VLAKFONTEIN SOLAR PV1 : ENVIRONMENTAL IMPACT ASSESSMENT TABLE

Impacts are evaluated and assessed in terms of the following criteria:

Extent of impact	***Explanation of extent***
Site	*Impacts limited to construction site and direct surrounding area*
Local	*Impacts affecting environmental elements within the local area / district*
Regional	*Impacts affecting environmental elements within the province*
National	*Impacts affecting environmental elements on a national level*

Duration of impact	***Explanation of duration***
Short term	*0 - 5 years. The impact is reversible in less than 5 years.*
Medium term	*5 - 15 years. The impact is reversible in less than 15 years.*
Long term	*>15 years, but where the impacts will cease if the project is decommissioned*
Permanent	*The impact will continue indefinitely and is irreversible.*

Probability of impact	***Explanation of Probability***
Unlikely	*The chance of the impact occurring is extremely low*
Possible	*The impact may occur*
Probable	*The impact will very likely occur*
Definite	*Impact will certainly occur*

Reversibility of impact	***Explanation of Reversibility Ratings***
Low	*The affected environment will not be able to recover from the impact - permanently modified*
Medium	*The affected environment will only recover from the impact with significant intervention*
High	*The affected environmental will be able to recover from the impact*

Significance of impact	***Explanation of Significance***
None	*There is no impact at all*
Low	*Impact is negligible or is of a low order and is likely to have little real effect*
Moderate	*Impact is real but not substantial*
High	*Impact is substantial*
Very high	*Impact is very high and can therefore influence the viability of the project*

Impact Assessment Tables

The impact assessment tables are provided in the pages below.

DESIGN AND PRE-CONSTRUCTION PHASE

IMPACT ON AGRICULTURAL POTENTIAL LAND DURING THE DESIGN PHASE

Impact Description

The impact on agricultural potential land should be considered in context with the following:

- The only agricultural land that will be used by the developments has limited agricultural production potential. The layout of the facility has deliberately avoided all higher potential land within the wider assessed area. It will only utilise land that was identified as having insufficient land capability for viable and sustainable crop production and is therefore only good enough for grazing. There is not a scarcity of such agricultural land in South Africa and it is therefore considered to be below the threshold for being prioritised for conservation as agricultural production land.
- The proposed developments offer positive impact on agriculture by way of improved financial security for farming operations, as well as security benefits against stock theft and other crime.
- The PV panels will not totally exclude agricultural production. The area can still be used to graze sheep that will, in addition, be protected against stock theft within the security area of each facility.
- The loss of agricultural potential by occupation of land is not permanent. The land will become fully available again for agricultural production once the proposed activity ceases.
- The proposed development poses a low risk in terms of causing soil degradation, which can be adequately and fairly easily managed by standard, best practice mitigation management actions.
- The proposed developments are within a REDZ, which is an area that has specifically been designated within South Africa for the prioritisation of renewable energy development. The designation of the REDZ has taken into account the country's need to balance renewable energy development against the need to ensure the conservation of land required for agricultural production and national food security.
- The proposed development will also have the wider societal benefits of generating additional income and employment in the local economy.
- It will contribute to the country's need for energy generation, particularly renewable energy that has lower environmental and agricultural impact, on a national scale, than existing, coal powered energy generation.

Cumulative impact description

- The trend and development of solar farms in the macro areas is already evident in the numerous applications for solar farms in the macro area currently with the DFFE or already authorised. The precedent has already been created as a result from the existing energy crisis in the country and the potential of the macro area for solar farm development.

Mitigation

- Only land where no high agricultural potential exists must be used for the purpose of solar farm development.
- A “No Objection” letter was obtained from DALRRD for the Vlakfontein Solar PV1 (Pty) Ltd, for the Change in Land Use for the purpose of renewable energy infrastructure (Solar PV farm) and purposes incidental thereto.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Development of a solar farm on land with agricultural potential land	Site	Long Term	Definite	High	Low	Low

Impact on Irreplaceable Resources (*after* mitigation)	~~Yes~~	No

Cumulative impact rating (*after* mitigation) If high, please explain	Low	~~Medium~~	~~High~~

RISK OF FAILURE OF STRUCTURES DURING DESIGN PHASE

Impact Description

Poor design and non-compliance with relevant legal requirement will result in structural failures and subsequent leaks with resultant negative impact that include:

- electrocution of personnel
- veld fires
- damage to property
- groundwater pollution

This impact is associated with the substation; the BESS; the diesel storage facility as well as the construction of new roads and road upgrades if and where applicable.

Cumulative impact description

- Impact will be severe if any personnel member is electrocuted as a result of negligence and/or structural failure.
- Impact could be significant since it could extend to adjacent properties (i.e. veld fires) and could cause damage to other solar facilities and farm structures and the macro area in terms of disruption of electricity supply.
- Failure of the diesel tank installation and the BESS will cause groundwater pollution.

Mitigation

- Continuous communication should take place with Eskom to ensure compliance with their most recent policies, design standards and specifications. The following Eskom policies must be adhered to and compliance must form part of the conditions of the EMPr :
    - Renewable Energy Generation Plant Setbacks to Eskom Infrastructure, dated 15 September 2020
    - Standard Eskom requirements for work in or near Eskom servitudes
    - LES and SE inputs for new substations to IPP requirement, dated 3 March 2022
- A Safety Officer must be appointed to ensure compliance with the Occupational Health and Safety Act, No 181 of 1993, as amended (Responsibilities must include the provision of Personal Protective Equipment, the undertaking of safety inspections, safety awareness training, etc.)
- A Fire Management Plan must be compiled.

Diesel Storage Facility (Design considerations)-

- Compliance with SANS 10089-1:2008; Part 1: Storage and distribution of petroleum products in above-ground installations must be done.
- Provision must be made for a thick reinforced concrete spillage containment slab laid to fall to a catch pit connected to an oil/grease separator
- The storage tank must be fully contained within the bunded area to contain spillage of hydrocarbons and contaminated rainwater and prevent the ingress of hydrocarbon spillages and contaminated rainwater into the ground or surface water.
- Spillages from the tank bund must be retained and released in a controlled manner to an oil separator.
- Allowance must be made for the removal of hazardous substances to an appropriate waste facility.
- Spillages of hydrocarbons and contaminated water must be collected from the following areas :
    - Diesel tank bunded area
    - Product receiving station and receiving pipelines
    - Vehicle servicing area
- Hydrocarbon (oil, diesel, petrol) waste as well as hydrocarbon containing material must be regarded as hazardous waste and separated from general waste.
- All hazardous substances at the site must be adequately stored and accurately identified, recorded and labelled prior to removal to a registered hazardous waste facility.

BESS

- State-of-the-art technology should be used, i.e., not old technology as it presents higher risks.
- The design should be subject to a full Hazard and Operability Study (HAZOP) prior to commencement of procurement. HAZOP is s detailed technical systematic study that looks at the intricacies of the design, the control system, the emergency system etc. and how these may fail under abnormal operating conditions. Additional safeguards may be suggested by the team doing the study.

Geotechnical Studies

A geotechnical study must be undertaken to confirm the geotechnical constraints associated with the site. Appropriate specifications in terms of materials and foundations must be provided to inform the detail design of all the facilities and road upgrades. Specific requirement in terms of foundations must be supplied.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Risk of failure of structures	Local	Short Term	Possible	High	Medium to Very High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON HERITAGE AND VISUAL RESOURCES DURING THE DESIGN PHASE

Impact Description

<u>Visual Impact</u>

- The proposed development construction would result in a partial loss of rural sense of place from the removal of vegetation, the movement of large earth moving machinery and the construction vehicles.
- Windblown dust generated from vegetation removal, as well as dust from moving vehicles.
- Potential soil erosion from temporary access roads and laydown areas.
- Windblown litter from the laydown and construction sites.
- Lights at night for security detracting from the current, semi-dark rural sense of place.

Consider in context with the following:

Visually, the regional landscape has a high absorption capacity. There are many visually intrusive artificial features present in the macro areas which will serve to detract and diminish the visual impact presented by the new PV installations and supporting infrastructure. These include numerous powerlines, converging on a large regional Mercury Transmission Substation, mining features (mine dump) and agro-industrial features. While the reflective nature of the PV panels may draw attention to the installations, visual intensity from receptors located over 6km from the site will further be diminished by hazy atmospheric conditions which tend to prevail during the highveld winters.

Heritage Impact

- No archaeological sites had been identified.

Cumulative impact description

- Degradation of landscape resources that currently have some visual appeal where not exposed to the surrounding mining landscapes.
- Change in land use from rural agricultural to that of a semi-industrial landscape.

Mitigation

Visual

- Retaining of a 30m buffer on the rural roads as a No-go development area. The exception is the areas within 1.2km of the Mercury Substation where no setback buffer is required as the landscape character is already degraded.
- Retaining existing medium-sized trees within the setback buffer.
- The PV area fencing should be placed around the development area and not extend to the road. The buffer area should be retained for agricultural land uses to reduce grass growth that could become a dry season fire risk.
- Exclusion of wetland and drainage lines (and associated areas).
- Exclusion of development of steep slopes greater than 1:10m where applicable.
- The buildings should be painted a grey-brown colour.
- Fencing around the laydown and office complex areas should be simple, diamond shaped (to catch wind-blown litter) and appear transparent from a distance. The fences should be checked monthly for the collection of litter caught on the fence.
- Fencing should be located around the PV panels and appear transparent at a distance and not extended to the road areas.
- Lighting needs to be restrained and should be limited to strategic nodes/ office areas. Fencing should have not security lights at night.
- No overhead lighting should be utilised.
- Signage from the roads needs to be understated.

Heritage

- It was recommended that tree avenues located along roads, access routes and farm boundaries be retained as far as possible.

- A portion of the tree plantation located within 200m of the marked farm homestead should also be retained in order to shield the existing homestead from the PV facilities and retain some sense of place.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape Character	Site	Short Term	Probable	High	High	Medium
Visual intrusion from Key Observation Points	Site	Short Term	Possible	High	High	Medium

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

RISK OF EROSION TO BE ADDRESSED DURING THE DESIGN PHASE

Impact Description

- It is necessary to ensure that measures are in place to prevent uncontrolled stormwater with subsequent erosion causing damage to PV, electrical infrastructure and roads and a loss of soil.
- Appropriate onsite drainage is required in context with the following:
    - High value of BESS, PV panels, roads, ect..
    - The severe consequences in not reaching operational targets and the potential of contractual penalties and loss of income.
    - The strategic importance of power supply into the ESKOM distribution network.
- Poor stormwater planning where trucks are serviced and diesel is stored could result in groundwater contamination.

Cumulative impact description

The development footprint of approximately 284ha is significant in size; however, consideration must be taken of the fact that the site is not directly affected by a wetland or river and the slope is generally flat. The cumulative impact is therefore expected to be of medium/low significance.

Mitigation

<u>General mitigation measures</u>

- A detail Stormwater Management Plan (SWMP) must be compiled to address all the project components associated with this application.
- The SWMP must ensure the following :
    - Compliance with applicable regulations
    - Implementation of appropriate design measures that will allow surface and subsurface movement of water along drainage lines so as not to impede natural surface and subsurface flows.
    - Drainage measures must promote the dissipation of stormwater run-off.
    - Prevent off-site migration of contaminated storm water or increased soil erosion.

- Contaminated stormwater must be separated from general stormwater. The stormwater management plan must specifically ensure that contaminated water from the vehicle servicing area and diesel storage facility is separated from the general stormwater. Untreated contaminated water may not be allowed to be disposed of onto adjacent land.
- Allowance must be made in the design to approximately equal the concentration time under natural conditions to minimise the flow impact downstream.
- The on-site systems must be carefully designed using contour following canals and storm water canals, in order to follow natural flow patterns in such a way that :
  - Erosion is prevented.
  - Infrastructural damage is prevented.
- To limit future maintenance cost, the on-site drainage canal slope and profile must be designed in such a way that neither erosion of the trenches nor the deposit of material occurs.
- It is recommended that only the essential portion of land be cleared of vegetation. Vegetation, even though sparse, serves a very important function to limit erosion through the dissipation of energy as physical objects in the flow path, and by their roots binding the soil.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Risk of erosion	Site	Short term	Possible	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**NONE**	Medium	High

IMPACT ON TERRESTRIAL AND AQUATIC BIODIVERSITY DURING THE DESIGN PHASE

Impact Description

In order to ensure that the proposed project is developed in an environmental sustainable manner, it is necessary to identify means to implement the EMPr, provide guidelines/specifications in terms of the design and compile relevant managements plan(s). etc. These measures must be implemented prior to commencement of construction to ensure effective implementation of the Environmental Authorisation and the EMPr.

Site clearing and preparation

Certain areas of the site will need to be cleared of vegetation and some areas may need to be levelled. Envisaged impacts:

Loss of plant species
Loss of rare/medicinal species
Loss of animal species
Loss of biodiversity
Increased soil erosion
Alien plant invasion

Wetland/Seasonal stream area degradation

- Soil compaction, erosion and sedimentation for the river and riparian area
- Soil and water pollution for the stream and riparian area

- Spread and establishment of alien invasive species in the stream and riparian area

Cumulative impact description

Based on the proposed development as well as the known developments planned in the region the cumulative impact on biodiversity (as listed above) should be negligible if all mitigation as recommended is implemented.

Mitigation

Project Site Layout

The project site layout as proposed which was guided by the Combined Environmental Sensitivity Map (included as Appendix B(4) of the BAR may not be amended without appropriate consideration of relevant environmental sensitivities and relevant approvals. This map clearly confirms the No Go areas in terms of the delineated watercourse with buffer zone and the heritage and visual constraints.

Demarcation of areas

- Clear demarcation must take place by method to be determined between the ECO and the Contractor of the outside boundaries of the delineated watercourse . These areas should be fenced off prior to construction and zoned as a no-go area. Fences must not restrict the dispersal or exploratory movements of remaining faunal species. Palisade fencing with a minimum of 15cm gap is recommended adjacent to the conserved wetlands and buffer zones as well as along the seasonal stream and buffer zone.
- The entire area to be developed must be clearly demarcated prior to initial site clearance and to prevent construction personnel from leaving the demarcated area

Planning for the construction period

- To minimise the effect on the vegetation, insects, small mammals, and environment it is recommended that the construction be done within the winter period as far as possible, when most plants are dormant and animals less active.
- Where vegetation of areas not to be developed needs to be "opened" to gain access it is recommended that the herbaceous species are cut short rather than removing them.
- Vegetation clearance should be restricted to the approved development areas allowing remaining animals the opportunity to move away from the disturbance. The Environmental Control Officer (ECO) should recommend, and the ECO should monitor these areas.
- Any disturbed or eroded areas within the PV sites should be appropriately revegetated.
- No hazardous materials should be stored within the demarcated buffer of the wetland area as per the Aquatic Impact Assessment.
- Provision of adequate toilet facilities must be implemented to prevent the possible contamination of ground (borehole) and surface water in the area.
- No cleaning of equipment should be done within the demarcated buffer zoneas per the Aquatic Impact Assessment. This includes the establishment of temporary and permanent offices and ablution facilities
- All vehicles and equipment should be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area outside of the demarcated buffers as per the Aquatic Impact Assessment of the watercourses to prevent ingress of hydrocarbons into topsoil.
- No dumping or storage of waste should take place within the watercourse areas.

Water Use Authorisation

- The PV components and associated infrastructure will be constructed immediately adjacent to the

delineated watercourses (within 500m from a wetland), which pose a risk of changing the bed, banks or characteristics of the watercourses or impeding or diverting flow in the watercourses. Also, an existing access road crossing a watercourse area will be upgraded and developed. Water Use Authorisation is therefore required.

- A preliminary risk assessment was compiled as per DWS requirement and it was concluded that, provided the recommended mitigation measures are implemented, the risk of the activities degrading the adjacent aquatic features will be low; therefore the water use activities would fall within the ambit of General Authorisations for Section 21 (c) and (i) water use activities.

This must be obtained prior to commencement of construction.

Appointment of Contractors

The EA, Generic EMPR and the Site Specific EMPR must form part of the tender documents.

Appointment of an Environmental Control Officer

- To be responsible to monitor that all requirements in terms of the Site-Specific and Generic EMPR are implemented during the construction phase.
- The ECO must confirm that all requirement as per the Environmental Authorisation is adhered to, i.e. actions required prior to commencement of construction.
- To ensure Environmental Awareness Training takes place.

Alien Invasive Management

Appoint an ecologist to compile an Alien Invasive Management Plan for implementation during the construction and the operation phases of the project.

Habitat Restoration/Rehabilitation Plan

Appoint an ecologist to compile a Habitat Restoration/Rehabilitation Plan for implementation before the end of the construction phase, prior to the operational phase.

Disturbed areas around the wetlands as well as the proposed buffer zones must be re-vegetated with an indigenous (to the area) grass seed mixture.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of plant and animal species	Site	Medium term	Probable	Medium	Moderate	Low
Wetland degradation	Local	Medium term	Probable	Low	High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~Yes~~	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**NONE**	~~Medium~~	~~High~~

IMPACT ON AVIFAUNA TO BE ADDRESSED DURING THE DESIGN PHASE

Impact Description

Entrapment of birds in the perimeter fences could lead to mortality.

Cumulative impact description

There are currently three approved renewable energy projects within a 30km radius around the proposed Mercury Solar PV Cluster. Mortality due to entrapment in fences is a possibility at all the existing and planned renewable energy facilities. However, the cumulative impact on species of conservation concern is expected to be low, given the highly transformed habitat and location of all the projects.

Mitigation

- If possible, use a single perimeter fence to prevent birds from getting trapped between fences.
- Increase the spacing between at least the top two wires to a minimum of 30cm and ensure they are correctly tensioned

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Entrapment of birds in perimeter fences	Site	Long term	Possible	High	Low	Low

Impact on Irreplaceable Resources (*after* mitigation). If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**NONE**	Medium	High

HUMAN SAFETY & ENVIRONMENTAL HEALTH IMPACT RESULTING FROM THE BESS DURING DESIGN AND PLANNING

Impact Description

- A High Level Safety Health and Environment Risk Assessment was prepared for the Mercury Cluster Solar PV by iSHEcon Chemical Process Safety Engineers.
- Risk is made up of two components:
    - The probability of a certain hazardous event or incident occurring.
    - The severity of the consequences of that hazardous event / incident.
- The assessment of risk comprises:
    - Identification of the likely hazards and hazardous events related to the operation of the installation.
    - Estimation of the likelihood/probability of these hazardous events occurring.
    - Estimation of the consequences of these hazardous events.
    - Estimation of the risk and comparison against certain acceptability criteria.
- This risk assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high, i.e., from a SHE perspective no fatal flawswere found with the proposed Lithium-ion or Sodium-Ion Solid-state BESS installations at the Mercury Solar PV Cluster near Viljoenskroon.
- At a large facility, without installation of the state-of-the art battery technology that includes protective features, there can be significant risks to employees and first responders. The latest battery designs include many preventative and mitigative measures to reduce these risks to tolerable levels.

Mitigation

Detailed and technical mitigation measures have been compiled in compliance with the Occupational Health and Safety Act, 1993 (Act No 85 of 1993). The design engineers must ensure that all these relevant requirements are met. Below is a summary of the key issues.

General

The findings and requirements of the High Level Safety Health and Environment Risk Assessment prepared for the Mercury Cluster Solar PV by iSHEcon Chemical Process Safety Engineers must be implemented during all phases of the project development.

The following recommendations have been made:

- There are numerous different battery technologies but using one consistent battery technology system for all the BESS installations associated with the Mercury PV facilities would allow for easy of training, maintenance, emergency response and could significantly reduce risks in a remote location.
- State-of-the-art battery technology should be used with all the necessary protective features e.g. draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.
- Neither sodium-ion or lithium-ion solid state battery technology type presents any safety or health fatal flaws, so either type could be used.
- Ensure the mitigative measures are included in the design.
- The overall design should be subject to a full Hazop prior to finalization of the design.
- Prior to bringing any solid-state battery containers into the country:
    - An Emergency Response Plan should be in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating.
    - An End-of-Life plan should be in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, module and containers.
- The site layout and spacing between solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.
- Under certain weather conditions, the noxious smoke from a fire in a solid-state battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc.
- All the current proposed BESS locations are over 500m from isolated farmhouses.
- Where there is a choice of alternative locations for the BESS, those that are further from water courses would be preferred. Solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want these run-offs to enter water courses directly. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in this SHE RA. However, the current separation of over 300m seems reasonable.
- Any bulk diesel storage for generators / vehicles should be fully bunded and the generators designed with the OHS Act noise limitations in mind.
- It is recommended that once the technology has been chosen and more details of the actual design are available, that this risk assessment be updated.

Impact Assessment –
The risk assessment was done in significant extent and appropriate detail in the risk assessment report. The impact assessment for the purpose of the Basic Assessment Report was slightly different assessed and is summarised below.
The risk assessment has found that with suitable preventative and mitigative measures in place, none of the identified potential risks are excessively high. Detail of the impact is described under the Construction and Operational Phases.
Overall impact is provided below.

Name of Impact	Ease of mitigation	Significance before mitigation	Significance after mitigation
Overall impact of the BESS on the environment	Ranging from complex to easy	Ranging from High to Low	Ranging from Low to Very Low

CONSTRUCTION PHASE

IMPACT ON AGRICULTURAL LAND DURING CONSTRUCTION

Impact Description

- Loss of agricultural potential by occupation of land:
  Agricultural land directly occupied by the development infrastructure will become unavailable for agricultural use, with consequent potential loss of agricultural productivity for the duration of the project lifetime. This impact is relevant only in the construction phase. No further loss of agricultural land use occurs in subsequent phases.
- Loss of agricultural potential by soil degradation:
  This impact only occurs during the construction and decommissioning phases, but only becomes relevant once the land is returned to agricultural land use after decommissioning. Soil can be degraded by impacts in three different ways: erosion; topsoil loss; and contamination. Erosion can occur as a result of the alteration of the land surface run-off characteristics, which can be caused by construction related land surface disturbance, vegetation removal, and the establishment of hard surface areas including roads. Loss of topsoil can result from poor topsoil management during construction related excavations. Hydrocarbon spillages from construction activities can contaminate soil. Soil degradation will reduce the ability of the soil to support vegetation growth.

Cumulative impact description

- Loss of agricultural potential by occupation of land
- Loss of agricultural potential by soil degradation

Mitigation

Loss of agricultural potential by occupation of land
None possible

Loss of agricultural potential by soil degradation

- Stormwater management control measures to be implemented.
- Maintain vegetation strips where possible.
- Strip, stockpile en re-spread topsoil

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of agricultural potential by occupation of land	Site	Long Term	Definite	High	Low	Low
Soil Degradation	Site	Long Term	Possible	Medium	Low	None

Impact on Irreplaceable Resources (*after* mitigation)	~~**Yes**~~	**No**

Cumulative impact rating (*after* mitigation) If high, please explain	**Low**	~~Medium~~	~~High~~

IMPACT ON TERRESTRIAL BIODIVERSITY DURING THE CONSTRUCTION PHASE

Impact description

Loss of Fauna & Flora

Envisaged impacts:

- Vegetation clearance/habitat destruction
- Soil erosion and pollution
- Spread and establishment of alien invasive plant species
- Negative effect of human activities on fauna and road mortalities
- Loss of biodiversity

Degradation of watercourse areas

- Envisaged impacts:
- Erosion of streambank
- Loss of wetland habitat
- Soil & water pollution

Cumulative impact description

- Based on the proposed development the cumulative impact on biodiversity would be negligible if all mitigation as recommended is implemented.
- Based on the proposed development the cumulative impact on watercourses during the construction phase of the area would be negligible if all mitigation as recommended below is implemented.

Mitigation

- All temporary stockpile areas, litter and dumped material and rubble must be removed and disposed of at a licensed land fill facility. Proof of safe disposal must be obtained and kept on record for monitoring purposes.
- The careful position of soil piles, and runoff control, during all phases of development, and planting of

some vegetative cover after completion (indigenous groundcover, grasses etc.) will limit the extent of erosion occurring on the site.

- Undeveloped areas that were degraded due to human activities must be rehabilitated using indigenous to the area vegetation.
- Hazardous chemicals must be stored on an impervious surface accompanied by Safety Data Sheets (SDS) and protected from the elements. These chemicals must be strictly controlled, and records kept of when it was used and by whom
- Limit human activity in the no-developed areas as well as the completed areas to the minimum required for ongoing operation
- Any alien plant observed should be reported to the environmental manager and should be removed as soon as possible.
- Regular monitoring (monthly) for damage to the environment as well as establishment of alien plant species must be conducted.
- No development should be allowed in the delineate watercourse with buffer area. Drainage must be controlled to ensure that runoff from the site will not culminate in off-site pollution or result in rill and gully erosion or any erosion of the watercourses
- Ensure that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage
- The release of storm water must be designed such that the force of the water is reduced to prevent unnecessary erosion
- No dumping of waste should take place within the watercourse areas. If any spills occur, they should be cleaned up immediately.
- Adequate toilet facilities must be provided for all staff to prevent pollution of the environment
- No person/s must be allowed within the fenced-off watercourse areas unless for rehabilitation or alien plant removal.
- Implementation of the conditions of the Water Use Authorisation must take place

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of fauna & flora	Site	Medium Term	Probable	Medium	Moderate	Low
Watercourse degradation	Local	Long term	Possible	Low	High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	~~Yes~~	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	~~Medium~~	~~High~~

IMPACT ON AQUATIC HABITAT DURING CONSTRUCTION

Impact Description

Disturbance to aquatic habitat and impact on water quality

Cumulative impact description

Aquatic ecosystem deterioration

Mitigation

- The recommended buffers between the delineated aquatic ecosystems and all the proposed project activities should be maintained.
- If the construction and operation of the PV modules does not require modification to the topography, topsoils or removal of indigenous grassland such that wetland functionality within these degraded wetland areas could be retained, the modules could be placed within the wetland areas mapped as being of low sensitivity.
- Clearing of indigenous vegetation should not take place within the aquatic features and the recommended buffers.
- The existing road infrastructure should be utilised as far as possible to minimise the overall disturbance.
- During the construction phase, site management must be undertaken at the laydown and construction sites. This should specifically address on-site stormwater management and prevention of pollution measures from any potential pollution sources during construction activities such as hydrocarbon spills.
- Any stormwater that does arise within the construction sites must be handled appropriately to trap sediments and reduce flow velocities.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Disturbance of aquatic habitat and water quality	Site	Short term	Possible	High	High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON AVIFAUNA TO BE ADDRESSED DURING THE CONSTRUCTION PHASE

Impact Description

- Displacement of priority species due to disturbance and habitat destruction (vegetation clearance) associated with construction of the PV facility and associated infrastructure.
- Displacement of priority species due to habitat transformation (vegetation clearance and the presence of the solar panels) associated with construction of the PV plant and associated infrastructure.

Note the following:

- Of importance in the assessment area of the Vlakfontein Solar PV1 is the drainage line associated with a wetland. Wetlands are important refuges for a number of priority species, including the Marsh Owl that often breeds in the tall rank grassland around wetlands.
- The resources are not irreplaceable. There are no species of conservation concern at the PV site.
- The PV site is highly transformed, which makes it generally unsuitable for species of conservation concern.

Cumulative impact description

There are currently three approved renewable energy projects within a 30km radius around the proposed Mercury Solar Cluster, namely the 75MW Buffels Solar PV 1 Solar Energy Project, the 100MW Orkney PV Solar Energy Project and 132kV powerline, and the Kabi Vaalkop Photovoltaic Facility, Substation and Powerlines. Displacement due to disturbance associated with the construction of the PV facilities is a possibility at all the planned renewable energy facilities. However, the cumulative impact on species of conservation concern is expected to be low, given the highly transformed habitat and location of all the projects.

Mitigation

- Construction activity should be restricted to the immediate footprint of the infrastructure.
- Access to the remainder of the site should be strictly controlled to prevent unnecessary disturbance of priority species.
- Measures to control noise and dust should be applied according to current best practice in the industry.
- Maximum use should be made of existing access roads and the construction of new roads should be kept to a minimum.
- The mitigation measures proposed by the vegetation specialist must be strictly enforced.
- A 50m buffer zone must be maintained around the drainage line running through the centre of the PV site.
- Rehabilitation of vegetation must take place under the guidance of a vegetation specialist after the conclusion of the construction phase.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Displacement of Priority Species due to disturbance	Site	Short term	Probable	High	High	Moderate
Displacement of Priority Species due to habitat transformation	Site	Short term	Probable	High	High	Moderate

Impact on Irreplaceable Resources (*after* mitigation). If yes, please explain		Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON HERITAGE, ARCHAEOLOGY AND PALAEONTOLOGY RESOURCES DURING CONSTRUCTION

Impact Description

- Heritage: It is possible that cultural landscape resources may be impacted by the proposed development.
- Archaeology: It is possible that significant archaeological resources may be impacted by the proposed development
- Palaeontology: Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying deep soils and sands of the Quaternary. There is a very small chance that fossils may occur in the shales below ground of the early Permian Vryheid Formation.

Cumulative impact description

Destruction or negative impact to significant cultural landscape heritage

Mitigation

Heritage

- Retention of the tree avenues located along roads, access routes and farm boundaries where possible. Implementation of the mitigation measures outlined in the VIA

Archaeology

- Should any archaeological resources or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward. Based on the nature of the project area, especially in the northern part of the site, surface activities may impact upon the fossil heritage in the development footprint.

Palaeontology

Since there is a small chance that fossils may be discovered and/or disturbed, a Fossil Chance Find Protocol is recommended. The following Chance Fossil Finds Procedure must be implemented during the course of construction activities:

- When excavations begin underground rocks are exposed, the rocks must be given a cursory inspection by the ECO (or other designated person). Any fossiliferous material (plants, insects, bone, coal, tracks, plant impressions) should be put aside in a suitably protected place. This way the project activities will not be interrupted.
- Photographs of similar fossils are provided as an appendix of the EMPR to assist in recognising the fossil plants, vertebrates, invertebrates or trace fossils in the shales and mudstones.
- Photographs of the putative fossils must be sent to a palaeontologist for a preliminary assessment.
- If the above-mentioned palaeontologist found any possible fossil material, a qualified palaeontologist should visit the site to inspect the selected material and check the dumps where feasible.
- Fossil plants or vertebrates that are considered to be of good quality or scientific interest by the palaeontologist must be removed, catalogued and housed in a suitable institution where they can be made available for further study. Before the fossils are removed from the site a SAHRA permit must be obtained. Annual reports must be submitted to SAHRA as required by the relevant permits.
- If no good fossil material is recovered then no site inspections by the palaeontologist will be necessary. A final report by the palaeontologist must be sent to SAHRA once the project has been completed and only if there are fossils.
- If no fossils are found and the excavations have finished then no further monitoring is required.

Impact Assessment

Name of Impact	***Extent***	***Duration***	***Probability***	***Reversibility of impact***	***Significance without mitigation***	***Significance after mitigation***
Heritage: Disturbance to cultural landscape which consists of tree avenues along existing roads	Site	Permanent	Possible	Irreversible	Moderate	Low
Archaeology: Potential	Site	Permanent	Possible	Irreversible	Moderate	Low

identification of archaeological resources						
Palaeontology: Potential discovery of palaeontological resources	SIte	Permanent	Possible	Irreversible	Moderate	Low

Impact on Irreplaceable Resources *(after mitigation)* *If yes, please explain* *Artefacts cannot be repaired or replaced but their loss is inconsequential in heritage terms.*	~~*YES*~~	***NO***

Cumulative impact rating *(after mitigation)* *If high, please explain*	***LOW***	*Medium*	*High*

RISK OF GROUNDWATER POLLUTION DURING CONSTRUCTION

Impact Description

- The risk for groundwater pollution during the construction period is generally associated with oil spills resulting from construction vehicles and placement of engineering structure.
- Poor waste management could result in unnecessary impact on groundwater and natural habitat.
- Should ineffective construction techniques and methods be used, it could lead the structural failure with associated risk to the environment.
- Increased risk for soil, groundwater and surface water pollution results mostly from poor waste management.
- Increased risk for spillages – associated with construction activities, maintenance and repair of vehicles, etc.

Cumulative impact description

Not applicable

Mitigation

Strict measures must be implemented :

- Emergency incident reporting and remedial measures must be in place.
- Adequate oil containment precautions must be taken.
- A bio-remediation contractor must be appointed to rehabilitate large oil spills. The regional officer of the Department of Water & Sanitation will advise in this regard.
- Small oil spills must be cleaned immediately with an oil spill kit.
- Proper maintenance procedures for vehicles and equipment must be followed.
- Servicing of vehicles may only take place in designated areas, in this case on a concrete surface within the switching station site.
- Drip trays should be used during the servicing of vehicles. The content thereof must be disposed in accordance with relevant hazardous material disposal requirement.
- Measures to contain accidental spills must be readily available on site (spill kits).
- All hazardous substance spills must be reported to the Contractor and the ECO, recorded and

investigated.

Waste Management Procedures must include the following:-

- General household waste (i.e. strict control over labourers; no burning or burying of waste; provision of dustbin and garbage bags; regular removal preferably by municipal waste removal; etc.)
- Construction waste (i.e. stringent daily clean-up and either disposal at registered waste site or preferably sold for recycling purposes)
- Sewage waste (labourers to be provided with proper ablution facilities- chemical toilets must be provided and serviced by a reputable outside company; no effluent to be dumped on adjacent land). Written proof of servicing of the chemical toilets must be obtained and kept on site in the ECO file.
- Hazardous waste (i.e. oil contaminated waste to be moved to registered hazardous waste landfill site; adequate storage and labelling of hazardous materials on site). Stormwater should not be discharged into the working areas and it should be ensured that stormwater leaving the footprint of the proposed development areas is not contaminated by any substance, whether that substance is solid, liquid, vapour or any combination thereof. Way slips or written proof of disposal at an appropriately registered waste facility must be obtained and kept on site in die ECO File.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Risk of groundwater pollution	Local	Medium	Possible	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

RISK OF EROSION DURING CONSTRUCTION

Impact Description

- Potential soil erosion from temporary access roads and laydown areas.
- To cause the loss of soil by erosion is an offence under the Soil Conservation Act, Act No 76 of 1969.
- The impact will occur where large areas of land are exposed and where stormwater is allowed to cascade freely across the site.
- Construction vehicles and insufficient construction roads could also result in erosion.

Cumulative impact description

Erosion may spread, however the application of mitigation measures will minimise this impact to acceptable levels.

Mitigation

- The specifications of the Stormwater Management Plan must be implemented.
- It is recommended that access and service roads, as well as stormwater systems are constructed at the commencement of the construction phase to ensure that suitable stormwater management measures are in place at the least additional cost.
- These permanent routes must be used also for construction purposes. In order to preserve the

natural state of the surface and vegetation as far as practically possible, off-road driving should be restricted to the absolute essential.

- Space for lay-down areas for construction material and for construction facilities is restricted on site. The flowing should however be taken into account:
    - Temporary or permanent soil stockpiles should be placed in such a way to minimize the impact on surface flow.
    - High resolution site survey data must be used to design stormwater ditches to direct surface flood water past any stockpiles.
- Site clearing should be limited to the essential.
- Construction waste must be collected and stored safely for disposal in accordance with the relevant waste regulations, protocols, and product specifications.
- Care must be taken not to leave any waste on site that can lead to future contamination of the site or the downstream area.
- Training with regards to stormwater management of construction personnel must be undertaken as part of their induction.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Increased risk of erosion	Local	Medium	Possible	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

SOCIAL IMPACT DURING THE CONSTRUCTION PHASE

Impact Description

<u>Presence of construction workers and potential impacts on family structures and social networks</u>

The presence of construction workers poses a potential risk to family structures and social networks. While the presence of construction workers does not in itself constitute a social impact, the manner in which construction workers conduct themselves can impact on local communities. The most significant negative impact is associated with the disruption of existing family structures and social networks. This risk is linked to potentially risky behaviour, mainly of male construction workers, including:

- An increase in alcohol and drug use.
- An increase in crime levels.
- The loss of girlfriends and/or wives to construction workers.
- An increase in teenage and unwanted pregnancies.
- An increase in prostitution.
- An increase in sexually transmitted diseases (STDs), including HIV.
- Increased exposure to COVID-19.

Due to the location of the proposed site no workers will be accommodated on site. Based on experience with other renewable energy projects, local farmers are not in favour of a construction workers being accommodated on the site due to potential safety and security risks they pose.
The majority of non-local construction workers are likely to be accommodated in Klerksdorp and Orkney. As indicated above, the majority of low skilled and semi-skilled work opportunities can be taken up by members from the local community. Employing members from the local community to fill these job categories will reduce the risk and mitigate the potential impacts on the local communities. Where possible these workers should be sourced from the surrounding towns of Klerksdorp and Orkney. These workers will be from the local community and form part of the local family and social network and, as such, the potential impact will be reduced.

The findings of the SIA indicate that unemployment levels in the area are high. The creation employment opportunities for low and semi-skilled workers from the area would therefore represent a positive socio-economic benefit. While the risks associated with construction workers at a community level will be low, at an individual and family level they may be significant, especially in the case of contracting a sexually transmitted disease or an unplanned pregnancy. This has been borne out from the experiences with other solar energy projects in the Northern Cape Province, for example projects located near Poffadder. However, given the nature of construction projects it is not possible to totally avoid these potential impacts at an individual or family level.

Potential Influx of job seekers

Large construction projects tend to attract people to the area in the hope that they will secure a job, even if it is a temporary job. These job seekers can in turn become "economically stranded" in the area or decide to stay on irrespective of finding a job or not. As in the case of construction workers employed on the project, the actual presence of job seekers in the area does not in itself constitute a social impact. However, the manner in which they conduct themselves can impact on the local community. The main areas of concern associated with the influx of job seekers include:

- Impacts on existing social networks and community structures.
- Competition for housing, specifically low-cost housing.
- Competition for scarce jobs.
- Increase in incidences of crime. The concern is that these job seekers may not leave town immediately and, in some cases, may stay indefinitely

However, the influx of job seekers is however typically associated with large construction projects that extend over a number of years. The proposed project does not represent a large construction project. The potential for the influx of job seekers is therefore likely to be low. The potential impacts associated with the influx of job seekers are therefore likely to be low.

Risk to safety, livestock, and farm infrastructure

The presence on and movement of construction workers on and off the site poses a potential safety threat to local famers and farm workers in the vicinity of the site. In addition, farm infrastructure, such as fences and gates, may be damaged and stock losses may also result from gates being left open and/or fences being damaged. Stock theft linked directly or indirectly to the presence of construction workers on the site also poses a risk to farming activities.
The risk to farming operations and increased risk of crime was raised as a key issue by the local landowners. The presence of construction workers on the site increases the exposure of farming operations and livestock to the outside world, which, in turn, increased the potential risk of stock theft and crime. The safety and security risks of associated with construction phase would be higher if all of the PV SEFs associated with the Northern Cluster are constructed concurrently. This is directly linked to the increase in the number of construction workers in the area.
The potential risks (safety, livestock, and farm infrastructure) can be effectively mitigated by careful planning

and managing the movement of construction on the site workers during the construction phase. Mitigation measures to address these risks are outlined below.

Increased risk of veld fires

The presence of construction workers and construction-related activities on the site poses an increased risk of grass fires that could, in turn pose, a threat to livestock, crops, and farm infrastructure. Grass fires were identified aa a concern and pose a threat to livestock and farming operations. The potential risk of grass fires is heightened by the windy conditions in the area, specifically during the dry, windy winter months from May to October. The risk of grass fires would be higher if all of the PV SEFs associated with the Northern Cluster are constructed concurrently. This is directly linked to the increase in construction related activities and number of construction workers on site.

In terms of potential mitigation measures the option of constructing a firebreak around the perimeter of the site prior to the commencement of the construction phase should be investigated. In addition, a fire-fighting vehicle should be present on the site during the construction phase.

Noise, dust, and safety impacts associated with construction related activities and vehicles.

Construction activities, including the movement of heavy construction vehicles, have the potential to create noise, dust, and safety impacts and damage roads, specifically unsurfaced farm roads. Damage caused by movement of heavy construction vehicles along local roads, specifically the S729 and Vermaasdrift Road, and impact on access to the silos at Vierfontein and Viljoenskroon, specifically during harvesting period of May to July, were raised as key concerns. The roads are in a poor condition following the recent heavy rains. The risk of damage to roads and impacts associated with construction related activities would be higher if all of the PV SEFs associated with the Northern Cluster are constructed concurrently.

The preparation of the site and associated levelling and clearing of vegetation will expose the soil to wind and result in dust. The dust impacts will be exacerbated during windy periods.

Impact on productive farmland

Good quality agricultural land is a scarce and finite resource. The loss of high-quality agricultural land should therefore be avoided and or minimised by careful planning in the final layout of the proposed PV SEF facilities. The final disturbance footprint can be reduced by careful site design and management of operation. The impact on farmland associated with the construction phase can also be mitigated by minimising the footprint of the construction related activities and ensuring that disturbed areas are fully rehabilitated on completion of the construction phase.

The landowner indicted that there were no concerns with the proposed layout. Only portions of the relevant properties are considered suitable for cropping. The loss of cropped areas can be accommodated within their larger operation.

The farm house on Zaaiplaats 190/RE is occupied by a farm manager, who will be relocated. The farm labourer dwellings on the property are leased out to Harmony Moab and this agreement will be cancelled. Illegal dwellers had been removed.

Cumulative impact description

The site is located within the Klerksdorp REDZ. The potential for cumulative impacts associated with combined visibility (whether two or more solar facilities will be visible from one location) and sequential visibility (e.g., the effect of seeing two or more solar facilities along a single journey), therefore exists. However, the area has been identified as suitable for the establishment of large scale renewable energy facilities. The cumulative impact on the areas sense of place associated with the northern part of the Mercury PV Solar Cluster is therefore rated as Low Negative.

Impacts on family and community relations that may, in some cases, persist for a long period of time. Also,

in cases where unplanned / unwanted pregnancies occur or members of the community are infected by an STD, specifically HIV and or AIDS, the impacts may be permanent and have long term to permanent cumulative impacts on the affected individuals and/or their families and the community.

Overall loss of farmland could affect the livelihoods of the affected farmers, their families, and the workers on the farms and their families. However, disturbed areas can be rehabilitated.

If damage to local farm roads is not repaired then this will affect the farming activities in the area and result in higher maintenance costs for vehicles of local farmers and other road users, and also impair access to silos. The costs will be borne by road users who were not responsible for the damage. Dust impacts to crops could also impact on quality.

Mitigation

Presence of construction workers and potential impacts on family structures and social networks

- The proponent should prepare a Stakeholder Engagement Plan (SEP) and Community Health, Safety and Security Plan (CHSSP) prior to commencement of construction phase.
- Where possible, the proponent should make it a requirement for contractors to implement a 'locals first' policy for construction jobs, specifically for semi and low-skilled job categories.
- The proponent should consider the option of establishing a Monitoring Forum (MF) in order to monitor the construction phase and the implementation of the recommended mitigation measures. The MF should be established before the construction phase commences, and should include key stakeholders, including representatives from local communities, local MLM Councillor, farmers, and the contractor(s). The MF should also be briefed on the potential risks to the local community associated with construction workers.
- The proponent and the contractor(s) should, in consultation with representatives from the MF, develop a code of conduct for the construction phase. The code should identify which types of behaviour and activities are not acceptable. Construction workers in breach of the code should be dismissed. All dismissals must comply with the South African labour legislation.
- The proponent and the contractor should implement an HIV/AIDS and COVID-19 awareness programme for all construction workers at the outset of the construction phase.
- The construction area should be fenced off before construction commences and no workers should be permitted to leave the fenced off area.
- The contractor should provide transport for workers to and from the site on a daily basis. This will enable the contactor to effectively manage and monitor the movement of construction workers on and off the site.
- Where necessary, the contractors should make the necessary arrangements to enable low and semi-skilled workers from outside the area to return home over weekends and/ or on a regular basis. This would reduce the risk posed to local family structures and social networks.
- The contractor must ensure that all construction workers from outside the area are transported back to their place of residence within 2 days for their contract coming to an end.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Potential Influx of job seekers

It is impossible to stop people from coming to the area in search of a job. However, as indicated above, the proponent should ensure that the employment criteria favour local residents in the area. In addition:

- The proponent, in consultation with the MLM and CoMLM, should investigate the option of establishing a MF to monitor and identify potential problems that may arise due to the influx of job seekers to the area. The MF should also include the other proponents of solar energy projects in the area.

- The proponent should implement a "locals first" policy, specifically with regard to unskilled and low skilled opportunities.
- The proponent should implement a policy that no employment will be available at the gate.

Risk to safety, livestock, and farm infrastructure

- The proponent should prepare a Stakeholder Engagement Plan (SEP) and Community Health, Safety and Security Plan (CHSSP) prior to commencement of construction phase.
- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc. during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- Traffic and activities should be strictly contained within designated areas.
- Strict traffic speed limits must be enforced on the farm.
- All farm gates must be closed after passing through.
- Contractors appointed by the proponent should provide daily transport for low and semi-skilled workers to and from the site. This would reduce the potential risk of trespassing on the remainder of the farm and adjacent properties.
- The proponent should consider the option of establishing a MF (see above) that includes local farmers and develop a Code of Conduct (CoC) for construction workers. This committee should be established prior to commencement of the construction phase. The Code of Conduct should be signed by the proponent and the contractors before the contractors move onto site.
- The proponent should hold contractors liable for compensating farmers and communities in full for any stock losses and/or damage to farm infrastructure that can be linked to construction workers. This should be contained in the Code of Conduct to be signed between the proponent, the contractors, and neighbouring landowners. The agreement should also cover loses and costs associated with fires caused by construction workers or construction related activities (see below).
- The Environmental Management Plan (EMP) must outline procedures for managing and storing waste on site, specifically plastic waste that poses a threat to livestock if ingested.
- Contractors appointed by the proponent must ensure that all workers are informed at the outset of the construction phase of the conditions contained on the Code of Conduct, specifically consequences of stock theft and trespassing on adjacent farms.
- Contractors appointed by the proponent must ensure that construction workers who are found guilty of stealing livestock and/or damaging farm infrastructure are dismissed and charged. This should be contained in the Code of Conduct. All dismissals must be in accordance with South African labour legislation.
- It is recommended that no construction workers, with the exception of security personnel, should be permitted to stay over-night on the site.

Increased risk of veld fires

- The proponent should enter into an agreement with the local farmers in the area whereby damages to farm property etc., during the construction phase will be compensated for. The agreement should be signed before the construction phase commences.
- The option of establishing a fire-break around the perimeter of the site prior to the commencement of the construction phase should be investigated.
- Contractor should ensure that open fires on the site for cooking or heating are not allowed except in designated areas.
- Smoking on site should be confined to designated areas.
- Contractor to ensure that construction related activities that pose a potential fire risk, such as welding, are effectively managed and are confined to areas where the risk of fires has been reduced. Measures to reduce the risk of fires include avoiding working in high wind conditions when the risk of fires is

greater. In this regard special care should be taken during the high risk dry, windy winter months.
- Contractor should provide adequate fire-fighting equipment on-site, including a fire fighting vehicle.
- Contractor to provide fire-fighting training to selected construction staff. No construction staff, with the exception of security staff, to be accommodated on site overnight.
- As per the conditions of the Code of Conduct, in the advent of a fire being caused by construction workers and or construction activities, the appointed contractors must compensate farmers for any damage caused to their farms. The contractor should also compensate the fire-fighting costs borne by farmers and local authorities.

Noise, dust, and safety impacts associated with construction related activities and vehicles.

- The movement of heavy vehicles associated with the construction phase should be timed to avoid times of the week, such as weekends, when the volume of traffic travelling along the local roads in the area may be higher.
- Damage to S729 and Vermaasdrift Road, and other local farm roads that may be impacted, should be repaired throughout the construction period.
- Construction related activities and movement of traffic should ensure that access to silos at Vierfontein and Viljoenskroon, specifically during harvesting period of May to July, is not impaired.
- Construction operations should be planned to minimise the total area cleared at any given time.
- Construction operations that have the potential to generate significant dust impacts, such as site clearance etc, should be timed to avoid harvesting times.
- Cleared areas should be rehabilitated once the construction phase has been completed.
- Dust suppression measures must be implemented on un-surfaced roads, such as wetting on a regular basis and ensuring that vehicles used to transport sand and building materials are fitted with tarpaulins or covers.
- All vehicles must be road-worthy, and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits.

Impact on productive farmland

- The loss of high-quality agricultural land should be avoided and or minimised by careful planning in the final layout of the proposed PV SEF facilities. The recommendations of the agricultural / soil assessment should be implemented.
- The site for the proposed SEF should be fenced off prior to commencement of construction activities.
- The footprint associated with the construction related activities (access roads, construction platforms, workshop etc.) should be minimised.
- An Environmental Control Officer (ECO) should be appointed to monitor the establishment phase of the construction phase.
- All areas disturbed by construction related activities, such as access roads on the site, construction platforms, workshop area etc., should be rehabilitated at the end of the construction phase.
- The implementation of a rehabilitation programme should be included in the terms of reference for the contractor/s appointed. The specifications for the rehabilitation programme should be drawn up by the Environmental Consultants appointed to manage the EIA.
- The implementation of the Rehabilitation Programme should be monitored by the ECO.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Presence of construction	Local	Short term	Probable	No in case of HIV & Aids	Medium	Low

workers and potential impacts on family structures and social networks						
Influx of job seekers	Local	Permanent	Probable	No in case of HIV & Aids	Low	Low
Risk to safety, livestock, and farm infrastructure	Local	Short Term	Probable	Yes	Medium	Low
Increased risk of veld fires	Local	Short Term	Probable	High (if compensations is paid for losses)	Medium	Low
Presence of construction workers and potential impacts on family structures and social networks	Local	Short Term	Probable	Yes	Medium	Low
Impact of construction activities and vehicles	Local	Short Term	Probable	Yes	Medium	Low
Loss of farmland	Local	Long Term	Probable	Yes	Medium	Low

Impact on Irreplaceable Resources (*after* mitigation). If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW & NONE**	Medium	High

IMPACT ON TRAFFIC DURING CONSTRUCTION

Impact Description
Traffic congestion due to an increase in traffic caused by the transportation of components, equipment, material and staff to site.

Cumulative impact description
The increase in construction traffic on roads will cause congestion which leads to an increase in dust and noise pollution.

Mitigation
- Stagger component delivery to site.
- Reduce the construction period.
- The use of mobile batch plants and quarries in close proximity to the site, if available and feasible.
- Staff and general trips should occur outside of peak traffic periods.

- Consider scheduling shift changes to occur outside peak hours to concentrate staff trips in off peak periods
- Regular maintenance of gravel roads by the Contractor during the construction phase and by Client/Facility Manager during operation phase.
- Dust Suppression of gravel roads during the construction phase, as required.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Traffic Congestion	Local	Short term	Probable	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation)	~~**Yes**~~	**No**

Cumulative impact rating (*after* mitigation) If high, please explain	**Low**	~~Medium~~	~~High~~

IMPACT ON HUMAN SAFETY & ENVIRONENTAL HEALTH RESULTING FROM THE BESS DURING CONSTRUCTION

Impact Description

Human Health

- Chronic exposure to toxic chemical or biological agents due to construction material, cement, paint truck fumes, etc.
- Exposure to noise (i.e. drilling, piling, generators, air compressors, etc.)
- Exposure to temperature extremes and/or humidity (i.e. heat during the day and cold in winter)
- Human Health - exposure to psychological stress (i.e.large projects bring many contractors into a small isolated community)
- Exposure to ergonomic stress (i.e. lifting of heavy equipment, working at awkward angles and at height, etc.)

Human and Equipment Safety

- Exposure to fire radiation from external fires (i.e. fire involving fuels used in vehicles, uncontrolled welding, etc,)
- Exposure to fire radiation due to damage to solid state battery containers
- Exposure to explosion over pressures (i.e. with solid state lithium containers, flammable gases generated by thermal run away reach explosive limits. Ignition on hot surfaces, static.)
- Exposure to acute toxic chemical and biological agents due to human pathogens, diseases, etc
- Exposure to acute toxic chemical and biological agents due to damage of batteries
- Exposure to violent release of kinetic or potential energy (i.e. resulting from moving of equipment, working at heights, etc)
- Exposure to electromagnetic waves (i.e. use of electrical machines, lighting strike, electrocution)

Environment

- Emissions to air (dust from construction in a generally hot and dry air)
- Emissions to water (i.e. caused by diesel for equipment, paints and solvernts, oil spills, etc.)
- Emissions to earth (i.e. mess area and solid waste disposal)

- Environment - waste of resources e.g., water, power etc. (i.e. water usage not controlled)

Public – Aesthetics (visual impact of bright surfaces and tall structures in a flat area)
Investors – financial (defective technology and extreme project delays)
Employees and investors- security (potential hi-jacking on route or theft on site, etc.)
Emergencies (i.e. fire explosions, toxic smoke, large spills, traffic accidents, etc.)
Investors – Legal (i.e. quick evolving of battery field, new codes and regulations, unknown hazards)

Mitigation

Detailed and technical mitigation measures have been compiled in compliance with the Occupational Health and Safety Act, 1993 (Act No 85 of 1993). The design engineers must ensure that all these relevant requirements are met. Below is a summary of the key issues.

General
The findings and requirements of the High Level Safety Health and Environment Risk Assessment prepared for the Mercury Cluster Solar PV by iSHEcon Chemical Process Safety Engineers must be implemented during all phases of the project development.

The following recommendations have been made:

- There are numerous different battery technologies but using one consistent battery technology system for all the BESS installations associated with the Mercury PV facilities would allow for easy of training, maintenance, emergency response and could significantly reduce risks in a remote location.
- State-of-the-art battery technology should be used with all the necessary protective features e.g. draining of cells during shutdown and standby-mode, full BMS with deviation monitoring and trips, leak detection systems.
- Neither sodium-ion or lithium-ion solid state battery technology type presents any safety or health fatal flaws, so either type could be used.
- Ensure preventative and mitigative measures provide by the specialist are included in the design.
- The overall design should be subject to a full Hazop prior to finalization of the design.
- Prior to bringing any solid-state battery containers into the country:
    - An Emergency Response Plan should be in place that would be applicable for the full route from the ship to the site. This plan would include details of the most appropriate emergency response to fires both while the units are in transit and once they are installed and operating.
    - An End-of-Life plan should be in place for the handling, repurposing or disposal of dysfunctional, severely damaged batteries, module and containers.
- The site layout and spacing between solid-state containers should be such that it mitigates the risk of a fire or explosion event spreading from one container to another.
- Under certain weather conditions, the noxious smoke from a fire in a solid-state battery container could travel some distance from the unit. The smoke will most likely be acrid and could cause irritation, coughing, distress etc. Close to the source of the smoke, the concentration of toxic gases may be high enough to cause irreversible harmful effects. Location of the facilities needs to ensure a suitable separation distance from public facilities/residences etc.
- All the current proposed BESS locations are over 500m from isolated farmhouses.
- Where there is a choice of alternative locations for the BESS, those that are further from water courses would be preferred. Solid-state systems may experience fires that may result in loss of containment of liquids or the use of large amounts of fire water which could be contaminated. One would not want

these run-offs to enter water courses directly. The buffer distance between water bodies and the facilities containing chemicals should be set in consultation with a water specialist and is therefore not specified in this SHE RA. However, the current separation of over 300m seems reasonable.

- Any bulk diesel storage for generators / vehicles should be fully bunded and the generators designed with the OHS Act noise limitations in mind.
- It is recommended that once the technology has been chosen and more details of the actual design are available, that this risk assessment be updated.

Impact Assessment - The risk assessment was done in significant extent and appropriate detail in the risk assessment report. The impact assessment for the purpose of the Basic Assessment Report was slightly different assessed and is summarised below.

Name of Impact	Ease of mitigation	Significance before mitigation	Significance after mitigation
Human Health - chronic exposure to toxic chemical or biological agents	Moderate	Moderate	Low
Human Health - exposure to noise	Easy	Moderate	Low
Human Health - exposure to temperature extremes and/or humidity	Easy	Low	Very Low
Human Health - exposure to psychological stress	Easy	Low	Very Low
Human Health - exposure to ergonomic stress	Moderate	Low	Low
Human and Equipment Safety - exposure to fire radiation	Complex	Moderate	Low
Human and Equipment Safety - exposure due to damage to containers	Complex	Moderate	Low
Human and Equipment Safety - exposure to explosion over pressures	N/a	Moderate	Low
Human and Equipment Safety - exposure to acute toxic chemical and biological agents	Complex	Moderate	Low
Human and Equipment Safety - exposure to acute toxic chemical and biological agents due to damaged batteries	Complex	Moderate	Low
Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Complex	High	Low
Human and Equipment Safety - exposure to electromagnetic waves	Complex	Moderate	Low
Environment - emissions to air	Easy	Low	Very Low
Environment - emissions to water	Moderate	Low	Low
Environment - emissions to earth	Easy	Low	Low
Environment - waste of resources e.g., water, power etc	Easy	Low	Very Low
Public – Aesthetics	Moderate	Moderate	Low
Investors – Financial	Moderate	Moderate	Low
Employees and investors - Security	Complex	Moderate	Low
Emergencies	Complex	Moderate	Low
Investors - Legal	Moderate	Moderate	Low

POST-CONSTRUCTION & OPERATIONAL PHASE

IMPACT ON AGRICULTURE DURING THE OPERATIONAL PHASE

Impact Description

Increased financial security

Enhanced agricultural potential through increased financial security for farming operations -Reliable income will be generated by the farming enterprises through the lease of the land to each energy facility. This is likely to increase their cash flow and financial security and could improve farming operations and productivity through increased investment into farming.

Improved security against stock theft and other crime

Improved security against stock theft and other crim e due to the presence of security infrastructure and personal at each facility.

Cumulative impact description

- Enhanced agricultural potential through increased financial security for farming operations.
- Improved security against stock theft and other crime

Mitigation

None possible.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Increased financial	Site	Long	Possible	High	Low	Low

security		Term				
Improved security against stock theft and other crime	Site	Long Term	Possible	High	Low	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain		~~Yes~~	**NO**
Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	~~Medium~~	~~High~~

IMPACT ON TERRESTRIAL HABITAT DURING OPERATION

Impact Description

- Loss of Fauna & Flora
- Envisaged impacts:
- Habitat destruction caused by clearance of vegetation
- Soil and water pollution
- Spread and establishment of alien invasive species
- Negative effect of human activities on fauna and road mortalities
- Negative effect of fences on dispersal movements of fauna
- Negative effect of light pollution on nocturnal fauna.

Cumulative impact description

Based on the implementation of the recommended mitigation measures, it is not thought that the continued maintenance of the sites would have an negative cumulative effect on biodiversity..

Mitigation

- All temporary stockpile areas, litter and dumped material and rubble must be removed and discarded in an environmentally friendly way
- Undeveloped areas that were degraded due to human activities must be rehabilitated with indigenous vegetation.
- Hazardous chemicals must be stored on an impervious surface and protected from the elements. These chemicals must be strictly controlled, and records kept of when it was used and by whom.
- Palisade fencing with adequate gaps (>15cm) is recommended for the conserved private open space around the seasonally inundated seepage wetlands and seasonal stream on the site.
- During the post-construction phase, artificial lighting must be restricted to security areas and not directed towards the conserved areas (seasonally inundated seepage wetlands and seasonal stream) in order to minimize the potential negative effects of the lights on the natural nocturnal activities.
- Regular monitoring must be undertaken to determine and degradation of the vegetation and or animal habitat.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Degradation of Ecosystem	Site	Medium	Unlikely	Medium	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON AQUATIC HABITAT DURING THE OPERATION PHASE

Impact Description

Degradation of the ecological condition of aquatic ecosystems; modification of flow and water quality; erosion; and alien vegetation invasion in aquatic features

Cumulative impact description

Aquatic ecosystem deterioration

Mitigation

- Alien plant growth and signs of erosion should be monitored on an ongoing basis to ensure that the disturbed areas do not become infested with invasive alien plants or eroded. Observed invasive alien plant growth should be cleared from the sites regularly according to measures as laid out in the EMPr for the project.
- Stormwater runoff infrastructure must be designed to mitigate both the flow and water quality impacts of any stormwater leaving developed areas. The runoff should rather be dissipated over a broad area covered by natural vegetation or managed using appropriate shaping with berms, channels and swales.
- Should any erosion features develop, they should be stabilised as soon as possible.
- Any water supply, sanitation services as well as solid waste management services required for the sites should preferably be provided by an off-site service provider.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Degradation of ecological condition; modification of flow and water quality; erosion; and alien vegetation invasion	Site	Short term	Possible	High	High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON AVIFAUNA TO BE ADDRESSED DURING THE OPERATIONAL PHASE

Impact Description
Mortality of priority species due to collisions with the solar panels.

Note:
- The resources are not irreplaceable. There are no species of conservation concern at the PV site.
- The PV site is highly transformed, which makes it generally unsuitable for species of conservation concern.
- The impact is likely to be insignificant to start with.

Cumulative impact description
There are currently numerous approved renewable energy projects within a 30km radius around the proposed Mercury Solar Cluster, including the 75MW Buffels Solar PV 1 Solar Energy Project, the 100MW Orkney PV Solar Energy Project and 132kV powerline, and the Kabi Vaalkop Photovoltaic Facility, Substation and Powerlines. Mortality due to collisions with the solar panels is a possibility at all the planned renewable energy facilities. However, the cumulative impact on species of conservation concern is expected to be low, given the highly transformed habitat and location of all the projects

Mitigation
No mitigation is required

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Mortality of priority species due to collisions	Site	Long term	Possible	High	Low	N/a

with the solar panels.						

Impact on Irreplaceable Resources (*after* mitigation). If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

RISK OF EROSION DURING THE OPERATIONAL PHASE

Impact Description

Diligence in stormwater management is essential and a full-time task, even during dry periods. Any lack of care may lead to the slow degrading of the site, rendering it susceptible to severe damage in the event of unexpected flooding, and subsequent potential damage to equipment on site due to gradual erosion due to normal rainfall events, or by unexpected huge damage due to random extreme flood events.

Cumulative impact description

The development footprint is small relatively small compared to the renewable energy projects in the macro area and the cumulative impact is therefore expected to be of low/negligible significance.

Mitigation

- Training with regards to stormwater management of site personnel must be undertaken as part of their induction. Refreshment training must be undertaken periodically.
- Regular conditional inspections of all storm water infrastructure are required.
- Inspection data must be recorded and accumulated for tracking purposes. Regular reporting should be a scheduled management task.
- Any item that may be found to be out of order, for instance accumulation of settled sand in a trench, or erosion, must be addressed and corrected without delay to keep the storm water system in a good and fully functional condition. Record must be kept on all repairs.
- Specific attention must be given to inspection during and after any rain and/or flood event to kerb any damage that may occur.
- The conditions of the Water Use Authorisation obtained during the Design & Pre-Construction Phase in terms of monitoring, maintenance, repair and reporting must be complied with. It is essential to make this a key responsibility of the relevant management manager.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Risk of Erosion	Local	Medium	Likely	High	High	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain		Yes	**NO**
Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

CONTINUOUS RISK FOR GROUNDWATER POLLUTION DURING THE OPERATIONAL PHASE

Impact Description

Spillages could occur with increased risk for groundwater pollution. This could typically happen during the transfer of petroleum product from road tanker to the storage tanks or during the servicing of maintenance and inspection vehicles. Leaks could occur with resultant pollution of groundwater. This would typically occur if structural failure happens or if appropriate waste management procedures are not followed.

Cumulative impact description

Impact is localised and no cumulative impact is expected.

Mitigation

- Prevent impact rather than manage impact:
    - Permanent staff as well as maintenance and inspection personnel must be appropriately trained in terms of waste management, specifically with regards to hazardous waste, inclusive of risk associated with the diesel storage facility, vehicle maintenance, etc. Appropriate Personal Protective Equipment (PPE) must at all times be provided.
    - Spillages of hydrocarbons and contaminated water must be collected from the following areas :
        - Diesel tank bunded area
        - Product receiving station and receiving pipelines.
        - Vehicle servicing area
    - The storage tank must be fully contained within the bunded area to contain spillage of hydrocarbons and contaminated rainwater and prevent the ingress of hydrocarbon spillages and contaminated rainwater into the ground or surface water.
    - Spillages from the tank bund must be retained and released in a controlled manner to an oil separator from where it could be temporarily stored and
    - Provision must be made for a thick reinforced concrete spillage containment slab laid to fall to a catch pit connected to an oil/grease separator.
    - Proper maintenance procedures for vehicles and equipment must be followed.
    - Servicing of vehicles may only take place in designated areas, in this case on a concrete surface within the switching station site.
    - Drip trays should be used during the servicing of vehicles. The content thereof must be disposed in accordance with relevant hazardous material disposal requirement.
    - As part of routine maintenance, the Applicant must undertake regular engineering inspections of the tank, tank valves and pumps to ensure that there are no leaks.
- Hydrocarbon (oil, diesel, petrol) waste as well as hydrocarbon containing material must be regarded as hazardous waste and separated from general waste.
- All hazardous substances at the site must be adequately stored and accurately identified, recorded and labelled prior to removal to a registered hazardous waste facility.
- Provide measures for emergency incident reporting and remedial measures and personnel must be appropriately trained.
- A bio-remediation contractor must be appointed to rehabilitate large oil spills. The regional officer of the Department of Water & Sanitation will advise in this regard.
- Small oil spills must be cleaned immediately with an oil spill kit. Measures to contain accidental spills must always be readily available on site (spill kits).
- All hazardous substance spills must be reported to the Contractor and the ECO, recorded and investigated.
- Follow acceptable maintenance and operational practises to ensure consistent, effective and safe performance of the infrastructure
- Also refer to the *Generic EMPr.*

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Risk for Groundwater pollution	Site	Short term	Possible	High	Moderate	None

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain		Yes	**NO**
Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	Medium	High

IMPACT ON VISUAL RESOURCES DURING THE OPERATIONAL PHASE

Impact Description

Long term operation of the PV project that will last for approximately 20 years. Given the long time periods, the PV panels will become a fixture in the landscape, changing the local sense of place to that of a semi-industrial landscape context, within a partially degraded rural landscape setting.

Consider in context with the following:

- Partial degradation of landscape resources due to the close proximity of the sites to the Mercury Substation as well as clear, Medium Exposure views of the northern mining landscapes.
- No tourist related activities in the ZVI making use of the landscape resources.

Cumulative impact description

The establishment of the area as a renewable energy node, could attract other renewable energy developers to the region, resulting in a more established renewable energy landscape, creating larger massing effect from inter-visibility and essentially resulting in a loss of the existing rural agrarian sense of place.

Mitigation

- Continued establishment of windbreaks (10m spacing between trees) along the roads at strategic locations where existing tree vegetation along the farm roads is limited.
- Continuation of soil erosion and wind-blown dust management.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Loss of landscape Character	Site	Long Term	Probable	High	Moderate	Low
Visual intrusion from Key Observation Points	Site	Long Term	Probable	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation) If yes, please explain		~~Yes~~	**NO**
Cumulative impact rating (*after* mitigation) If high, please explain	**LOW**	~~Medium~~	~~High~~

SOCIAL IMPACT DURING THE OPERATIONAL PHASE

Impact Description

The visual impacts and associated impact on sense of place

- Three mining areas, including the Vaal Reefs mine, and the associated mining infrastructure, slimes dams and overburden dumps are located within 6-10 km of the proposed SEFs. A large slimes dam associated with the mining operations is located 2 km and 3.5km to the west and north west of the Northern and Southern Cluster respectively. The visual character of the areas has also been affected by the Mercury Substation and associated transmission lines. The areas rural sense of place has therefore been impacted by the existing mining operations and transmission infrastructure. The potential impact of the proposed SEFs on the areas rural sense of place and adjacent land uses is therefore likely to be limited. This was confirmed by the feedback from the local landowners interviewed, none of whom raised concerns about potential visual impact on sense of place.
- In addition, the site is located within the Klerksdorp REDZ. The area has therefore been identified as suitable for the establishment of renewable energy facilities.

Potential impact on property values

As indicated above, the areas rural sense of place has been impacted by the existing mining operations and transmission infrastructure. The potential impact of the proposed SEFs on property values is therefore likely to be negligible. This was confirmed by the feedback from the local landowners interviewed, none of whom raised concerns about the potential impact on property values.

Potential impact on tourism

As indicated above, the areas rural sense of place has been impacted by the existing mining operations and transmission infrastructure. The potential for the proposed SEFs to impact on tourism sector and the perception of visitors to the area is therefore likely to be negligible.

Mitigation

The visual impacts and associated impact on sense of place.

The recommendations contained in the Visual Impact Assessment undertaken for this project and included in the paragraph above should also be implemented.

Potential impact on property values

The recommendations contained in the Agricultural Impact Assessment and the Visual Impact Assessment addressed in paragraphs above should be implemented.

Potential impact on tourism

The recommendations contained in the Visual Impact Assessment undertaken for this project and included in the paragraph above should also be implemented.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
The visual impacts and associated impact on sense of place	Local	Long Term	Probable	Yes	Low	Low
Potential impact on property values	Local	Long Term	Probable	Yes	Low	Low
Potential impact on tourism	Local	Long Term	Probable	Yes	Medium	Low

Impact on Irreplaceable Resources (*after* mitigation). If yes, please explain	Yes	**NO**

Cumulative impact rating (*after* mitigation) If high, please explain	**LOW & NONE**	Medium	High

TRAFFIC IMPACT DURING OPERATION

Impact Description
Traffic congestion due to an increase in traffic caused by staff trips, water deliveries and trips for maintenance requirements.

Cumulative impact description
The increase in traffic on roads will cause congestion which leads to an increase in dust and noise pollution.

Mitigation

- Water deliveries, staff trips and trips for maintenance requirements could be staggered or scheduled to occur outside of peak traffic periods.
- Consider scheduling shift changes to occur outside peak hours to concentrate staff trips in off peak periods.
- The provision of water tanks and/or use of boreholes.
- Spread the cleaning of the panels over a week.
- Using a larger water bowser.

Impact Assessment

Name of Impact	Extent	Duration	Probability	Reversibility of impact	Significance without mitigation	Significance after mitigation
Traffic Congestion	Local	Short Term	Probable	High	Moderate	Low

Impact on Irreplaceable Resources (*after* mitigation)	~~**Yes**~~	**No**

Cumulative impact rating (*after* mitigation) If high, please explain	**Low**	~~Medium~~	~~High~~

HUMAN SAFETY & ENVIRONENTAL HEALTH IMPACT RESULTING FROM THE BESS DURING OPERATION

Impact Description

Human Health

- Chronic exposure to toxic chemical or biological agents due to operation and maintenance failures
- Chronic exposure to toxic chemical or biological agents due to compromised battery compartments
- Exposure to noise (i.e. moving part inside containers, buildings, cooling systems, etc.)
- Exposure to temperature extremes and/or humidity (i.e. heat during the day, batteries generated heat within enclosed buildings, eetc.)
- Human Health - exposure to psychological stress (Exposure to psychological stress (i.e. isolated work station and monotonous repetitive work)
- Exposure to ergonomic stress (i.e. lifting of heavy equipment, working at awkward angles and at height, etc.)

Human and Equipment Safety

- Exposure to fire radiation from external fires
- Exposure to radiation due to electric fires of the Power Conversion System
- Exposure to explosion over pressures (i.e. transformer shorting and flammable gasses)
- Exposure to acute toxic chemical and biological agents due to human pathogens, diseases, etc.
- Exposure to acute toxic chemical and biological agents due to damage of battery components
- Exposure to violent release of kinetic or potential energy (i.e. resulting from moving of equipment, working at heights, etc)
- Exposure to electromagnetic waves (i.e. lighting strike, electrocution, ignition and burns)

Environment

- Emissions to air (not generally expected, but accidental release indoors of an asphyxiant may occur and this will replace oxygen)
- Emissions to water (i.e. cooling water blow-down, maintenance waste, spills, etc.)
- Emissions to earth (i.e. mess area and solid waste disposal
- Environment - waste of resources e.g., water, power etc. (i.e. disposal of batteries and containers)

Public – Aesthetics (visual impact of bright surfaces and tall structures in a flat area)
Investors – financial (defective technology and extreme project delays)
Employees and investors- security (potential hi-jacking on route or theft on site, etc.)
Employees and investors- security (i.e. cyber security attacks aimed at national grid).
Emergencies (i.e. fire explosions, toxic smoke, large spills, traffic accidents, etc)
Investors – Legal (i.e. quick evolving of battery field, new codes and regulations, unknown hazards)

Mitigation

Detailed and technical mitigation measures have been compiled in compliance with the Occupational Health and Safety Act, 1993 (Act No 85 of 1993).

From the details of accidents that have happened with BESS installations in general, it is clear that many potential problems manifest during the commissioning phase when units are first powered up to test functionality. This phase is critical and all controls, procedures, mitigation measures etc that

would be in place for full operation should be in place before commissioning commences.

General

The findings and requirements of the High Level Safety Health and Environment Risk Assessment prepared for the Mercury Cluster Solar PV by iSHEcon Chemical Process Safety Engineers must be implemented during all phases of the project development.

The risk assessment was done in significant extent and appropriate detail in the risk assessment report. The impact assessment for the purpose of the Basic Assessment Report was slightly different assessed and is summarised below.

Impact Assessment -

Name of Impact	Ease of mitigation	Significance before mitigation	Significance after mitigation
Human Health - chronic exposure to toxic chemical or biological agents	Easy	Moderate	Low
Human Health due to compromised battery compartments	Complex	Moderate	Low
Human Health - exposure to noise	Easy	Moderate	Low
Human Health - exposure to temperature extremes and/or humidity	Easy	Low	Very Low
Human Health - exposure to psychological stress	Easy	Low	Very Low
Human Health - exposure to ergonomic stress	Easy	Moderate	Low
Human and Equipment Safety - exposure to fire radiation due to external fires	Complex	High	Low
Human and Equipment Safety - exposure to fire radiation due to cooling failure of the Power Conversion System	Moderate	High	Low
Human and Equipment Safety - exposure to explosion over pressures	Moderate	Moderate	Low
Human and Equipment Safety - exposure to acute toxic chemical and biological agents due to human pathogens diseases, etc.	Moderate	Low	Low
Human and Equipment Safety - exposure to acute toxic chemical and biological agents due to damaged battery components	Moderate	Moderate	Low
Human and Equipment Safety - exposure to violent release of kinetic or potential energy	Moderate	Moderate	Low
Human and Equipment Safety - exposure to electromagnetic waves	Complex	Moderate	Low
Environment - emissions to air	Easy	Low	Very Low
Environment - emissions to water	Moderate	Low	Low
Environment - emissions to earth	Easy	Low	Very Low
Environment - waste of resources e.g., water, power etc	Easy	Low	Very Low
Public – Aesthetics	Easy	Moderate	Low
Investors – Financial	Easy	Moderate	Low
Employees and investors- security (potential	Moderate	Moderate	Low

hi-jacking on route or theft on site, etc.)			
Employees and investors – Security (i.e cyber security attacks, etc)	Complex	Moderate	Low
Emergencies	Complex	Moderate	Low
Investors - Legal	Complex	Moderate	Low

9.4 Decommissioning Phase

In the case of the proposed PV facility a decommissioning phase is likely to involve the disassembly and replacement of the existing components with more modern technology. This is likely to take place in the 20 - 28 years post commissioning. The most likely negative impact that will be associated with the replacement of old with new technology is the waste generated by the removal of the old solar panels and its associated structures.

The final decommissioning phase will have similar impacts and mitigation than the construction phase as assessed in this report and it will be possible to mitigated impacts to acceptable levels.

The decommissioning phase is likely to create additional, construction type jobs, as opposed to the jobs losses typically associated with decommissioning. This will be a positive impact.

The decommissioning phase will be addressed in full at that time by hand of the thén relevant legislation.