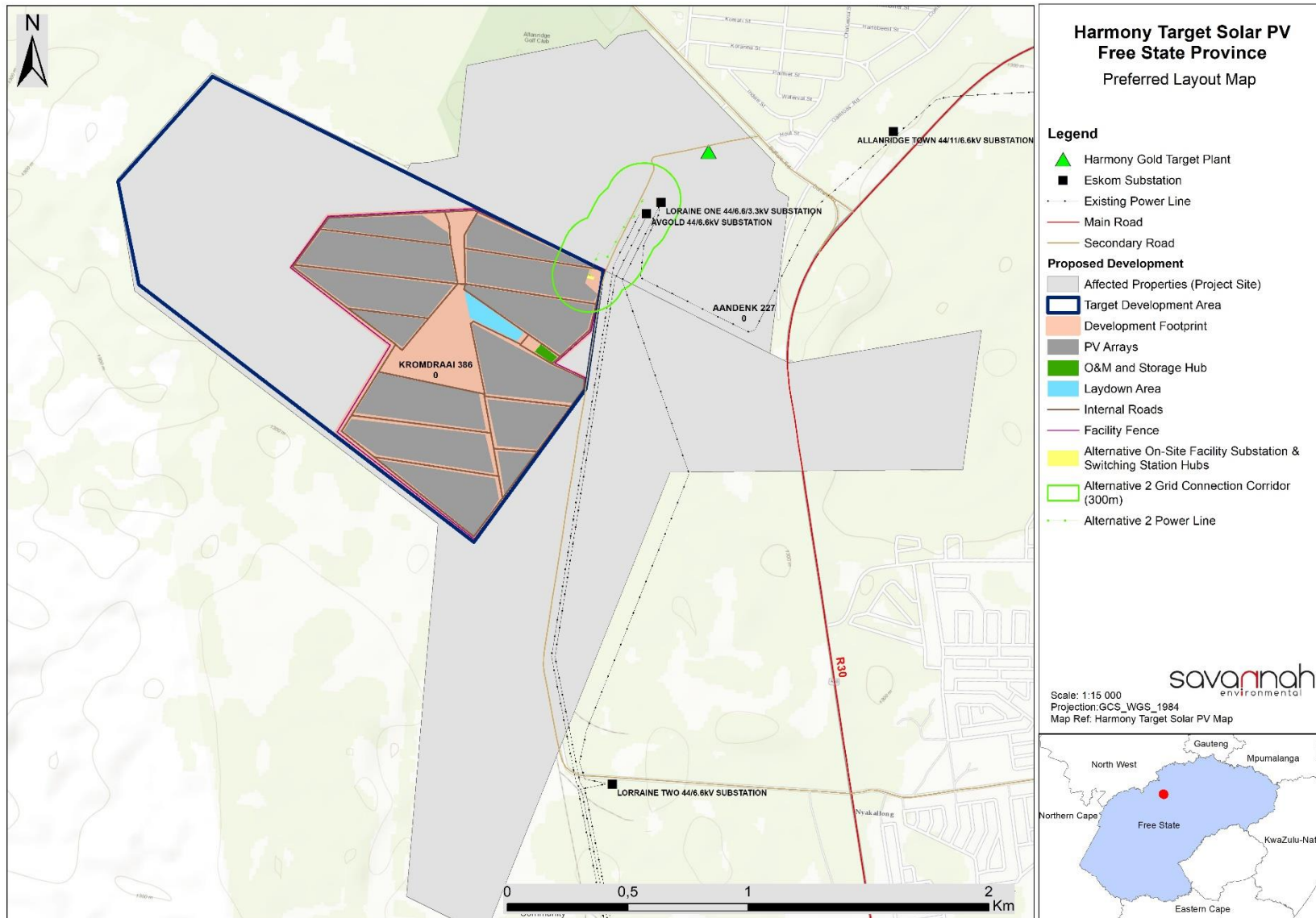


Figure 9.2: Facility layout of the grid connection corridor alternative for the Harmony Target Solar PV Facility, as was assessed as part of the EIA process (A3 map is included in **Appendix M**).

9.7 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 Target Solar PV facility and associated grid connection corridor 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. It is recommended that the alternative 2 grid line should be constructed based on having the lowest environmental impact.

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

30MW Solar PV facility: Harmony Target Solar PV facility located within the project site located on Portion 0 of the Farm Kromdraai 386 and Portion 0 of the Farm Aandenk 227, which are owned by the Mine but outside of the mining area. The grid connection for the facility will consist of underground cabling within the facility, an on-site facility substation and switching station to be connected to the existing Avgold Substation via a power line. Grid Connection Corridor Alternative 2 is the preferred alternative.

The following key conditions would be required to be included within an authorisation issued for the Harmony Target Solar PV Facility and associated grid connection corridor:

- » All mitigation measures detailed within this EIA report, as well as the specialist reports contained within **Appendices D to J** are to be implemented.
- » The EMPr as contained within **Appendix K** of this 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 Target Solar PV facility and associated grid connection corridor 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. The power line corridor is an exception.
- » Following the final design of the Harmony Target Solar PV facility and associated grid connection corridor, 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 from an avifauna specialist (during peak wet season), 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.

CHAPTER 10: REFERENCES

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Nid	Report Type	Author/s	Date	Title
108777	Heritage Impact Assessment Specialist Reports	Anton van Vollenhoven	30/11/2011	A REPORT ON A CULTURAL HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED WITS GOLD DBM PROJECT CLOSE TO VIRGINIA, FREE STATE PROVINCE
120259	PIA Desktop	Barry Millstead		Desktop Palaeontological Heritage Impact Assessment Report for the Oryx Solar Energy Facility
120639	Archaeological Specialist Reports	Jaco van der Walt	30/08/2013	Archeological Impact Assessment report for the Proposed Everest Solar Energy Facility
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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110094	HIA Phase 1	Nkosinathi Godfrey Tomose		Heritage Impact Assessment Study for the Proposed PV Solar Energy Facilities, near Excelsior, Free State Province
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