ESKOM HOLDINGS SOC (LTD)

KOMATI POWER STATION SOLAR PHOTOVOLTAIC, BATTERY ENERGY STORAGE SYSTEM, WIND ENERGY FACILITIES AND ANCILLARY INFRASTRUCTURE

DRAFT ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT REPORT
PART III – APPENDICES E1 – E7

22 AUGUST 2022 FINAL

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This Draft Environmental Impact Assessment Report (Report) for the Proposed Construction of a Solar Photovoltaic, Battery Energy Storage System and Wind Energy Facility at the Komati Power Station has been prepared by WSP Group Africa (Pty) Ltd (WSP) on behalf and at the request of Eskom Holdings SOC Ltd (Client), as part of the application process for Environmental Authorisation.

Unless otherwise agreed by us in writing, we do not accept responsibility or legal liability to any person other than the Client for the contents of, or any omissions from, this Report.

To prepare this Report, we have reviewed only the documents and information provided to us by the Client or any third parties directed to provide information and documents to us by the Client, as well as the supporting specialist studies. We have not reviewed any other documents in relation to this Report, except where otherwise indicated in the Report.

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DESKTOP AIR QUALITY IMPACT ASSESSMENT FOR THE ESKOM KOMATI SOLAR PHOTOVOLTAICS PROJECT

INTRODUCTION

Eskom Holdings SOC (Ltd) (Eskom) is a South African utility that generates, transmits and distributes electricity. Eskom supplies about 95% of the country's electricity. Eskom's 2035 strategy encompasses the journey that Eskom intends to take in response to the changing energy environment and the impact this has towards a sustainable power utility. This strategy is necessitated by the challenges that Eskom faces as a business as well as the global and local shifts occurring in the energy sector particularly with respect to environmental and climate change challenges, difficulties in accessing financing and changes to the macro industry environment significantly altering the energy supply industry (ESI). The road to 2035 includes the shutting down of several coal-fired power stations, repurposing and repowering, delivering new clean generation projects, expanding the transmission grid, and rolling out micro grid solutions. Several power stations are reaching the end of life. These stations will go into extended cold reserve and are most likely to be fully decommissioned in the future. Eskom is considering a shutdown, dismantling and repurposing of some of its fleet as it reaches its end of life. Komati Power Station, situated in Mpumalanga, will reach its end of life expectancy in September 2022. As such, Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100 MW of Solar Photovoltaics (PV) and 150 MW of Battery Energy Storage System (BESS).

The first phase of the Komati Power Station repurposing programme, i.e. the installation of the Solar PV and BESS necessitates an Environmental and Social Impact Assessment (ESIA). As part of the ESIA a desktop Air Quality Impact Assessment is required.

Importantly this ESIA is also being run concurrently with the scope of work for the shutdown and dismantling of the power station and is therefore treated as a separate assessment process to the shutdown and dismantling of the power station.

DESKTOP REVIEW

LOCATION OF SITE AND IDENTIFICATION OF SENSITIVE RECEPTORS

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift on the Highveld in the Mpumalanga Province of South Africa. Komati is surrounded by farmlands mostly practicing agriculture (maize and livestock). It is near Komati Village which includes the business areas (shopping centre) and industrial areas (mines).

Table 1 presents the sensitive receptors within the surrounding environment. Sensitive receptors are defined by the United States Environmental Protection Agency (USEPA) as areas where occupants are more susceptible to the adverse effects of exposure to pollutants. These areas include but are not limited to residential areas, hospitals/clinics, schools and day care facilities and elderly housing. The site layout and receptors are presented in **Figure 1**.

Table 1: Sensitive receptors within a 10 km radius of the proposed project

ID.	Sensitive Receptor Name	Latitude (S)	Longitude (E)	Distance from Site Boundary (km)	Direction from Site
SR1	Komati Village	26° 5'46.52"	29°27'37.62"	Within the boundary	
SR2	Residential Area 1	26° 8'37.05"	29°32'5.14"	7.3	Southeast
SR3	Residential Area 2	26° 4'9.85"	29°25'16.62"	3.7	Northwest
SR4	Residential Area 3	26° 5'14.28"	29°26'18.46"	1.2	Northwest
SR5	Residential Area 4	26° 5'24.70"	29°26'47.50"	0.4	Northwest
SR6	Residential Area 5	26° 2'5.40"	29°31'6.68"	7.2	Northeast

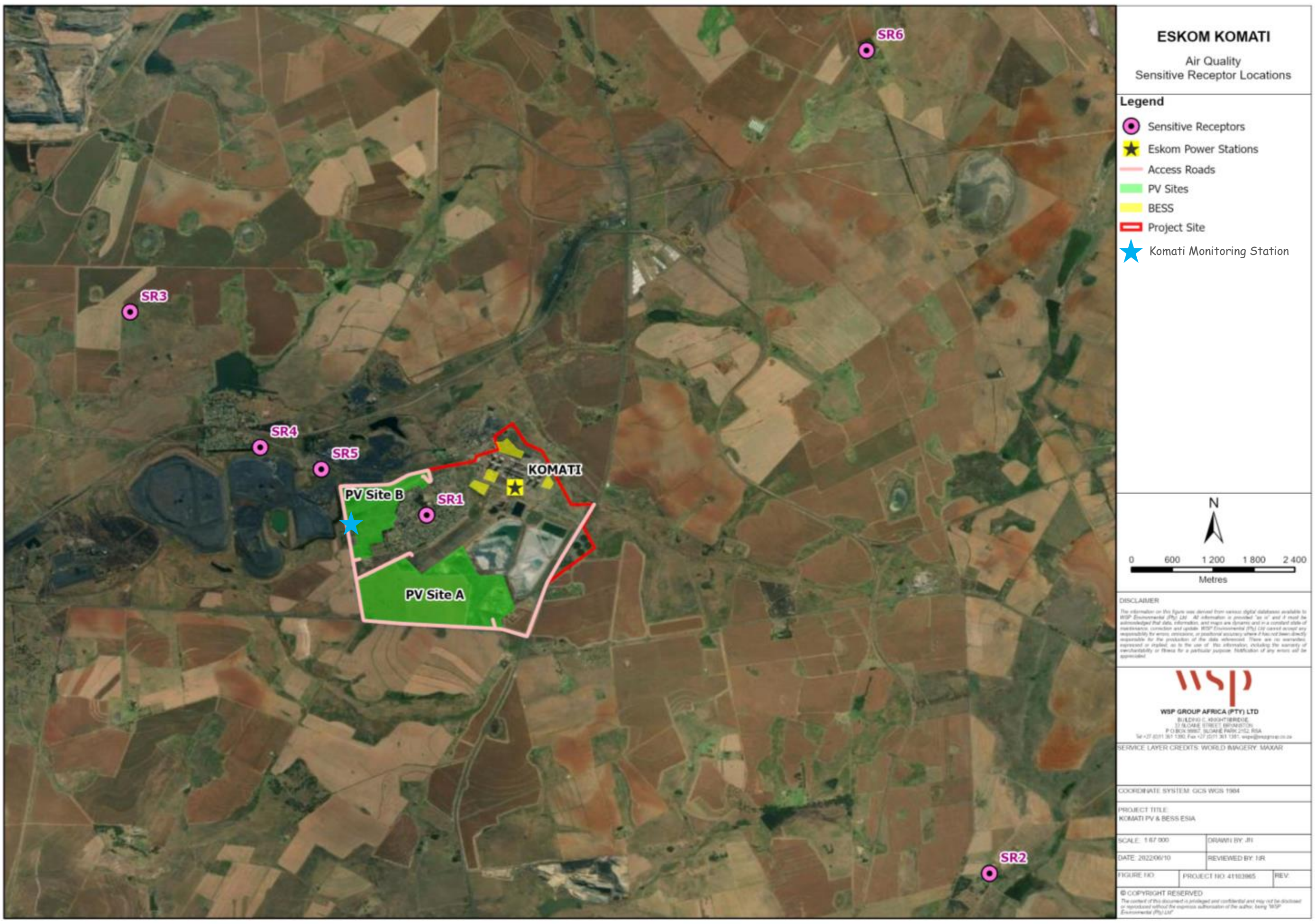

Figure 1: Site layout and sensitive receptors for the proposed project

METEOROLOGICAL OVERVIEW

Since meteorological conditions affect how pollutants emitted into the air are directed, diluted and dispersed within the atmosphere, the use of reliable data in an air quality assessment is of the utmost importance. Mechanical turbulence also influences mixing, and is largely influenced by wind speed, in combination with surface roughness. To assess site-specific meteorological conditions, data was sourced from the South African Air Quality Information System (SAAQIS) for the Komati station and analysed for the best recovery period over the last five years; namely January to December 2018. The Komati station is owned by Eskom and is located on site.

The South African National Accreditation System (SANAS, 2012) TR 07-03 standards stipulate a minimum data recovery of 90% for the dataset to be deemed representative of conditions during a particular reporting period. The percentage recovery for parameters recorded is above 90 % and is thus considered reliable for use in this assessment. Data recovery information for the assessed period is given in **Table 2**.

Table 2: Details of the Komati meteorological station

Station Name	Data Recovery			
	Temperature	Rainfall	Wind	Humidity
Komati	99.9	99.9	99.9	99.8

TEMPERATURE, RAINFALL AND HUMIDITY

- Summer temperatures for the region averaged at 20 °C while winter temperatures averaged at 11 °C (**Figure 2**).
- Komati received approximately 1082 mm of rainfall for 2018. Higher rainfall occurred during the warmer summer months (December, January and February), with drier conditions during cooler winter months (June, July and August). It was noted that the month of March also experienced high volumes of rainfall (**Figure 3**).
- Relative humidity was generally moderate for 2018 at 63% (**Figure 3**).

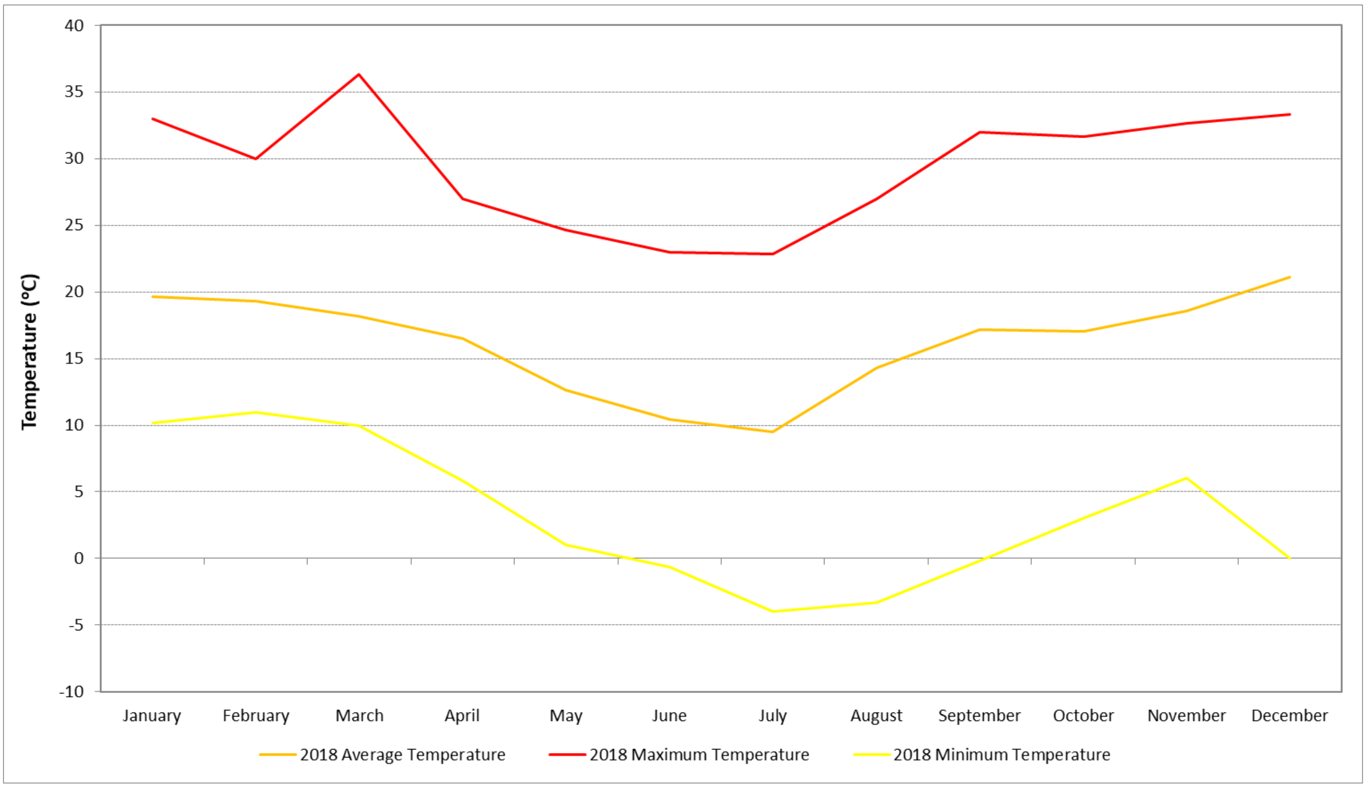

Figure 2: Average, maximum and minimum temperatures for the period January to December 2018 from the Komati station (SAAQIS)

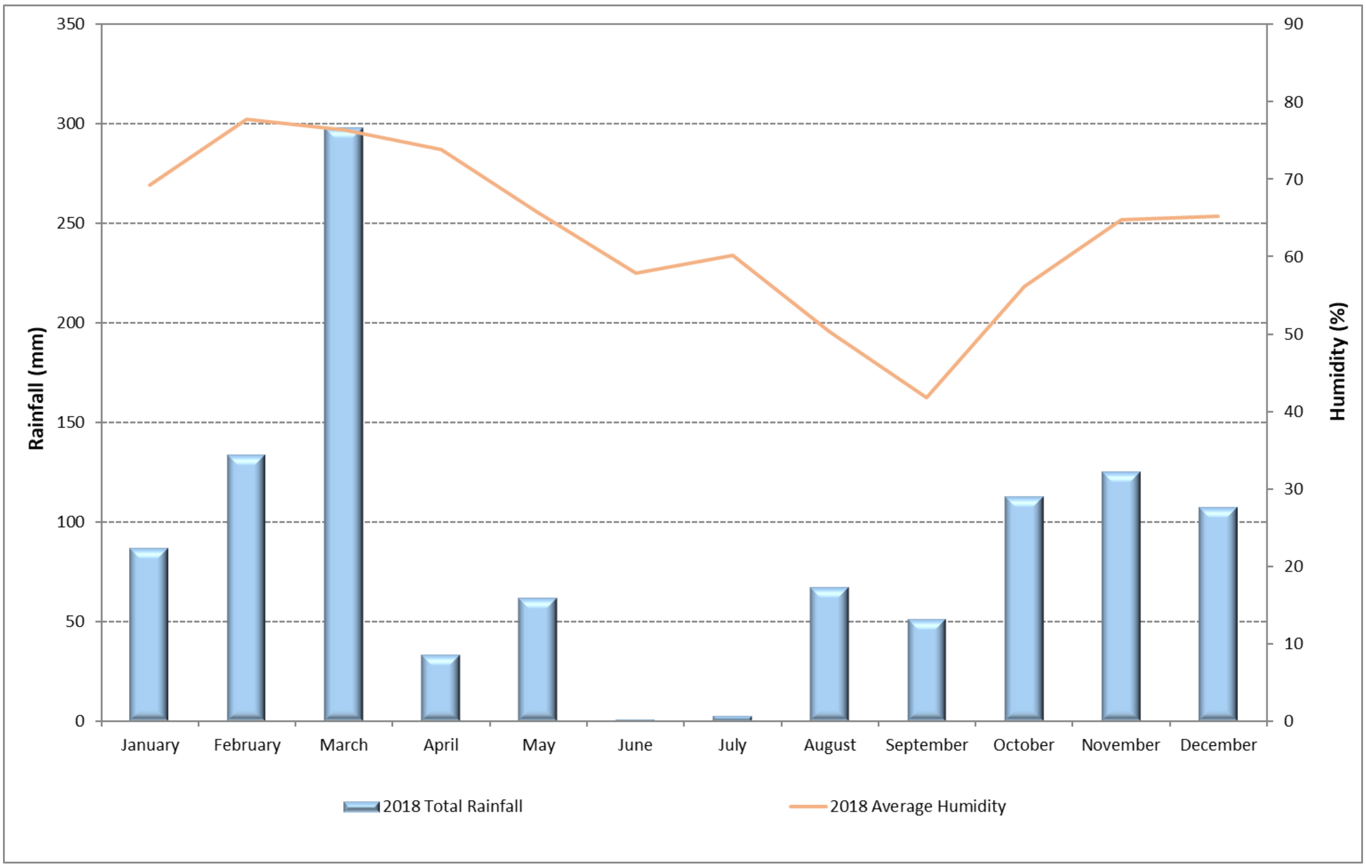

Figure 3: Monthly rainfall and average humidity for the period January to December 2018 from the Komati station (SAAQIS)

LOCAL WIND FIELD

Wind roses summarize wind speed and directional frequency at a location. Calm conditions are defined as wind speeds less than 1.0 m/s. Each directional branch on a wind rose represents wind originating from that direction. Each directional branch is divided into segments of colour, each representative of different wind speeds.

Typical wind fields are analysed for the full period (January to December 2018); diurnally for early morning (00h00–06h00), morning (06h00–12h00), afternoon (12h00–18h00) and evening (18h00–23h00); and seasonally for summer (December, January and February), autumn (March, April and May), winter (June, July and August) and Spring (September, October and November).

Wind roses from the Komati meteorological station are presented in **Figure 4** and are further discussed below.

- During the January to December 2018 period, light to strong north-north-easterly and westerly winds prevail in the region (calm conditions occurring 17 % of the time), with average wind speeds of 2.7 m/s expected.
- During the early morning hours (00h00-06h00) north-north-easterly, north-north-westerly, north and north-westerly winds prevail.
- Towards the latter morning (06h00-12h00) hours, a shift in winds is experienced with dominant winds from the west.
- In the afternoon (12h00-18h00) the westerly wind prevails.
- During the night (18h00-00h00) the north-north-easterly wind prevails yet again.
- Highest winds are experienced during the 12h00-18h00 period.
- Winds from the north-north-easterly prevail during the summer and autumn months whilst the winter and spring months show great directional variability. Additionally, winter and spring experience the strongest winds.

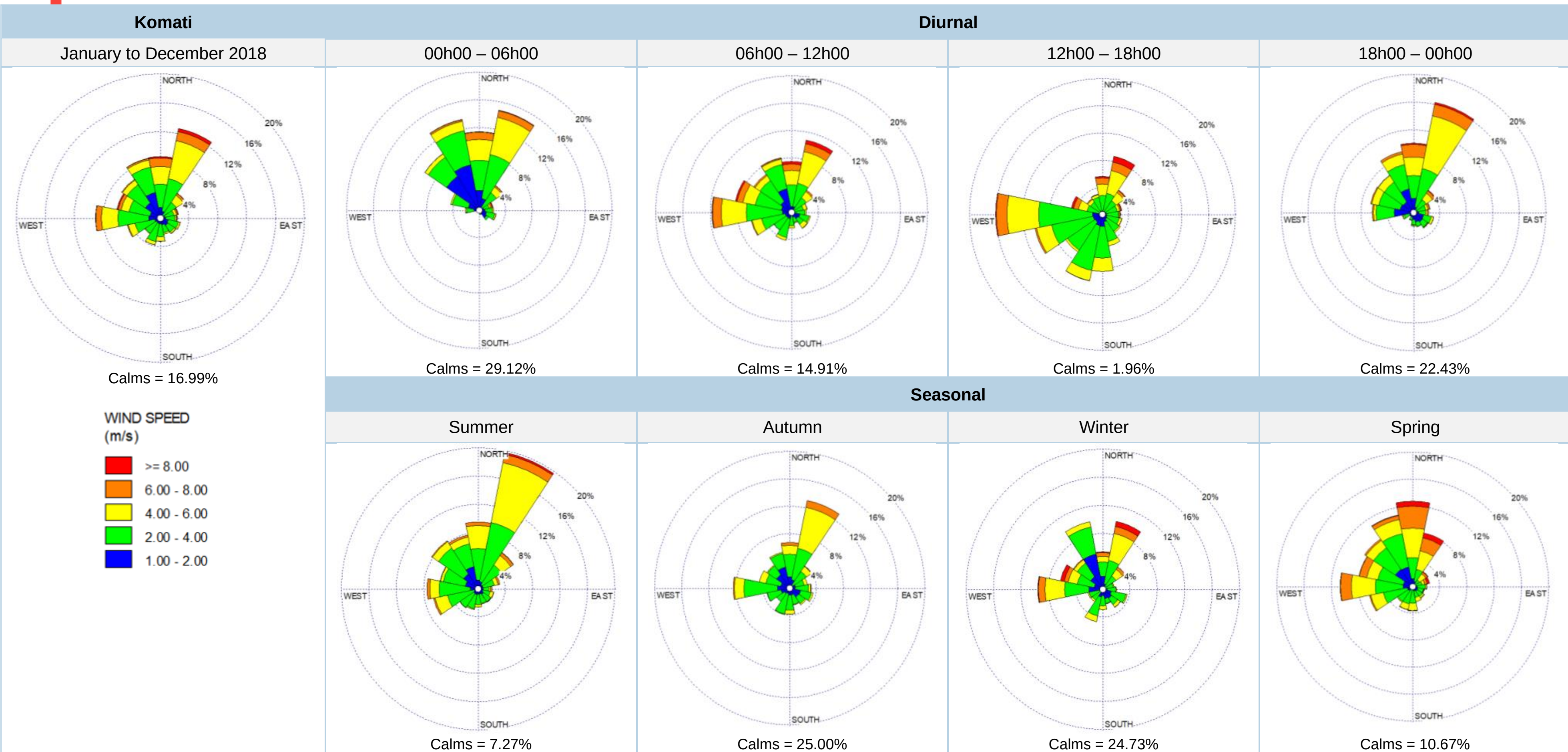

Figure 4: Local wind conditions for the period January to December 2018 from the Komati station (SAAQIS)

AIR QUALITY IMPACTS

EXISTING SOURCES OF EMISSIONS WITHIN THE PROJECT AREA

Existing air pollution sources in the vicinity of the proposed project include:

- Agricultural activities mostly from maize and livestock.
- Vehicle emissions from the R35, R542, nearby Goedehoop Colliery and internal Komati power station roads.
- Mining activities from the nearby Goedehoop Colliery.
- Industrial activities from the Komati Power Station.
- Domestic fuel burning from the Komati Village and nearby residential areas.
- Dust from unpaved roads from the nearby Goedehoop Colliery.
- Other fugitive dust sources such as wind erosion of exposed areas.

Background concentrations for particulate matter (i.e most specifically particle size of aerodynamic diameter of less than 10 and 2.5 microns (PM_{10} and $PM_{2.5}$)) were also sourced from the SAAQIS for the Komati station to evaluate the current situation within the receiving environment. The best recovery period over the last five years; namely January to December 2018 was utilized. Annual averages for PM_{10} and $PM_{2.5}$ were 62.7 µg/m^3 (above the annual average PM_{10} standard of 40 µg/m^3) and 6.5 µg/m^3, respectively (below the annual average $PM_{2.5}$ standard of 20 µg/m^3). The ***high existing sources of emissions for PM_{10} are likely a result of the abovementioned background sources***, however it must be noted that the ***background concentrations are likely to decrease once the existing Komati Power Station is fully decommissioned***, possibly resulting in compliance with the annual average PM_{10} standard of 40 µg/m^3. Further, the data recovery for PM_{10} and $PM_{2.5}$ was 82% and 85%, respectively, slightly below the recommended data recovery of 90% for the dataset to be deemed reliable.

PROPOSED SOURCES OF EMISSIONS FROM THE CONSTRUCTION AND OPERATIONAL PHASE OF THE SOLAR PV PROJECT

CONSTRUCTION PHASE

It is estimated that approximately 200-300 construction workers will be required on the site for this phase. During the construction phase of the proposed project the following activities are anticipated:

- **Site Preparation:** Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the Solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.
- **Transportation of Equipment:** All equipment will be transported to site by means of national, provincial and district roads. This includes but is not limited to, transformers, Solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- **Site Establishment Works:** The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g. use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of Solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- **Construction of the Solar PV Facility:** Trenches would need to be excavated for underground cabling to connect Solar PV arrays, inverter stations, and combiner substations. Foundations for the Solar PV array mounting structures and inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be utilised at the PV site. Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- **Construction of Electrical Interconnection Line:** Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- **Storage:** Storage of diesel and oil for construction activities.

Heavy construction activities, as outlined above, are a source of dust and PM_{10} and $PM_{2.5}$ emissions that can have a temporary impact on the local ambient air quality. Dust and particulate emissions vary substantially on a daily basis, depending on the level of activity, the specific operations and the prevailing meteorological conditions (USEPA, 1995).

With dominant north-north-easterly winds in the project region, as observed in **Figure 4**, air quality impacts are predicted to be the greatest at SR1 (Komati Village). Receptors SR4 and SR5 are relatively close to the proposed site and are also likely to be impacted.

Although receptors SR2, SR3 and SR6 are within a 10 km radius of the proposed site, they are unlikely to be impacted significantly given the distance and dominant wind directions to the proposed project site. Importantly, the necessary mitigation measures must be implemented during the construction phase to reduce impacts at all nearby receptors, with particular reference to the Komati Village, SR4 and SR5. Furthermore, it must be noted that emissions from construction activities are highly uncertain due to the site specific and erratic nature of construction activities. The construction phase is also expected to occur during daytime hours only and as such is considered to be limited and short-lived to the local project site area.

OPERATIONAL PHASE

The Solar PV plant is expected to have a minimum design life of 25 years. During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant. Thus, limiting the number of vehicle movements in and around the site. In addition, there will be periodic cleaning and washing of the Solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur two to four times a year, limiting the emissions to atmosphere to a minimum.

As such, minimal air quality impacts are anticipated during the operational phase of the proposed project, with changes in air quality unlikely to occur at the nearest sensitive receptors.

CUMULATIVE IMPACTS AS A RESULT OF THE PROPOSED SOLAR PV PROJECT

Cumulative impacts at the nearby receptors as a result of the construction phase of the proposed project (given the current background concentrations discussed above and the shutdown and decommissioning of the Komati Power Station) are likely to be low, below the annual average PM_{10} and $PM_{2.5}$ standards. Further, the construction phase is anticipated to be short-lived and thus will result in a restoration of current background conditions once the construction phase is completed.

MITIGATION MEASURES

CONSTRUCTION PHASE

Notwithstanding that impacts to ambient air quality associated with the construction phase of the project are considered to be of transient nature, the following mitigation measures would serve to further reduce such impacts to the receiving environment and sensitive receptors:

- Information regarding construction activities should be shared with all local communities (such as the Komati Village). Such information includes:
  - Proposed working times.
  - How long the activity is anticipated to take place.
  - What is being done, or why the activity is taking place.
  - Contact details of a responsible person on site should complaints arise to reduce emissions in a timely manner.
- Complaint's register must be kept to record all events.
- When working near (within 100 m) a potential sensitive receptor, limit the number of simultaneous activities to a minimum as far as possible.
- Speed limits (approximately 20-40 km/hr) can be enforced to control open dust sources.
- Wind speed reduction is a common method used to control open dust sources at construction sites as wind barriers and windbreaks tend to be readily available. It is also recommended to cease high dust construction activities, for e.g. land-clearing, during high wind speed events.
- Application of water can be used to reduce dust emissions.

General control methods for open dust sources, as recommended by the USEPA, are given in **Table 3**.

Table 3: Mitigation measures for general construction (USEPA, 1995)

Emission Source	Recommended Control Method
Debris handling	Wind speed reduction
	Wet suppression[1]
Truck transport[2]	Wet suppression
	Paving
	Chemical stabilisation[3]
Bulldozers	Wet suppression[4]
Pan scrapers	Wet suppression
Cut/fill material handling	Wind speed reduction
	Wet suppression
Cut/fill haulage	Wet suppression
	Paving
	Chemical stabilisation
General construction	Wind speed reduction
	Wet suppression
	Early paving of permanent roads

Notes:

(1) Dust control plans should contain precautions against watering programs that confound trackout problems.
(2) Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.
(3) Chemical stabilisation usually cost-effective for relatively long-term or semi-permanent unpaved roads
(4) Excavated materials may already be moist and may not require additional wetting.

OPERATIONAL PHASE

Minimal air quality impacts are anticipated during the operational phase of the proposed project therefore no mitigation measures are deemed necessary during the operational phase of the proposed project.

IMPACT ASSESSMENT RATING

All impacts of the proposed project operations were evaluated using a semi-quantitative risk assessment methodology. This system derives an environmental impact significance level on the basis of the magnitude, reversibility, extent, duration and probability of potentially significant impacts. The overall risk level is determined using professional judgement based on a clear understanding of the nature of the impact, potential mitigatory measures that can be implemented and changes in risk profile as a result of implementation of these mitigatory measures. Key localised air quality impacts associated with the proposed project operations include:

- Construction phase impacts of air quality on sensitive receptors.

Outcomes of the air quality impact assessment are contained within **Table 4** outlining the impact of each parameter and the resulting risk level. *Important to note that impacts predicted here are from the proposed project operations only and not a result of cumulative impacts.*

The resultant environmental air quality risks for sensitive receptors were ranked “low” during the construction phase of the proposed project with mitigation in place.

Table 4: Impact assessment of risks associated with the proposed project

Description	Without Mitigation							With Mitigation						
	Probability	Duration	Extent	Magnitude	Reversibility	Significance	**Risk Level**	Probability	Duration	Extent	Magnitude	Reversibility	Significance	**Risk Level**
Construction phase impacts of air quality on sensitive receptors	3	2	2	3	3	30	**Low**	2	2	1	2	3	16	**Low**

CONCLUSION

Given the nature of the proposed project, with emissions during the construction phase expected to be transient in nature and minimal emissions anticipated during the operational phase, it is in our opinion that the proposed project can be authorised with the recommended mitigation measures implemented during the construction phase of the proposed project. Furthermore, no additional air quality studies are required for the proposed project.

APPENDIX

E-2 -NOISE

DESKTOP NOISE IMPACT ASSESSMENT FOR THE ESKOM KOMATI SOLAR PHOTOVOLTAICS PROJECT

INTRODUCTION

Eskom Holdings SOC (Ltd) (Eskom) is a South African utility that generates, transmits and distributes electricity. Eskom supplies about 95% of the country's electricity. Eskom’s 2035 strategy encompasses the journey that Eskom intends to take in response to the changing energy environment and the impact this has towards a sustainable power utility. This strategy is necessitated by the challenges that Eskom faces as a business as well as the global and local shifts occurring in the energy sector particularly with respect to environmental and climate change challenges, difficulties in accessing financing and changes to the macro industry environment significantly altering the energy supply industry (ESI). The road to 2035 includes the shutting down of several coal-fired power stations, repurposing and repowering, delivering new clean generation projects, expanding the transmission grid, and rolling out micro grid solutions. Several power stations are reaching the end of life. These stations will go into extended cold reserve and are most likely to be fully decommissioned in the future. Eskom is considering a shutdown, dismantling and repurposing of some of its fleet as it reaches its end of life. Komati Power Station, situated in Mpumalanga, will reach its end of life expectancy in September 2022. As such, Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100 MW of Solar Photovoltaics (PV) and 150 MW of Battery Energy Storage System (BESS).

The first phase of the Komati Power Station repurposing programme, i.e. the installation of the Solar PV and BESS necessitates an Environmental and Social Impact Assessment (ESIA). As part of the ESIA a desktop Noise Impact Assessment is required.

Importantly this ESIA is also being run concurrently with the scope of work for the shutdown and dismantling of the power station and is therefore treated as a separate assessment process to the shutdown and dismantling of the power station.

DESKTOP REVIEW

LOCATION OF SITE AND IDENTIFICATION OF SENSITIVE RECEPTORS

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift on the Highveld in the Mpumalanga Province of South Africa. Komati is surrounded by farmlands mostly practicing agriculture (maize and livestock). It is near Komati Village which includes the business areas (shopping centre) and industrial areas (mines).

Table 1 presents the sensitive receptors within the surrounding environment. Sensitive receptors are identified as areas that may be impacted negatively due to noise associated with the proposed project. Examples of receptors include, but are not limited to, schools, shopping centres, hospitals, office blocks and residential areas. The site layout and receptors are presented in **Figure 1**.

Table 1: Sensitive receptors within a 5 km radius of the proposed project

ID.	Sensitive Receptor Name	Latitude (S)	Longitude (E)	Distance from Site Boundary (km)	Direction from Site
SR1	Komati Village	26° 5'46.52"	29°27'37.62"	Within the boundary	
SR2	Residential Area 1	26° 4'9.85"	29°25'16.62"	3.7	Northwest
SR3	Residential Area 2	26° 5'14.28"	29°26'18.46"	1.2	Northwest
SR4	Residential Area 3	26° 5'24.70"	29°26'47.50"	0.4	Northwest

Figure 1: Site layout and sensitive receptors for the proposed project

NOISE IMPACTS

EXISTING SOURCES OF NOISE WITHIN THE PROJECT AREA

Existing noise sources in the vicinity of the proposed project include:

- Agricultural activities mostly from maize and livestock.
- Vehicles along the R35, R542, nearby Goedehoop Colliery and internal Komati power station roads.
- Mining activities from the nearby Goedehoop Colliery.
- Industrial activities from the Komati Power Station.

PROPOSED SOURCES OF NOISE FROM THE CONSTRUCTION AND OPERATIONAL PHASE OF THE SOLAR PV PROJECT

CONSTRUCTION PHASE

It is estimated that approximately 200-300 construction workers will be required on the site for this phase. During the construction phase of the proposed project the following activities are anticipated:

- **Site Preparation:** Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the Solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.

- **Transportation of Equipment:** All equipment will be transported to site by means of national, provincial and district roads. This includes but is not limited to, transformers, Solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- **Site Establishment Works:** The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g. use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of Solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- **Construction of the Solar PV Facility:** Trenches would need to be excavated for underground cabling to connect Solar PV arrays, inverter stations, and combiner substations. Foundations for the Solar PV array mounting structures and inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be utilised at the PV site. Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- **Construction of Electrical Interconnection Line:** Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- **Storage:** Storage of diesel and oil for construction activities.

Given the type of noisy activities detailed above (i.e as a result of the concrete batching plant, equipment (such as excavators, graders, bulldozers, compactors, water bowsers, front end loaders, etc) and vehicles used during the construction activities of the proposed project), increased noise levels are likely to be anticipated at nearby receptors within a ~ 2.5 km radius (i.e at SR1, SR3 and SR4) of the proposed site during the construction phase, based on experience of similar construction studies. Importantly, for every doubling of distance, the sound level reduces by 6 dB. Noise levels are thus expected to be of most significance at SR1 (Komati Village) which is within the proposed project site boundary. As such, the necessary mitigation measures must be implemented during the construction phase to reduce impacts at all nearby receptors, with particular reference to the SR1, SR3 and SR4. However, it must be noted that noise levels from construction activities are highly uncertain due to the site specific and erratic nature of construction activities, with no set locations for equipment at a given time. Further, the construction phase is expected to occur during daytime hours only and is therefore limited and short-lived to the local project site area.

OPERATIONAL PHASE

The Solar PV plant is expected to have a minimum design life of 25 years. During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant. Thus, limiting the number of vehicle movements and electrical and mechanical equipment noise in and around the site. In addition, there will be periodic cleaning and washing of the Solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur two to four times a year, again limiting the noise levels to a minimum.

As such, minimal noise impacts are anticipated during the operational phase of the proposed project, with changes in noise unlikely to occur at the nearest sensitive receptors.

CUMULATIVE IMPACTS AS A RESULT OF THE PROPOSED SOLAR PV PROJECT

Cumulative impacts as a result of the construction phase are anticipated to be short-lived. As such, this will result in a restoration of current background conditions once the construction phase is completed.

MITIGATION MEASURES

CONSTRUCTION PHASE

Notwithstanding that impacts to noise associated with the construction phase of the project are considered to be of transient nature, the following mitigation measures would serve to further reduce such impacts to the receiving environment and sensitive receptors:

- Planning construction activities in consultation with local communities (such as the Komati Village) so that activities with the greatest potential to generate noise are planned during periods of the day that will result in least disturbance. Information regarding construction activities should be provided to all local communities. Such information includes:
  - Proposed working times.
  - Anticipated duration of activities.

  - Explanations on activities to take place and reasons for activities.
  - Contact details of a responsible person on site should complaints arise.
- When working near a potential sensitive receptor (within 100 m), limit the number of simultaneous activities to a minimum as far as possible.
- Using noise control devices, such as temporary noise barriers and deflectors for high impact activities, and exhaust muffling devices for combustion engines.
- Selecting equipment with the lowest possible sound power levels.
- Ensuring equipment is well-maintained to avoid additional noise generation.
- A drop height policy should be implemented onsite to reduce the level of noise generation when handling materials. All equipment operators should be trained in the policy such that drop height reduction is implemented onsite.
- It is recommended that a maximum speed of 20-40 km/h should be set on all unpaved roads.
- Ensure a reduction in unnecessary traffic volumes by developing plans to optimise vehicle usage and movement.
- Encouraging the receipt of materials during non-peak traffic hours to avoid traffic build-up and associated noise.
- Vehicles should not be allowed to idle for more than five minutes when not in use.

OPERATIONAL PHASE

Minimal noise impacts are anticipated during the operational phase of the proposed project and as such, no mitigation measures are deemed necessary during the operational phase of the proposed project.

IMPACT ASSESSMENT RATING

All impacts of the proposed project operations were evaluated using a semi-quantitative risk assessment methodology. This system derives an environmental impact significance level on the basis of the magnitude, reversibility, extent, duration and probability of potentially significant impacts. The overall risk level is determined using professional judgement based on a clear understanding of the nature of the impact, potential mitigatory measures that can be implemented and changes in risk profile as a result of implementation of these mitigatory measures. Key localised noise impacts associated with the proposed project operations include:

- Construction phase impacts of noise on sensitive receptors.

Outcomes of the noise impact assessment are contained within **Table 2** outlining the impact of each parameter and the resulting risk level. *Important to note that impacts predicted here are from the proposed project operations only and not a result of cumulative impacts.*

The resultant environmental noise risks for sensitive receptors were ranked "low" during the construction phase of the proposed project with mitigation in place.

Table 2: Impact assessment of risks associated with the proposed project

	Without Mitigation							With Mitigation						
Description	Probability	Duration	Extent	Magnitude	Reversibility	Significance	**Risk Level**	Probability	Duration	Extent	Magnitude	Reversibility	Significance	**Risk Level**
Construction phase impacts of noise on sensitive receptors	3	2	2	3	3	30	**Low**	2	2	1	2	3	16	**Low**

CONCLUSION

Given the nature of the proposed project, with noise during the construction phase expected to be short-lived and minimal noise anticipated during the operational phase, it is in our opinion that the proposed project can be authorised with the recommended mitigation measures implemented during the construction phase of the proposed project. Furthermore, no additional noise studies are required for the proposed project.

APPENDIX

E-3 SOIL AND AGRICULTURAL *POTENTIAL*

ESKOM HOLDINGS SOC (LTD)

KOMATI POWER STATION SOLAR PHOTOVOLTAIC, BATTERY ENERGY STORAGE SYSTEM FACILITIES AND ASSOCIATED INFRASTRUCTURE, MPUMALANGA PROVINCE

SOIL AND AGRICULTURAL POTENTIAL ASSESSMENT: SCOPING REPORT

20 JUNE 2022 FINAL

KOMATI POWER STATION SOLAR PHOTOVOLTAIC, BATTERY ENERGY STORAGE SYSTEM FACILITIES AND ASSOCIATED INFRASTRUCTURE, MPUMALANGA PROVINCE

SOIL AND AGRICULTURAL POTENTIAL ASSESSMENT: SCOPING REPORT

ESKOM HOLDINGS SOC (LTD)

TYPE OF DOCUMENT (VERSION)
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DATE: JUNE 2022

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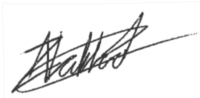
Signature				
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1 INTRODUCTION

WSP in Africa (WSP), a wholly owned affiliate of WSP Global Inc., has been appointed by Eskom Holdings SOC Ltd (Eskom) to undertake a Soil and Agricultural Potential Assessment for the proposed Solar Photovoltaics (PV) Energy and Battery Energy Storage System (BESS) Facilities and associated infrastructure at Komati Power Station in the Mpumalanga Province (herein referred to as the Project).

The aim of this scoping assessment was to provide preliminary descriptions of the soils identified and their distribution within the project area, and to establish some typical soil properties and current land use. A high-level screening of potential soil impacts and mitigation was also carried out.

1.1 PROJECT BACKGROUND

Eskom is a South African utility that generates, transmits and distributes electricity. Eskom supplies about 95% of the country's electricity. Eskom's 2035 strategy encompasses the journey that Eskom intends to take in response to the changing energy environment and the impact this has towards a sustainable power utility. This strategy is necessitated by the challenges that Eskom faces as a business as well as the global and local shifts occurring in the energy sector particularly with respect to environmental and climate change challenges, difficulties in accessing financing and changes to the macro industry environment significantly altering the energy supply industry (ESI).The road to 2035, includes the shutting down of a number of coal-fired power stations, repurposing and repowering, delivering new clean generation projects, expanding the Transmission grid, and rolling out micro grid solutions.

Several power stations are reaching the end of life. These stations will go into extended cold reserve and are most likely to be fully decommissioned in the future. Eskom is considering a shutdown, dismantling and repurposing of some of its fleet as it reaches its end of life. Komati Power Station, located near Middelburg in the Mpumalanga Province (**Figure 1-1**), will reach its end-of-life expectancy in September 2022 when Unit 9 will have reached its dead stop date (DSD). Units 1 to 8 have already reached their DSDs. Eskom has developed a Just Energy Transition Plan (EJET P) aimed at mitigating the negative social impacts resulting from the shutting down of plant and to implement projects for the repowering and repurposing related to the Komati power station. This is one of several initiatives in which Eskom proposes to establish a solar energy generating facility at the Komati Power Station which will include the installation of a Solar PV energy facility as well as BESS facilities (**Figure 1-2**).

1.2 LEGISLATIVE CONTEXT

The legislation that has direct implications for how soils are managed is the Conservation of Agricultural Resources (Act 43 of 1983) (CARA). Other environmental legislation such as the National Environmental Management Act (Act 107 of 1998) and the National Water Act (Act 36 of 1998) provide guidance on environmental activities and sets out the principles of Duty of Care, Pollution Control and Waste Management. The relevant sections of the CARA are discussed below.

The purpose of the CARA is to provide for the control over the utilization of the natural agricultural resources of the Republic to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants. The Act states that control measures may be applied to (amongst others):

- The utilization and protection of land which is cultivated;
- The prevention or control of waterlogging or salination of land;
- The restoration or reclamation of eroded land or land which is otherwise disturbed or denuded.

The Act further states that different control measures may be prescribed in respect of different classes of land users or different areas or in such other respects as the Minister may determine, stipulating that:

- Any land user who refuses or fails to comply with any control measure which is binding on him, shall be guilty of an offence.

The implication of this for the project is that control measures will be required to manage and where possible mitigate the impacts of the Project on soil and land capability.

1.3 STUDY LIMITATIONS

The limitations associated with the study are listed below:

- PV Site A has been significantly disturbed by existing agricultural activities making classification of the soil forms difficult.
- The BESS sites have been significantly disturbed owing to the historic construction of the Komati Power Station facilities.
- Site access was difficult owing to the terrain, a lack of access roads and inclement weather.
- The site could not be traversed such that an even grid matrix of classification points could be set up. As a result, some extrapolation of findings will be necessary.

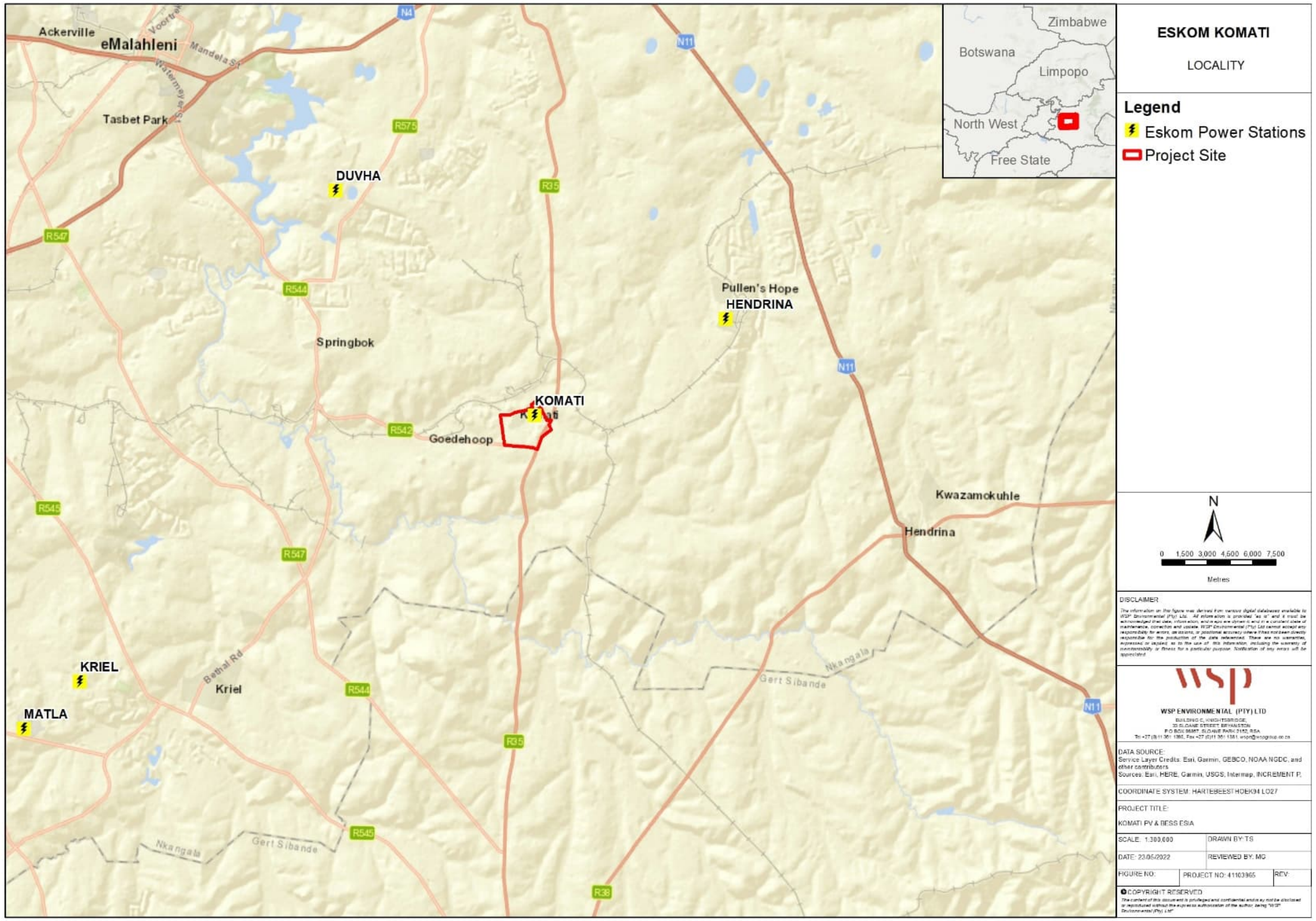


Figure 1-1: Locality Setting

Figure 1-2: Site Layout

2 PROJECT DESCRIPTION

2.1 SITE LOCATION

The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank in Ward 4 of the Steve Tshwete Local Municipality located within the Nkangala District Municipality in the Mpumalanga Province. The Solar PV facilities, BESS facilities and associated infrastructure will be located on Eskom-owned land. The locality of the facilities is illustrated in **Figure 1-1.**

2.2 SOLAR PV GENERATION PROCESS

South Africa experiences some of the highest levels of solar radiation in the world (between 4.5 and 6.5kWh/m^2/day) and therefore possesses considerable solar resource potential for solar power generation.

In terms of large-scale grid connected applications, the most commonly used technologies include PV and Concentrated Solar Power (CSP); these are described in some detail in the following sections.

It must be noted that this project is specific to solar power generation through the use of solar PV technology only.

2.2.1 PHOTOVOLTAIC (PV) SYSTEMS

Internationally, solar PV is the fastest-growing power generation technology. Approximately 139 GW was added to the installed capacity globally in 2020, increasing the installed capacity by 18% from the previous year. The total capacity from PVs was 760 GW globally, producing approximately 3% of the world's electricity[1]. In South Africa the solar PV installed capacity in 2020 grew by 37% compared to the previous year's value. As much as 3.6 GW of PV is planned to be installed by 2026, with approximately 1.48GW already installed as recorded in 2019. Utility-scale CSP plants were in operation long before solar PVs became widely commercialized, however PV has taken over the market, attributed to the declining costs of solar PV modules and associated system. In South Africa, this is also coupled with the supportive government policies. Global CSP capacity grew only 1.6 percent in 2020 to 6.2 GW.

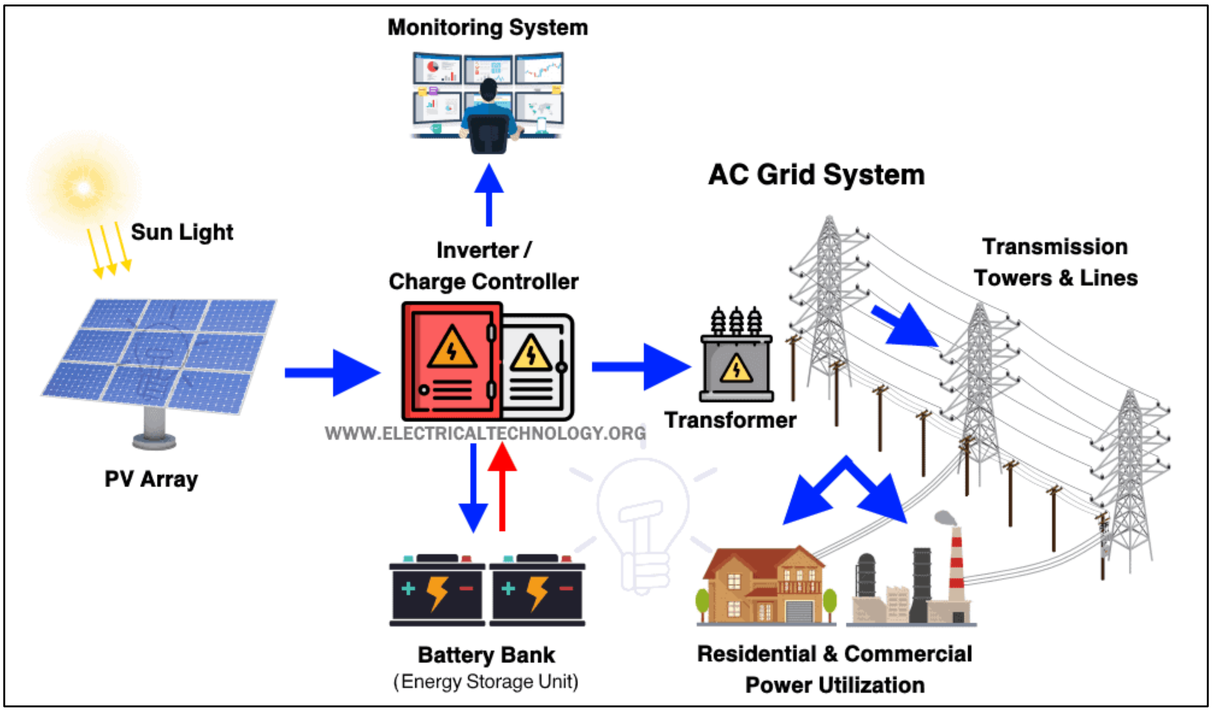
Large-scale or utility-scale PV systems are designed for the supply of commercial power into the electricity grid. Large-scale PV plants differ from the smaller units and other decentralised solar power applications because they supply power at the utility level, rather than to local users.

PV cells are made from semi-conductor materials that are able to release electrons when exposed to solar radiation. This is called the photo-electric effect. Several PV cells are grouped together through conductors to make up one module and modules can be connected together to produce power in large quantities. In PV technology, the power conversion source is via PV modules that convert light directly to electricity. This differs from the other large-scale solar generation technology such as CSP, which uses heat to drive a variety of conventional generator systems.

Solar panels produce direct current (DC) electricity, therefore PV systems require conversion equipment to convert this power to alternating current (AC), that can be fed into the electricity grid. This conversion is done by inverters. **Figure 2-1** provides an illustration of the main components of a solar PV power plant.

There are two primary alternatives for inverters in large scale systems; being centralised and string inverters.

[1] https://www.c2es.org/content/renewable-energy/

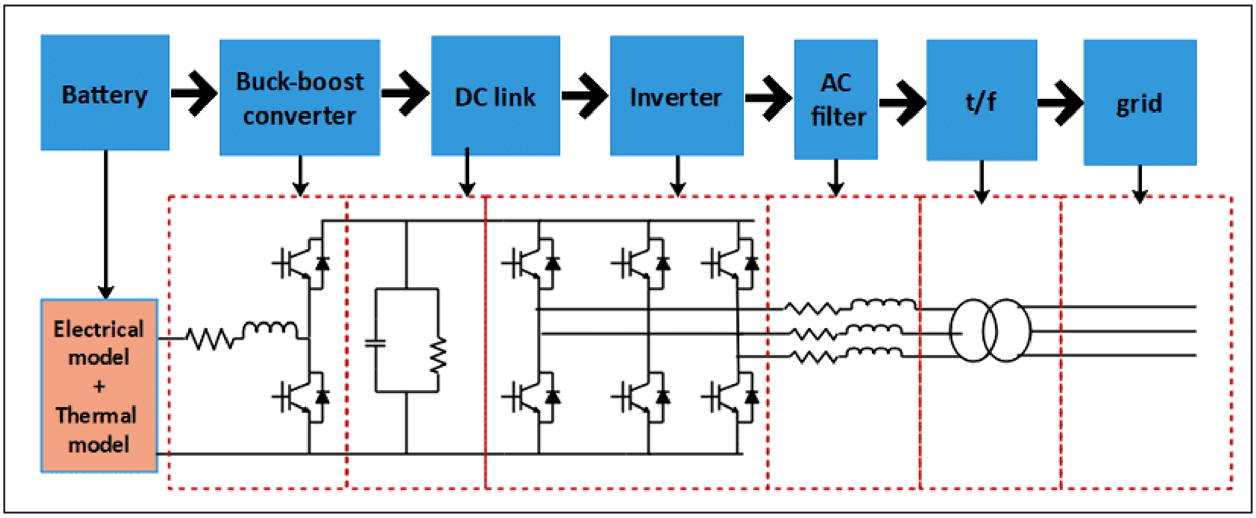


Source: www.electricaltechnology.org/2021/07/solar-power-plant.html

Figure 2-1: Illustration of the Main Components of a Solar Power Plant

2.3 BESS TECHNOLOGY

BESS consist of two main parts: battery modules and the accompanying Battery Management System (BMS), and a Power Conditioning System (PCS) used to enable the interface of the batteries to the grid. Individual battery cells are connected in a series/parallel arrangement in order to obtain the desired nominal voltage for highest efficiency and required storage capacity. The PCS is a bidirectional power conversion device (inverter), enabling alternating current (AC) power from the grid to be converted to direct current (DC) to charge the batteries in a controlled manner, and discharge DC battery power to feed AC power onto the grid (**Figure 2-2**).



Source: www.researchgate.net

Figure 2-2: BESS Components Schematic

2.4 PROJECT INFRASTRUCTURE

The proposed project will comprise the following key components:

– Solar Energy Facility;
– Grid Connection (i.e. powerlines);
– Site Substation and BESS; and
– Ancillary infrastructure

These items are discussed in more detail below and will be expanded upon within the final ESIA report.

2.4.1 SOLAR ENERGY FACILITY

The total site area for PV installation is approximately 200-250 hectares to allow for the construction of a PV facility with capacity up to 100 MW. Solar PV modules which convert solar radiation directly into electricity, will occupy a space of up to a total of approximately 720,000 m^2. The solar PV modules will be elevated above the ground and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the boundaries, and O&M access roads in between the PV module rows. **Table 2-1** provides a high-level project summary of the proposed Facilities.

Table 2-1: High-level Project Summary – Renewable Energy Facilities

	SOLAR PV SITE A	SOLAR PV SITE B
Extent	156 Ha	54 Ha
Buildable Area	127 Ha	50 Ha
Capacity	71.5 MW	28.5 MW

2.4.2 GRID CONNECTION

TRANSMISSION LINE

The transmission line will either be 132kV or 275KV steel single or double structure with kingbird conductor. The powerline towers will either be steel lattice or monopole structures.

Figure 2-3 below provides an example of a conventional lattice tower compared with a monopole structure. Pole positions will only be available once the powerline design has started. It is anticipated that towers will be located approximately 200m to 250m apart.

Figure 2-3: Conventional Lattice Powerline Tower Compared with a Steel Monopile Structure

SERVITUDE

The registered servitude will likely between 36 m and 40 m. The length of the transmission line and associated servitude area is currently unknown and will be finalised prior to completion of the ESIA report. The servitude is required to ensure safe construction, maintenance and operation of the powerline.

SUBSTATIONS

On-site substations will be established within the extent of the Solar Site A and Solar Site B. The site itself is very homogenous and there are no significant features in the immediate vicinity of the substation location that might be affected by the development. The following infrastructure is proposed:

– A high voltage substation yard to allow for multiple 132 kV or 275 kV feeder bays and transformers;
– The control building, telecommunication infrastructure, oil dams(s) etc; and
– All the access road infrastructure to and within the substation.

SITE ACCESS

The project area and surrounding areas are already easily accessible. New access roads or tracks may be required to provide access to sections of the powerline route. Access roads will be approximately 4m in width and will be mostly a two-track gravel road under the OHPL in order to access pylons for construction and maintenance purposes.

2.4.3 BESS

Eskom propose to establish up to four BESS facilities with the existing footprint of the Komati Power Station.

The BESS footprints will range from 2 ha to 6 ha. The BESS storage capacity will be up to 150 MW.

It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following Engineering, Procurement, and Construction (EPC) procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers. The BESS components will arrive on site pre-assembled.

2.4.4 ANCILLARY INFRASTRUCTURE

Ancillary infrastructure associated with the project will be confirmed once the Conceptual Design is complete, however, it is anticipated that the following will be applicable:

- Access roads;
- Perimeter roads;
- Below-ground electrical cables;
- Above-ground overhead lines;
- Meteorological Station;
- Operations and Maintenance (O&M) Building including control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities);
- Spares Warehouse and Workshop;
- Hazardous Chemical Store;
- Security Building;
- Parking areas and roads;
- Temporary laydown areas;
- Temporary concrete batching plant
- Construction camps and temporary laydown areas; and
- Onsite substations.

3 ENVIRONMENTAL SETTING

3.1 CLIMATE

RAINFALL

Rainfall in the area is almost exclusively in the form of showers and thunderstorms and falls mainly in the summer months from October to March. The maximum rainfall usually occurs in January. The winter months are usually dry. The mean annual precipitation for Catchment B11B is 687 mm and the mean annual evaporation is 1550 mm. Mean monthly evaporation exceeds the mean monthly precipitation for every month of the year thus this is a water deficit area.

TEMPERATURE

Average daily maximum temperatures vary from 27°C in January to 17°C in July, but in extreme cases these may rise to 38°C and 26°C, respectively. In comparison, average daily minima of 13°C and 0°C can be expected, with temperatures falling to 1°C and –13°C, respectively, on unusually cold days. Frost conditions are also common over the 120-day period from May to September.

These climatic conditions typically give rise to chemically weathered red and yellow soils.

3.2 SURFACE WATER

Komati Power Station occurs within the upper Olifants Water Management Area (WMA), Highveld aquatic Ecoregion and B11B quaternary catchment that have been classified as a Class D (largely modified) system. The Koringspruit River traverses the area and has been classified as a Class D (largely modified) river. Soils with signs of wetness are likely to be found in the vicinity of the watercourses.

3.3 GEOLOGY

The site forms part of the Highveld Coalfield and falls within the Carboniferous to early Jurassic aged Karoo Basin, a geological feature that covers much of South Africa. In the Komati area, shales typically define lower and upper levels of the series, with coal measures and associated detrital sediments present between (Truswell, 1977). Two sedimentary units are of interest in this area; the Dwyka Formation, and the Vryheid Formation. The Dwyka Formation is essentially comprised of a succession of glacial deposits characterized by angular to rounded clasts of basement within a silt and clay matrix that were emplaced from the Late Permian, although varved shales, sandstone, and conglomerates typical of a fluvio-glacial environment also occur (Botha *et al.*, 1998). The formation unconformably overlies an undulating basement surface defined by lithologies associated with the Bushveld Complex in the area.

The soils associated with the study area are thus anticipated to contain kaolinitic clays.

3.4 TOPOGRAPHY

The surface topography of the area is typical of the Mpumalanga Highveld, consisting in the main of a gently undulating plateau. The flood plains of the local streams are at an average elevation of approximately 1595 meters above mean sea level (mamsl). Altitudes vary from ±1650 mamsl at the higher parts south of the ashing facility to ±1595 mamsl which defines the base of the Koringspruit to the north of the Komati Power Station.

The Komati Power Station is situated on a topographic flat ±1605 mamsl with a poor drainage pattern, which may cause signs of wetness within the soils. The southeast-northwest orientated Geluksspruit is another drainage feature of significance and drains the area east and north towards the Koringspruit. This stream was diverted to prevent ingress into power plant areas and remains so due to the location the current Komati Power Station.

4 PRELIMINARY FINDINGS

The preliminary findings presented below utilised:

- Soil Class Map of South Africa, and
- Land Capability Map of South Africa.

4.1 SOIL CLASS

The dominant soil classes database was created for assessing the agricultural potential of soils in conjunction with other soils properties such as depth, texture together with rainfall data. Dominance in this context is referred to a class having 40% or more of a single constituent. The aim was to establish a manageable number of classes that would not be too general for making various interpretations.

The study site incorporated two soil classes (**Figure 4-1**):

- Soil Class S3:
  - Description: Red or yellow structureless soils with a plinthic horizon.
  - Favourable Properties: Favourable water holding properties.
  - Limitations: Imperfect drainage, unfavourable in high rainfall areas.
- Soil Class S17:
  - Description: Comprises of an association of classes 1 to 4 **-** Undifferentiated structureless soils.
  - Favourable Properties: Favourable physical properties.
  - Limitations: One or more of; low base status, restricted soil depth, excessive or imperfect drainage, high erodibility.

4.2 LAND CAPABILITY

The classic eight-class land capability system (Klingebiel & Montgomery,1961) was adapted for use with GIS in South Africa, taking data availability into account by Schoeman *et al.*, 2000.

Land capability classes are interpretive groupings of land units with similar potentials and continuing limitations or hazards. Land capability involves consideration of (i) the risks of land damage from erosion and other causes and (ii) the difficulties in land use owing to physical land characteristics, including climate. Social and economic variables are not considered. Class concepts are set out in **Table 4-1** and broad land use options in the **Table 4-2**.

Table 4-1: Land Capability: Class Concepts

Class	Concepts
I	Land in Class I has few limitations that restrict its use; it may be used safely and profitably for cultivated crops; the soils are nearly level and deep; they hold water well and are generally well drained; they are easily worked, and are either fairly well supplied with plant nutrients or are highly responsive to inputs of fertilizer; when used for crops, the soils need ordinary management practices to maintain productivity; the climate is favourable for growing many of the common field crops.
II	Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices; it may be used for cultivated crops, but with less latitude in the choice of crops or management practices than Class I; the limitations are few and the practices are easy to apply.
III	Land in Class III has severe limitations that reduce the choice of plants or require special conservation practices, or both; it may be used for cultivated crops, but has more restrictions than Class II; when used for cultivated crops, the conservation practices are usually more difficult to apply and to maintain; the number of practical alternatives for average farmers is less than that for soils in Class II.
IV	Land in Class IV has very severe limitations that restrict the choice of plants, require very careful management, or both; it may be used for cultivated crops, but more careful management is required than for Class III and conservation practices are more difficult to apply and maintain; restrictions to land use are greater than those in Class III and the choice of plants is more limited.
V	Land in Class V has little or no erosion hazard but has other limitations which are impractical to remove that limit its use largely to pasture, range, woodland or wildlife food and cover. These limitations restrict the kind of plants that can be grown and prevent normal tillage of cultivated crops; it is nearly level; some occurrences are wet or frequently flooded; others are stony, have climatic limitations, or have some combination of these limitations.
VI	Land in Class VI has severe limitations that make it generally unsuited to cultivation and limit its use largely to pasture and range, woodland or wildlife food and cover; continuing limitations that cannot be corrected include steep slope, severe erosion hazard, effects of past erosion, stoniness, shallow rooting zone, excessive wetness or flooding, low water-holding capacity; salinity or sodicity and severe climate.
VII	Land in Class VII has very severe limitations that make it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife; restrictions are more severe than those for Class VI because of one or more continuing limitations that cannot be corrected, such as very steep slopes, erosion, shallow soil, stones, wet soil, salts or sodicity and unfavourable climate.
VIII	Land in Class VIII has limitations that preclude its use for commercial plant production and restrict its use to recreation, wildlife, water supply or aesthetic purposes; limitations that cannot be corrected may result from the effects of one or more of erosion or erosion hazard, severe climate, wet soil, stones, low water-holding capacity, salinity or sodicity.

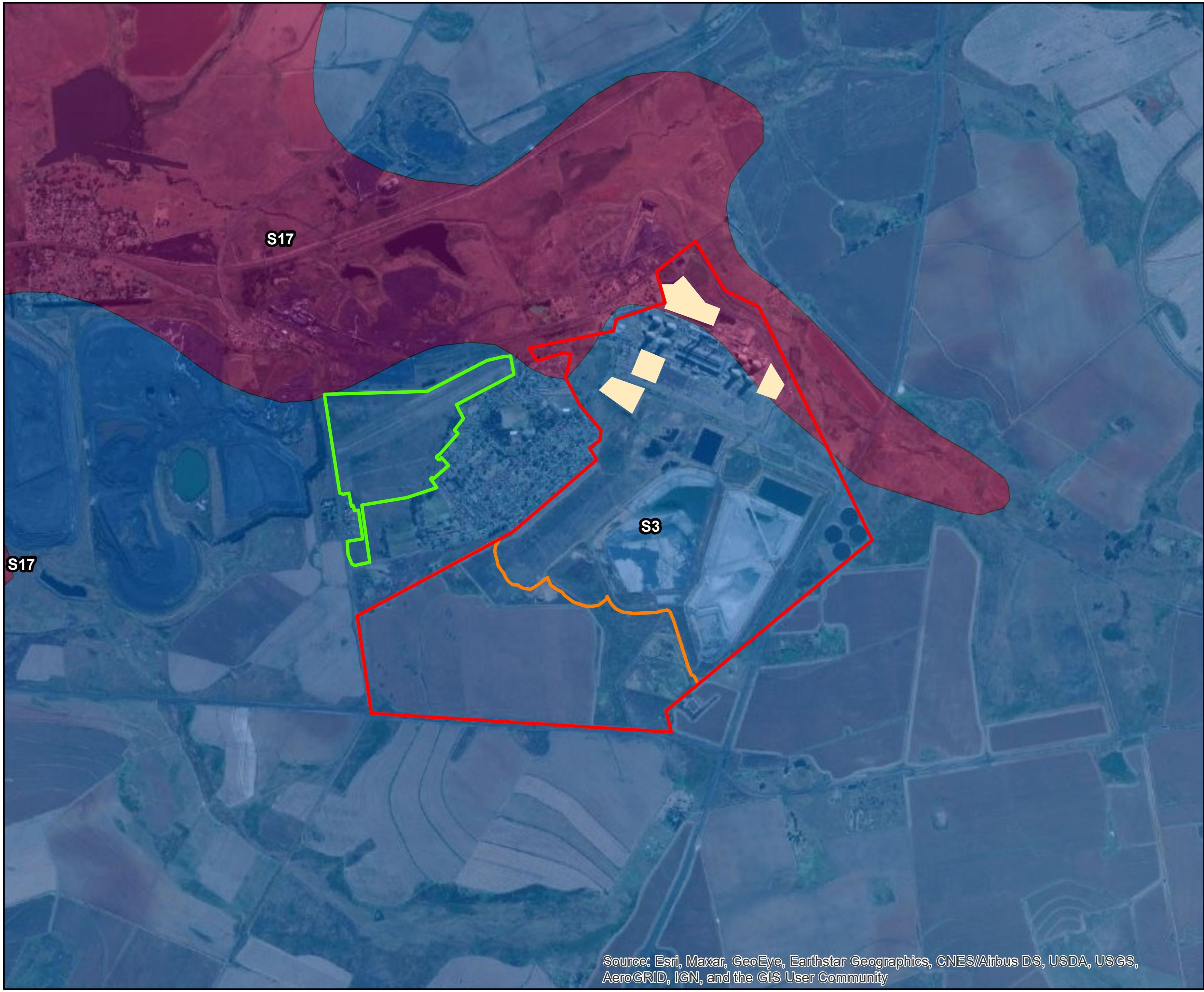
Table 4-2: Land Capability: Broad Land Use Options

Land capability class	Land use options									Land capability groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	Arable land
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W	F	LG	MG						Grazing
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									Wildlife

W - Wildlife
F - Forestry
LG - Light grazing
MG - Moderate grazing
IG - Intensive grazing
LC - Poorly adapted cultivation
MC - Moderately well adapted cultivation
IC - Intensive, well adapted cultivation
VIC - Very intensive, well adapted cultivation

The study site incorporated two soil classes (**Figure 4-2**). These are elaborated below:

- Land Capability Class II:
  - Land in Class II has some limitations that reduce the choice of plants or require moderate conservation practices; it may be used for cultivated crops, but with less latitude in the choice of crops or management practices than Class I where the limitations are few and the practices are easy to apply.
- Land Capability IV:
  - Land in Class IV has very severe limitations that restrict the choice of plants, require very careful management, or both. It may be used for cultivated crops, but more careful management is required than for Class III and conservation practices are more difficult to apply and maintain; restrictions to land use are greater than those in Class III and the choice of plants is more limited.



ESKOM HOLDINGS SOC LTD

KOMATI POWER STATION

SOIL CLASS

Legend

- Site Boundary
- BESS Sites
- PV Site A
- PV Site B

Soil Class Code

- S17
- S3

N

0 115 230 460 690 920

Meters

DISCLAIMER

The information on this figure was derived from various digital databases available to WSP Environmental (Pty) Ltd. All information is provided "as is" and it must be acknowledged that data, information, and maps are dynamic and in a constant state of maintenance, correction and update. WSP Environmental (Pty) Ltd cannot accept any responsibility for errors, omissions, or positional accuracy where it has not been directly responsible for the production of the data referenced. There are no warranties, expressed or implied, as to the use of this information, including the warranty of merchantability or fitness for a particular purpose. Notification of any errors will be appreciated.

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DATA SOURCE:

SOUTH AFRICAN DEPARTMENT OF RURAL DEVELOPMENT AND LAND REFORM- CHIEF DIRECTORATE: NATIONAL GEO SPATIAL INFORMATION

PROJECTION: GCS_WGS_1984

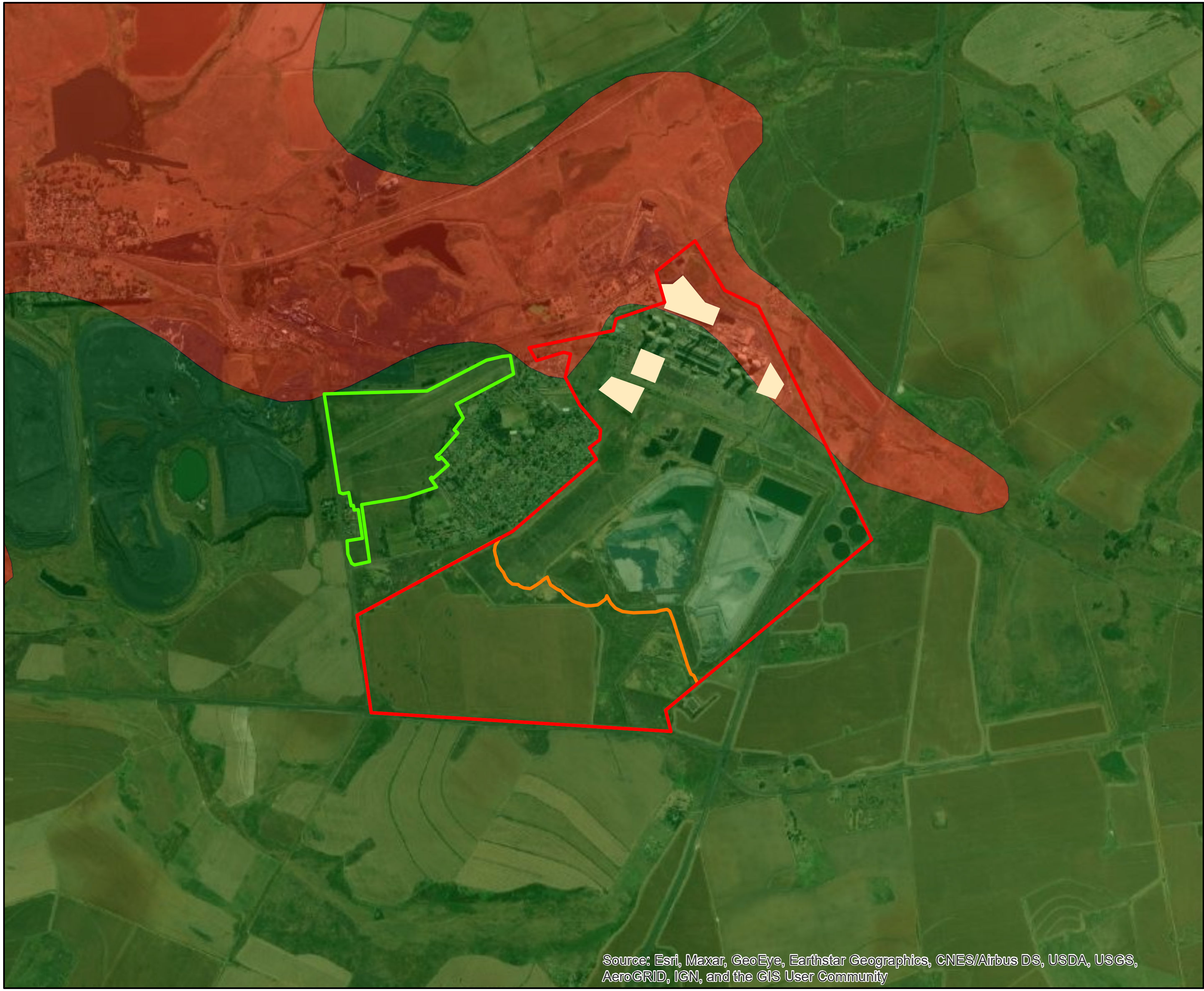
PROJECT TITLE:
ESKOM KOMATI SOLAR PV ESIA

SCALE: 1:30 000	DRAWN BY: TUMELO TSEPHE	
DATE: 2021/06/19	REVIEWED BY: ZAKARIYA NAKHOODA	
FIGURE NO: 4-1	PROJECT NO: 41103965	REV: 0

ESKOM HOLDINGS SOC LTD

KOMATI POWER STATION

LAND CAPABILITY



Legend

- Site Boundary
- BESS Sites
- PV Site A
- PV Site B

Land Capability Class

- II
- IV

N

0 115 230 460 690 920

Meters

DISCLAIMER

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CHIEF DIRECTORATE: NATIONAL GEO SPATIAL INFORMATION

PROJECTION: GCS_WGS_1984

PROJECT TITLE:
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SCALE: 1:30 000	DRAWN BY: TUMELO TSEPHE
DATE: 2021/06/19	REVIEWED BY: ZAKARIYA NAKHOODA

FIGURE NO: 4-1	PROJECT NO: 41103965	REV: 0

4.3 SENSITIVITY

A sensitivity assessment is currently being undertaken as part of the broader project. This information will be included within the final ESIA report.

5 IMPACT SCREENING

5.1 METHODOLOGY

The screening tool used to undertake the high-level impacts and mitigation assessment within this document is based on two criteria; probability and consequence (**Table 4-1**), where the latter is based on the intensity, extent, and duration of the impact. The scales and descriptors used for scoring probability and consequence are detailed in **Table 4-2** and **Table 4-3** respectively.

Table 5-1: Significance Screening Tool

		CONSEQUENCE SCALE			
		1	**2**	**3**	**4**
PROBABILITY SCALE	**1**	**Very Low**	**Very Low**	**Low**	**Medium**
	2	**Very Low**	**Low**	**Medium**	**Medium**
	3	**Low**	**Medium**	**Medium**	**High**
	4	**Medium**	**Medium**	**High**	**High**

Table 5-2: Probability Scores and Descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 5-3: Consequence Scores Descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.

3	Severe: A long term impact on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impact on the affected system(s) or party(ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impact on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (**Table 4-4**) has been applied according to the nature and significance of the identified impacts.

Table 5-4: Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	Positive Impacts (+ve)
Negligible	**Negligible**
Very Low	**Very Low**
Low	**Low**
Medium	**Medium**
High	**High**

5.2 HIGH LEVEL IMPACTS AND MITIGATION

At this stage in the assessment the potential impacts of soil erosion, compaction and contamination have been assessed.

5.2.1 SOIL EROSION

Some erosion will occur wherever soils are disturbed, especially if mitigation measures are not correctly implemented. The less structured soils will be more vulnerable to erosion compared to the more clay-rich soils. Soil erosion can lead to sedimentation of the watercourses within the vicinity of the site, and to the loss of arable soil, especially topsoil, for rehabilitation purposes.

Soil erosion mitigation measures that should be considered include a phase-appropriate stormwater management plan, correct soil stripping, stockpiling and monitoring, with emphasis on quick revegetation of bare soils.

Based on this desktop assessment, the site soils appear to be devoid of macrostructure and highly erodible. Soil erosion probability is thus highly probable and potential consequences moderately severe, making the significance Medium.

5.2.2 SOIL COMPACTION

The more clay-rich soils identified on site will be more vulnerable to compaction compared to the sandier soils, and wet soils will be more vulnerable to compaction than the dry soils are. Soil compaction reduces the pore space available for air and water within soil, reducing soil arability and increasing the risk of soil erosion.

Soil compaction cannot be fully mitigated against as compacted soil cannot regain its original structure. Soils can be ripped to make them more suitable for cultivation, however. Soil compaction mitigation measures that should be considered include limiting vehicle routes on site by demarcating traffic areas and limiting vehicle access, and by stripping soils when they are dry.

Based on this desktop assessment, it appears that soils with signs of wetness will be present across the site. Soil compaction probability is thus definite and potential consequences are Severe, making the significance High.

5.2.3 SOIL CONTAMINATION

The more clay-rich soils identified on site will be more vulnerable to contamination than the sandier soils will as the more clay-rich soils are more chemically active and will interact with the contaminants. All soils will be at risk of contamination, especially from hydrocarbons, as a result of the Project, especially during the construction phase.

Contamination mitigation measures that should be considered will include frequent vehicle maintenance, equipping onsite vehicles with drip trays, strict control of the potential contaminants entering the site and adequate waste disposal facilities on site.

Soil contamination probability is Probable and potential consequences moderately severe, making the significance Medium.

At this stage no soils-related fatal flaws are evident for the proposed project. The areas on site that need to be buffered are the watercourses.

6 PLAN OF STUDY FOR EIA

6.1 SITE ASSESSMENT

A free format soils classification survey of the study area will be undertaken on foot, using a spade, a hand-held bucket auger and a hand-held Dutch auger to identify soil forms present on site. Current activities at the site and specific areas of land use will be noted. The soil types encountered will be reported upon and mapped as part of the EIA study.

6.2 SOIL CAPABILITY ASSESSMENT

The soils will be classified by form in accordance with the South African soil taxonomic system (Soil Classification Working Group, 1991) and the area's land capability will be assessed and mapped based on the results of the classification study. The South African land capability classification system by Scotney *et al.* (1987) will be used to classify and map land capability (see **Table 5-1**). This system is useful in that it is able to quickly provide an overview of the agricultural capability and limitations of the soils in question and is useful for land capability comparisons. This system, however, is agriculturally focussed, offering little information about the soil potential for alternative uses. For this reason, a soil suitability assessment tool for alternative uses developed in-house by WSP and informed by the IEMA Land and Soils in EIA Guide (IEMA, 2021) will also be applied to the site (see **Table 5-2**). A key aspect of this method is that input is gathered in an interdisciplinary manner.

Table 6-1: Land Capability Classification System (Scotney *et al.*, 1987)

Land Capability Group	Land Capability Class	Increased intensity of use									Limitations
Arable	I	W	F	LG	MG	IG	LC	MC	IC	VIC	No or few limitations. Very high arable potential. Very low erosion hazard
	II	W	F	LG	MG	IG	LC	MC	IC	-	Slight limitations. High arable potential. Low erosion hazard
	III	W	F	LG	MG	IG	LC	MC	-	-	Moderate limitations. Some erosion hazards
	IV	W	F	LG	MG	IG	LC	-	-	-	Severe limitations. Low arable potential. High erosion hazard.
Grazing	V	W	-	LG	MG	-	-	-	-	-	Water course and land with wetness limitations
	VI	W	F	LG	MG	-	-	-	-	-	Limitations preclude cultivation. Suitable for perennial vegetation
	VII	W	F	LG	-	-	-	-	-	-	Very severe limitations. Suitable only for natural vegetation
Wildlife	VIII	W	-	-	-	-	-	-	-	-	Extremely severe limitations. Not suitable for grazing or afforestation.

W - Wildlife
F - Forestry
LG - Light grazing
MG – Moderate grazing
IG - Intensive grazing
LC - Light cultivation
MC - Moderate cultivation
IC - Intensive cultivation.
VIC – Very intensive cultivation

Table 6-2: Alternative Land Capability Classification System

PROPOSED USE		(ENTER USE HERE)	COMMENTS
Limitations		(enter use-specific limitations here)	(explain capability class decision here)
Capability Class		**Limitations To Proposed Use**	
1	Very good	None or Marginal	
2	Good	Slight	
3	Fair	Moderate	
4	Poor	Considerable, Long-Term	
5	Very Poor	Severe, Long-term, Irreversible	

6.3 SOIL IMPACT ASSESSMENT

The impact assessment undertaken in **Section 4** of this document will be expanded upon based on the outcomes of the final site visit and further soil assessment.

7 REFERENCES

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- Scotney, D.M, F Ellis, R. W. Nott, T.P. Taylor, B.J., Van Niekerk, E. Vester and P.C. Wood. 1987. A system of soil and land capability classification for agriculture in the SATBVC states. Dept. Agric. Pretoria.

APPENDIX

E- 4 *SURFACE WATER*

REPORT

Scoping Assessment for the Proposed Eskom Komati Solar PV Facility

WSP Africa

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1.0 INTRODUCTION

Golder Associates Pty Ltd (member of WSP) was appointed by Eskom Holdings SOC (Ltd) to provide a scoping assessment for the proposed Eskom Komati Solar Photovoltaics (PV) project. WSP will carry out an Environmental Impact Assessment (EIA) for the Solar PV project in line with World Bank's Environmental and Social Framework, and the South African Legislations. The purpose of this scoping assessment is to provide a description of the proposed project, including a sufficient level of detail to enable stakeholders to identify relevant issues and concerns.

2.0 PROJECT DESCRIPTION

The Eskom Komati Solar PV project will comprise of the following:

The specifications of the Solar PV and Battery Energy Storage System (BESS) project including aspects of construction and operation are outlined below:

- The total site area for PV installation is approximately 200 to 250 hectares to allow for the construction of a PV facility with capacity up to 100 MW and BESS up to 150 MW.
- Solar PV modules, up to a total of approximately 720,000 m^2, that convert solar radiation directly into electricity. The solar PV modules will be above the ground and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the boundaries, and Operation and Maintenance (O&M) access roads in between the PV module rows.
- Inverter stations, each occupying a footprint of approximately 30 m^2, with up to 100 Inverter stations installed on the identified sites. Each Inverter station will contain an inverter step-up transformer, and switchgear. The Inverter stations will be distributed on the site, located alongside its associated Solar PV module arrays. The Inverter station will perform conversion of Direct Current (DC) to Alternating Current (AC), and step-up the LV voltage of the inverter to the appropriate voltage to allow the electricity to be fed into the appropriate substation / grid Point of Connection (PoC). Inverter stations will connect several arrays of Solar PV modules and will be placed along the internal roads for easy accessibility and maintenance.
- Below ground electrical cables with trenching for connecting PV arrays, Inverter stations, O&M buildings, and Combiner Substations.
- Above ground overhead lines for connecting Combiner Substations to grid PoC.
- Adequately designed foundations and mounting structures that will support the Solar PV modules and Inverter stations.
- Access roads to the Komati PV sites.
- Perimeter roads around the PV sites.
- Internal roads for access to the Inverter stations.
- Internal roads/paths between the Solar PV module rows, to allow access to the Solar PV modules for O&M activities.
- Infrastructure required for the operation and maintenance of the Komati PV installations:
  - Meteorological Station
  - O&M Building – comprising control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities (including water supply and sewage infrastructure).

  - Spares Warehouse and Workshop.
  - Hazardous Chemical Store – approx. 30 m^2 .
  - Security Building.
  - Parking areas and roads.
- Small diameter water supply pipeline from existing supply infrastructure.
- Fire water supply during Construction and Operation.
- Sewage interconnection to existing infrastructure.
- Stormwater channels.
- Perimeter fencing of the Komati PV sites, with access gates.
- Temporary laydown area, occupying a footprint up to approx. 10 hectares. The laydown area will be used during construction and rehabilitated thereafter.
- Temporary concrete batching plant, occupying a footprint up to approx. 1 hectare. The concrete batching plant area will be used during construction and rehabilitated thereafter.
- Temporary site construction office area, occupying a footprint up to approx. 1 hectare. This area will accommodate the offices for construction contractors during construction and rehabilitated thereafter.

3.0 BACKGROUND

Eskom Holdings SOC (Ltd) is a South African utility that generates, transmits and distributes electricity. Eskom supplies about 95 % of the country's electricity. Eskom's 2035 strategy encompasses the journey that Eskom intends to take in response to the changing energy environment and the impact this has towards a sustainable power utility. This strategy is necessitated by the challenges that Eskom faces as a business as well as the global and local shifts occurring in the energy sector particularly with respect to environmental and climate change challenges, difficulties in accessing financing and changes to the macro industry environment significantly altering the energy supply industry (ESI).

The road to 2035, includes the shutting down of a number of coal-fired power stations by 2035, repurposing and repowering, delivering new clean generation projects, expanding the transmission grid, and rolling out micro grid solutions.

Several power stations are reaching the end of life. These stations will go into extended cold reserve and are most likely to be fully decommissioned in the future. Eskom is considering a shutdown, dismantling and repurposing of some of its fleet as it reaches its end of life. Komati Power Station, situated in Mpumalanga will reach its end-of-life expectancy in September 2022.

Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100 MW of Solar PV and 150 MW of BESS.

4.0 PROJECT LOCATION AND EXTENT

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa. The station is located in the Steve Tshwete Municipality, along the R35 as shown in Figure 1. The GPS coordinates for the power plant is: 26.0896668 S, 29.4655907 E. The station has a total of 9 units, five 100 MW units on the east (Units 1 to 5) and four 125 MW units on the west (Units 6 to 9), with a total installed capacity of 1000 MW. Its units operated on a simple Rankine Cycle without reheat and with a low superheat pressure, resulting in a lower thermodynamic efficiency (efficiency up to 27 %). Komati Units are small and have a higher operating & maintenance cost per megawatt generated compared to modern newer stations. Komati Power Station will reach its end-of-life expectancy in September 2022 when Unit 9 will have reached its Dead Stop Date (DSD). Units 1 to 8 have already reached its DSD.

The parcels of land in Komati for the proposed development is provided in Figure 2. The identified parcels of land are owned by Eskom.

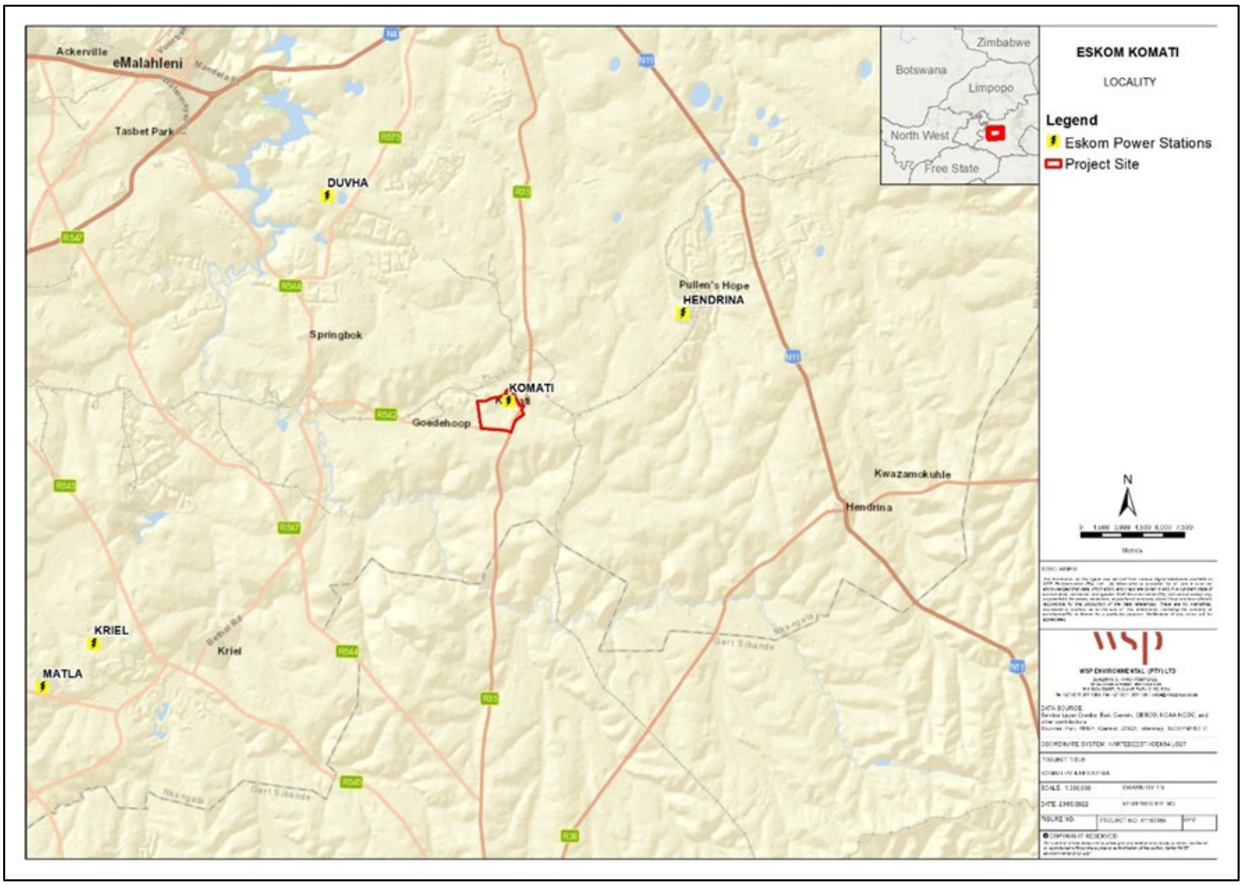


Figure 1: Locality Map

Figure 2: Site layout and proposed PV sites

5.0 APPLICABLE LEGISLATION, GUIDELINES AND STANDARDS

5.1 The World Bank Environmental and Social Framework

The World Bank Environmental and Social Framework sets out the World Bank's commitment to sustainable development, through a Bank Policy and a set of Environmental and Social Standards that are designed to support Borrowers' projects, with the aim of ending extreme poverty and promoting shared prosperity.

The ten Environmental and Social Standards establish the standards that the Borrower and the project will meet through the project life cycle, as follows:

- Environmental and Social Standard 1: Assessment and Management of Environmental and Social Risks and Impacts.
- Environmental and Social Standard 2: Labour and Working Conditions.
- Environmental and Social Standard 3: Resource Efficiency and Pollution Prevention and Management.
- Environmental and Social Standard 4: Community Health and Safety.
- Environmental and Social Standard 5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement.
- Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.
- Environmental and Social Standard 7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities.

- Environmental and Social Standard 8: Cultural Heritage.
- Environmental and Social Standard 9: Financial Intermediaries.
- Environmental and Social Standard 10: Stakeholder Engagement and Information Disclosure.

5.2 The National Water Act (Act 36 of 1998)

Water resources management in South Africa is governed by the National Water Act (Act 36 of 1998) (NWA). The Department of Water and Sanitation (DWS) must, as custodians of water, ensure that resources are used, conserved, protected, developed, managed, and controlled in a sustainable manner for the benefit of all persons and the environment.

5.3 The use of Water for Mining and Related Activities

Government Notice 704 (Government Gazette 20119 of June 1999) (hereafter referred to as GN704), was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources. The three main conditions of GN704 applicable to this project are:

- No residue or substance which causes or is likely to cause pollution of a water resource may be used in the construction of any dams, impoundments or embankments or any other infrastructure which may cause pollution of a water resource.
- Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of the flow of a 1:50-year recurrence interval storm event. Clean and dirty water systems should therefore not spill into each other more frequently than once in 50-years. Any dirty water dams should also have a minimum freeboard of 0.8 m above the full supply level.
- All dirty water or substances which may cause pollution should be prevented from entering a clean water resource (by spillage, seepage, erosion etc.) and it should be ensured that water used in any process is recycled as far as practicable.

5.4 South African Water Quality Guidelines

The NWA, Section 21 (f) and (g), states that the discharging of water containing waste into a water resource and disposing of waste which may detrimentally impact on a water resource should be prevented. The South African Water Quality Guidelines (SAWQG) are a series of documents published by (Department of Water Affairs) DWA, which forms an integral part of the water quality management strategy to safe keep and maintain the water quality in South Africa. These guidelines are used by the DWA as a primary source of information and decision-support to judge the fitness for use of water and for other water quality management purposes. The content of the SAWQG provides information on the ideal water quality and acceptable concentrations for various constituents of concern.

5.5 National Environmental Management Act

The National Environmental Management Act (NEMA), 1998 (Act No 107 of 1998) covers the control and management of environmental impacts and, *inter alia*, provides a framework for measures that “prevent pollution and ecological degradation; promotes conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development

6.0 BASELINE OVERVIEW

6.1 Climate

6.1.1 Rainfall

The rainfall data was generated using a rainfall simulator which was sourced through the Design Rainfall Estimation Program (Smithers & Schulze, 2002) and the Daily Rainfall Extraction Utility (Kunz, 2004). Data was sourced for rainfall stations that are within close proximity to the study area. The rainfall stations presented in Table 1 summarize the rainfall data used in the analysis.

Table 1: Metadata for the rainfall stations

Station number	Name	Distance (km)	Record period (years)	Period of records	Reliability (%)	MAP (mm)
0478577 W	Vaalkraanz	11.4	80	1920 - 2000	11.7	693
0478546 W	Vandyksdrift	11.8	80	1920 - 2000	59.8	686
0478786 W	Blinkpan (Pol)	2.5	80	1920 - 2000	25	643

6.1.1.1 Comparison of rainfall stations

The average monthly plot was used to compare the rainfall records as shown in Figure 3. The rainfall records cover the same time periods, and the average monthly rainfall depths for the different stations have a similar pattern. During the wet season, the highest average rainfall was recorded in the month of January. The driest month on average was recorded in the month of July.

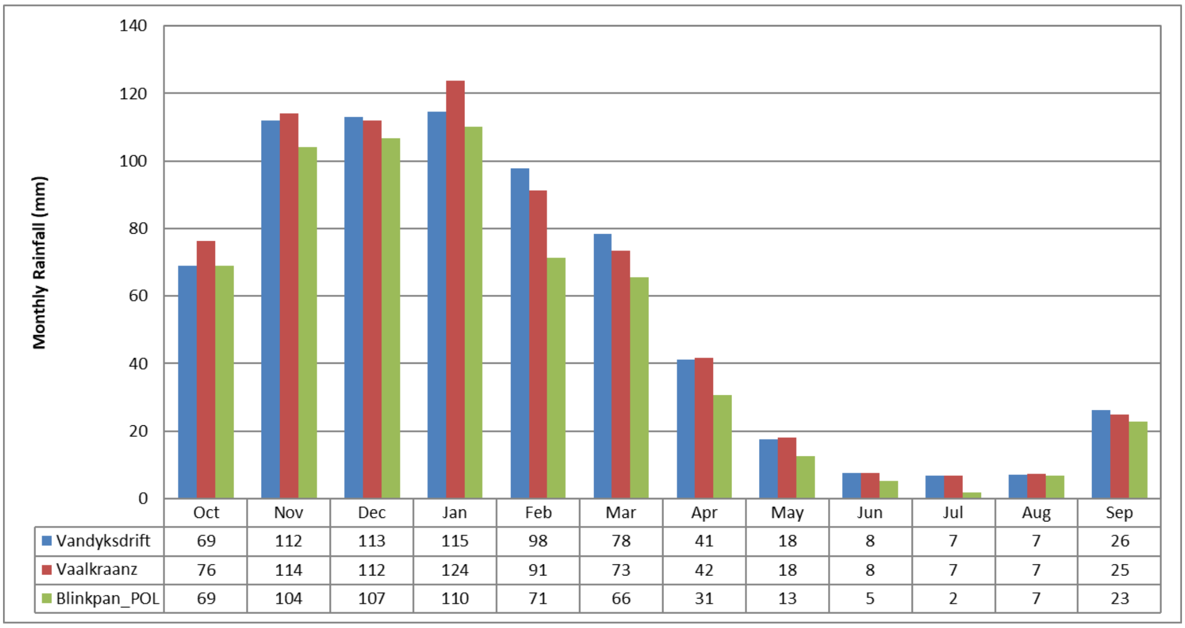


Figure 3: Average monthly rainfall for the stations

The Vandyksdrift, Vaalkraanz and Blinkpan (POL) rainfall stations show a similar increasing trend as observed in Figure 4. The trends are consistent throughout, with no significant changes in slope. Figure 4 shows the total cumulative rainfall over time.

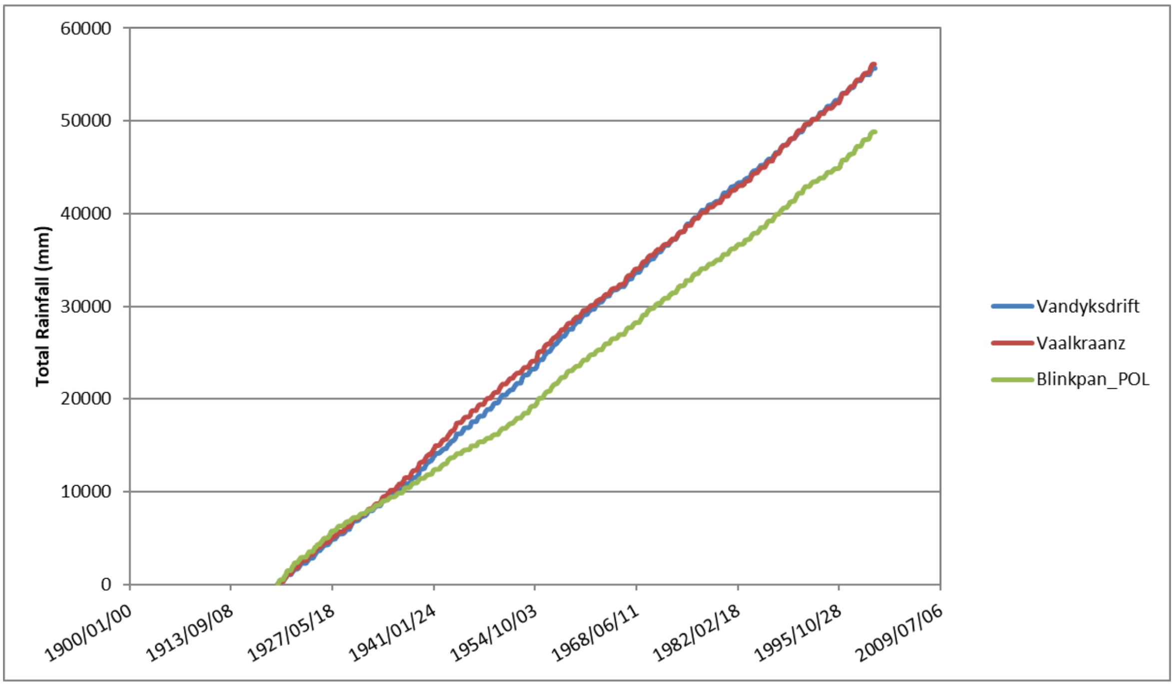


Figure 4: Cumulative rainfall for the stations analyzed

The station 0478546 W Vandyksdrift was chosen as the station that is representative of the study for the following reasons:

- The station is within proximity of the site.
- The station has the highest reliability data set (having the lowest percentage of patched or missing data).
- The station has long duration of recorded data.

6.1.1.2 Vandyksdrift rainfall station

Vandyksdrift rainfall station is situated approximately 12 km from the site with 80-years of recorded data. It has the highest reliability (less patched data) of the analysed stations. The maximum recorded 24-hour rainfall depth is 97 mm, recorded on the 26th of April 1960, as shown in Figure 5. Figure 6 shows the annual rainfall depths. The mean annual precipitation for the station is 693 mm.

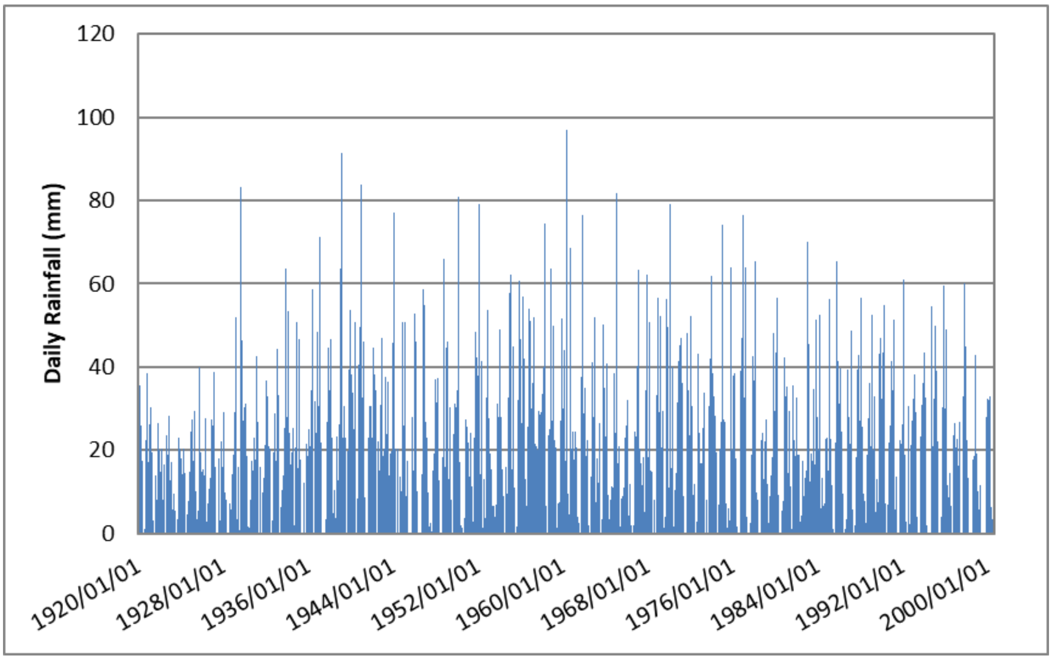


Figure 5: Vandyksdrift weather station daily rainfall

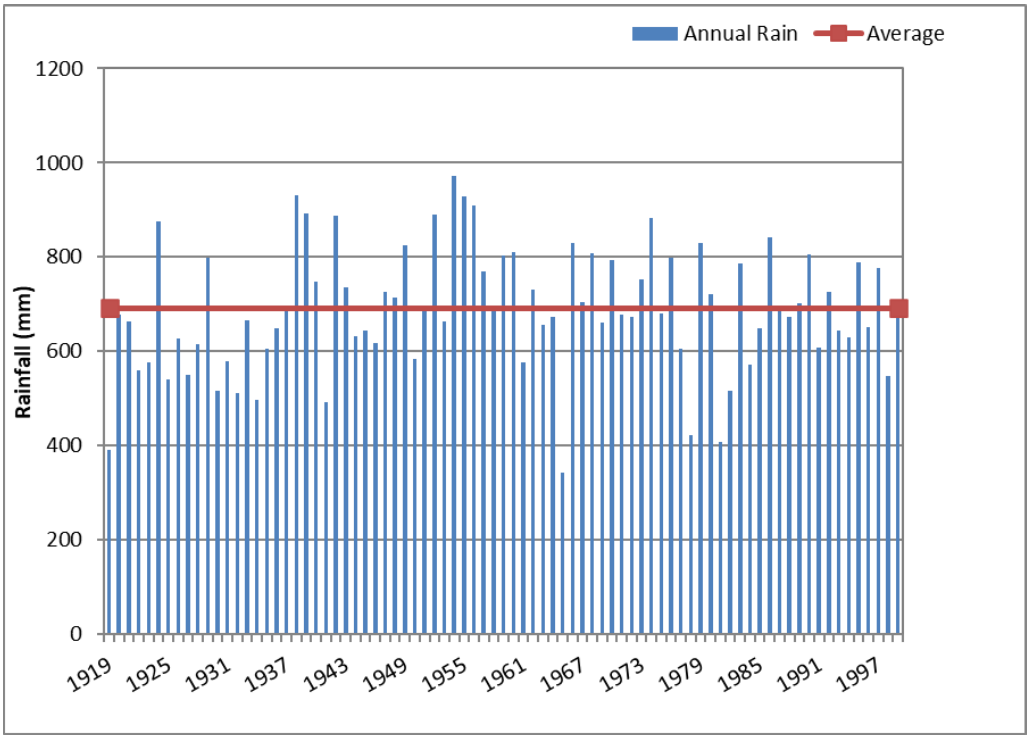


Figure 6: Vandyksdrift weather station annual rainfall readings and mean annual precipitation (MAP)

6.1.1.3 Design rainfall estimation

The 24-hour rainfall depths for several recurrence intervals at the Vandyksdrift station were calculated from the data available. To determine the likely magnitude of storm events, a statistical approach, using chi square statistics method (NIST/SEMATECH e-Handbook of Statistical Methods), was applied to the available recorded daily rainfall depths. This method statistically analyses the maximum daily rainfall depths for each year to determine the different recurrence intervals. The probability distribution with the best fit (R^2=0.993) was found to be the Pearson III distribution (see Figure 5), this was used to estimate the 24-hour storm rainfall depths associated with the various recurrence intervals as summarised in Table 2.

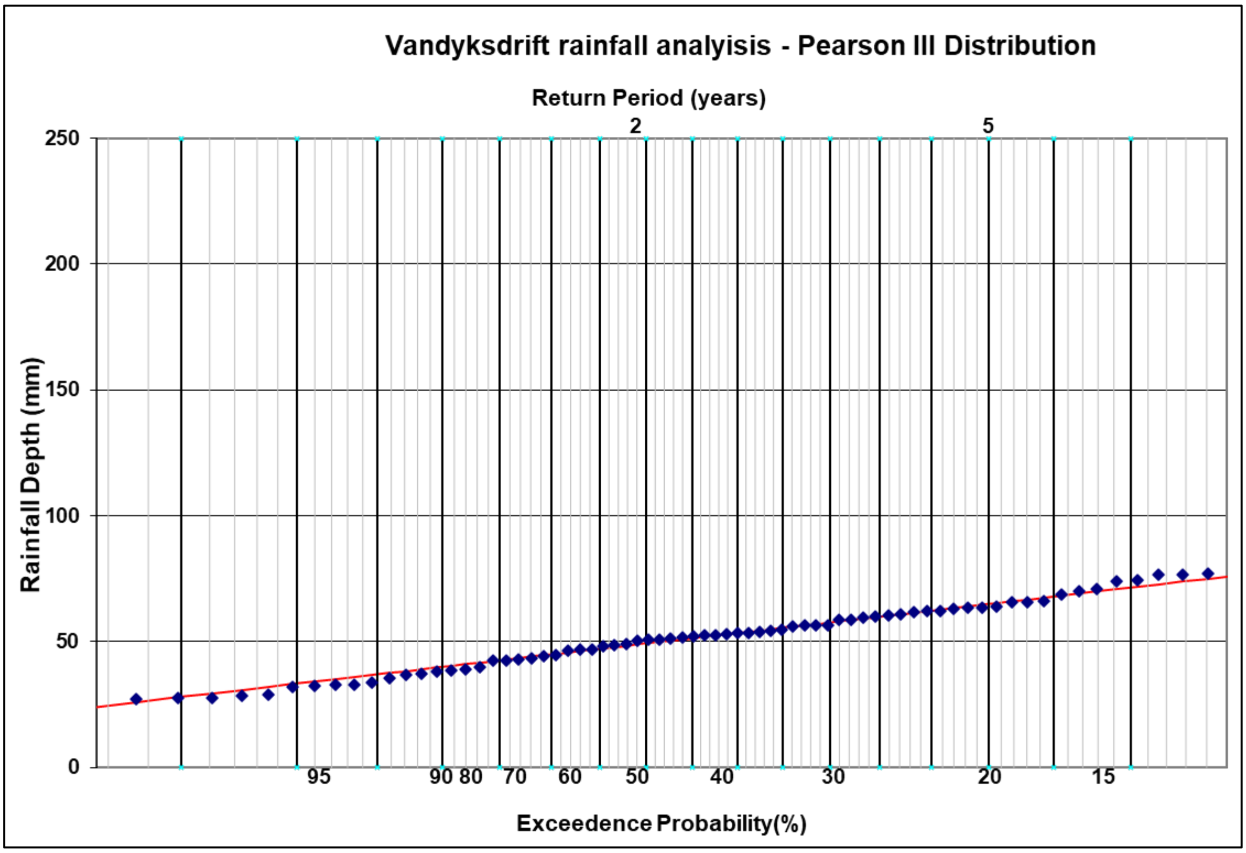


Figure 5 : Vandyksdrift Pearson III distribution

Table 2: Computed 24-hour rainfall depths for various annual recurrence intervals

Return period in years	5	10	20	25	50	100	200	500	100
24-hours Rainfall Depth (mm/d)	68	76	83	85	91	96	101	107	112

6.1.2 Evaporation

The average S-Class pan evaporation is 2087.9 mm/year measured at B1E002 station. The station is approximately 13 km away from the site area. The highest average monthly evaporation occurs in November, as shown in Table 3. Figure 7 plots the monthly average evaporation and the monthly average rainfall readings for the Komati area. From the figure, it is observed that the mean annual evaporation is generally higher than the rainfall throughout the year.

Table 3: Average S-Pan evaporation

Month	S-Pan evaporation (mm/month)
January	200.9
February	163.5
March	193.8

Month	S-Pan evaporation (mm/month)
April	161.9
May	139.3
June	113.1
July	120.6
August	161.2
September	187.7
October	199.9
November	214.8
December	212.7
Total	2069.4

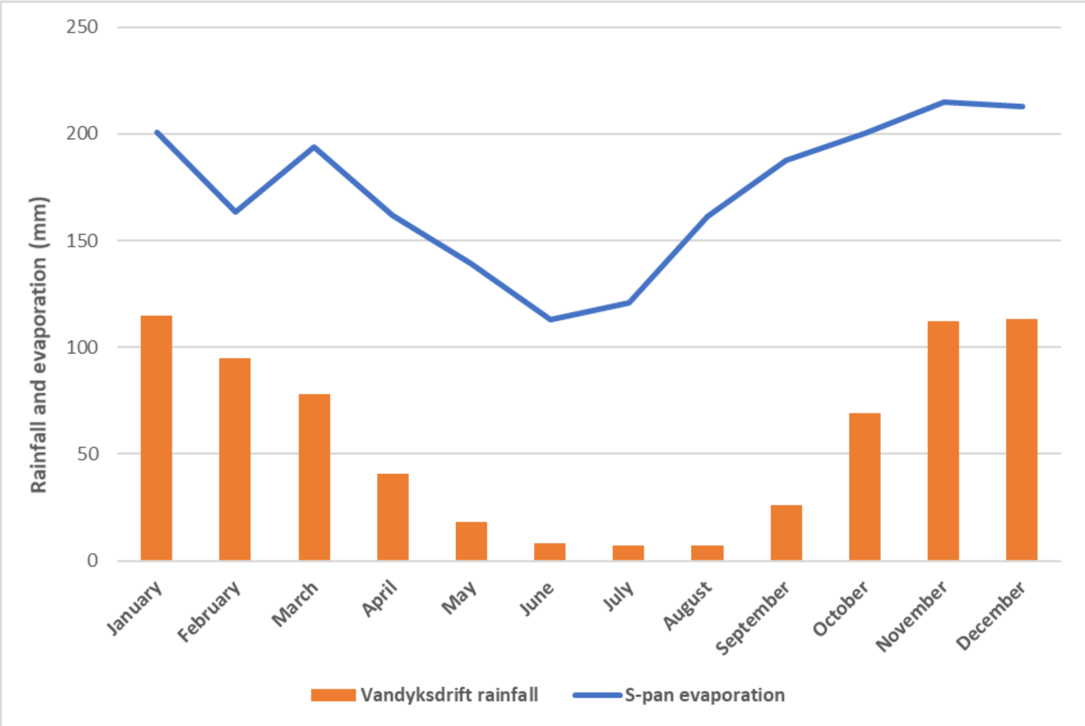


Figure 7: Rainfall and evaporation comparison

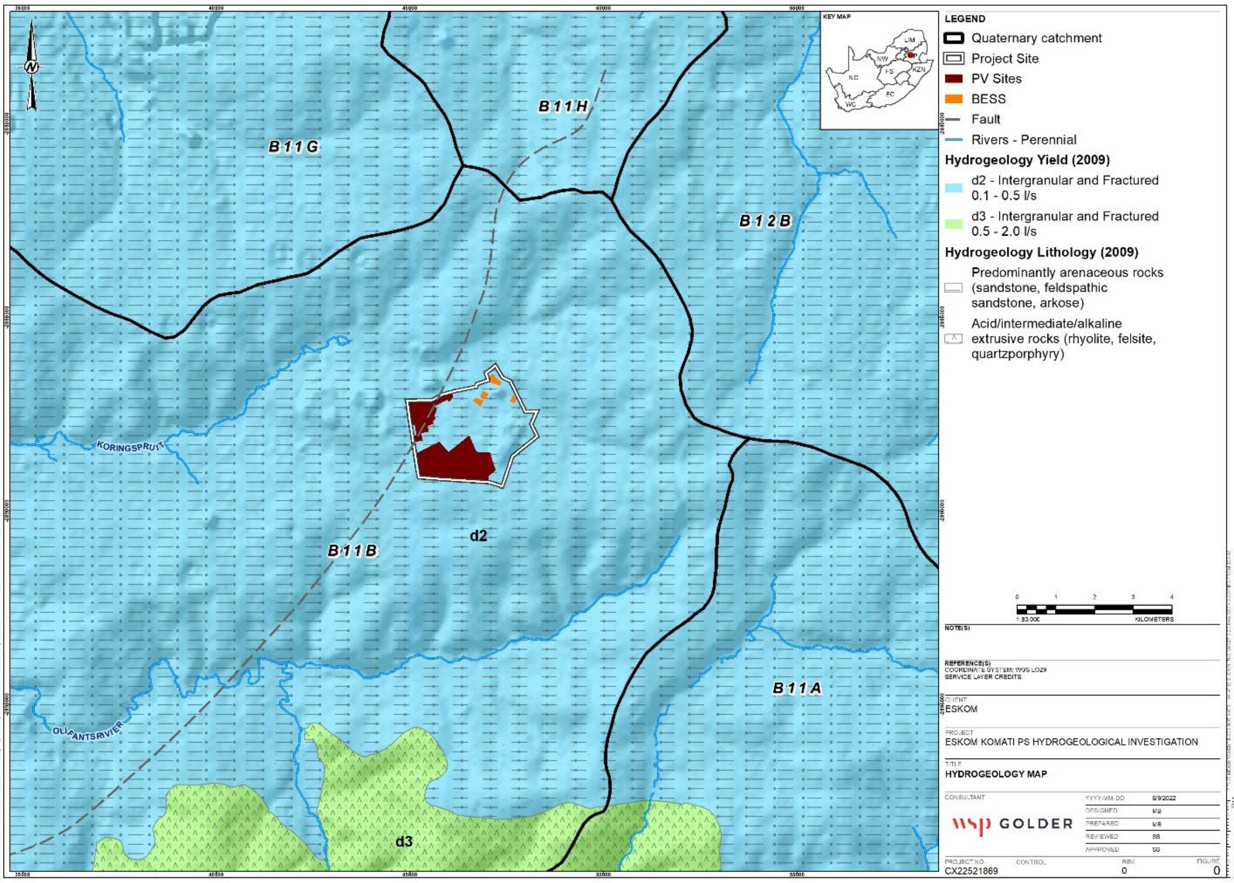
6.2 Temperature

According to GHT Consulting, average daily maximum temperatures in the Komati area vary from 27°C in January to 17°C in July, but in extreme cases these may rise to 38°C and 26°C, respectively. In comparison, average daily minima of 13°C and 0°C can be expected, with temperatures falling to 1 and –13°C, respectively, on unusually cold days. Frost conditions are also common over the 120-day period from May to September.

7.0 HYDROLOGICAL DESCRIPTION

7.1 Catchment description

Komati Power Station occurs within the upper Olifants Water Management Area (WMA), in the B11B quaternary catchment and can be sub-divided into secondary drainage regions compromising of smaller streams and creeks. This catchment receives 687 mm rainfall per year and experiences 1 550 mm of evaporation annually. The surface topography of the area is typical of the Mpumalanga Highveld, consisting in the main of a gently undulating plateau. The flood plains of the local streams are at an average elevation of approximately 1595 meters above mean sea level (mamsl). Altitudes vary from ±1650 mamsl at the higher parts south of the ashing facility to ±1595 mamsl which defines the base of the Koring Spruit to the north of the Komati Power Station.



8.0 IMPACT ASSESSMENT

Based on the existing information in the area, a preliminary impact assessment was conducted and outlined in the section below. The impacts will be verified by relevant specialists during the EIA Phase. The key issues and concerns for the surface water study have been unpacked in the subsections below.

8.1 Major areas of concern for surface water impact

The following section describes those activities that would have an impact on the surface water resources in the area in which the associated activities are proposed. For the purposes of this scoping impact assessment, the proposed project has been subdivided into the construction, operational, and closure phases. The cumulative impacts will only be included in the EIA phase.

The major activities of concern relating to the surface water resources are:

Construction phase

- Contamination of stormwater runoff;
- Erosion at the construction site.

Operational phase

- Contamination of stormwater runoff;
- Erosion during operation;
- Flooding.

Closure/decommissioning phase

- Contamination of stormwater runoff.

8.2 Impact assessment methodology

The significance of the identified impacts on the various environmental components were determined using the approach outlined below. An impact screening tool has been used in the scoping phase. The screening tool is based on two criteria, namely probability; and consequence (Table 6), where the latter is based on general consideration to the intensity, extent, and duration.

The scales and descriptors used for scoring probability and consequence are detailed in Table 4 and Table 5 respectively.

Table 4: Significance screening tool

	Consequence scale				
Probability scale		1	2	3	4
	1	Very Low	Very Low	Low	Medium
	2	Very Low	Low	Medium	Medium
	3	Low	Medium	Medium	High
	4	Medium	Medium	High	High

Table 5: Probability scores and descriptors

Score	Descriptor
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable**: The possibility of the impact occurring is very low

Table 6: Consequence score descriptions

Score	Negative	Positive
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

The nature of the impact must be characterized as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (Table 7) has been applied according to the nature and significance of the identified impacts.

Table 7: Impact Significance Colour Reference System to indicate the Nature of the impact

Negative Impacts (-ve)	Positive Impacts (+ve)
Negligible	Negligible
Very Low	Very Low
Low	Low
Medium	Medium
High	High

8.3 Construction phase impacts

During the construction phase of the solar PV project, the following activities are anticipated:

- **Site Preparation** - Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.

- **Transportation of Equipment** - All equipment to site will be transported by means of national, provincial and district roads. This includes but is not limited to, transformers, solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- **Site Establishment Works** - The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g., use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- **Construction of the Solar PV Facility** - Trenches would need to be excavated for underground cabling to connect Solar PV arrays, Inverter stations, and Combiner Substations. Foundations for the solar PV array mounting structures and Inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be implemented at the PV site. Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- **Water consumption during construction phase** - The water consumption during the construction phase is estimated as 15,000 kilolitres (total for construction period estimated as 24-months) - The Contractor should in any case be made responsible for securing electricity, water, and any other services during construction.
- **Construction of Electrical Interconnection Line** - Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- **Storage of diesel and oil for construction activities**.

Once all the construction activities are completed the site will be rehabilitated where possible and practical. All temporal structures and facilities will be removed from site and the area rehabilitated.

The associated impacts in the construction phase for the abovementioned activities are described in the following section:

8.3.1 Contamination of stormwater runoff

Stormwater runoff could, in the case of the temporary construction yards, laydown areas, and offices for the construction workers, potentially come in contact with areas dedicated for the handling of contaminants.

The contaminants from areas in which contractor vehicles and equipment are housed, as well as from the areas in which the construction vehicles and equipment are being used, will include hydrocarbons that may be spilled or leaked during use. This could result in contaminated stormwater runoff being discharged downstream. During construction, it is expected that the magnitude of the impact will be **low** and will require mitigation to reduce the risk.

8.3.1.1 Mitigation

The following mitigation measures are proposed:

- Ensure clean-up of hydrocarbon spills from machinery is done immediately, and contaminated soils disposed of to a permitted site.
- After construction, the land must be cleared of debris, surplus materials, and equipment. All parts of the land must be left in a condition as close as possible to that prior to construction.

Should the measures described above be implemented during construction, then the impact significance will reduce to **low – very low**.

8.3.2 Erosion during construction

Soil stripping, stockpiling, excavations of underground cabling, foundations for the solar PV array mounting structure and construction of stormwater berms may result in loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes, resulting in increased sedimentation to water resources.

The removal or disturbance of vegetation during the construction of roads could result in the concentration of flow and consequently in accelerated erosion along roads where steep slopes dominate, which will result in an increase of suspended solids and sedimentation of the downstream environment. Erosion of the proposed roads is further possible at watercourse crossings due to the concentration of flow. Removal or disturbance of vegetation from areas such as new roads, the construction yards and the substation / control building could also result in erosion due to the soil stability being affected. During construction, it is expected that the magnitude of the impact will be **moderate** and will require mitigation to reduce the risk

8.3.2.1 Mitigation

The following mitigation measures are proposed:

- Avoid clearing during the wet season when short heavy downpours can be expected. This should help to limit erosion.
- Minimize the extent of earthworks.
- Encourage the use of natural flow paths downstream of construction sites.
- The discharge of stormwater should be spread over a wide area to reduce the energy as a result of concentrated flow and return to dispersed flow downstream of the construction site.
- Re-use stockpiled soil within as short a period as possible.

Should the measures described above be implemented during construction, then the impact significance will reduce from **moderate – very low**.

8.4 Operation phase impacts

During the operation phase of the solar PV project, the following activities are anticipated:

- During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant.
- In addition, there will be periodic cleaning and washing of the solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur 2-4 times a year.
- The water consumption during operation - estimated water required per year during operation is 10,000 kilolitres (total per year for the design life of plant).

The associated impacts in the operation phase for the abovementioned activities are described in the following section:

8.4.1 Flooding

In the operation phase, soil compaction and erosion may occur due to vehicle movement during routine maintenance. This activity will lead to an increase in impervious surfaces. This activity, however, will only occur occasionally and has therefore been considered to be infrequent and negligible. The impact significance is expected to be **low.**

8.4.1.1 Mitigation

Protect structures such as the solar PV bases and substation / control building from localised flooding by constructing cut-off berms / diverting flow on the uphill side in flood prone areas.

Should the measures described above be implemented during the operation phase, the impact significance will reduce from **low – very low.**

8.4.2 Contamination of stormwater runoff

Stormwater runoff in the vicinity of the substation / control building and solar PV's could come into contact with dedicated areas where hazardous substances are handled such as fuels and oils which could result in contaminated stormwater runoff being discharged downstream. Furthermore, typical activities during maintenance include washing of solar panels with water that includes chemicals. This water could also potentially contaminate nearby watercourses. This PV module cleaning will be performed when required 2 – 4 times a year and has therefore been considered to be infrequent and negligible.

During the operational phase, it is expected that the magnitude of the impact will be **low** and will require mitigation to reduce the risk.

8.4.2.1 Mitigation

- Prevent stormwater runoff to come in contact with dedicated areas where hazardous substances are handled, by diverting flow with berms and cut-off drains to divert stormwater runoff away from the site and discharge diverted stormwater as per pre-development conditions, and good house-keeping.
- Clean solar panels with water that contains no chemicals.

8.4.3 Erosion during operation

In the operational phase, the potential impacts due to the additional hardened surfaces include erosion of the surrounding environment. Eroded soil particles carried to downstream water resources can also result in the decrease in quality of nearby watercourses, due to sedimentation. The impact significance in the operation phase is expected to be **moderate**.

8.4.3.1 Mitigation

In summary, the following mitigation measures are proposed:

- Design stormwater management facilities to comply with regulation GN 704.
- Stormwater infrastructure installed to mitigate possible hydrological impacts must be regularly maintained throughout the lifespan of the infrastructure to ensure its optimum functionality.
- Apply erosion protection measures such as stonepitching downstream of steep roadside channels.

Should the measures described above be implemented during the operation phase, the impact significance will reduce from **moderate – very low**.

8.5 Closure/decommissioning

The aim of the rehabilitation is to bring back the work site to a stabilised condition, as close as possible to pre-construction conditions and to the satisfaction of the landowner. Once all the construction activities are completed the site will be rehabilitated where possible and practical. All temporal structures and facilities will be removed from site and the area rehabilitated. The rehabilitation of the area would entail the following activities:

- Removal of PV modules;
- Removal of associated infrastructure;

- Land reform.

8.5.1 Contamination of stormwater runoff

Similarly, to the construction phase, the runoff during the rehabilitation (decommissioning/ closure) phase may contain contaminants. In addition, soil compaction to reshape the landform may cause increased runoff which may still contain higher concentrations of contaminants and sediment.

The magnitude is therefore rated as low, with a short-term duration, extending to the site. The probability is low with the resultant impact significance of the runoff during rehabilitation expected to be **low**.

8.5.1.1 Mitigation

All pollution control mechanisms are to be in accordance with GN 704, and all necessary pollution control mechanisms must be protected and repaired or established when stockpiles or residue deposits are reclaimed, removed, or rehabilitated so that water pollution is minimized and abated.

Should the measures described above be implemented then the impact significance should be reduced from **low – very low**.

8.6 Impact Assessment summary

The predicted environmental impacts resulting from the proposed project activities in the scoping phase are listed in Table 8, along with their significance ratings before and after mitigation

Table 8: Impact assessment summary

Project Name	Eskom Komati Solar PV Surface Water Impact Assessment																		
Impact Assessment																			
CONSTRUCTION																			
Impact number	**Aspect**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+	**E+**	**R+**	**D)x**	**P=**	**S**	**Rating**	**(M+**	**E+**	**R+**	**D)x**	**P=**	**S**	**Rating**
Impact 1:	Stormwater runoff	Stormwater runoff could, in the case of the temporary construction yards, laydown areas, and offices for the construction workers, potentially come in contact with areas dedicated for the handling of contaminants.	Construction	Negative	Moderate	4	1	3	2	2	**20**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	Erosion	Soil stripping, stockpiling, excavations of underground cabling, foundations for the solar PV array mounting structure and construction of stormwater berms may result in loss of soils through erosion, particularly for topsoil stockpiles with unvegetated steep slopes, resulting in increased sedimentation to water resources	Construction	Negative	Moderate	2	2	3	2	4	**36**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
OPERATIONAL																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+	**E+**	**R+**	**D)x**	**P=**	**S**		**(M+**	**E+**	**R+**	**D)x**	**P=**	**S**	
Impact 1:	Flooding	In the operation phase, soil compaction and erosion may occur due to vehicle movement during routine maintenance. This activity will lead to an increase in impervious surfaces. This activity, however, will only occur occasionally and has therefore been considered to be infrequent and negligible.	Operational	Negative	Moderate	3	1	3	2	2	**18**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	Stormwater runoff	Stormwater runoff in the vicinity of the substation / control building and solar PV's could come into contact with dedicated areas where hazardous substances are handled such as fuels and oils which could result in contaminated stormwater runoff being discharged downstream. Furthermore, typical activities during maintenance include washing of solar panels with water that includes chemicals. This water could also potentially contaminate nearby watercourses.	Operational	Negative	Moderate	4	1	3	2	2	**20**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 3:	Erosion	In the operational phase, the potential impacts due to the additional hardened surfaces include erosion of the surrounding environment. Eroded soil particles carried to downstream water resources can also result in the decrease in quality of nearby watercourses, due to sedimentation.	Operational	Negative	Moderate	2	2	3	2	4	**36**	**N3**	2	1	1	2	2	**12**	**N1**
					Significance	**N3 - Moderate**							**N1 - Very Low**						
DECOMISSIONING																			
Impact number	**Receptor**	**Description**	**Stage**	**Character**	**Ease of Mitigation**	**Pre-Mitigation**							**Post-Mitigation**						
						(M+	**E+**	**R+**	**D)x**	**P=**	**S**		**(M+**	**E+**	**R+**	**D)x**	**P=**	**S**	
Impact 1:	Stormwater runoff	Similarly, to the construction phase, the runoff during the rehabilitation (decommissioning/ closure) phase may contain contaminants. In addition, soil compaction to reshape the landform may cause increased runoff which may still contain higher concentrations of contaminants and sediment.	Decommissioning	Negative	Moderate	4	1	3	2	2	**20**	**N2**	2	1	1	2	2	**12**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						

9.0 PLAN FOR EIA PHASE

An in-depth impact assessment will be conducted during the EIA Phase, which will include an assessment of the potential impacts associated with the proposed development on the features present on site and the mitigation measures to be implemented to adequately protect these features. The impacts to be assessed will include:

- Assessment of water quality changes.
- Assessment of hydrology (stormwater management).
- Assessment of the cumulative impacts of the proposed development.

10.0 CONCLUSION AND RECOMMENDATIONS

Due to the nature of the construction activities, it can be concluded that the majority of the surface water impacts would be of a water quality nature. The potential impacts primarily include erosion and stormwater runoff coming in contact with areas dedicated to collection, containment and treatment of hazardous substances such as fuel storage areas as well as localized flooding. Mitigation measures must be put into place to prevent or reduce the impact on the downstream environment.

Stormwater management is required both during and after the construction of the solar PV to prevent damage to property, degradation of the water quality in nearby water resources and negative impacts to the surrounding environment. The impacts during construction phase are temporary, while impacts during operational phase are permanent and could result in a greater cumulative impact, which will be addressed in the EIA phase. Impacts during both these phases should be controlled at the source, to minimize or prevent the long-term and short-term impacts.

11.0 REFERENCES

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https://golderassociates.sharepoint.com/sites/161403/project files/6 deliverables/22521869-352927-1_eskomeia/22521869-352927-1_eskom eia report_final_15072022.docx

APPENDIX A

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APPENDIX

E-5 *TERRESTRIAL BIODIVERSITY*

REPORT

Eskom Komati Solar Photovoltaics and Battery Energy Storage System - Terrestrial Biodiversity Specialist Assessment - Scoping Report

Eskom Holdings SOC Ltd

Submitted to:

Eskom Holdings SOC Ltd

Submitted by:

Golder Associates Africa (Pty) Ltd.

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Distribution List

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Executive Summary

Eskom Holdings SOC (Ltd) (Eskom) is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa. Authorisation at a national level, and financing at the international level, must be sought, supported by an Environmental and Social Impact Assessment (ESIA) that is aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; the International Finance Corporation (IFC) Performance Standards; Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

Golder Associates Africa (Pty) (Ltd), now a member of WSP (Golder), was appointed to undertake the necessary ecological baseline studies and impact assessments, in support of the scoping, baseline and impact assessment phases of the environmental regulatory process required to authorise development-related activities.

This report describes the baseline terrestrial ecology of areas that will be impacted by the proposed infrastructure developments at Komati Power Station, and documents the results of the scoping-level screening of the potential impacts of the proposed Project on terrestrial ecosystems and biodiversity, i.e. vegetation communities and flora and fauna species.

The report also provides a preliminary set of recommended measures for the mitigation of any negative impacts for inclusion in the updated EMPr for the Project, to ensure that the lender objectives of No Net Loss (NNL) of Natural Habitats, and Net Gain (NG) of Critical Habitats, as well as South African biodiversity legislative and policy requirements, are satisfactorily met.

DETAILS OF THE SPECIALIST

Table 1: Details of specialist

Specialist Information	
Name:	Tebogo Khoza
Phone number:	+27 78 230 48176202
Email:	tebogo.khoza@wsp.com
SACNASP Registration Number	119651
Curriculum Vitae	See Appendix B

Declaration of Independence by Specialist

I, Tebogo Khoza declare that I –

- Act as the independent specialist for the undertaking of a specialist section for the proposed project.
- Do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed;
- Do not have nor will have a vested interest in the proposed activity proceeding;
- Have no, and will not engage in, conflicting interests in the undertaking of the activity;
- Undertake to disclose, to the competent authority, any information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan, or document.

ACRONYMS AND ABBREVIATIONS

Abbreviation	Explanation
AC	Alternating Current
BESS	Battery Energy Storage System
CARA	Conservation if Agricultural Resources Act
DC	Direct Current
DSD	Dead Stop Date
EA	Environmental Authorisation
EHSG	Environmental, Health and Safety Guidelines
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
ESIA	Environmental Social Impact Assessment
GIIP	Good International Industry Practices
IFC	International Finance Corporation
LSA	Local Study Area
MBSP	Mpumalanga Biodiversity Sector Plan
MRA	Mining Rights Area
NEMA	National Environmental Management Act
NEMBA	National Environmental Management Biodiversity Act
NFEPA	Freshwater Ecosystem Priority Areas
NG	Net Gain
NNL	No Net Loss
NPAES	National Protected Area Expansion Strategy
NWM5	National Wetland Map 5
PES	Present Ecological State
PoC	Point of Connection
PV	Photovoltaics
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
ToPS	Threatened or Protected Species
WBG	World Bank Group

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1.0 INTRODUCTION AND BACKGROUND

Eskom Holdings SOC (Ltd) (Eskom) is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. Eskom plans to install 100 MW of Solar Photovoltaics (PV) and 150 MW of Battery Energy Storage System (BESS), for which authorisation at a national level, and financing at the international level, must be sought, supported by an Environmental and Social Impact Assessment (ESIA) that is aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; the International Finance Corporation (IFC) Performance Standards; Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

Golder Associates Africa (Pty) (Ltd), now a member of WSP (Golder), was appointed to undertake the necessary ecological baseline studies and impact assessments, in support of the scoping, baseline and impact assessment phases of the environmental regulatory process required to authorise development-related activities.

1.1 Purpose of the report

This report describes the baseline terrestrial ecology of areas that will be impacted by the proposed infrastructure developments at Komati Power Station, and documents the results of the scoping-level screening of the potential impacts of the proposed Project on terrestrial ecosystems and biodiversity, i.e. vegetation communities and flora and fauna species.

The report also provides a preliminary set of recommended measures for the mitigation of any negative impacts for inclusion in the updated Environmental Management Programme (EMPr) for the Project, to ensure that the lender objectives of No Net Loss (NNL) of Natural Habitats, and Net Gain (NG) of Critical Habitats, as well as South African biodiversity legislative and policy requirements, are satisfactorily met.

2.0 PROJECT LOCATION AND EXTENT

The Komati Power Station is situated about 37 km from Middelburg, 43 km from Bethal and 40 km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa (Figure 1).

2.1 Current Operation

The station has a total of 9 units, five 100 MW units on the east (Units 1 to 5) and four 125 MW units on the west (Units 6 to 9), with a total installed capacity of 1000 MW. Komati Power Station will reach its end-of-life expectancy in September 2022 when Unit 9 will have reached its dead stop date (DSD). Units 1 to 8 have already reached its DSD.

2.2 Proposed Infrastructure and Activities

Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100 MW of Solar Photovoltaics (PV) and 150 MW of Battery Energy Storage System (BESS). The parcels of land in Komati for the proposed development are owned by Eskom. The proposed infrastructure that are the subject of the current application process are illustrated in Figure 2.

2.2.1 Project Components

The specifications of the Solar PV and BESS project including aspects of construction and operation are outlined below:

- The total site area for PV installation is approximately 200-250 hectares to allow for the construction of a PV facility with capacity up to 100 MW and BESS up to 150 MW.

- Solar PV modules, up to a total of approximately 720,000 m^2, that convert solar radiation directly into electricity. The solar PV modules will be elevated above the ground, and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the boundaries, and O&M access roads in between the PV module rows.
- Inverter stations, each occupying a footprint up to approximately 30 m^2, with up to 100 Inverter stations installed on the identified sites. Each Inverter station will contain an inverter step-up transformer, and switchgear. The Inverter stations will be distributed on the site, located alongside its associated Solar PV module arrays. The Inverter station will perform conversion of DC (direct current) to AC (alternating current), and step-up the LV voltage of the inverter to the appropriate voltage to allow the electricity to be fed into the appropriate substation / grid point of connection (PoC). Inverter stations will connect several arrays of Solar PV modules and will be placed along the internal roads for easy accessibility and maintenance.
- Below ground electrical cables with trenching for connecting PV arrays, Inverter stations, O&M buildings, and Combiner Substations.
- Above ground overhead lines for connecting Combiner Substations to grid PoC.
- Adequately designed foundations and mounting structures that will support the Solar PV modules and Inverter stations.
- Access roads that provide access to the Komati PV sites.
- Perimeter roads around the PV sites.
- Internal roads for access to the Inverter stations.
- Internal roads/paths between the Solar PV module rows, to allow access to the Solar PV modules for operations and maintenance activities.
- Infrastructure required for the operation and maintenance of the Komati PV installations: -
  - Meteorological Station
  - O&M Building – comprising control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities (including water supply and sewage infrastructure)
  - Spares Warehouse and Workshop
  - Hazardous Chemical Store – approx. 30 m^2
  - Security Building
  - Parking areas and roads
- Small diameter water supply pipeline from existing supply infrastructure.
- Fire water supply during Construction and Operation.
- Sewage interconnection to existing infrastructure.
- Stormwater channels.
- Perimeter fencing of the Komati PV sites, with access gates.

- Temporary laydown area, occupying a footprint up to approx. 10 hectares. The laydown area will be used during construction and rehabilitated thereafter.
- Temporary concrete batching plant, occupying a footprint up to approx. 1 hectare. The concrete batching plant area will be used during construction and rehabilitated thereafter.
- Temporary site construction office area, occupying a footprint up to approx. 1 hectare. This area will accommodate the offices for construction contractors during construction and rehabilitated thereafter.

2.2.2 Solar PV Construction

It is estimated that approximately 200-300 construction workers will be required on the site. During the construction phase of the project the following activities are anticipated:

- Site Preparation - Vegetation and topsoil will be cleared for the footprint of the infrastructure as well as for the access roads to the solar PV site, internal roads and the laydown yard, etc. The topsoil removed will need to be stored for rehabilitation purposes of the site.
- Transportation of Equipment - All equipment to site will be transported by means of national, provincial and district roads. This includes but is not limited to, transformers, solar PV modules, inverters, excavators, graders, trucks, compacting equipment, construction material, etc.
- Site Establishment Works - The site will have temporary laydown areas and offices for the construction contractors. This will include the contractor's chosen electricity supply infrastructure e.g., use of generators and fuel storage that will be required to conform to acceptable measures to ensure no harm to the environment. The laydown area will also be used for assembling of solar PV modules and structures. A concrete batching plant may also be required as part of the site establishment works.
- Construction of the Solar PV Facility
  - Trenches would need to be excavated for underground cabling to connect Solar PV arrays, Inverter stations, and Combiner Substations.
  - Foundations for the solar PV array mounting structures and Inverter stations may need to be excavated, with the final extent depending on the geotechnical studies that will be conducted. The geotechnical studies will determine the type of foundations that can be utilised at the PV site.
  - Construction of access, perimeter, and internal gravel roads may require material to be imported from outside the site, from a permitted quarry.
- Water consumption during construction phase - The water consumption during the construction phase is estimated as 15,000 kilolitres (total for construction period estimated as 24 months) - The Contractor should in any case be made responsible for securing electricity, water, and any other services during construction.
- Construction of Electrical Interconnection Line - Construction and installation of overhead electrical interconnection lines, connecting the Solar PV facilities to the grid PoC.
- Storage of diesel and oil for construction activities.
- Once all the construction activities are completed the site will be rehabilitated where possible and practical. All temporal structures and facilities will be removed from site and the area rehabilitated.
- Solar glare reflection – proximity to air strip.
- End of life waste management for both solar panels and batteries.

2.2.3 Solar PV Operation

The solar PV plant has a minimum design life of 25 years.

- During the life of the Solar PV facility, there will be normal maintenance of all electrical and mechanical components of the plant.
- In addition, there will be periodic cleaning and washing of the solar PV modules. This PV module cleaning will be performed when required, and it is estimated to occur 2-4 times a year.
- The water consumption during operation - estimated water required per year during operation is 10,000 kilolitres (total per year for design life of plant).

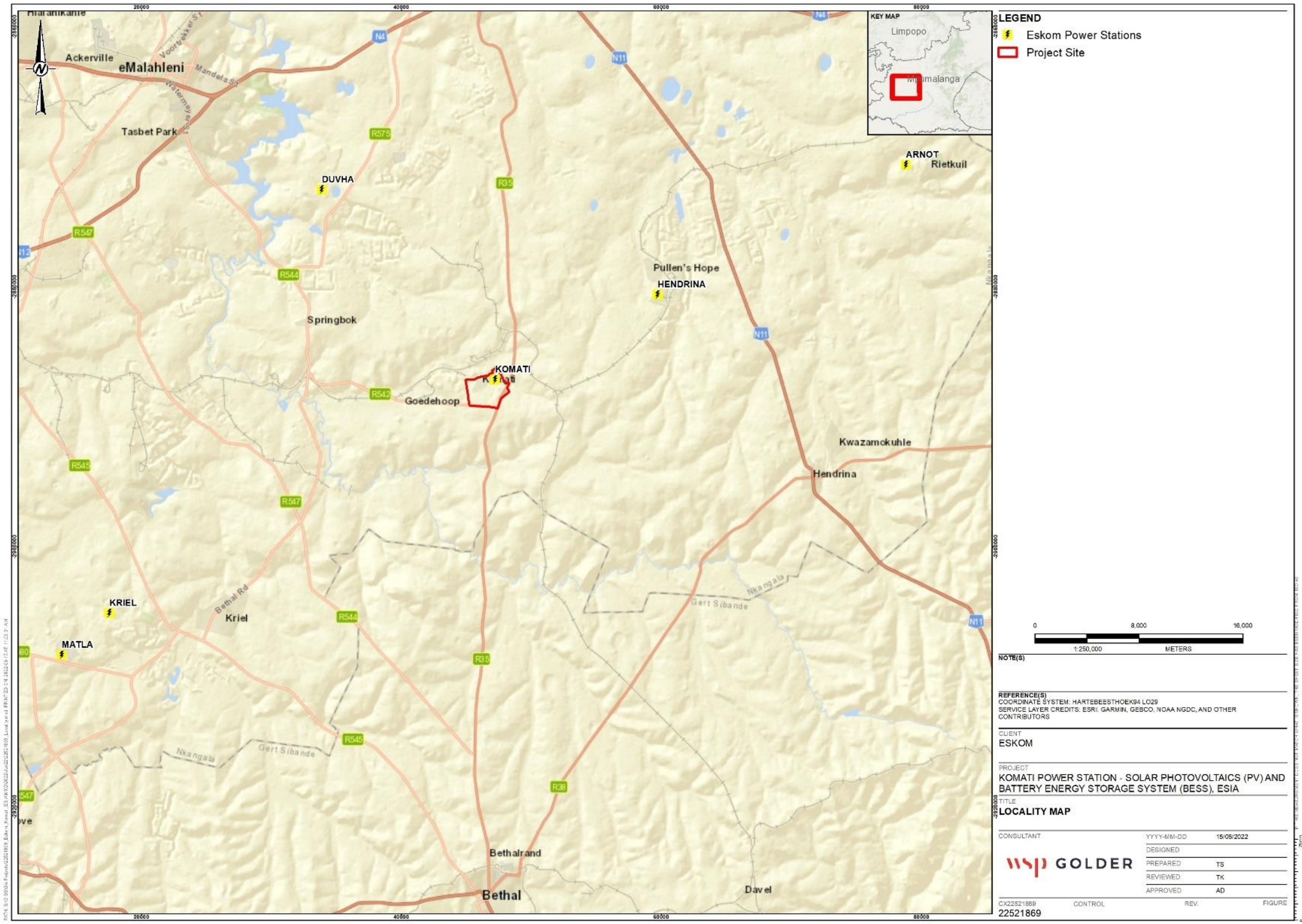

Figure 1: Eskom Komatipoort Locality Map

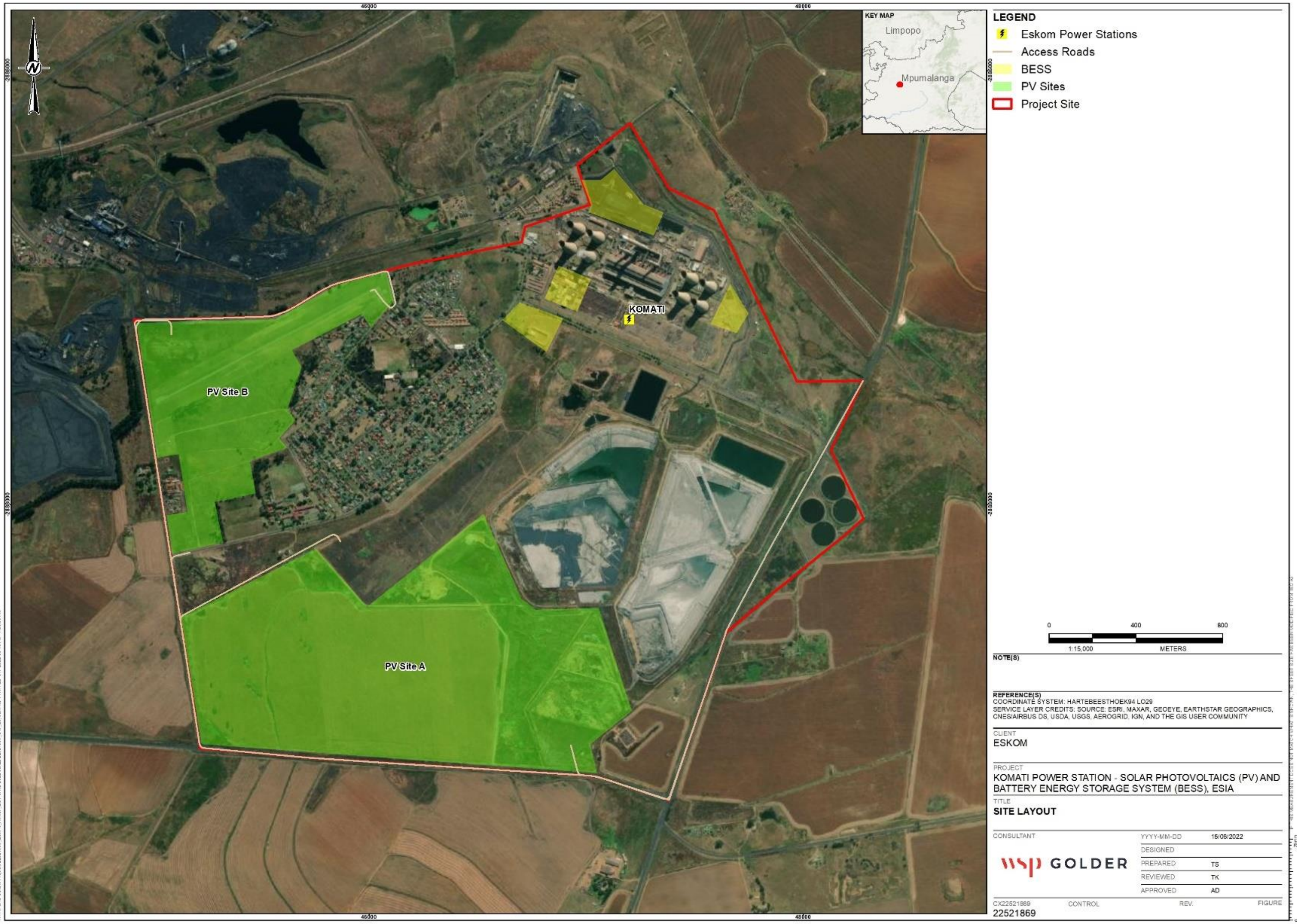

Figure 2: Proposed infrastructure overview

3.0 APPLICABLE LEGISLATION, POLICY AND STANDARDS

The ESIA must be aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; the IFC Performance Standards; and Good International Industry Practices (GIIP) and South African legislation and applicable regulations.

Biodiversity-related South African legislation and policy, and international lender standard requirements that were used to guide this scoping assessment are summarized as follows.

3.1 South African Legislation and Policy

Applicable national and provincial legislation, associated regulations and policies that are pertinent to biodiversity, which were used to guide the Environmental Impact Assessment (EIA), include:

- National Environmental Management Act (NEMA) (Act No. 107 of 1998) including Section 24, concerning Procedures for the assessment and minimum criteria for reporting on identified themes in terms of Sections 24(5)(a) and (h) and 44 of the NEMA, when applying for environmental authorisation;
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on terrestrial biodiversity; and
  - Protocol for the specialist assessment and minimum report content requirements for environmental impacts on aquatic biodiversity;
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004) (NEMBA), specifically:
  - ToPS – National lists of critically endangered, endangered, vulnerable and protected species (2007);
  - National list of threatened terrestrial ecosystems for South Africa (2011) (NEMBA Threatened Ecosystems, 2011);
  - National list of alien and invasive species (2016);
- Environment Conservation Act (Act No. 73 of 1989), specifically the Lists of declared weeds and invader plants (CARA, 1983);
- National Water Act (Act No. 36 of 1998);
- Mpumalanga Biodiversity Sector Plan (2015); and
- National Protected Area Expansion Strategy (2016).

Recent, relevant South African national policies and guidance were also taken into consideration, in the development of the baseline description and impact assessment process, including:

- Draft National Biodiversity Offset Policy (2017); and
- Species Environmental Assessment Guideline (SANBI, 2020).

3.2 Lender requirements

The ESIA must be aligned to the requirements of the World Bank Environmental & Social Framework; World Bank Group (WBG) Environmental, Health and Safety Guidelines (EHSG) both for general and sector; and the International Finance Corporation (IFC) Performance Standards. The specific standards relevant to the assessment of biodiversity for the ESIA, and which guide this scoping study, are summarized in the sections that follow.

3.2.1 World Bank Environmental and Social Standard 6

The World Bank's (WB) Environmental and Social Standard 6 (ESS6) on Biodiversity Conservation and Sustainable Management of Living Natural Resources (World Bank, 2016) separates habitat into four categories for the purposes of implementing a differentiated risk management approach to habitats based on their sensitivity and values. The categories include 'Modified habitat', 'Natural habitat', 'Critical Habitat' and 'Legally protected and internationally and regionally recognized areas of biodiversity value'; each of which have varying levels of Borrower obligation in terms of biodiversity mitigation and management, and offset requirements.

Whilst the assessment of Modified and Natural habitats is largely based on the establishment of the ecological condition of mapped habitat/vegetation units, and the boundaries of legally protected and/or internationally recognised areas of high biodiversity value are generally defined; the identification and assessment of Critical Habitat requires additional, focussed effort – usually focussed on the presence of Critically Endangered, Endangered, range-restricted or migratory/congregatory species in significant numbers.

3.2.2 International Finance Corporation's Performance Standard 6

The IFC's Performance Standard 6 also sets specific biodiversity protection and conservation standards relating to potential project impact; that are largely aligned with the ESS6 requirements. The specific requirements are separated according to the following categories:

- **Modified Habitat:** areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition. PS6 relates to areas of modified habitat that have significant biodiversity value and requires that impacts on such biodiversity must be minimised, and mitigation measures implemented as appropriate.
- **Natural Habitat**: viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition. In such areas, the conservation outcome required by PS6 is no-net-loss of biodiversity value achieved using the "like-for-like" or better principle of biodiversity offsets, where feasible.
- **Critical Habitat:** areas with high biodiversity value, including (i) habitat of significant importance to Critically Endangered and/or Endangered species; (ii) habitat of significant importance to endemic and/or restricted-range species; (iii) habitat supporting globally significant concentrations of migratory species and/or congregatory species; (iv) highly threatened and/or unique ecosystems; and/or (v) areas associated with key evolutionary processes. When a project occurs in critical habitat supporting exceptional biodiversity value, a net gain in biodiversity value is required by PS6. This is achievable through appropriate biodiversity offsets.
- **Legally Protected and Internationally Recognised Areas:** such areas often have high biodiversity value; when this is the case these areas are likely to qualify as critical habitat. As such, the conservation outcome required by PS6 is also a net gain in biodiversity value, as well as obtaining the relevant legal permits, following standard governmental regulatory procedures, and engagement of affected communities and other stakeholders.
- **Invasive Alien Species:** the development project should not intentionally introduce any new alien species (unless carried out within the appropriate regulatory permits) and should not deliberate any alien species with a high risk of invasive behaviour under any circumstance. PS6 requires that any introduction of alien species be the subject of a risk assessment for potential invasive behaviour, and that the project should implement measures to avoid the potential for accidental or unintended introductions.

3.3 Good International Industry Practices (GIIP)

Best practice guidelines that were taken into consideration in the development of the socping report include:

- BirdLife South Africa's best practise guidelines for the assessment and monitoring of impacts of solar power generating facilities on birds in southern Africa (Jenkins et al., 2017).

4.0 METHODOLOGY

This scoping level terrestrial biodiversity baseline description and preliminary impact assessment took cognisance of Government Notice No. 320, published in 2020 under the National Environmental Management Act (1998) concerning 'Procedures for the Assessment and Minimum Criteria for Reporting on Identified Environmental Theme in terms of Sections 24(5)(a) and (h) and 44 of the National Environmental Management Act (1998), when applying for Environmental Authorisation'.

In line with the assessment and reporting requirements set out in the protocol, this scoping-level terrestrial ecology assessment included two main study components; a desktop literature review, supplemented by a scoping site visit. The objectives and tasks associated with these components are described below.

4.1 Study Area

The study area for the scoping study was defined as follows (Figure 3):

- Local Study Area (LSA): The proposed development footprint plus all areas encompassed by the Project site boundary, within which direct impacts on biodiversity receptors (i.e. direct habitat loss, fauna mortality) could occur.
- Regional Study Area (RSA) was considered to be the catchment within which the proposed development is situated (Figure 3) which is considered to be an ecologically appropriate area of analysis for the identification of sensitive biodiversity receptors with potential to occur in the LSA, and within which indirect impacts on biodiversity receptors (e.g., dust deposition, sensory disturbance, hydrological changes) could occur.

4.2 Literature Review

The aim of the desktop literature review component was to collate and review the extensive available ecological information related to important biodiversity and conservation features in the project area, key ecological processes and function, and the likely composition and structure of local flora and fauna communities.

The existing comprehensive specialist reports that were reviewed and consolidated to assess terrestrial fauna, flora and vegetation include:

1) Animal Demographic Unit – Virtual Museum;
2) South African Bird Atlas – Project 2;
3) Construction and Operation of Ash Dam Extension 3 & The Deviation of Transmission and Distribution Lines at Komati Power Station, Mpumalanga (2008);
4) National spatial planning datasets, namely the Mpumalanga Biodiversity Sector Plan (MBSP), National Freshwater Ecosystem Priority Areas (NFEPA), National Wetland Map 5 (NWM5), National Environmental Management Biodiversity Act (NEMBA) Threatened Ecosystems, and National Protected Area Expansion Strategy (NPAES), provide a regional/national context for assessing the biodiversity significance of the site.

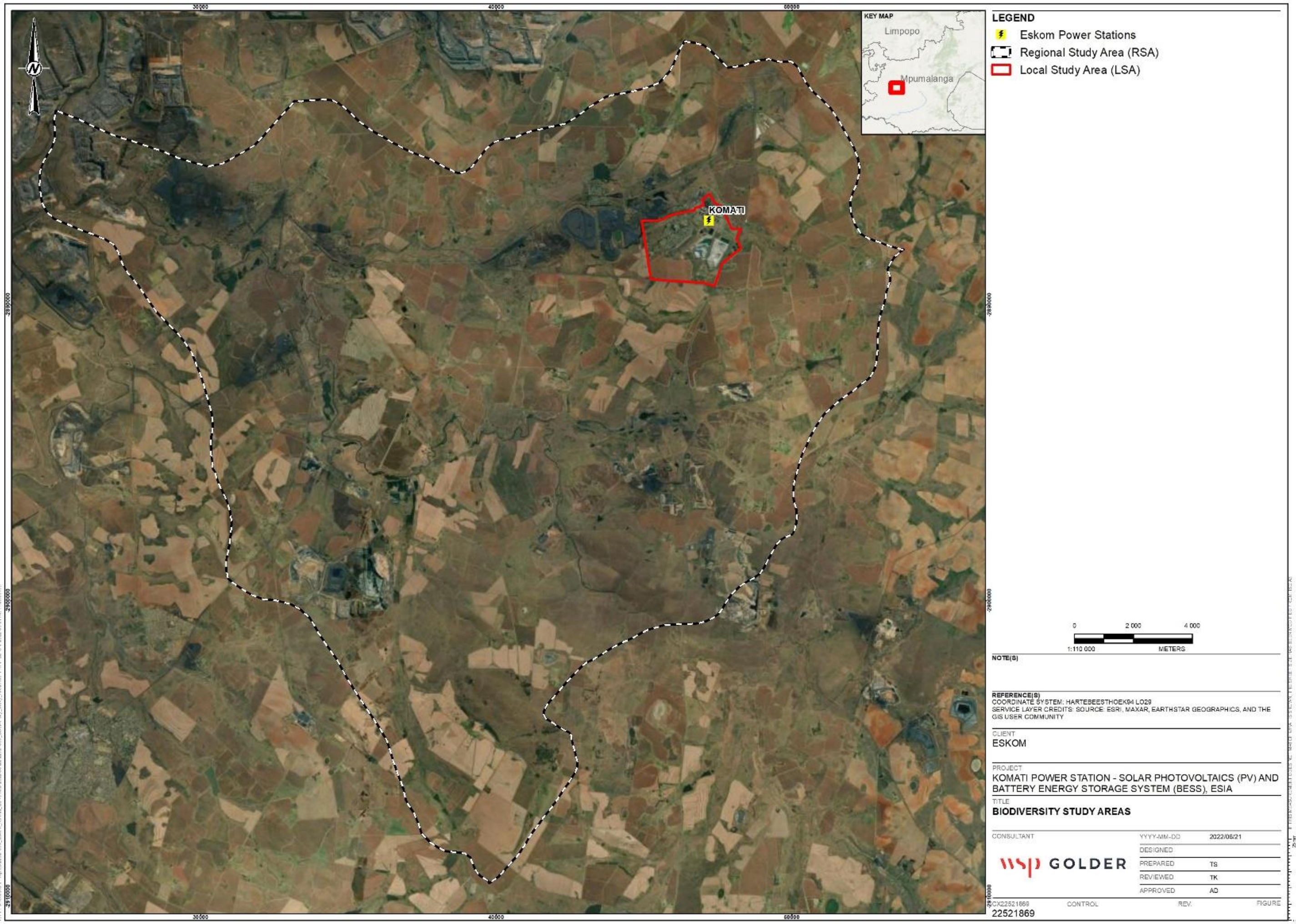

Figure 3: Local and regional study areas

4.3 Scoping Site Visit

The desktop assessment is supported by data gathered during field surveys that were conducted on 31 May – 01 June, and 17 June 2022. The objectives of the field visit were to:

- Verify and update the information in the preliminary desk-based vegetation map (i.e. verify boundaries); and
- Search for species of conservation concern (specifically birds) within the proposed infrastructure footprint and surrounds to scope the (forthcoming) avifauna baseline assessment.

4.4 Scoping Level Screening of Impacts and Mitigation

Appendix 2 of GNR 982, as amended, requires the identification of the significance of potential impacts during scoping. To this end, an impact screening tool has been used in the scoping phase (Table 2). The screening tool is based on two criteria; namely probability (Table 3) and consequence (Table 4), where the latter is based on general consideration to the intensity, extent, and duration.

Table 2: Significance screening tool

	CONSEQUENCE SCALE				
PROBABILITY SCALE		**1**	**2**	**3**	**4**
	1	**Very Low**	**Very Low**	**Low**	**Medium**
	2	**Very Low**	**Low**	**Medium**	**Medium**
	3	**Low**	**Medium**	**Medium**	**High**
	4	**Medium**	**Medium**	**High**	**High**

Table 3: Probability scores and descriptors

SCORE	DESCRIPTOR
4	**Definite**: The impact will occur regardless of any prevention measures
3	**Highly Probable**: It is most likely that the impact will occur
2	**Probable**: There is a good possibility that the impact will occur
1	**Improbable:** The possibility of the impact occurring is very low

Table 4: Consequence score descriptions

SCORE	NEGATIVE	POSITIVE
4	Very severe: An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated.	Very beneficial: A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit.

SCORE	NEGATIVE	POSITIVE
3	Severe: A long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time consuming or some combination of these.	Beneficial: A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult, expensive or time consuming, or some combination of these.
2	Moderately severe: A medium to long term impacts on the affected system(s) or party (ies) that could be mitigated.	Moderately beneficial: A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way.
1	Negligible: A short to medium term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary.	Negligible: A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.

The nature of the impact must be characterised as to whether the impact is deemed to be positive (+ve) (i.e. beneficial) or negative (-ve) (i.e. harmful) to the receiving environment/receptor. For ease of reference, a colour reference system (Table 5) has been applied according to the nature and significance of the identified impacts.

Table 5: Impact Significance Colour Reference System to Indicate the Nature of the Impact

Negative Impacts (-ve)	Positive Impacts (+ve)
Negligible	**Negligible**
Very Low	**Very Low**
Low	**Low**
Medium	**Medium**
High	**High**

4.5 Study Assumptions and Limitations

4.5.1 Data used for Specialist Assessments

- The baseline description is based on available national datasets and published literature for the Komati region, supplemented by field survey data (observations and photographs) taken during the wetland survey and avifauna scoping surveys conducted during May and June 2022 respectively.
- Vegetation, flora and fauna studies will be conducted later in the year, during the appropriate season (anticipated early wet season 2022).
- This scoping report was prepared on the basis of the site sensitivity verification process undertaken in response to the national web-based screening report. The site sensitivity verification was completed via desktop analysis of the extensive existing baseline knowledge of species and habitats in the study area, supplemented by cross-referencing to the most recent species conservation assessments.
- It is therefore considered that there are no sampling or information limitations pertaining to terrestrial animal or plant species impacting on this scoping-level terrestrial biodiversity description, screening of impacts, and preliminary recommended mitigation measures.

4.5.2 Assumptions, uncertainties, or gaps in knowledge

- The baseline description is qualitative and based on the available desktop information supplemented by preliminary scoping-level data gathered during the site visits.
- The preliminary identification of potential impacts and mitigation measures focus on fauna and flora species of concern with potential to occur in the study area.
- The selection of species of concern for the scoping level screening of impacts was based on the level of knowledge (that is, ecology and conservation status) of the species to act as surrogates for all species in the area, and adopts the hypothesis that conditions which support vertebrates and/or vascular plant species of concern are likely to also support species of concern from other taxonomic groups.

5.0 BASELINE DESCRIPTION

This section summarises the baseline biodiversity environment of the local and regional study areas. It draws upon existing studies, published information, local knowledge and scoping site visits.

5.1 Regional Biodiversity Context

The regional study area is located in the high lying (elevations from 1200 to 1800 m) Highveld ecoregion, which is characterised by plains with a moderate to low relief, as well as various grassland vegetation types. The ecoregion predominantly receives early to late summer rainfall ranging between 400 to 1000 mm per annum. The mean annual temperature is moderate (in the east) and hot (in the west) ranging between 12 to 20°C (Kleynhans, 2005).

The regional study area is situated in a landscape that is characterised by intensive agricultural crop cultivation, numerous coal mines and collieries, rail lines, and the power station itself, interspersed by areas of wetlands and secondary grasslands in valley bottoms where conditions for cultivation are unsuitable.

5.1.1 Environmental Screening Tool

The proposed infrastructure footprint was assessed at desktop level using the National Web-based Environmental Screening Tool. According to the Tool, the Terrestrial Biodiversity Theme for the study area is rated 'Very High Sensitivity' due to its overlap with land mapped as 'Critical Biodiversity Area' (CBA) 2 by the Mpumalanga Biodiversity Sector Plan, 2019 (Figure 4).

The National Web Based Screening Tool also indicated that remnant wetland areas of the LSA are considered to be of Medium sensitivity due to their support of several plant Species of Conservation Concern (SCC), including *Pachycarpus suaveolens*; and as 'high to very high' sensitivity in terms of the Animal Species Theme due to the potential presence of fauna SCC including Black-footed cat (*Felis nigripes*), Maquassie Shrew (*Crocidura maquassiensis*), African Marsh Rat (*Dasymys robertsii*), Spotted-necked Otter (*Hydrictis maculicollis*), and Oribi (*Ourebia ourebi ourebi*).

5.1.2 Terrestrial Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs)

The proposed development site was compared to available spatial biodiversity planning datasets in order to assess the local and regional biodiversity context of the site. The following datasets were considered:

1) Mpumalanga Biodiversity Sector Plan (MBSP; 2015)

The LSA predominantly falls within areas categorised Heavily or Moderately Modified Areas, whilst Other Natural Areas occur at some of the proposed development site portions. A Critical Biodiversity Area occurs at the west, largely covering the portion proposed for the establishment of the solar PV Site B (Figure 4).

CBAs are those areas (outside of Protected Areas) that are required to meet biodiversity targets for biodiversity pattern (species and ecosystems) and ecological processes. These are areas of high biodiversity value and should remain in a natural state that is maintained in good ecological condition (Lötter, 2015). The CBA within which the proposed PV Site B is situated is bordered by the Goedehoop Colliery operations on the north and west, and a residential area on the east and farmlands on the south, all of which encompass Heavily or Moderately Modified Areas**.** Thus the level of anthropogenic disturbance renders the CBA unlikely to meet biodiversity targets for species and ecosystems and ecological processes.

5.1.3 Priority Areas for Protected Area Expansion

None of the proposed infrastructure coincides with areas that have been identified as Priority Focus Areas as part of the National Protected Area Expansion Strategy (2016) (Figure 5).

5.1.4 Protected Areas

No Protected Areas, Important Bird Areas (IBAs) nor Key Biodiversity Areas (KBAs) occur within the proposed development site (Lötter, 2015; BirdLife International (2022). The nearest IBA is Amersfoort - Bethal - Carolina District which is situated approximately 15 km southeast of the LSA.

5.1.5 Freshwater Ecosystem Priority Area sub-catchments

The proposed development footprint in relation to FEPA sub-catchments is illustrated on Figure 6. The closest NFEPA Water Management Area occurs approximately 40km away from the proposed development footprint, and as such are not included as receptors for the current impact assessment, or considered further here.

5.1.6 Strategic Water Source Areas

Similarly to FEPA sub-catchments, no strategic water source areas occur within close proximity to the proposed development footprint, and as such are not included as receptors for the current impact assessment, or considered further here.

5.1.7 National Wetland Map 5

The proposed development footprint in relation to wetlands mapped as part of the National Wetland Map 5 project (van Deventer, 2019) is illustrated on Figure 7. These include an area of hillslope seep wetland to the west of the existing power station infrastructure, and a channlled valley bottom wetland system along the northern boundary of the site.

5.1.8 Indigenous forests

No indigenous forest habitat occurs within the study area, which is characterised by currently/previously cultivated areas, disturbed grounds, secondary grassland (e.g. at the airstrip) and the existing power station infrastructure.

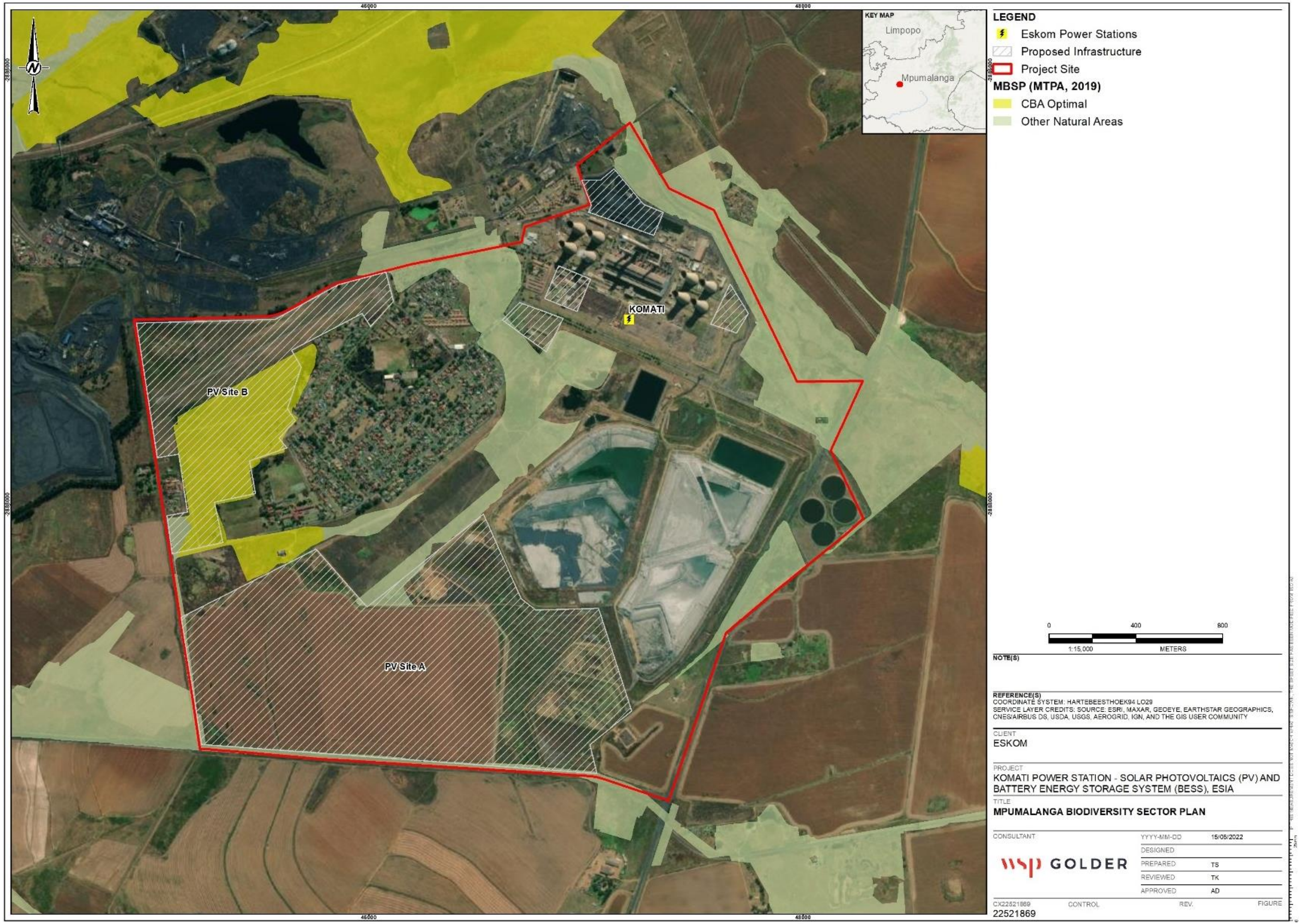

Figure 4: Mpumalanga Biodiversity Sector Plan in relation to the proposed development

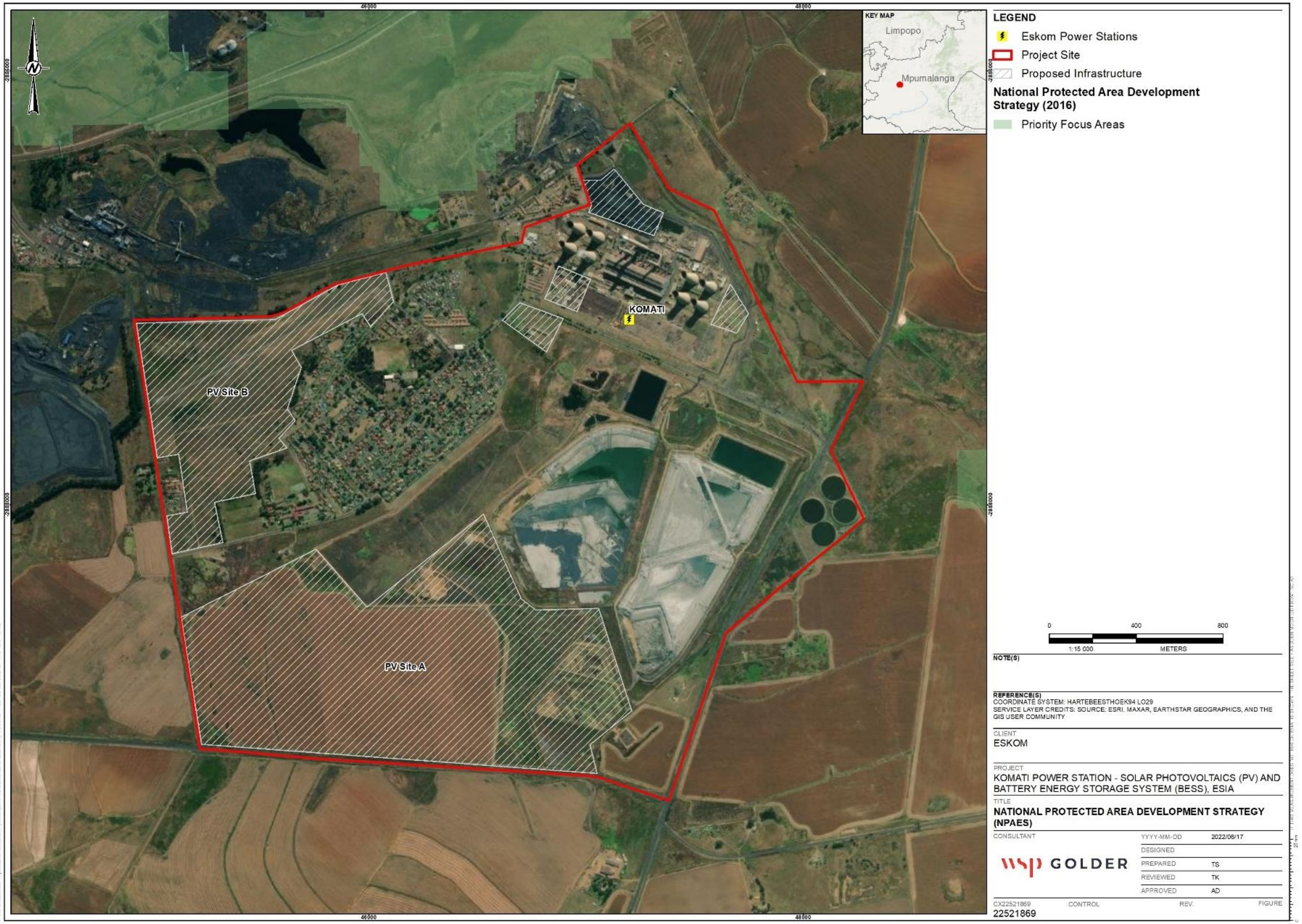

Figure 5: Priority Areas for Protected Area Expansion in relation to the proposed development

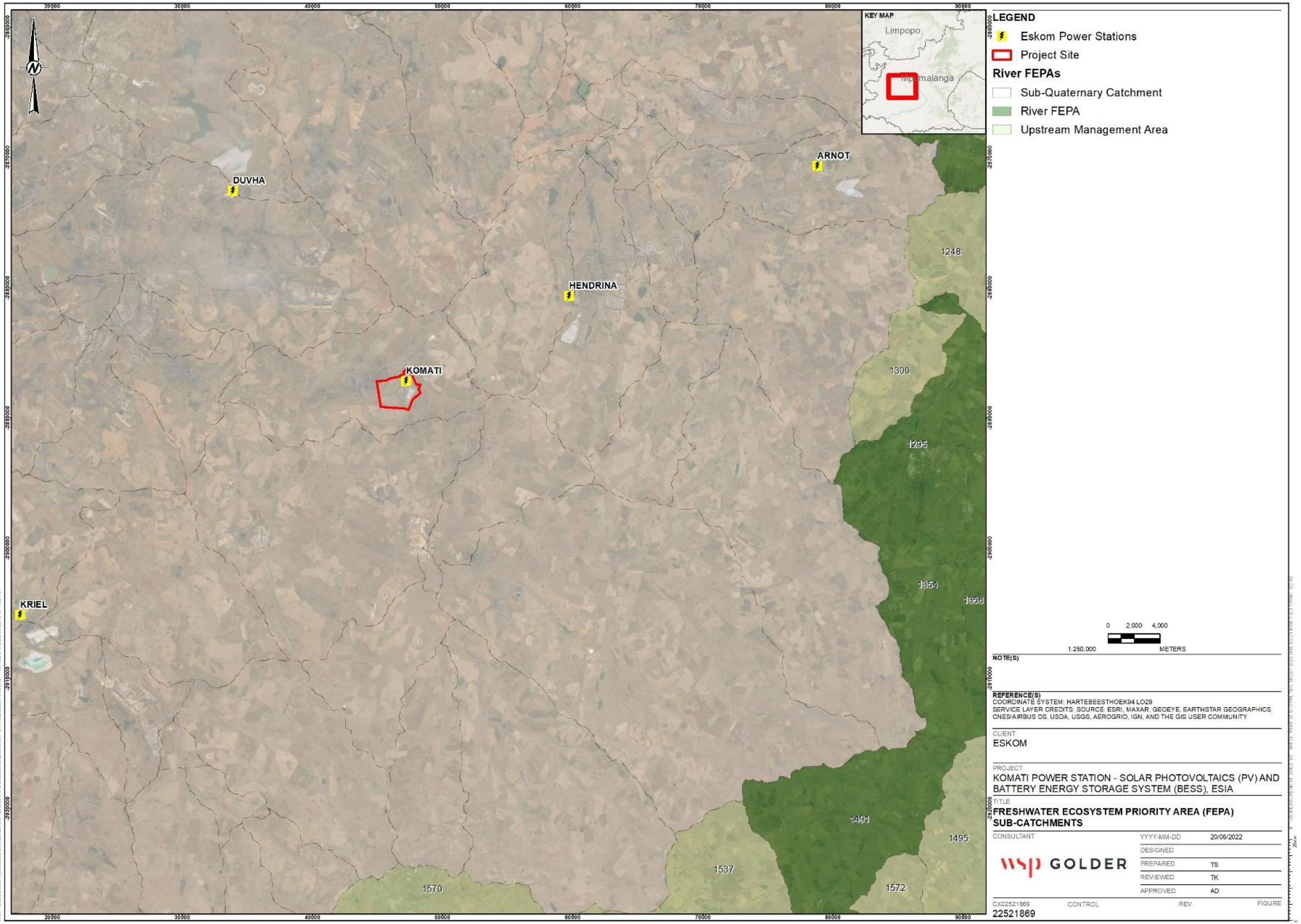

Figure 6: Proposed development in relation to FEPA sub-catchments

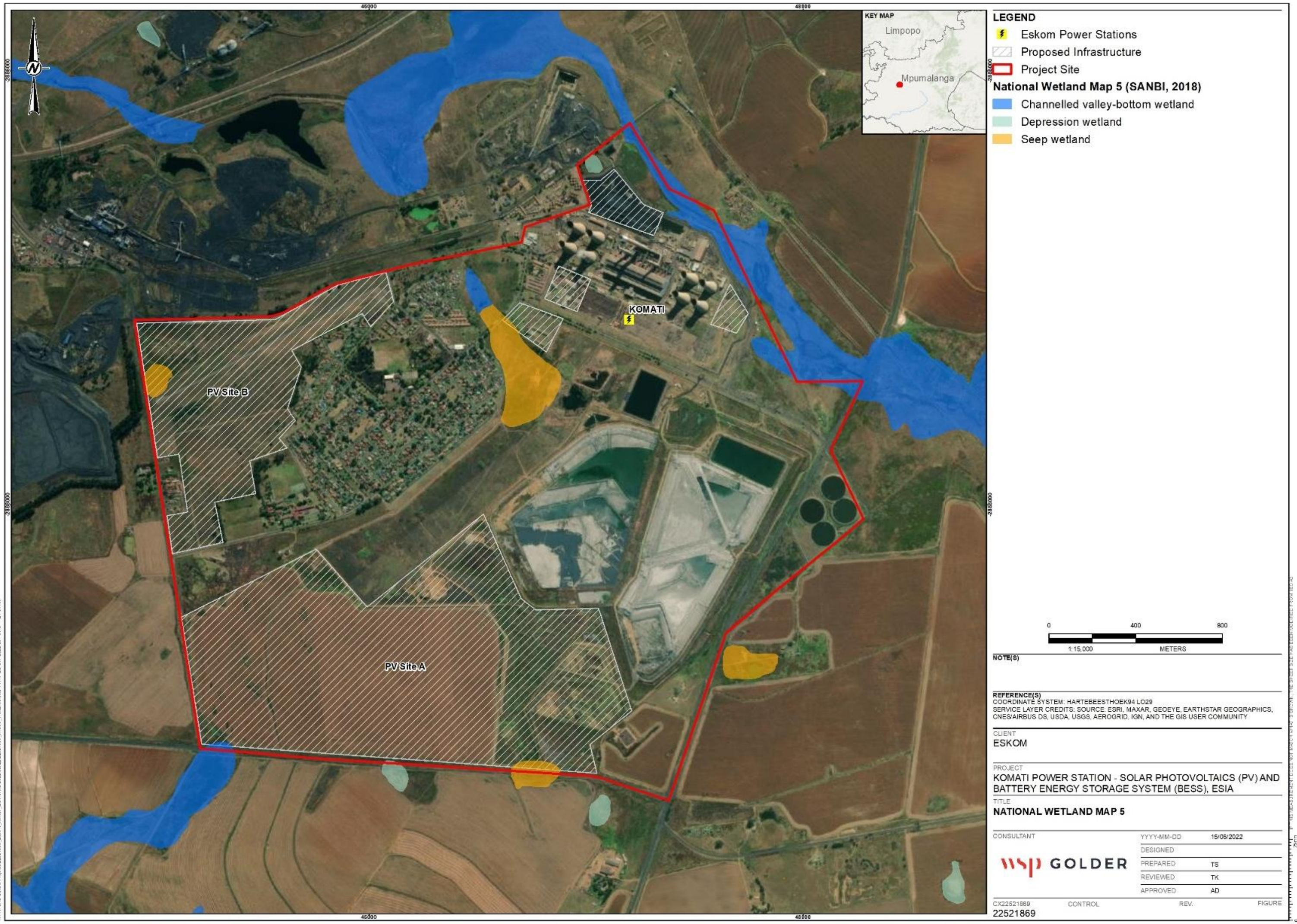

Figure 7: Proposed development in relation to mapped wetland habitat (National Wetland Map 5, 2015)

5.2 Terrestrial Vegetation and Flora

5.2.1 Vegetation types

The site is situated within a single vegetation type, Eastern Highveld Grassland (Gm12) (Figure 8), remnant patches of which may occur in non-transformed areas of the project site.

The Eastern Highveld Grassland spans across approximately 1,2 million hectares in the Mpumalanga Province. This is a poorly protected vegetation type with only about 35% remaining natural (Lötter M.c., 2014). According to Mucina & Rutherford (2006), the Eastern Highveld Grassland (Gm 12) vegetation unit is dominated by the usual highveld grass composition, including species such as *Aristida aequiglumis*, *A. congesta*; *Digitaria monodactyla*, *D. tricholaenoides*; *Eragrostis chloromelas*, *E. curvula*, *E. plana*. E*. racemosa*; *Themeda triandra*; *Tristachya leucothrix*, and *T. rehmanii,* with small scattered rocky outcrops with wiry, sour grasses and some woody species.

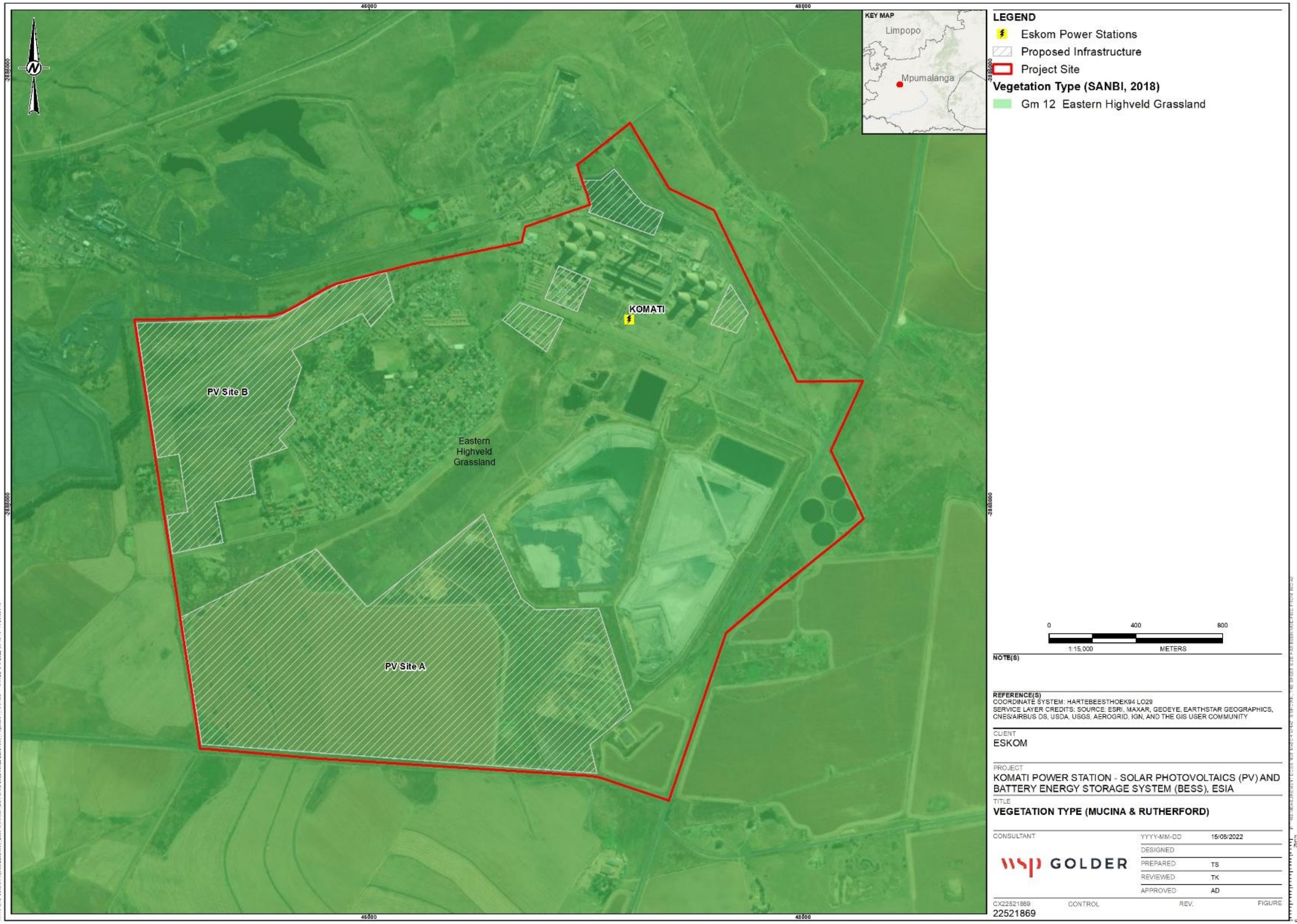

Figure 8: Proposed development in relation to Mucina & Rutherford vegetation types

5.2.2 Vegetation and Flora Features of Conservation Concern

5.2.2.1 NEMBA Threatened Ecosystems

Eastern Highveld Grassland is considered to be Vulnerable nationally (Figure 9) (Government notice 1002/2011, in terms of section 52(1)(a) of NEMBA)), as only a very small fraction is conserved in statutory reserves (Nooitgedacht Dam and Jericho Dam Nature Reserves) and approximately 44% has been transformed, primarily by cultivation, plantations, mines, urbanisation and the building of dams.

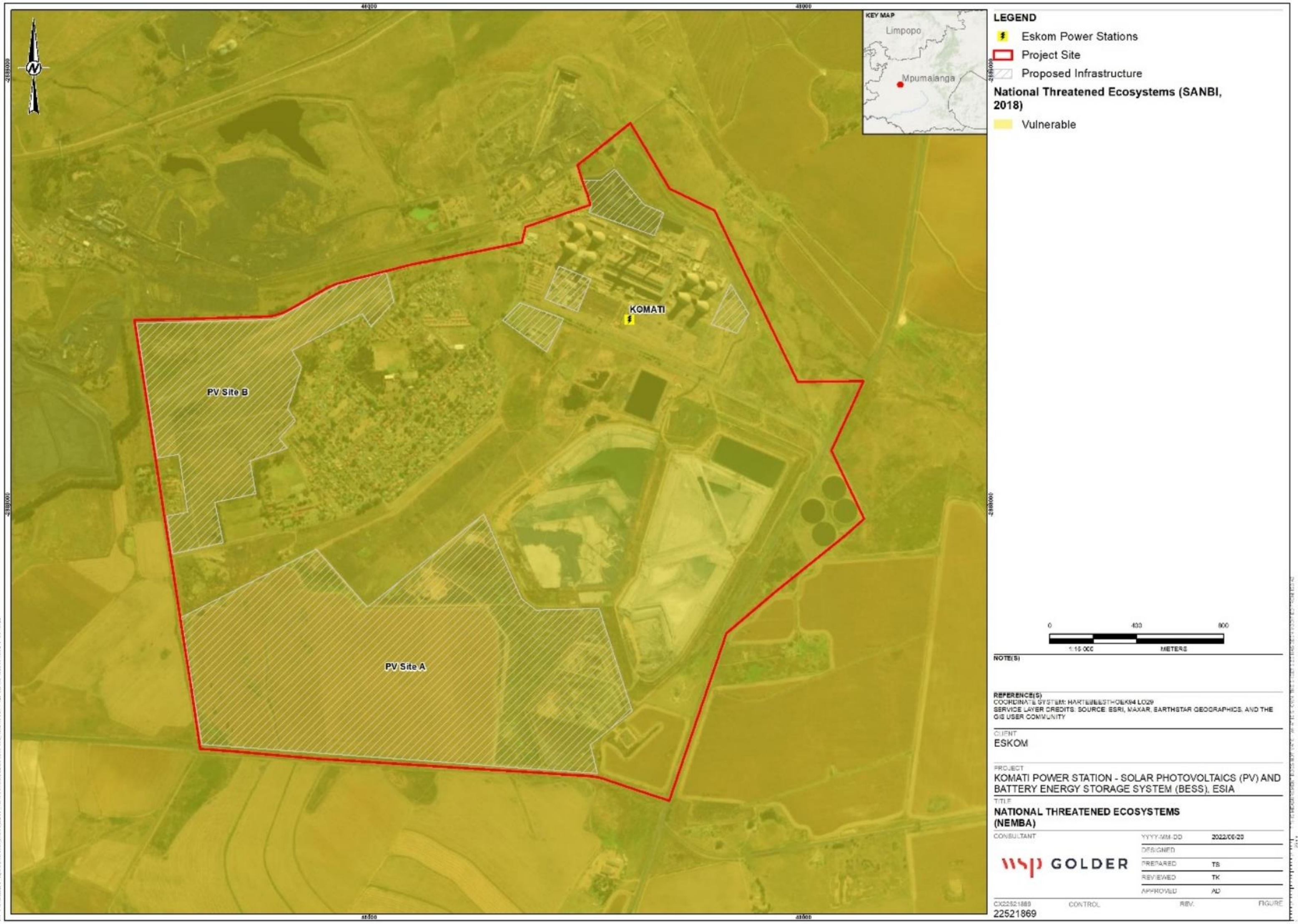

Figure 9: Proposed development in relation to the National Threatened Ecosystems (SANBI, 2018)

5.2.2.2 Flora Species of Conservation Concern

A list of flora SCC which occur within the region are provided in Table 6. Eight of the species are nationally red-listed with classifications ranging between Near Threatened to Rare. The species *Eucomis montana* and *Eucomius autumnalis* are protected under the Mpumalanga Nature Conservation Act No. 10 of 1998.

Table 6: Confirmed/expected SCC in the region

Scientific Name	RSA Red List Status	Mpumalanga Protected/Threatened Species
Anacampseros subnuda subsp. lubbersii	Vulnerable	-
Callilepis leptophylla	Least Concern	✓
Eucomis montana	Least Concern	✓
Eucomius autumnalis	Least Concern	✓
Frithia humilis	Vulnerable	-
Gladiolus paludosus	Vulnerable	-
Ilex mitis var. mitis	Least Concern	✓
Jamesbrittenia macrantha	Near Threatened	-
Khadia alticola	Rare	-
Khadia carolinensis	Vulnerable	-
Miraglossum davyi	Vulnerable	-
Pachycarpus suaveolens	-	✓
Streptocarpus denticulatus	Vulnerable	-

5.3 Fauna

According to the Mpumalanga Biodiversity Sector Plan Handbook (2014), the province hosts a relatively high faunal diversity with approximately 173 mammal, 575 bird, 171 reptile, 51 amphibian and 62 fish species. This high species richness is attributed to the wide variety of habitats within the savanna, forest and grassland biomes. However, the project area is expected to host a low species diversity due to current and historic agriculture and mining/power-generation land uses resulting in the largely disturbed nature of the area.

5.3.1 Mammals

Although no mammal species were directly observed within the LSA during an Environmental Impact Assessment undertaken for the Komati Power Station in 2008 (Synergistics Environmental Services, 2008), signs of Common Reedbuck (*Redunca redunca*), Grey Duiker (*Sylvicapra grimmia*) and Porcupine (*Hystrix africaeaustralis*) were observed. Data obtained from the Animal Demographic Unit (ADU) Virtual Museum show that six species have been photographed within the grid coordinates (Quarter Degree Square (QDS)) of interest (i.e. 2629AB and the neighbouring 2629BA; Table 7).

Table 7: Confirmed/expected mammal species within the 2629AB and 2629BA QDS (Synergistics Environmental Services, 2008; Animal Demographic Unit Virtual Museum, 2022)

Common Name	Scientific Name	RSA Red List Status	Mpumalanga Protected Species
African Marsh Rat	*Dasymys robertsii*	Vulnerable	-
Black-footed cat	*Felis nigripes*	Vulnerable	-
Blesbok	*Damaliscus pygargus phillipsi*	Least Concern	-
Common Genet	*Genetta genetta*	Least Concern	-
Maquassie Shrew	*Crocidura maquassiensis*	Vulnerable	-
Oribi	*Ourebia ourebi ourebi*	Vulnerable	Protected
Serval	*Leptailurus serval*	Near Threatened	-
Southern African Hedgehog	*Atelerix frontalis*	Near Threatened	Protected
Spotted-necked Otter	*Hydrictis maculicollis*	Vulnerable	Protected
Xeric Four-striped Grass Rat	*Rhabdomys pumilio*	Least Concern	-

Mammal species of conservation concern

Three of the ten species that have been confirmed or expected within the 2629AB and 2629BA are classified as Least Concern. Although the national screening tool indicates the potential presence of the provincially protected species including Black-footed cat, Oribi and the Spotted-necked Otter, these are not considered likely to be present due to the transformed nature of the habitats within the study area. There is a potential for Maquassie Shrew and/or African Marsh Rat to occur in remnant wetland habitats, however the presence of African Marsh Rat is considered unlikely since African Marsh Rats are dependent on intact rivers and wetland ecosystems and have not been found in artificial or degraded wetlands (Pillay, 2016); whilst the transformed nature of much of the study area limits its suitability for the rare Maquassie Shrew.

5.3.2 Birds

A total of 115 bird species have been confirmed or are expected to occur within the 2605_2925 coverage based on the data retrieved from the South African Bird Atlas Project 2 (SABAP2; 2022), of these species, 29 were classified as species of conservation concern (Table 8). Only two of these species are red listed at the national level; the Saddle-billed Stork (*Ephippiorhynchus senegalensis*) which is listed as Endangered (EN) and the Secretary bird (*Sagittarius serpentarius*) listed as Vulnerable (VU) at national and global level.

Table 8: Confirmed/expected bird species within the 2629AB QDS (Animal Demographic Unit Virtual Museum, 2022)

Common Name	Scientific Name	SA National redlist status (2016)	IUCN 2020 (Global Status)	Mpumalanga Protected Species
Common Sandpiper	*Actitis hypoleucos*	-	Least Concern	Protected
Egyptian Goose	*Alopochen aegyptiaca*	-	Least Concern	Protected
African Pipit	*Anthus cinnamomeus*	-	Least Concern	Protected
Common Buzzard	*Buteo buteo*	-	Least Concern	Protected

Common Name	Scientific Name	SA National redlist status (2016)	IUCN 2020 (Global Status)	Mpumalanga Protected Species
Little Stint	*Calidris minuta*	-	Least Concern	Protected
Ruff	*Calidris pugnax*	-	Least Concern	Protected
Common Ringed Plover	*Charadrius hiaticula*	-	Least Concern	Protected
Kittlitz's Plover	*Charadrius pecuarius*	-	Least Concern	Protected
Three-banded Plover	*Charadrius tricollaris*	-	Least Concern	Protected
Saddle-billed Stork	*Ephippiorhynchus senegalensis*	Endangered	Least Concern	Protected
African Snipe	*Gallinago nigripennis*	-	Least Concern	Protected
Black-winged Stilt	*Himantopus himantopus*	-	Least Concern	Protected
Barn Swallow	*Hirundo rustica*	-	Least Concern	Protected
Little Bittern	*Ixobrychus minutus*	-	Least Concern	Protected
Cape Wagtail	*Motacilla capensis*	-	Least Concern	Protected
Capped Wheatear	*Oenanthe pileata*	-	Least Concern	Protected
African Spoonbill	*Platalea alba*	-	Least Concern	Protected
Glossy Ibis	*Plegadis falcinellus*	-	Least Concern	Protected
African Swamphen	*Porphyrio madagascariensis*	-	Least Concern	Protected
Tawny-flanked Prinia	*Prinia subflava*	-	Least Concern	Protected
Secretary bird	*Sagittarius serpentarius*	Vulnerable	Vulnerable	Protected
African Stonechat	*Saxicola torquatus*	-	Least Concern	Protected
African Sacred Ibis	*Threskiornis aethiopicus*	-	Least Concern	Protected
Wood Sandpiper	*Tringa glareola*	-	Least Concern	Protected
Common Greenshank	*Tringa nebularia*	-	Least Concern	Protected
Marsh Sandpiper	*Tringa stagnatilis*	-	Least Concern	Protected
Blacksmith Lapwing	*Vanellus armatus*	-	Least Concern	Protected
Crowned Lapwing	*Vanellus coronatus*	-	Least Concern	Protected
African Wattled Lapwing	*Vanellus senegallus*	-	Least Concern	Protected

The national screening tool report for the site also indicates that three additional bird species are considered likely to occur; African Grass Owl (*Tyto capensis*), Caspian tern (*Hydroprogne caspia*) and White-bellied Bustard

(*Eupodotis senegalensis*). During the avifauna scoping site visit conducted on 17 June 2022, habitats with potential to support African Grass Owl were mapped (Figure 10), since this species has the greatest likelihood of being affected by the proposed Project, should this species be present (breeding) in the LSA. Comprehensive surveys to confirm the presence of any significant populations of bird SCC within the LSA will be conducted later in 2022 (see Section 7.0).

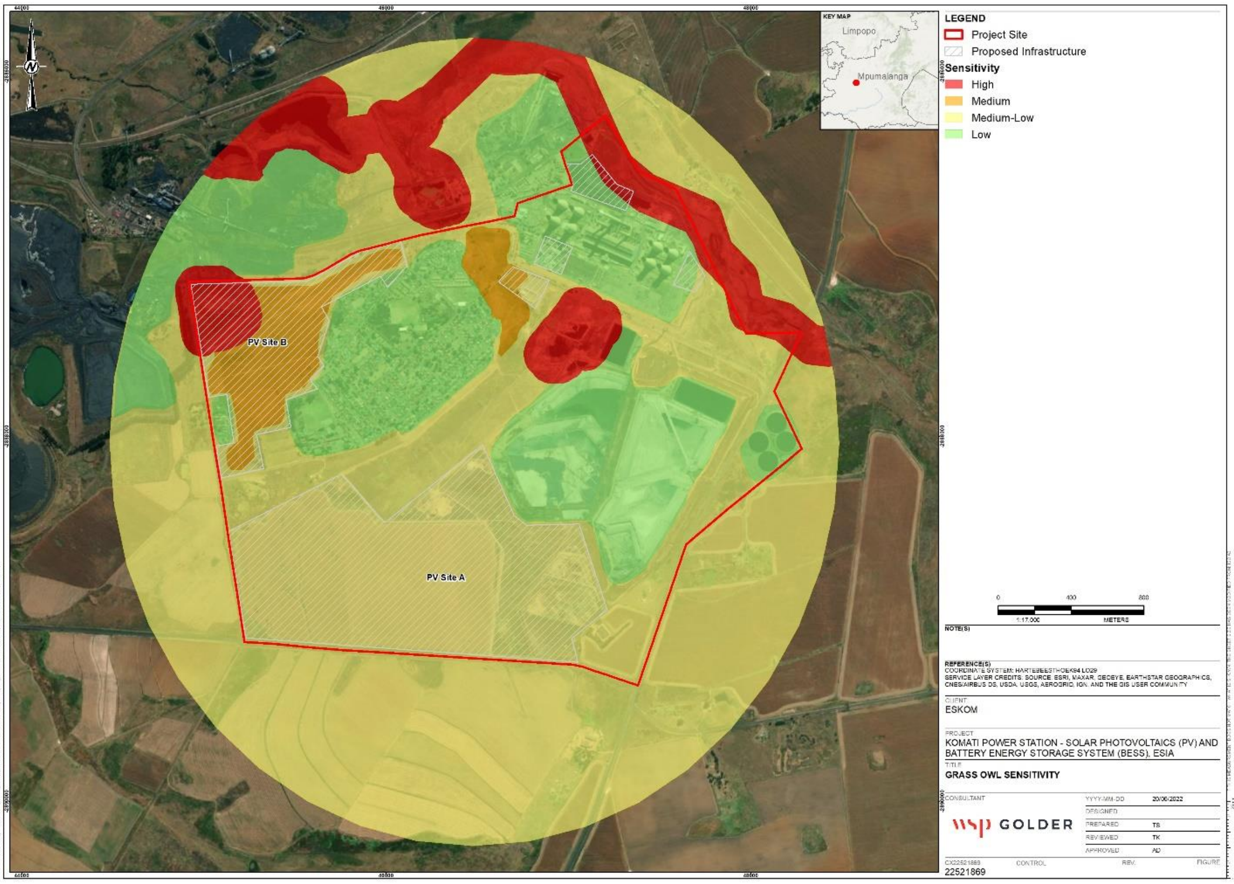

Figure 10: Grass owl sensitivity map

5.3.3 Herpetofauna

Data retrieved from the ADU Virtual Museum indicate the occurrence of three frog species within the 2629BA QDS, no records of amphibians are held for the 2629AB QDS (Table 9). None of the frog species are considered SC. Ten reptile species were recorded from both 2629BA and 2629AB QDSs (Table 10). All herpetofauna species were classified as Least Concern. No herpetofauna SCC were flagged for the study area by the national screening tool.

Table 9: Previously confirmed frog species within the 2629BA QDS (Animal Demographic Unit Virtual Museum, 2022)

Common Name	Scientific Name	RSA Red List Status
Guttural Toad	*Sclerophrys gutturalis*	Least Concern
Common Platanna	*Xenopus laevis*	Least Concern
Delalande's River Frog	*Amietia delalandii*	Least Concern

Table 10: Previously confirmed Reptile species within the 2629AB and 2629BA QDS (Animal Demographic Unit Virtual Museum, 2022)

Common Name	*Scientific name*	RSA Red List status	Mpumalanga Protected Species
Bibron's Blind Snake	*Afrotyphlops bibronii*	Least Concern	-
Black-headed Centipede-eater	*Aparallactus capensis*	Least Concern	-
Cape Skink	*Trachylepis capensis*	Least Concern	Protected
Mole Snake	*Pseudaspis cana*	Least Concern	-
Red-lipped Snake	Crotaphopeltis hotamboeia	Least Concern	-
Rhombic Egg-eater	*Dasypeltis scabra*	Least Concern	-
Rinkhals	*Hemachatus haemachatus*	Least Concern	-
Speckled Rock Skink	Trachylepis punctatissima	Least Concern	Protected
Spotted Grass Snake	*Psammophylax rhombeatus*	Least Concern	-
Transvaal Gecko	*Pachydactylus affinis*	Least Concern	Protected

5.4 Existing Impacts on Biodiversity and Drivers of Change

The proposed project infrastructure will be situated in close proximity to the existing power generation facilities and activities. All areas visited are currently experiencing some level of impact from the surrounding agricultural activities primarily through habitat transformation, and disturbance arising from power generation facilities and activities.

The presence of the existing power station facilities within close proximity to the proposed development footprint is expected to have an established impact on faunal species that are susceptible to sensory disturbance, particularly mammals and bird species which would actively avoid areas of high mechanical/human disturbance. Site lighting at night is also considered to be a likely factor in deterrence of these fauna from utilising the proposed development footprint for foraging/roosting purposes, and may also be driving changes in localised invertebrate distribution patterns, with certain species (and their predators e.g. bats) likely to be attracted to site security lighting at night, whilst others are deterred by it.

5.5 Natural, Modified and Critical Habitats

The study area is dominated by agricultural cultivation, power station infrastructure and residential/industrial areas, interspersed with some remnant wetland habitat. While some very disturbed wetland habitat has been identified in the eastern extent of PV Site A, it is no longer considered to constitute 'Natural' habitat as defined by WB ESS6 or IFC PS6, due to its heavily degraded state and loss of ecological function. The channelled valley bottom wetland to the north east of the site, and the seep wetland that crosses the northern boundary of the site, while moderately modified/disturbed, still support biodiversity and deliver ecological services to an extent that enables them both to be considered 'Natural' habitat (Figure 11) as defined by the lender standards.

Figure 11: Natural, modified and critical habitat

At present, no areas of potentially Critical habitat, as defined by IFC and WB standards, have been identified within the study area.

6.0 SCREENING OF POTENTIAL IMPACTS

The construction and operation of the proposed new infrastructure is anticipated to result in the following key impacts on terrestrial biodiversity receptors:

1) Direct impacts through clearing of land and resultant loss of biodiversity (flora and fauna SCC, ecosystems of concern).
2) Establishment and spread of alien and invasive species.
3) Loss and fragmentation of faunal habitats.
4) Injury and mortality of fauna SCC.
5) Collision risks to birds.

The outcomes of the screening of the potential impacts are summarised in Table 11 and described in detail in the following sections.

6.1 Construction Phase

Construction phase impacts largely arise as a result of direct impacts on the receiving environment due to clearing of land in advance of project development, and resultant loss of biodiversity. The earthworks and activities involved during the construction phase of the Project can potentially exert negative impacts on sensitive ecosystems, and flora and fauna species. Potential impacts primarily relate to vegetation clearing, direct loss/mortalities, sensory disturbance, and general anthropogenic influences associated with the construction of the proposed infrastructure.

6.1.1 Direct loss and disturbance of natural habitat and associated flora Species of Conservation Concern

The proposed development areas largely fall within non-transformed areas however surrounded by farmlands and mining operations. Furthermore, the areas appear to lack the diversity of species and likely dominated by a single species. The consequence of the potential impact is therefore considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance. With the implementation of mitigation measures such as restricting vegetation clearing to the development footprint, the consequence of the impact occurring can be reduced, resulting in a residual impact of Low significance

6.1.2 Establishment and spread of alien and invasive species

Disturbances caused by vegetation clearing and earth works during construction will exacerbate the establishment and spread of alien invasive vegetation. Alien plant infestations can spread exponentially, suppressing, or replacing indigenous vegetation. This may result in a breakdown of ecosystem functioning and a loss of biodiversity. Consequently, the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance.

With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the construction phase, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance

6.1.3 Loss and fragmentation of faunal habitats

The proposed development sites are surrounded by farmlands and mining operations, and as such remnant areas of fauna habitat restricted to wetlands/grasslands are already considered to be fragmented. This loss of landscape connectivity renders inhabiting populations of fauna isolated from other populations within the region. The LSA supports some potential habitat for Grass owl, the destruction of which is probable and would result in severe consequences, amounting to a potential impact of Medium significance. Should Grass Owl be confirmed on the site during avifauna surveys, mitigation measures will need to be applied to ensure that loss/fragmentation of their habitat is avoided, in which case the probability and potential consequence of the impact can be reduced, resulting in a residual potential impact of Very Low significance.

6.1.4 Injury and mortality of faunal species of conservation concern

The bulk earthworks involved in site development in advance have the potential to injure/kill individual faunal species of concern, particularly ground-dwelling and relatively slow-moving herpetofauna species that are vulnerable to heavy machinery movements and site clearance activities. However, the probability of the potential impact occurring is expected to be low given the transformed/disturbed nature of most available habitat. The potential consequence of the potential impact is thus considered negligible, resulting in a potential impact of Low significance.

The application of the recommended mitigations to implement measures to reduce the level of noise/sensory disturbance arising from site activities and infrastructure, will reduce the likelihood of the impact resulting in a residual impact of Very Low significance.

6.2 Operational Phase

Operational phase impacts relate to the ongoing risk of spread of the alien and invasive plant species that were present at baseline, and may have been spread into new areas during the construction phase; fragmentation of fauna habitats/barriers to movement due to security fencing, and the risk of injury/mortality presented to fauna by vehicular traffic and solar PV infrastructure.

6.2.1 Spread of alien and invasive species

The potential establishment of alien invasive species in, and immediately adjacent to, the proposed development footprint will continue to be an impact of concern during the operational phase. Without mitigation, the consequence of the potential impact is considered moderately severe, while the possibility of the impact occurring is highly probable, amounting to a potential impact of Medium significance.

With the development of an auditable AIS Management Plan for the project, and the strict implementation of the recommended active control and monitoring measures throughout the operational phase, the probability of the impact occurring can be reduced, resulting in a residual impact of Low significance.

6.2.2 Fragmentation of fauna habitats/barriers to movement

The solar PV arrays will be fenced off for security purposes, which will present a barrier to movement for larger faunal species. The likelihood of the impact occurring is considered improbable, since significant populations of larger mammals are not expected to utilise the immediate surrounds due to sensory disturbance/habitat transformation; while the consequence of the impact, should it occur, could be moderately severe, amounting to an impact of Low significance. No specific mitigation measures are proposed, since the security fencing will remain in place for the duration of the operation period (and as such the potential barrier to movement will remain), and the pre-mitigation impact is of Low significance, which is considered acceptable.

6.2.3 Injury and mortality of bird species of conservation concern

The presence of the Solar PV modules and ancillary infrastructure (particularly overhead transmission lines) in the landscape throughout the operational period may pose a risk of collision/electrocution to birds. The probability of the impact occurring is considered highly probable, and the consequence of the impact is expected to be moderately severe, amounting to an impact of Medium significance prior to mitigation. With the implementation of mitigation measures such as using avian-safe infrastructure designs, the probability of collisions/ electrocution occurring can be reduced, resulting in a residual impact of Low significance.

6.2.4 Injury and mortality of other faunal species of conservation concern

Increased vehicular traffic in the study area during the operation phase may pose a risk of injury and mortality of fauna SCC (and non-SCC). The probability of the impact occurring is considered probable, and the consequence moderately severe since the study area consists of significant vehicular traffic due to existing land uses. The significance of the impact is therefore considered to be Low. Upon implementation of recommended mitigation measures such as adhering to prescribed speed limits for construction and maintenance vehicles, the probability of the impact occurring can be reduced, resulting in a residual impact of Very Low significance.

Table 11: Terrestrial Biodiversity Impact summary

ACTIVITY	POTENTIAL IMPACT	AFFECTED RECEPTORS	PHASE In which impact is anticipated	Probability	Consequence	Significance without Mitigation	Probability	Consequence	Significance with Mitigation
Clearance of indigenous vegetation	Direct Loss and disturbance of natural habitat and associated flora SCC	Sensitive habitats, flora SCC	Construction	3	2	Medium	3	1	Low
	Establishment and spread of AIS	Sensitive habitats, flora SCC	Construction	3	2	Medium	2	2	Low
	Loss and fragmentation of faunal habitat	Fauna SCC (Grass owls)	Construction	2	3	Medium	1	2	Very Low
Vehicular Traffic, noise and lighting	Injury and mortality of fauna SCC	Fauna SCC	Construction	3	1	Low	2	1	Very Low
Maintenance of Solar PV infrastructure	Establishment and spread of AIS	Sensitive habitats, flora SCC	Operation	3	2	Medium	2	2	Low
	Fragmentation of fauna habitats/barriers to movement	Fauna SCC	Operation	2	2	Low	-	-	-
PV and powerline infrastructure	Electrocution of bird SCC	Birds SCC	Operation	3	2	Medium	1	2	Very Low
Vehicular Traffic	Injury and mortality of fauna SCC	Fauna SCC	Operation	3	1	Low	2	1	Very Low

6.3 Mitigation Measures

Mitigation measures that are designed to avoid and minimise the loss and degradation of the ecological resources on the site are summarised in the sections that follow.

6.3.1 Identification of areas to be avoided (including buffers)

- Loss of Natural habitat should be avoided by ensuring that proposed infrastructure/activities are situated outside of these areas. Should Natural habitat loss be unavoidable, net gain will need to be secured via an appropriately designed offset, to achieve the requirements of IFC PS6 and WB ESS6, as well as those of the DFFE.
- Areas of undisturbed, natural grassland and wetland habitat should be avoided to the extent possible. Areas of direct loss must be addressed via additional conservation actions/offsets as required.
- A loss/disturbance buffer zone of at least 100 m should be maintained between the maximum extent of construction works and the outer boundary of wetlands and riparian zones.

6.3.2 Minimisation

- To prevent loss of natural habitat (grasslands, wetlands) and flora SCC beyond the direct disturbance footprint, prior to any vegetation clearing, the development footprints should be clearly marked out with flagging tape/posts in the field. Vegetation clearing should be restricted to the proposed project footprints only, with no clearing permitted outside of these areas.
- The extent of disturbance should be limited by restricting all construction activities to the servitude as far as practically possible.
- Locate all stockpiles, laydown areas and temporary construction infrastructure at least 50 m from the edge of delineated wetlands.
- A search and rescue survey for all flora SCC should then be conducted within these marked footprints prior to the commencement of construction to determine the number of potentially impacted plant species of conservation concern. Based on the findings of the survey, clearing and/or relocation permits should be obtained from the relevant authority to clear or rescue and relocate potentially impacted plant SCC.
- Rescued plants should be relocated to an adjacent area of natural habitat..
- Glare reduction measures for PV panels and the use of safe perching devices and/or deterrents to reduce the risk of bird collision with panels or electrocution on associated powerline infrastructure should be implemented.
- Speed limits on mine should be expanded to construction areas via appropriate signage and enforced on all access roads to proposed new infrastructure locations. Dust suppression activities should also be expanded to include additional road at new infrastructure areas.
- A search and rescue survey for herpetofauna species should be done immediately in advance of site clearance activities in non-transformed habitats (i.e. remnant grasslands and wetlands). Any observed individuals should be relocated to nearby areas of natural habitats. Where snakes require relocation, this should be done by a certified snake handler for health and safety reasons.
- Dirty water resulting from construction and operational phases should not be allowed to freely flow on surfaces and or into the nearby watercourses and should be directed to the storm water management infrastructure (drains for example).

- The development of a biodiversity management plan that provides a practical framework for the delivery of the preceding mitigation measures is recommended.

6.3.3 Alien and Invasive Species Management

- An alien and invasive species management plan should be developed for the Project, which includes details of strategies and procedures that must be implemented on site to control the spread of alien and invasive species. A combined approach using both chemical and mechanical control methods, with periodic follow-up treatments informed by regular monitoring, is recommended.

6.3.4 Biodiversity Management Plan

- Specific provision for biodiversity conservation, including details of any required offsets, should be made in the project BMP/BAP, in alignment with the objectives of the MBSP (2019).

- Inclusion of a practical framework and schedule, details of key performance indicators, and recommended monitoring protocols for the delivery of existing and currently recommended mitigation measures in the BMP is recommended.

6.4 Monitoring Requirements

The following monitoring requirements are anticipated:

- The presence of alien and invasive flora species should be documented prior to the commencement of the development of the infrastructure and rehabilitation activities, and the baseline case used as a benchmark against which the spread of these species can be monitored. Annual monitoring inspections should identify target areas for clearing and subsequent rehabilitation/re-vegetation programmes.

- A record of fauna mortalities/injury due to interactions with Project infrastructure/activities should be kept on site and regularly reviewed to inform the need for implementation of any additional mitigation measures.

6.5 Cumulative Impacts

The landscape within which the proposed infrastructure is located is heavily to moderately modified and fragmented as a consequence of the existing mining operations, farmlands and residential areas. While the currently proposed project infrastructure largely avoids the loss of significant areas of natural habitat and associated flora SCC due to active avoidance of these areas as part of the ongoing planning process, vegetation clearing would result in loss of additional species and habitats of conservation concern, contributing to cumulative impacts in terms of direct losses of these receptors.

7.0 ADDITIONAL PLANNED BASELINE DATA GATHERING STUDIES AT ESIA STAGE

Additional baseline data gathering surveys and impact assessments that will be conducted at ESIA phase, and reported in the format required by the NEMA-gazetted protocols for minimum reporting requirements for terrestrial and avifauna specialist assessments, will include the following:

- Terrestrial Biodiversity Specialist Assessment:
  - Terrestrial fauna surveys (focussing on mammal and herpetofauna SCC with potential to occur in the LSA) will be done later in 2022 (wet season)
  - Vegetation mapping and flora surveys (focussing on the identification of any flora SCC with potential to occur in the LSA, and mapping of AIS) will be done during late October 2022 (wet season).
- Avifauna Specialist Assessment:

- A comprehensive field survey will be conducted during a single, 5 day, peak season survey, and will include sample counts of small terrestrial species, counts of large terrestrial species and raptors, focal site surveys and incidental observations.
- The Avifaunal Impact Assessment Report will be compiled within one month upon completion of the field survey and analysis of the primary field data, and will contain full analysis of the findings.

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APPENDIX A

Document Limitations

APPENDIX B

Specialist CVs

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APPENDIX

E-6 HERITAGE

APAC
APELSER ARCHAEOLOGICAL CONSULTING

Comprehensive and Professional Solutions for all Heritage Related Matters

CK 2006/014630/23 **VAT NO.: 4360226270**

A DESKTOP HERITAGE IMPACT ASSESSMENT REPORT FOR THE ESKOM KOMATI POWER STATION SOLAR PV ESIA MPUMALANGA PROVINCE

For:

WSP Group Africa (Pty) Ltd
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REPORT: **APAC022/51**

Project Number: 41103965

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DISCLAIMER:

Although all efforts are made to identify all sites of cultural heritage (archaeological and historical) significance during an assessment of study areas, the nature of archaeological and historical sites are as such that it is always possible that hidden or subterranean sites, features or objects could be overlooked during the study. APELSER Archaeological Consulting can't be held liable for such oversights or for costs incurred as a result thereof.

Clients & Developers should not continue with any development actions until SAHRA or one of its subsidiary bodies has provided final comments on this report. Submitting the report to SAHRA is the responsibility of the Client unless required of the Heritage Specialist as part of their appointment and Terms of Reference

SUMMARY

APelser Archaeological Consulting (APAC) was appointed by WSP Group Africa (Pty) Ltd to conduct a Phase 1 Heritage Impact Assessment (HIA) for the Komati Solar PV and BESS Environmental and Social Impact Assessment (ESIA). As part of this a Desktop-based assessment for inclusion in a Preliminary ESIA Report was requested. A Palaeontological Impact Assessment (PIA) forms part of the study and will be presented in a separate report. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa.

Background research indicates that there are several cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls, but no known ones in the specific study area. This report discusses the results of the background research and provides recommendations on the way forward at the end.

From a Cultural Heritage point of view it is recommended that the proposed Solar electricity generating facility and associated infrastructure as part of Eskom's repurposing program for the Komati Power Station be allowed to continue, taking into consideration the recommendations put forward at the end.

CONTENTS

1. INTRODUCTION

APelser Archaeological Consulting (APAC) was appointed by WSP Group Africa (Pty) Ltd to conduct a Phase 1 Heritage Impact Assessment (HIA) for the Komati Solar PV and BESS Environmental and Social Impact Assessment (ESIA). As part of this a Desktop-based assessment for inclusion in a Preliminary ESIA Report was requested. A Palaeontological Impact Assessment (PIA) forms part of the study and will be presented in a separate report. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa.

Background research indicates that there are several cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls, but no known ones in the specific study area.

The client indicated the location and boundaries of the study area and the assessment concentrated on this portion.

2. TERMS OF REFERENCE

The Terms of Reference for the study was to:

1. Identify all objects, sites, occurrences and structures of an archaeological or historical nature (cultural heritage sites) located on the portion of land that will be impacted upon by the proposed development;

2. Assess the significance of the cultural resources in terms of their archaeological, historical, scientific, social, religious, aesthetic and tourism value;

3. Describe the possible impact of the proposed development on these cultural remains, according to a standard set of conventions;

4. Propose suitable mitigation measures to minimize possible negative impacts on the cultural resources;

5. Review applicable legislative requirements;

It should be noted that No Field-Based Assessment was conducted as part of this Appointment and that the results and recommendations made in this report are based on the scrutiny of previous research and assessments in the area and aerial images of the study area.

3. LEGISLATIVE REQUIREMENTS

Aspects concerning the conservation of cultural resources are dealt with mainly in two Acts. These are the National Heritage Resources Act (Act 25 of 1999) and the National Environmental Management Act (Act 107 of 1998).

3.1. The National Heritage Resources Act

According to the Act the following is protected as cultural heritage resources:

a. Archaeological artifacts, structures and sites older than 100 years
b. Ethnographic art objects (e.g. prehistoric rock art) and ethnography
c. Objects of decorative and visual arts
d. Military objects, structures and sites older than 75 years
e. Historical objects, structures and sites older than 60 years
f. Proclaimed heritage sites
g. Grave yards and graves older than 60 years
h. Meteorites and fossils
i. Objects, structures and sites of scientific or technological value.

The National Estate includes the following:

a. Places, buildings, structures and equipment of cultural significance
b. Places to which oral traditions are attached or which are associated with living heritage
c. Historical settlements and townscapes
d. Landscapes and features of cultural significance
e. Geological sites of scientific or cultural importance
f. Sites of Archaeological and paleontological importance
g. Graves and burial grounds
h. Sites of significance relating to the history of slavery
i. Movable objects (e.g. archaeological, paleontological, meteorites, geological specimens, military, ethnographic, books etc.)

A Heritage Impact Assessment (HIA) is the process to be followed in order to determine whether any heritage resources are located within the area to be developed as well as the possible impact of the proposed development thereon. An Archaeological Impact Assessment (AIA) only looks at archaeological resources. An HIA must be done under the following circumstances:

a. The construction of a linear development (road, wall, power line, canal etc.) exceeding 300m in length
b. The construction of a bridge or similar structure exceeding 50m in length
c. Any development or other activity that will change the character of a site and exceed 5 000m^2 or involve three or more existing erven or subdivisions thereof
d. Re-zoning of a site exceeding 10 000 m^2
e. Any other category provided for in the regulations of SAHRA or a provincial heritage authority

Structures

Section 34 (1) of the Act states that no person may demolish any structure or part thereof which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.

A structure means any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith.

Alter means any action affecting the structure, appearance or physical properties of a place or object, whether by way of structural or other works, by painting, plastering or the decoration or any other means.

Archaeology, palaeontology and meteorites

Section 35(4) of the Act deals with archaeology, palaeontology and meteorites and states that no person may, without a permit issued by the responsible heritage resources authority (National or Provincial):

a. destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site or any meteorite;

b. destroy, damage, excavate, remove from its original position, collect or own any archaeological or paleontological material or object or any meteorite;

c. trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or paleontological material or object, or any meteorite;

d. bring onto or use at an archaeological or paleontological site any excavation equipment or any equipment that assists in the detection or recovery of metals or archaeological and paleontological material or objects, or use such equipment for the recovery of meteorites;

e. alter or demolish any structure or part of a structure which is older than 60 years as protected.

The above mentioned may only be disturbed or moved by an archaeologist, after receiving a permit from the South African Heritage Resources Agency (SAHRA). In order to demolish such a site or structure, a destruction permit from SAHRA will also be needed.

Human remains

Graves and burial grounds are divided into the following:

a. ancestral graves
b. royal graves and graves of traditional leaders

c. graves of victims of conflict
d. graves designated by the Minister
e. historical graves and cemeteries
f. human remains

In terms of Section 36(3) of the National Heritage Resources Act, no person may, without a permit issued by the relevant heritage resources authority:

a. destroy, damage, alter, exhume or remove from its original position of otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;

b. destroy, damage, alter, exhume or remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority; or

c. bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation, or any equipment which assists in the detection or recovery of metals.

Human remains that are less than 60 years old are subject to provisions of the Human Tissue Act (Act 65 of 1983) and to local regulations. Exhumation of graves must conform to the standards set out in the **Ordinance on Excavations** (**Ordinance no. 12 of 1980**) (replacing the old Transvaal Ordinance no. 7 of 1925).

Permission must also be gained from the descendants (where known), the National Department of Health, Provincial Department of Health, Premier of the Province and local police. Furthermore, permission must also be gained from the various landowners (i.e. where the graves are located and where they are to be relocated to) before exhumation can take place.

Human remains can only be handled by a registered undertaker or an institution declared under the **Human Tissues Act** (**Act 65 of 1983 as amended**).

3.2. The National Environmental Management Act

This Act states that a survey and evaluation of cultural resources must be done in areas where development projects, that will change the face of the environment, will be undertaken. The impact of the development on these resources should be determined and proposals for the mitigation thereof are made.

Environmental management should also take the cultural and social needs of people into account. Any disturbance of landscapes and sites that constitute the nation's cultural heritage should be avoided as far as possible and where this is not possible the disturbance should be minimized and remedied.

4. METHODOLOGY

4.1. Survey of literature

A survey of available literature was undertaken in order to place the development area in an archaeological and historical context. The sources utilized in this regard are indicated in the bibliography.

4.2. Field survey

The field assessment section of the study is normally conducted according to generally accepted HIA practices and aimed at locating all possible objects, sites and features of heritage significance in the area of the proposed development. The location/position of all sites, features and objects is determined by means of a Global Positioning System (GPS) where possible, while detail photographs are also taken where needed.

No field work was undertaken as part of this assessment.

4.3. Oral histories

People from local communities are sometimes interviewed in order to obtain information relating to the surveyed area. It needs to be stated that this is not applicable under all circumstances. When applicable, the information is included in the text and referred to in the bibliography.

4.4. Documentation

All sites, objects, features and structures identified are documented according to a general set of minimum standards. Co-ordinates of individual localities are determined by means of the Global Positioning System (GPS). The information is added to the description in order to facilitate the identification of each locality.

5. DESCRIPTION OF THE AREA & PROJECT

The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank (eMalahleni), via Vandyksdrift in the Mpumalanga Province of South Africa. The station has a total of 9 units, five 100MW units on the east (Units 1 to 5) and four 125 MW units on the west (Units 6 to 9), with a total installed capacity of 1000 MW. Its units operated on a simple Rankine Cycle without reheat and with a low superheat pressure, resulting in a lower thermodynamic efficiency (efficiency up to 27%). Komati Units are small and have a higher operating & maintenance cost per megawatt generated compared to modern newer stations. Komati Power Station will reach its end-of-life expectancy in September 2022 when Unit 9 will have reached its dead stop date (DSD). Units 1 to 8 have already reached its DSD.

Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS). The parcels of land in Komati for the proposed development are owned by Eskom.

The current assessments form part of the Environmental and Social Impact Assessment (ESIA) for the first phase of Komati Power Station repurposing programme, i.e. the installation of the Solar PV and BESS.

Based on aerial images (Google Earth) of the study and proposed development parcels it is clear that the area has been heavily impacted by development of the existing Power Station & its related infrastructure, residential & related developments as well as agricultural activities. The larger geographical area within which the study and proposed development areas are located have also been impacted by mining. The original natural and historical landscape has been severely altered through these activities and if any sites, features or material of cultural heritage (archaeological and/or historical) significance or origin were present here in the past it would have been extensively disturbed or destroyed as a result.

The topography of the study and development area is relatively flat and open, with no rocky outcrops, ridges or hills present.

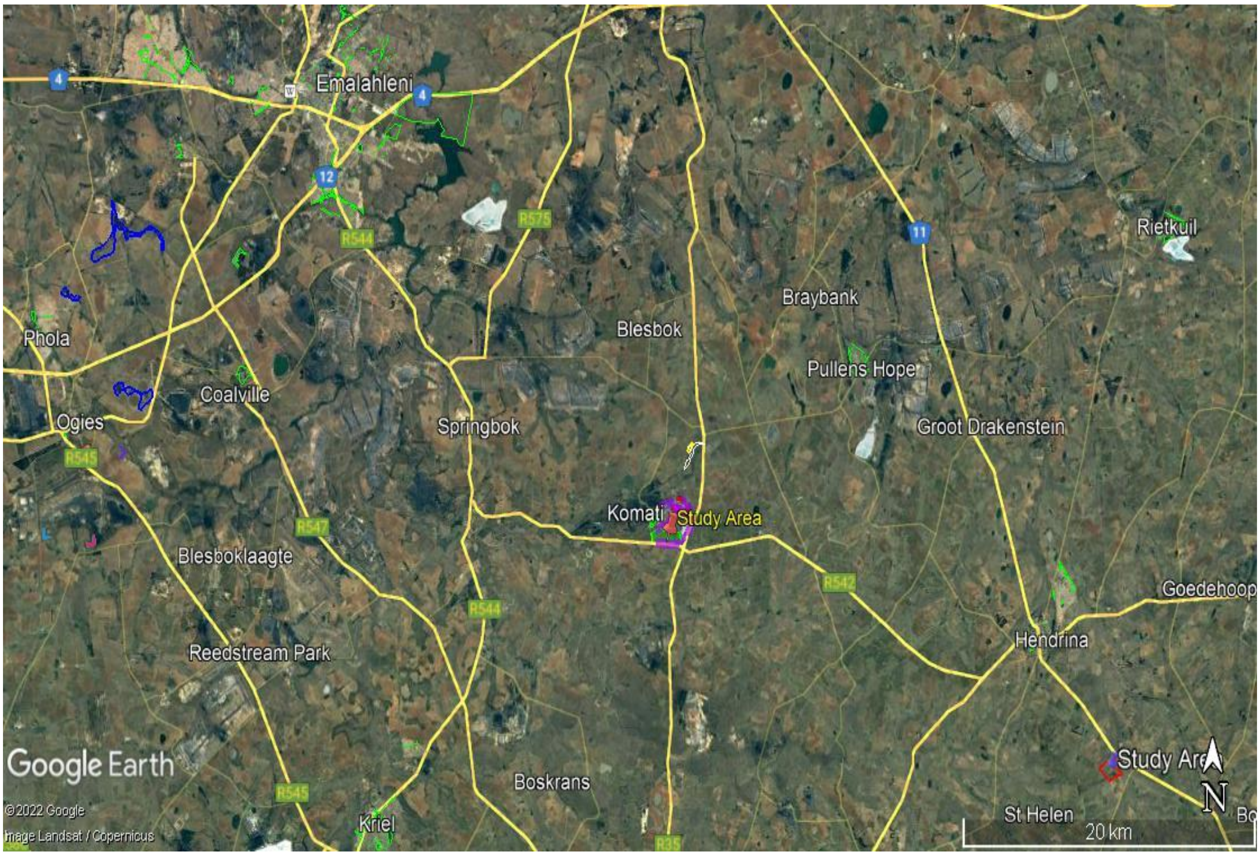

Figure 1: General location of the Eskom Komati Power Station study area (Google Earth 2022).

Figure 2: Closer view of the study & proposed development areas. Note the heavily transformed and impacted nature of the specific and general area (Google Earth 2022).

6. DISCUSSION

The Stone Age is the period in human history when lithic (stone) material was mainly used to produce tools. In South Africa the Stone Age can be divided in basically into three periods. It is however important to note that dates are relative and only provide a broad framework for interpretation. A basic sequence for the South African Stone Age (Lombard et.al 2012) is as follows:

Earlier Stone Age (ESA) up to 2 million – more than 200 000 years ago
Middle Stone Age (MSA) less than 300 000 – 20 000 years ago
Later Stone Age (LSA) 40 000 years ago – 2000 years ago

It should also be noted that these dates are not a neat fit because of variability and overlapping ages between sites (Lombard et.al 2012: 125).

There are no known Stone Age sites in close proximity to the study area, although rock paintings (associated with the Later Stone Age) are known south of eMalahleni (Witbank) near the confluence of the Olifants River and Rietspruit, as well as a rock art site to the southeast of Middelburg (Bergh 1999:4-5). Heritage surveys have recorded few outstanding Stone Age sites, rock paintings and engravings in the Eastern Highveld - mainly as a result of limited extensive archaeological surveys. Stone tools have however been recorded around some of the pans which occur on the Eastern Highveld (Pistorius 2010:16). Some individual

Later Stone Age artifacts were identified in the larger area during a 2007 HIA for Goedgevonden Colliery, but the location of the site is not indicated (De Jong 2007: 19).

The possibility of finding Stone Age material in the study area is always a possibility. These would however more specifically be individual artifacts and small scatters of artifacts in open-air contexts if they are present.

The Iron Age is the name given to the period of human history when metal was mainly used to produce metal artifacts. In South Africa it can be divided in two separate phases (Bergh 1999: 96-98), namely:

Early Iron Age (EIA) 200 – 1000 A.D
Late Iron Age (LIA) 1000 – 1850 A.D.

Huffman (2007: xiii) however indicates that a Middle Iron Age should be included. His dates, which now seem to be widely accepted in archaeological circles, are:

Early Iron Age (EIA) 250 – 900 A.D.
Middle Iron Age (MIA) 900 – 1300 A.D.
Late Iron Age (LIA) 1300 – 1840 A.D.

No Early or Middle Iron Age sites are known to occur in the study area (Bergh 1999: 6-7). According to Pistorius the Eastern Highveld had probably not been occupied by Early Iron Age communities, but was occupied by Late Iron Age farming communities such as the Sotho, Swazi and Ndebele who established stone walled settlement complexes. Seemingly these sites are more common towards the eastern perimeters of the Eastern Highveld. Small, inconspicuous stone walled sites have been observed along the Olifants River but are an exception and not the rule (Pistorius 2010:16-17).

There are a fairly large number of Late Iron Age stone walled sites in the bigger geographical area that includes Lydenburg, Dullstroom, Machadodorp, Badplaas and Belfast (Bergh 1999: 6-7). Late Iron Age sites have been identified to the north and east of Middelburg in the vicinity of Belfast (Bergh 1999: 7). Some of these sites might be related to the so-called Marateng facies of the Urewe pottery tradition of the LIA, dating to between AD1650 and 1840 (Huffman 2007: 207). During the 19th century the Ndzundza Ndebele inhabited the land to the north of Middelburg, but it seems as if the area directly surrounding the town was largely uninhabited. The Ndebele of Mzilikazi did move through this area during the *difaqane* which probably left it uninhabited for some time (Bergh 1999: 10-11).

The historical age started with the first recorded oral histories in the area. The first European people to move through this area were the party of the traveler Robert Schoon who passed through during 1836 (Bergh 1999: 13). Although the Voortrekkers moved across the Vaal River during the 1830's, it seems as if Europeans only settled here after 1850 (Bergh 1999: 14-15).

One historic event took place in the region. During the Anglo-Boer War, the British forces under Brigadier-General Beatson were attacked by the ZAR forces, led by Gen. Muller. More than 50 British soldiers were killed. Afterwards, Brigadier-Gen. Beatson accused the Australian forces of cowardice. They mutinied against him and some were arrested, court-martialled and sentenced to death. Fortunately, these sentences were later commuted to imprisonment. This battle took place on the farm Wilmansrust 47IS, just to the south of the power station. A monument to commemorate this event was erected on this farm, but during the early 1970s it was relocated to the town of Bethal. The site investigation for the power station was started in 1957, and the first unit was commissioned in 1961 and the last in 1966. In 1990 the station was completely mothballed (Van Schalkwyk 2007: 4). Construction of the power station began during 1961.

With no physical field assessments conducted in the study and proposed development areas it is difficult to determine without a doubt if any sites, features or material of cultural heritage origin or significance are located here and if there will be any impacts on such sites as a result of the planned development activities. Based on aerial images of the areas it is however clear that there has been substantial impacts on them (including the development of the existing Power Station and related infrastructure, agricultural residential and industrial) and if any sites, features or material of archaeological and/or historical origin and significance did exist in these specific areas in the past they would have been substantially disturbed or destroyed as a result.

It is evident from the desktop study that archaeological/historical sites and finds do occur in the larger geographical landscape within which the specific study area is located. Based on this it is always possible that open-air Stone Age sites could be found in the area, in the form of individual stone tools or small scatters of tools if present. The possibility of Iron Age sites in the area is highly unlikely with no rocky outcrops, ridges and hills present. The likelihood of recent historical sites and features being present in the area is also low, although this cannot be excluded. If any are present it would most likely be remnants of homesteads and unknown/unmarked graves. During a 2007 Heritage Survey for the Komati Power Station Ash Dam Extension (on the farm Komati Power Station 58IS, a subdivision of the original farm Koornfontein 27IS), no Stone Age, Iron Age or recent historical sites, features or material were identified in the area (Van Schalkwyk 2007: 4).

The planned Solar PV facility development and related infrastructure (including the Battery Energy Storage System and overhead power lines) is located in already heavily disturbed areas and the likelihood of any cultural heritage sites or features being located here is very low. The often subterranean nature of archaeological and/or historical sites and features should however always be taken into consideration and there is always a possibility of these occurring in an area earmarked for development. This could include unmarked or unknown graves or burials.

Figure 3: Closer view of a section of the study and development areas. The residential area of Komati is visible, as well as an airstrip, open and cleared open spaces and parts of the existing Power Station infrastructure. The areas in green are for the Solar PV facility, red for the BESS and purple lines the overhead lines (Google Earth 2022).

Figure 4: Another section of the area with one of the alternative areas for the Solar PV facility in the green polygon and sections of the powerlines in purple shown. The agricultural fields in the area as well as the impacts of activities associated with the Komati Power Station is evident (Google Earth 2022).

Figure 5: Closer view of the Komati Power Station area with sections of the powerlines in purple and the BESS areas in red shown. The heavily disturbed nature of the area is clear (Google Earth 2022).

Based on the desktop research there is therefore a very low likelihood of any significant sites, features or material of archaeological and/or historical origin or nature being present in the study and proposed development areas. The impact of the proposed development on cultural heritage resources will therefore be very low.

With no fieldwork as yet undertaken there is always a possibility that some previously unknown heritage resources could be located in the area, even though previous studies did not identify any. The often subterranean nature of archaeological and/historical sites and features should also always be taken into consideration. This could include unmarked or unknown graves or burials.

7. CONCLUSIONS AND RECOMMENDATIONS

APelser Archaeological Consulting (APAC) was appointed by WSP Group Africa (Pty) Ltd to conduct a Phase 1 Heritage Impact Assessment (HIA) for the Komati Solar PV and BESS Environmental and Social Impact Assessment (ESIA). As part of this a Desktop-based assessment for inclusion in a Preliminary ESIA Report was requested. A Palaeontological Impact Assessment (PIA) forms part of the study and will be presented in a separate report.

The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Vandyksdrift in the Mpumalanga Province of South Africa.

Background research indicates that there are several cultural heritage (archaeological & historical) sites and features in the larger geographical area within which the study area falls, but no known ones in the specific study area.

No physical field assessments have been conducted in the study and proposed development areas yet and it is therefore difficult to determine without a doubt if any sites, features or material of cultural heritage origin or significance are located here and if there will be any impacts on them as a result of the planned development activities. Aerial images however clearly show the substantial impacts of past developments on the study area and if any sites, features or material of archaeological and/or historical origin and significance did exist here in the past it would have been substantially disturbed or destroyed as a result.

The desktop study does show that archaeological/historical sites and finds occur in the larger geographical landscape within which the specific study area is located. During a 2007 Heritage Survey for the Komati Power Station Ash Dam Extension (on the farm Komati Power Station 58IS, a subdivision of the original farm Koornfontein 27IS), no Stone Age, Iron Age or recent historical sites, features or material were however identified in the area.

There is a very low likelihood of any significant sites, features or material of archaeological and/or historical origin or nature being present in the study and proposed development areas. The impact of the proposed development on cultural heritage resources will therefore be very low. However, with no fieldwork as yet undertaken in the areas, there is a possibility that some previously unknown heritage resources could be located in the area, even though previous studies did not identify any.

It is recommended that a site visit to the proposed development areas be undertaken to ensure that no cultural heritage sites, features or material exist here, and that might be negatively impacted by the proposed development actions before the development commences.

The often subterranean nature of archaeological and/historical sites and features should also always be taken into consideration. This could include unmarked or unknown graves or burials. Should any be exposed during any development activities a Specialist should then be called in to investigate and provide recommendations on the way forward in terms of any required mitigation measures.

8. REFERENCES

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APPENDIX A: DEFINITION OF TERMS:

Site: A large place with extensive structures and related cultural objects. It can also be a large assemblage of cultural artifacts, found on a single location.

Structure: A permanent building found in isolation or which forms a site in conjunction with other structures.

Feature: A coincidental find of movable cultural objects.

Object: Artifact (cultural object).

(Also see Knudson 1978: 20).

APPENDIX B: DEFINITION/ STATEMENT OF HERITAGE SIGNIFICANCE

Historic value: Important in the community or pattern of history or has an association with the life or work of a person, group or organization of importance in history.

Aesthetic value: Important in exhibiting particular aesthetic characteristics valued by a community or cultural group.

Scientific value: Potential to yield information that will contribute to an understanding of natural or cultural history or is important in demonstrating a high degree of creative or technical achievement of a particular period

Social value: Have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons.

Rarity: Does it possess uncommon, rare or endangered aspects of natural or cultural heritage.

Representivity: Important in demonstrating the principal characteristics of a particular class of natural or cultural places or object or a range of landscapes or environments characteristic of its class or of human activities (including way of life, philosophy, custom, process, land-use, function, design or technique) in the environment of the nation, province region or locality.

APPENDIX C: SIGNIFICANCE AND FIELD RATING:

Cultural significance:

- Low: A cultural object being found out of context, not being part of a site or without any related feature/structure in its surroundings.

- Medium: Any site, structure or feature being regarded less important due to a number of factors, such as date and frequency. Also any important object found out of context.

- High: Any site, structure or feature regarded as important because of its age or uniqueness. Graves are always categorized as of a high importance. Also any important object found within a specific context.

Heritage significance:

- Grade I: Heritage resources with exceptional qualities to the extent that they are of national significance

- Grade II: Heritage resources with qualities giving it provincial or regional importance although it may form part of the national estate

- Grade III: Other heritage resources of local importance and therefore worthy of conservation

Field ratings:

i. National Grade I significance: should be managed as part of the national estate

ii. Provincial Grade II significance: should be managed as part of the provincial estate

iii. Local Grade IIIA: should be included in the heritage register and not be mitigated (high significance)

iv. Local Grade IIIB: should be included in the heritage register and may be mitigated (high/ medium significance)

v. General protection A (IV A): site should be mitigated before destruction (high/medium significance)

vi. General protection B (IV B): site should be recorded before destruction (medium significance)

vii. General protection C (IV C): phase 1 is seen as sufficient recording and it may be demolished (low significance)

APPENDIX D: PROTECTION OF HERITAGE RESOURCES:

Formal protection:

National heritage sites and Provincial heritage sites – Grade I and II
Protected areas - An area surrounding a heritage site
Provisional protection – For a maximum period of two years
Heritage registers – Listing Grades II and III
Heritage areas – Areas with more than one heritage site included
Heritage objects – e.g. Archaeological, palaeontological, meteorites, geological specimens, visual art, military, numismatic, books, etc.

General protection:

Objects protected by the laws of foreign states
Structures – Older than 60 years
Archaeology, palaeontology and meteorites
Burial grounds and graves
Public monuments and memorials

APPENDIX E: HERITAGE IMPACT ASSESSMENT PHASES

1. Pre-assessment or Scoping Phase – Establishment of the scope of the project and terms of reference.

2. Baseline Assessment – Establishment of a broad framework of the potential heritage of an area.

3. Phase I Impact Assessment – Identifying sites, assess their significance, make comments on the impact of the development and makes recommendations for mitigation or conservation.

4. Letter of recommendation for exemption – If there is no likelihood that any sites will be impacted.

5. Phase II Mitigation or Rescue – Planning for the protection of significant sites or sampling through excavation or collection (after receiving a permit) of sites that may be lost.

6. Phase III Management Plan – For rare cases where sites are so important that development cannot be allowed.

APPENDIX

E-7 *PALEONTOLOGY*

Eskom Komati Power Station Solar PV and BESS ESIA

City of eMalahleni Metropolitan Municipality, Nkangala District Municipality, Mpumalanga Province.

Farm: Kroonfontein 27-IQ, Goedehoop 46-IQ

Fourie, H. Dr heidicindy@yahoo.com

012 322 7632/079 940 6048

Palaeontological Impact Assessment: Phase 1 Field Study

Facilitated by: Anton Pelser Archaeological Consulting cc

833 B St Bernard Street,

Garstfontein, 0081

Tel: 083 459 3091

2022/06/20

Ref: Pending

Plant fossil – Ecca Group

B. Executive summary

Outline of the development project: Anton Pelser Archaeological Consulting cc has facilitated the appointment of Dr H. Fourie, a palaeontologist, to undertake a Palaeontological Impact Assessment (PIA), Phase 1: Field Study of the suitability of the proposed Eskom Komati Power Station Solar PV and BESS ESIA in the City of eMalahleni Metropolitan Municipality, Nkangala District Municipality, Mpumalanga Province on the Farm: Kroonfontein 27-IQ and Goedehoop 46-IQ.

The applicant, Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS).

The Project includes one locality Option (see Figure 2):
Option 1: An area blocked in green and red. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Van Dyksdrift in the Mpumalanga Province of South Africa. The GPS coordinates for the power plant is: 26.0896668 S, 29.4655907 E.
The approximate size of the site is 200-250 hectares.

Legal requirements:-

The **National Heritage Resources Act (Act No. 25 of 1999) (NHRA)** requires that all heritage resources, that is, all places or objects of aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance are protected. The Republic of South Africa (RSA) has a remarkably rich fossil record that stretches back in time for some 3.5 billion years and must be protected for its scientific value. Fossil heritage of national and international significance is found within all provinces of the RSA. South Africa's unique and non-renewable palaeontological heritage is protected in terms of the National Heritage Resources Act. According to this act, palaeontological resources may not be excavated, damaged, destroyed or otherwise impacted by any development without prior assessment and without a permit from the relevant heritage resources authority.

The main aim of the assessment process is to document resources in the development area and identify both the negative and positive impacts that the development brings to the receiving environment. The PIA therefore identifies palaeontological resources in the area to be developed and makes recommendations for protection or mitigation of these resources.

"palaeontological" means any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or traces.

For this study, resources such as geological maps, scientific literature, institutional fossil collections, satellite images, aerial maps and topographical maps were used. It provides an assessment of the observed or inferred palaeontological heritage within the study area, with recommendations (if any) for further specialist palaeontological input where this is considered necessary.

A Palaeontological Impact Assessment is generally warranted where rock units of **LOW** to **VERY HIGH** palaeontological sensitivity are concerned, levels of bedrock exposure within the study area are adequate; large scale projects with high potential heritage impact are planned; and where the distribution and nature of fossil remains in the proposed area is unknown. The specialist will inform whether further monitoring and mitigation are necessary.

Types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act (Act No.25 of 1999):

(i) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens.
This report adheres to the guidelines of Section 38 (1) of the National Heritage Resources Act (Act No. 25 of 1999). 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 300 m in length; (b) the construction of a bridge or similar structure exceeding 50 m in length; (c) any development or other activity which will change the character of a site (see Section 38); (d) the re-zoning of a site exceeding 10 000 m² (1 ha) in extent; (e) or any other category of development provided for in regulations by SAHRA or a PHRA authority.

This report (Appendix 6, **1c)** aims to provide comment and recommendations on the potential impacts that the proposed development could have on the fossil heritage of the area and to state if any mitigation or conservation measures are necessary.

Outline of the geology and the palaeontology:
The geology was obtained from map 1:100 000, Geology of the Republic of South Africa (Visser 1984) and 2628 East Rand (Keyser *et al.* 1986), 1:250 000 geological maps.

Figure: The geology of the development area.
Legend to Figure and short explanation.
Jd – Dolerite (pink). Jurassic.
Pv – Sandstone, shale and grit with coal and oil-shale beds (grey). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.
…… – (black) Lineament (Possible dyke).
--f— Fault.
┴5˚ - Strike and dip.
□ – Approximate position of solar plant (blocked in black).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Palaeontology – Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity can generally be **LOW** to **VERY HIGH**, and here locally in the development area **VERY HIGH** for the Vryheid Formation (SG 2.2 SAHRA APMHOB, 2012).

The Ecca Group, Vryheid Formation (Pv) may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

Summary of findings (**1d**): The Phase 1: Field Study will be undertaken at a later stage, the desktop was compiled in June 2022 in the winter in dry and cool conditions during the official Covid-19 Level 1 lockdown, and the following is reported:

Field Observation: Still to be conducted.

The Project includes one locality Option present on the Vryheid Formation:
Option 1: An area blocked in green and red. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Van Dyksdrift in the Mpumalanga Province of South Africa. The GPS coordinates for the power plant is: 26.0896668 S, 29.4655907 E.
The approximate size of the site is 200-250 hectares.

Recommendation:
The potential impact of the development on fossil heritage is **VERY HIGH** and therefore a field survey is necessary for this development (according to SAHRA protocol). A Phase 1 Palaeontological Impact Assessment: Field Study will be done. A Phase 2: Mitigation will be recommended if the Phase 1: Field Study finds fossils or if fossils are found during the development.

Concerns/threats **(1k,l,m)** to be added to EMPr:

1. Threats are earth moving equipment/machinery (for example haul trucks, front end loaders, excavators, graders, dozers) during construction, the sealing-in, disturbance, damage or destruction of the fossils by development, vehicle traffic, and human disturbance.
2. Special care must be taken during the digging, drilling, blasting and excavating of foundations, trenches, channels and footings and removal of overburden not to intrude fossiliferous layers.

The recommendations are **(1g)**:

1. Mitigation will be needed if fossils are found during the development.
2. No consultation with parties was necessary. The Environmental Control Officer must familiarise him- or herself with the formations present and its fossils and follow protocol.

3. The development may go ahead with caution.
4. The ECO together with the mine geologist must survey for fossils before and or after clearing, blasting, drilling or excavating.
5. The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities. For a chance fossil find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation.

Stakeholders: Developer – Eskom.
Environmental – Anton Pelser Archaeological Consulting cc. 833 B St Bernard Street, Garstfontein, 0081. Tel: 083 459 3091.
Landowner – N/a.

C. Table of Contents

D. Background information on the project

Report

This report is part of the environmental impact assessment process under the National Environmental Management Act, as amended (Act No. 107 of 1998) (NEMA) and includes Appendix 6 (GN R326 of 7 April 2017) of the Environmental Impact Assessment Regulations (see Appendix 2). It also is in compliance with The Minimum Standards for Palaeontological Components of Heritage Impact Assessment Reports, SAHRA, APMHOB, Guidelines 2012, Pg 1-15 **(2)**.

Outline of development

This report discusses and aims to provide the developer with information regarding the location of palaeontological material that will be impacted by the development. In the pre-construction phase it may be necessary for the developer to apply for the relevant permit from the South African Heritage Resources Agency depending on the presence of fossils (SAHRA / PHRA).

The applicant, Eskom is proposing the establishment of a solar electricity generating facility and associated infrastructure as part of its repurposing programme for Komati Power Station. The plan is to install 100MW of Solar Photovoltaics (PV) and 150MW of Battery Energy Storage System (BESS).

X

Figure 1: Lay-out plan of development and topography (WSP).

The Komati Power Station has a total of nine units, five 100MW units on the east (Units 1 to 5) and four 125 MW units on the west (Units 6 to 9), with a total installed capacity of 1000 MW. Its units operated on a simple Rankine Cycle without reheat and with a low superheat pressure, resulting in a lower thermodynamic efficiency (efficiency up to 27%). Komati Units are small and have a higher operating & maintenance cost per megawatt generated compared to modern newer stations. Komati Power Station will reach its end-of-life expectancy in September 2022 when Unit 9 will have reached its dead stop date (DSD). Units 1 to 8 have already reached its DSD.

The parcels of land in Komati for the proposed development is provided in the figure (Figure 2) below. The identified parcels of land are owned by Eskom.

The specifications of the Solar PV and BESS project including aspects of construction and operation are outlined below:

— The total site area for PV installation is approximately 200-250 hectares to allow for the construction of a PV facility with capacity up to 100 MW and BESS up to 150 MW.

— Solar PV modules, up to a total of approximately 720,000 m2, that convert solar radiation directly into electricity. The solar PV modules will be elevated above the ground, and will be mounted on either fixed tilt systems or tracking systems (comprised of galvanised steel and aluminium). The Solar PV modules will be placed in rows in such a way that there is allowance for a perimeter road and security fencing along the boundaries, and O&M access roads in between the PV module rows.

— Inverter stations, each occupying a footprint up to approximately 30 m2, with up to 100 Inverter stations installed on the identified sites. Each Inverter station will contain an inverter step-up transformer, and switchgear. The Inverter stations will be distributed on the site, located alongside its associated Solar PV module arrays. The Inverter station will perform conversion of DC (direct current) to AC (alternating current), and step-up the LV voltage of the inverter to the appropriate voltage to allow the electricity to be fed into the appropriate substation / grid point of connection (PoC). Inverter stations will connect several arrays of Solar PV modules and will be placed along the internal roads for easy accessibility and maintenance.

— Below ground electrical cables with trenching for connecting PV arrays, Inverter stations, O&M buildings, and Combiner Substations.

— Above ground overhead lines for connecting Combiner Substations to grid PoC.

— Adequately designed foundations and mounting structures that will support the Solar PV modules and Inverter stations.

— Access roads that provide access to the Komati PV sites.

— Perimeter roads around the PV sites.

— Internal roads for access to the Inverter stations.

— Internal roads/paths between the Solar PV module rows, to allow access to the Solar PV modules for operations and maintenance activities.

— Infrastructure required for the operation and maintenance of the Komati PV installations:

- Meteorological Station
- O&M Building – comprising control room, server room, security equipment room, offices, boardroom, kitchen, and ablution facilities (including water supply and sewage infrastructure)
- Spares Warehouse and Workshop
- Hazardous Chemical Store – approx. 30 m2
- Security Building
- Parking areas and roads

— Small diameter water supply pipeline from existing supply infrastructure.

— Fire water supply during Construction and Operation.

— Sewage interconnection to existing infrastructure.

— Stormwater channels.

— Perimeter fencing of the Komati PV sites, with access gates.

— Temporary laydown area, occupying a footprint up to approx. 10 hectares. The laydown area will be used during construction and rehabilitated thereafter.

— Temporary concrete batching plant, occupying a footprint up to approx. 1 hectare. The concrete batching plant area will be used during construction and rehabilitated thereafter.

— Temporary site construction office area, occupying a footprint up to approx. 1 hectare. This area will accommodate the offices for construction contractors during construction and rehabilitated thereafter.

The Project includes one locality Option (see Figure 2):
Option 1: An area blocked in green and red. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Van Dyksdrift in the Mpumalanga Province of South Africa. The GPS coordinates for the power plant is: 26.0896668 S, 29.4655907 E.
The approximate size of the site is 200-250 hectares.

<u>Rezoning/ and or subdivision of land:</u> No.
<u>Name of Developer and Consultant:</u> Eskom and Anton Pelser Archaeological Consulting cc.
<u>Terms of reference:</u> Dr H. Fourie is a palaeontologist commissioned to do a palaeontological impact assessment: field study to ascertain if any palaeontological sensitive material is present in the development area. This study will advise on the impact on fossil heritage mitigation or conservation necessary, if any.
<u>Short *Curriculum vitae* (***1ai,aii***):</u> Dr Fourie obtained a Ph.D from the Bernard Price Institute for Palaeontological Research (now ESI), University of the Witwatersrand. Her undergraduate degree is in Geology and Zoology. She specialises in vertebrate morphology and function concentrating on the Therapsid Therocephalia. At present she is curator of a large fossil invertebrate collection, Therapsids, dinosaurs, amphibia, fish, reptiles, and plants at Ditsong: National Museum of Natural History. For the past 14 years she carried out field work in the North West, Western Cape, Northern Cape, Eastern Cape, Limpopo, Mpumalanga, Gauteng and Free State Provinces. Dr Fourie has been employed at the Ditsong: National Museum of Natural History in Pretoria (formerly Transvaal Museum) for 26 years.
<u>Legislative requirements:</u> South African Heritage Resources Agency (SAHRA) for issue of permits if necessary. National Heritage Resources Act (Act No. 25 of 1999). An electronic copy of this report must be supplied to SAHRA.

E. Description of property or affected environment

Location and depth:
The proposed Eskom Komati Power Station Solar PV and BESS ESIA will be situated in the City of eMalahleni Metropolitan Municipality, Nkangala District Municipality, Mpumalanga Province on the Farm: Goedehoop 46-IQ.

Depth is determined by the related infrastructure to be developed and the thickness of the formation in the development area as well as depth of the foundations, footings and channels to be developed. Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to determine due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot. Geological maps do not provide depth or superficial cover, it only provides mappable surface outcrops. The depth can be verified with test pit results or drill cores.

Figure 2: Google Earth image showing lay-out (Geovicon).

F. Description of the Geological Setting

Description of the rock units:
Large areas of the southern African continent are covered by the Karoo Supergroup (Figure 3). It covers older geological formations with an almost horizontal blanket. Several basins are present with the main basin in the central part of south Africa and several smaller basins towards Lebombo, Springbok Flats and Soutpansberg. An estimated age is 150 – 180 Ma. And a maximum thickness of 7000 m is reached in the south. Three formations overlie the Beaufort Group, they are the Molteno, Elliot and Clarens Formations. The Elliot Formation is also known as the Red Beds and the old Cave Sandstone is known as the Clarens Formation. At the top is the Drakensberg Basalt Formation with its pillow lavas, pyroclasts, etc. (Kent 1980, Snyman 1996). The Beaufort Group is underlain by the Ecca Group which lies on the Dwyka Group.

Figure 3: Geology of the development area **(1h)**.

Legend to Figure and short explanation.

Jd – Dolerite (pink). Jurassic.

Pv – Sandstone, shale and grit with coal and oil-shale beds (light brown). Vryheid Formation, Ecca Group, Karoo Supergroup. Permian.

…… – (black) Lineament (Possible dyke).

--f— Fault.

┴5˚ - Strike and dip.

□ – Approximate position of solar plant (blocked in black).

<u>*Mining Activities on Figure:*</u>

C – Coal.

Mining past and present have an influence on the project.

Dolerite dykes (Jd) occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. Permian sediments are extensively intruded and thermally metamorphosed (baked) by sub-horizontal sills and steeply inclined dykes of the Karoo Dolerite Suite. These early Jurassic (183 Ma) basic intrusions baked the adjacent mudrocks and sandstones to form splintery hornfels and quartzites respectively. Thermal metamorphism by dolerite intrusions tends to reduce the palaeontological heritage potential of the adjacent sediments.

The Ecca Group is early to mid-Permian (545-250 Ma) in age. Sediments of the Ecca group are lacustrine and marine to fluvio-deltaic (Snyman 1996). The Ecca group is known for its coal (mainly the Vryheid Formation) (five coal seams) and uranium. Coalfields formed due to the accumulation of plant material in shallow and large swampy deltas (see Appendix 1). The Ecca Group conformably overlies the Dwyka Group and is conformably overlain by the Beaufort Group, Karoo Supergroup. It consists essentially of mudrock (shale), but sandstone-rich units occur towards the margins of the present main Karoo basin in the south, west and north-east, with coal seams also being present in the north-east (Kent 1980, Johnson 2009).

The Vryheid Formation is named after the type area of Vryheid-Volksrust. In the north-eastern part of the basin the Vryheid Formation thins and eventually wedges out towards the south, southwest and west with increasing distance from its source area to the east and northeast (Johnson 2009). The Vryheid Formation consists essentially of sandstone, shale, and subordinate coal beds, and has a maximum total thickness of 500 m. It forms part of the Middle Ecca (Kent 1980). This formation has the largest coal reserves in South Africa. The pro-delta sediments are characterised by trace and plants fossils (Snyman 1996).

Coal has always been the main energy source in industrial South Africa. It is in Mpumalanga, south of the N4, that most of the coal-fired power stations are found. Eskom is by far the biggest electricity generator in Africa. Thick layers of coal just below the surface are suited to open-cast mining and where the overlying sediments are too thick, shallow underground mining. In 2003, coal was South Africa's third most valuable mineral commodity and is also used by Sasol for fuel- and chemicals-from-coal (Norman and Whitfield 2006). Grodner and Cairncross (2003) proposed a 3-D model of the Witbank Coalfield to allow easy evaluation of the sedimentary rocks, both through space and time. Through this, one can interpret the environmental conditions present at the time of deposition of the sediments. This can improve mine planning and mining techniques. The Vryheid Formation is underlain by the Dwyka Group and is gradually overlain by mudstones (and shale) and sandstones of the Volksrust Formation. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

Ecca rocks are stable and lend themselves well to developments. It is only unstable in or directly above mining activities (Snyman 1996). Dolerite dykes occur throughout the Karoo Supergroup. Structural geological features such as dykes and faults can have a measurable influence on ground water flow and mass transport. The Vryheid Formation sediments may attain a thickness of 120 – 140 m. A typical profile includes soil and clay, sandstone and siltstone, shale, 2 upper seam, shale, 2 seam, sandstone, no 1 seam, shale and dolomite at the bottom. The typical colours for the Vryheid Formation are grey and yellow for the sediments and black for the coal seam. The thickness of the grey shale can vary and this is interlayered with the also variable yellow sandstone and coal seams.

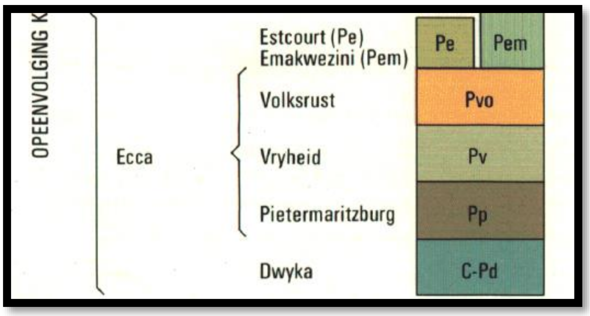

Figure 4: Lithostratigraphic column of the development area (Vryheid 2730).

Field Observation: Will be conducted at a later stage.

It is recommended to wait for the response from SAHRA on the Phase 1: Field Study (this report). SAHRA protocol must be followed.

G. Background to Palaeontology of the area

Summary: When rock units of moderate to very high palaeontological sensitivity are present within the development footprint, a desk top and or field scoping (survey) study by a professional palaeontologist is usually warranted. The main purpose of a field scoping (survey) study would be to identify any areas within the development footprint where specialist palaeontological mitigation during the construction phase may be required (SG 2.2 SAHRA AMPHOB, 2012).

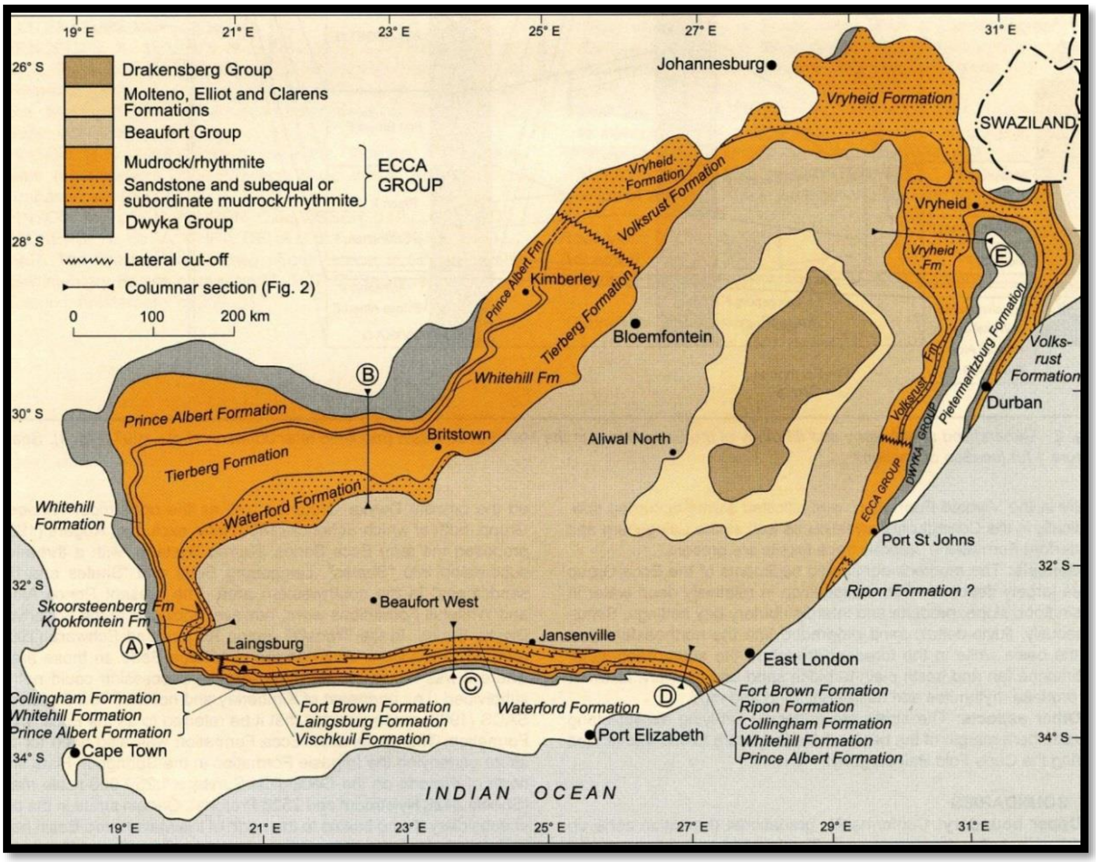

Figure 12: Extent of the Karoo Supergroup (Johnson 2009).

The Ecca Group, Vryheid Formation (Figure 12) may contain fossils of diverse non-marine trace, *Glossopteris* flora, mesosaurid reptiles, palaeoniscid fish, marine invertebrates, insects, and crustaceans (Johnson 2009). *Glossopteris* trees rapidly colonised the large deltas along the northern margin of the Karoo Sea. Dead vegetation accumulated faster than it could decay, and thick accumulations of peat formed, which were ultimately converted to coal. It is only in the northern part of the Karoo Basin that the glossopterids and cordaitales, ferns, clubmosses and horsetails thrived (McCarthy and Rubidge 2005).

The Glossopteris flora is thought to have been the major contributor to the coal beds of the Ecca. These are found in Karoo-age rocks across Africa, South America, Antarctica, Australia and India. This was one of the early clues to the theory of a former unified Gondwana landmass (Norman and Whitfield 2006).

Fossils in South Africa mainly occur in rocks of sedimentary nature and not in rocks from igneous or metamorphic nature. Therefore, if there is the presence of Karoo Supergroup strata the palaeontological sensitivity is generally **LOW** to **VERY HIGH**.

Table 1: Taken from Palaeotechnical Report (Groenewald 2012) (**1cA)**.

Vryheid (Pv)		Light grey coarse- to fine-grained sandstone and siltstone. Dark coloured siltstone due to presence of carbon enrichment and coal beds	Abundant plant fossils of *Glossopteris* and other plants. Trace fossils. The reptile *Mesosaurus* has been found in the southern part of the Karoo Basin

Table 2: Criteria used (Fossil Heritage Layer Browser/SAHRA) **(1cB)**:

Rock Unit	Significance/vulnerability	Recommended Action
Vryheid Formation	**Very High**	Field assessment and protocol for finds is required

Databases and collections: Ditsong: National Museum of Natural History. Evolutionary Studies Institute, University of the Witwatersrand (ESI).
Impact: **VERY HIGH** for the Vryheid Formation, Karoo Supergroup. There are significant fossil resources that may be impacted by the development (mudstone, shale) and if destroyed are no longer available for scientific research or other public good (Almond, *et al.* 2009).

The Project includes one locality Option (see Figure 2) (**1f,j)** The palaeontological sensitivity is as stated above.
Option 1: An area blocked in green and red. The Komati Power Station is situated about 37km from Middelburg, 43km from Bethal and 40km from Witbank, via Van Dyksdrift in the Mpumalanga Province of South Africa. The GPS coordinates for the power plant is: 26.0896668 S, 29.4655907 E.
The approximate size of the site is 200-250 hectares.

All the land involved in the development was assessed **(ni,nii)** and none of the property is unsuitable for development (see Recommendation B).

H. Description of the Methodology (1e)

The palaeontological impact assessment study was undertaken in June 2022. A Phase 1: Field Survey of the affected portion includes photographs (in 7.1 mega pixels) taken of the site with a digital camera (Canon PowerShot A470). Additionally, Google Maps will be accessed on a cellular phone/tablet for navigation. A Global Positioning System (GPS) (Garmin eTrex 10) is used to record fossiliferous finds and outcrops (bedrock) when the area is not covered with topsoil, subsoil, overburden, vegetation, grassland, trees or waste. The survey did identify the Karoo Supergroup. A literature survey is included and the study relied heavily on geological maps.

SAHRA document 7/6/9/2/1 (SAHRA 2012) requires track records/logs from archaeologists not palaeontologists as palaeontologists concentrate on outcrops which may be recorded with a GPS. Isolated occurrences of rocks usually do not constitute an outcrop. Fossils can occur in dongas, as nodules, in fresh rock exposures, and in riverbeds. Finding fossils require the experience and technical knowledge of the professional palaeontologist, but that does not mean that an amateur can't find fossils. The geology of the region is used to predict what type of fossil and zone will be found in any particular region. Archaeozoologists concentrate on more recent fossils in the quaternary and tertiary deposits.

Assumptions and Limitations (**1i**):-
The accuracy and reliability of the report **may be** limited by the following constraints:

1. Most development areas have never been surveyed by a palaeontologist or geophysicist.
2. Variable accuracy of geological maps and associated information.
3. Poor locality information on sheet explanations for geological maps.
4. Lack of published data.

5. Lack of rocky outcrops.
6. Inaccessibility of site.
7. **Insufficient data** from developer and exact lay-out plan for all structures.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include:

1. Recommendations for the future of the site.
2. Description of work done (including number of people and their responsibilities.
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan.
6. Possible declaration as a heritage site or Site Management Plan.

The National Heritage Resources Act No. 25 of 1999 further prescribes.

Act No. 25 of 1999. National Heritage Resources Act, 1999.
National Estate: 3 (2) (f) archaeological and palaeontological sites,
(i)(1) objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens,
Heritage assessment criteria and grading: (a) Grade 1: Heritage resources with qualities so exceptional that they are of special national significance;
(b) Grade 2: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and (c) Grade 3: Other heritage resources worthy of conservation.
SAHRA is responsible for the identification and management of Grade 1 heritage resources.
Provincial Heritage Resources Authority (PHRA) identifies and manages Grade 2 heritage resources.
Local authorities identify and manage Grade 3 heritage resources.

No person may damage, deface, excavate, alter, remove from its original position, subdivide or change the planning status of a provincially protected place or object without a permit issued by a heritage resources authority or local authority responsible for the provincial protection.
Archaeology, palaeontology and meteorites: Section 35.
(2) Subject to the provisions of subsection (8) (a), all archaeological objects, palaeontological material and meteorites are the property of the State.
(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

I. Description of significant fossil occurrences

All Karoo Supergroup geological formations are ranked as **LOW** to **VERY HIGH**, and here the impact is potentially **VERY HIGH** for the Vryheid Formation.

Fossils likely to be found are mostly plants (Appendix 1) such as '*Glossopteris* flora' of the Vryheid Formation. The aquatic reptile *Mesosaurus* and fossil fish may also occur with marine invertebrates, arthropods and insects. Trace fossils can also be present. During storms a great variety of leaves, fructifications and twigs accumulated and because they were sandwiched between thin films of mud, they were preserved to bear record of the wealth and the density of the vegetation around the pools. They make it possible to reconstruct the plant life in these areas and wherever they are found, they constitute most valuable palaeobotanical records (Plumstead 1963) and can be used in palaeoenvironmental reconstructions (Appendix 1).

Details of the location and distribution of all significant fossil sites or key fossiliferous rock units are often difficult to be determined due to thick topsoil, subsoil, overburden and alluvium. Depth of the overburden may vary a lot.

The threats are:-

- Earth moving equipment/machinery (front end loaders, excavators, graders, dozers) during construction,
- The sealing-in or destruction of fossils by development, vehicle traffic, prospecting, mining, and human disturbance. See Description of the Geological Setting (F) above.

J. Recommendation

a. There is no objection (see Recommendation B) to the development, it was necessary to request a Phase 1 Palaeontological Impact Assessment: Field Study to determine whether the development will affect fossiliferous outcrops as the palaeontological sensitivity of the area is **VERY HIGH**. A Phase 2 Palaeontological Mitigation is only required if the Phase 1 Palaeontological Assessment identified a fossiliferous formation (Karoo Supergroup) and fossils or if fossils are found during construction. Protocol is attached (Appendix 2).
b. This project may benefit the community, will create short- and long-term employment, the life expectancy of the community, the growth of the community, and social development in general.

c. Preferred choice: Locality Option 1 is preferred and possible.
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting SAHRA must be notified. All construction activities must be stopped, a 30 m no-go barrier constructed and a palaeontologist should be called in to determine proper mitigation measures.
e. Consultation with parties was not necessary **(1o,p,q).**
f. This report must be submitted to SAHRA/PHRA together with the Heritage Impact Assessment Report.

Sampling and collecting:
Wherefore a permit is needed from the South African Heritage Resources Agency (SAHRA / PHRA).

a. Objections: Cautious. See heritage value and recommendation.
b. Conditions of development: See Recommendation.
c. Areas that may need a permit: Yes.
d. Permits for mitigation: **Needed from SAHRA/PHRA prior to Mitigation**.

K. Conclusions

a. All the land involved in the development was assessed and none of the property is unsuitable for development (see Recommendation B).
b. All information needed for the Phase 1 Palaeontological Impact Assessment and Field Study was provided by the Consultant. All technical information was provided by Anton Pelser Archaeological Consulting cc.
c. Areas that would involve mitigation and may need a permit from the South African Heritage Resources Agency are discussed.
d. The following should be conserved: if any palaeontological material is exposed during clearing, digging, excavating, drilling or blasting, SAHRA must be notified. All development activities must be stopped, a 30 m barrier constructed, and a palaeontologist should be called in to determine proper mitigation measures.
e. Condition in which development may proceed: It is further suggested that a Section 37(2) agreement of the Occupational, Health and Safety Act 85 of 1993 is signed with the relevant contractors to protect the environment (fossils) and adjacent areas as well as for safety and security reasons.

L. Bibliography

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Declaration (1b)

I, Heidi Fourie, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project for which I was appointed to do a palaeontological assessment. There are no circumstances that compromise the objectivity of me performing such work.

I accept no liability, and the client, by receiving this document, indemnifies me against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the use of the information contained in this document.

It may be possible that the Phase 1: Field Study may have missed palaeontological resources in the project area as outcrops are not always present or visible while others may lie below the overburden of earth and may only be present once development commences.

This report may not be altered in any way and any parts drawn from this report must make reference to this report.

<u>POPI Act 2013 Statement</u>

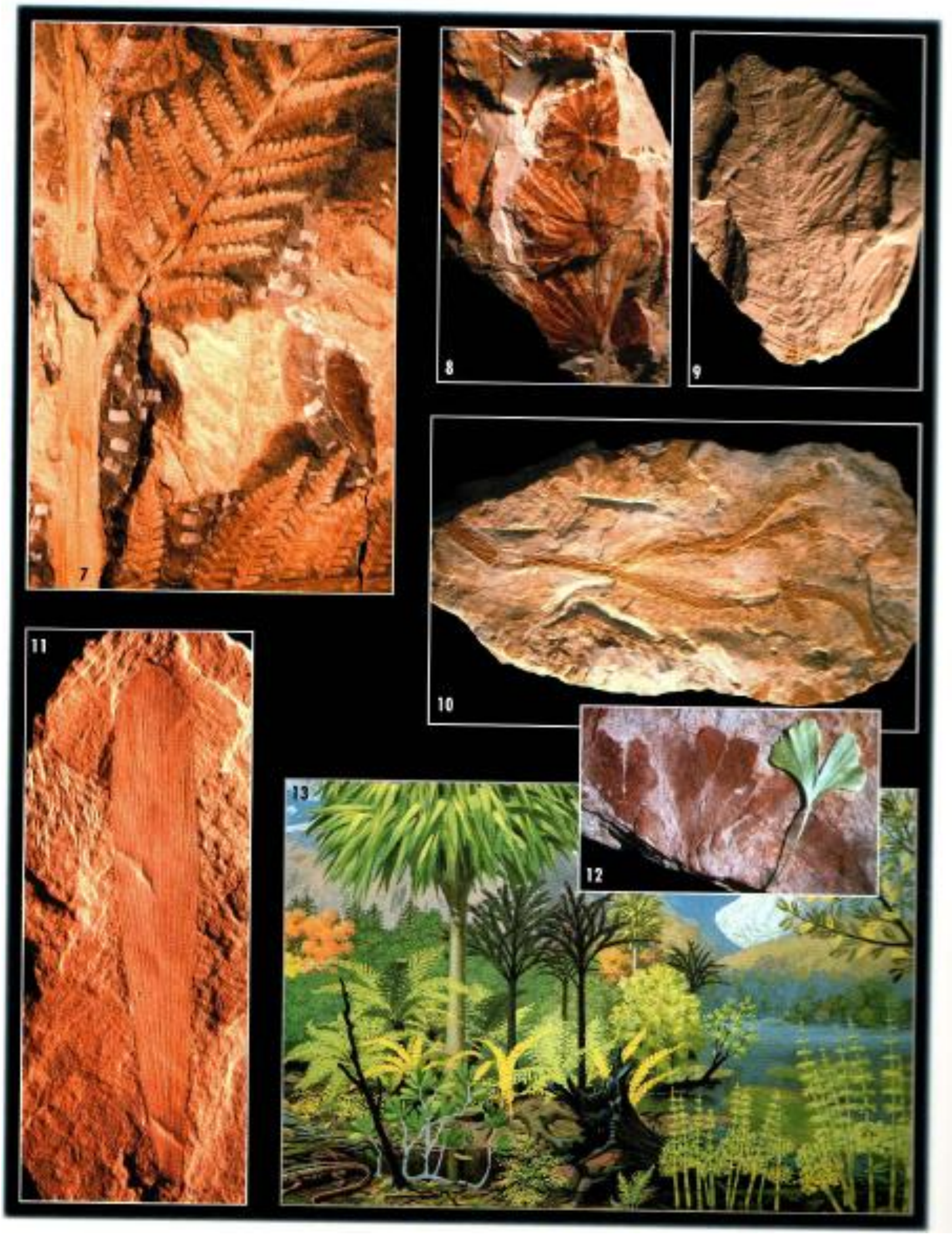
It provides that everyone has the right to privacy and includes a right to protection against the unlawful collection, retention dissemination and use of personal information contained in this document and pertains to the phone and contact details, signature and contents.

As per the Declaration Section none of the information may be shared without the permission of the author.

The report will be signed as soon as comments have been included.

Heidi Fourie
2022/06/20

Appendix 1: Example of Vryheid Formation Fossils (MacRae 1999)



Appendix 2: **Protocol for Chance Finds and Management Plan (1k,l,m)**

This section covers the recommended protocol for a Phase 2 Mitigation process as well as for reports where the Palaeontological Sensitivity is **LOW**; this process guides the palaeontologist / palaeobotanist on site and should not be attempted by the layman / developer. As part of the Environmental Authorisation conditions, an Environmental Control Officer (ECO) will be appointed to oversee the construction activities in line with the legally binding Environmental Management Programme (EMPr).

- The EMPr already covers the conservation of heritage and palaeontological material that may be exposed during construction activities.

- For a chance find, the protocol is to immediately cease all construction activities, construct a 30 m no-go barrier, and contact SAHRA for further investigation. Construction workers must be informed that this is a no-go area.
- It is recommended that the EMPr be updated to include the involvement of a palaeontologist for pre-construction training of the ECO or during the digging and excavation phase of the development.
- The ECO must visit the site after clearing, drilling, excavations and blasting and keep a photographic record.
- The developer may be required to survey the areas affected by the development and indicate on plan where the construction / development / mining will take place. Trenches may have to be dug to ascertain how deep the sediments are above the bedrock (can be a few hundred metres). This will give an indication of the depth of the topsoil, subsoil, and overburden, if need be trenches should be dug deeper to expose the interburden.

Mitigation will involve recording, rescue and judicious sampling of the fossil material present in the layers sandwiched between the geological / coal layers. It must include information on number of taxa, fossil abundance, preservational style, and taphonomy. This can only be done during mining or excavations. In order for this to happen, in case of coal mining operations, the process will have to be closely scrutinised by a professional palaeontologist / palaeobotanist to ensure that only the coal layers are mined and the interlayers (siltstone and mudstone) are surveyed for fossils or representative sampling of fossils are taking place.

The palaeontological impact assessment process presents an opportunity for identification, access and possibly salvage of fossils and add to the few good plant localities. Mitigation can provide valuable onsite research that can benefit both the community and the palaeontological fraternity.

A Phase 2 study is very often the last opportunity we will ever have to record the fossil heritage within the development area. Fossils excavated will be stored at a National Repository.

A Phase 2 Palaeontological Impact Assessment: Mitigation will include (SAHRA) -

1. Recommendations for the future of the site.
2. Description and purpose of work done (including number of people and their responsibilities).
3. A written assessment of the work done, fossils excavated, not removed or collected and observed.
4. Conclusion reached regarding the fossil material.
5. A detailed site plan and map.
6. Possible declaration as a heritage site or Site Management Plan.
7. Stakeholders.
8. Detailed report including the Desktop and Phase 1 study information.
9. Annual interim or progress Phase 2 permit reports as well as the final report.
10. Methodology used.

Mitigation involves planning the protection of significant fossil sites, rock units or other palaeontological resources and/or excavation, recording and sampling of fossil heritage that might be lost during development, together with pertinent geological data. The mitigation may take place before and / or during the construction phase of development. The specialist will require a Phase 2 mitigation permit from the relevant Heritage Resources Authority before a Phase 2 may be implemented.

The Mitigation is done in order to rescue representative fossil material from the study area to allow and record the nature of each locality and establish its age before it is destroyed and to make samples accessible for future research. It also interprets the evidence recovered to allow for education of the public and promotion of palaeontological heritage.

Should further fossil material be discovered during the course of the development (*e. g.* during bedrock excavations), this must be safeguarded, where feasible *in situ,* and reported to a palaeontologist or to the Heritage Resources authority. In situations where the area is considered palaeontologically sensitive (*e. g.* Karoo Supergroup Formations, ancient marine deposits in the interior or along the coast) the palaeontologist might need to monitor all newly excavated bedrock. The developer needs to give the palaeontologist sufficient time to assess and document the finds and, if necessary, to rescue a representative sample.

When a Phase 2 palaeontological impact study is recommended, permission for the development to proceed can be given only once the heritage resources authority has received and approved a Phase 2 report and is satisfied that (a) the palaeontological resources under threat have been adequately recorded and sampled, and (b) adequate development on fossil heritage, including, where necessary, *in situ* conservation of heritage of high significance. Careful planning, including early consultation with a palaeontologist and heritage management authorities, can minimise the impact of palaeontological surveys on development projects by selecting options that cause the least amount of inconvenience and delay.

Three types of permits are available; Mitigation, Destruction and Interpretation. The specialist will apply for the permit at the beginning of the process (SAHRA 2012).

The Palaeontological Society of South Africa (PSSA) does not have guidelines on excavating or collecting, but the following is suggested:

1. The developer needs to clearly stake or peg-out (survey) the areas affected by the mining/ construction/ development operations and dig representative trenches and if possible supply geological borehole data. When the route is better defined, it is recommended that a specialist undertake a 'walk through' of the entire road as well as construction areas, including camps and access roads, prior to the start of any construction activities, this may be done in sections.
2. When clearing vegetation, topsoil, subsoil or overburden, hard rock (outcrop) is found, the contractor needs to stop all work.
3. A Palaeobotanist / palaeontologist (contact SAHRIS for list) must then inspect the affected areas and trenches for fossiliferous outcrops / layers. The contractor / developer may be asked to move structures, and put the development on hold.
4. If the palaeontologist / palaeobotanist is satisfied that no fossils will be destroyed or have removed the fossils, development and removing of the topsoil can continue.
5. After this process the same palaeontologist / palaeobotanist will have to inspect and offer advice through the Phase 2 Mitigation Process. Bedrock excavations for footings may expose, damage or destroy previously buried fossil material and must be inspected.
6. When permission for the development is granted, the next layer can be removed, if this is part of a fossiliferous layer, then with the removal of each layer of sediment, the palaeontologist / palaeobotanist must do an investigation (a minimum of once every week).
7. At this stage the palaeontologist / palaeobotanist in consultation with the developer / mining company must ensure that a further working protocol and schedule is in place. Onsite training should take place, followed by an annual visit by the palaeontologist / palaeobotanist.

Fossil excavation if necessary, during Phase 2:

1. Photography of fossil / fossil layer and surrounding strata.
2. Once a fossil has been identified as such, the task of extraction begins.

3. It usually entails the taking of a GPS reading and recording lithostratigraphic, biostratigraphic, date, collector and locality information.
4. Using Paraloid (B-72) as an adhesive and protective glue, parts of the fossil can be kept together (not necessarily applicable to plant fossils).
5. Slowly chipping away of matrix surrounding the fossil using a geological pick, brushes and chisels.
6. Once the full extent of the fossil / fossils is visible, it can be covered with a plaster jacket (not necessarily applicable to plant fossils).
7. Chipping away sides to loosen underside.
8. Splitting of the rock containing palaeobotanical material should reveal any fossils sandwiched between the layers.

This document forms part of the Environmental Monitoring Programme. For practical reasons a palaeontologist/palaeobotanist may be required to be on site as predetermined. If any fossil material is discovered then a Phase 2 rescue operation may be necessary, and a permit will be required.

The South African Heritage Resources Agency has the following documents in place:
Guidelines to Palaeontological Permitting policy.
Minimum Standards: Palaeontological Component of Heritage Impact Assessment reports.
Guidelines for Field Reports.
Palaeotechnical Reports (Eastern Cape, North West, Northern Cape, Mpumalanga, Gauteng, Western Cape, Free State, Kwazulu Natal, and Limpopo)

Appendix 3:
Table 2: Listing points in Appendix 6 of the Act and position in Report (bold in text).

Section in Report	Point in Act	Requirement
B	1(c)	Scope and purpose of report
B	1(d)	Duration, date and season
B	1(g)	Areas to be avoided
D	1(ai)	Specialist who prepared report
D	1(aii)	Expertise of the specialist
F Figure 3	1(h)	Map
F, B	1(ni)(iA)	Authorisation
F, B	1(nii)	Avoidance, management, mitigation and closure plan
G Table 1	1(cA)	Quality and age of base data
G Table 2	1(cB)	Existing and cumulative impacts
G, D	1(f)	Details or activities of assessment
G	1(j)	Description of findings
H	1(e)	Description of methodology
H	1(i)	Assumptions
J	1(o)	Consultation
J	1(p)	Copies of comments during consultation
J	1(q)	Information requested by authority
Declaration	1(b)	Independent declaration
Appendix 2	1(k)	Mitigation included in EMPr
Appendix 2	1(l)	Conditions included in EMPr
Appendix 2	1(m)	Monitoring included in EMPr
D	2	Protocol or minimum standard

Appendix 4: Impact Statement

The development footprint is situated on the Vryheid Formation (Pv) of the Ecca Group, Karoo Supergroup with a Very High palaeontological sensitivity. The nature of the impact is the destruction of Fossil Heritage. Loss of fossil heritage will have a negative impact. The extent of the impact only extends in the region of the development activity footprint and may include transport routes. The expected duration of the impact is assessed as potentially permanent. The intensity/magnitude of the impact is high as it is destructive. The probability of the impact occurring will be definite and will occur regardless of preventative measures.

In the absence of mitigation procedures (should fossil material be present within the affected area) the damage or destruction of any palaeontological materials will be irreversible. With Mitigation the impact will be moderate and the cumulative impact is low. Impacts on palaeontological heritage during the mining/construction and premining/preconstruction phase could potentially occur and is regarded as having a high possibility. The significance of the impact occurring will be as below:

S= (2+5+8)5

75 High (>60).