Preferred Alternative Impact Assessment

Post Construction Phase

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MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Identification (and assessment) of impacts and risks for each alternative

3(1) A basic assessment report… must include –

(h) a full description of the process followed to reach the proposed preferred alternative within the site, including – (v) ***the impacts and risks identified for each alternative, including*** *the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts - (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated; (vii)* ***positive and negative impacts that the proposed activity and alternatives will have*** *on the environment and on the community that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects; (viii)* ***the possible mitigation measures*** *that could be applied and level of residual risk.*

Appendix 1 (Basic Assessment Report) of the EIA Regulations, 2014 as amended

Assessment of Preferred Alternative

The identified impacts, comments received from I&APs and findings contained in specialist assessments, were assigned to the applicable phases of development (planning and design, pre-construction, construction, and post-construction) and aspects of the receiving environment so that they can be logically managed /mitigated for by the responsible role players at the appropriate time.

The receiving environment referred to as "environmental attributes" or "aspects" in Appendix 1 of the EIA Regulations, 2014 as amended, includes:

(1) Legal System, (2) Terrestrial fauna, (3) Terrestrial flora, (4) Aquatic fauna, (5) Aquatic flora, (6) Soil and Rock, (7) Ground and Surface Water, (8) Atmosphere, (9) Terrestrial and Avian ecosystem, (10) Aquatic ecosystem, (11) Economical, (12) Social, (13) Property, (14) Land use, (15) Health and Safety, (16) Security, (17) Public services, (18) Visual aesthetics and (19) Heritage and Culture.

Similar impacts, those are impacts resulting in the same response from the receiving environment are assessed collectively as cumulative impacts.

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Post Construction Phase

Receiving Environment: Terrestrial Fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - terrestrial	Temporary structures and infrastructure	**Impact:** The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species. **Consequence:** - Altered (composition and structure) or dysfunctional ecosystem (indirect). - Altered biodiversity pattern (indirect). - Reduced resilience to climate change (indirect).	quantity	01

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 01 (Animal species)

- The site lies within the range of 63 terrestrial mammals, including three listed species (EWT & SANBI, Red Data Book of Mammals of South Africa, Lesotho and Swaziland, 2016). The five listed species are the Brown Hyaena Hyaena brunnea (NT), South African Hedgehog Atelerix frontalis (NT), the African White-tailed Rat Mystromys albicaudatus (VU), the Black-footed Cat Felis nigripes (VU) and the Serval Leptailrus serval (NT). While the Hedgehog and Black-footed Cat are likely to occur in the broad area, the Brown Hyaena is less likely to be present due to naturally low population density as well as persecution from farmers. Adequate cover and water are essential habitat requirements for the Serval and given the sparse cover at the site this species is unlikely to occur here and the area is not viewed as important habitat for this species which favours tall grassland.
- Sedentary animals pose a higher risk of harm than active animals.
- Faunal diversity in the area is quite high and a wide array of species were directly or indirectly observed during the site visit. The majority of species observed are medium sized mammals, typical of the area and no particularly rare or notable species were observed. Species that were observed in the area include Cape Porcupine Hystrix africaeaustralis, Steenbok Raphicerus campestris, Duiker Sylvicapra grimmia, Springbok Antidorcas marsupialis, Aardvark Orycteropus afer, Rock Hyrax Procavia capensis, Cape Hare Lepus capensis, Hewitt's Red Rock Rabbit Pronologus saundersiae, South African Ground Squirrel Xerus inauris, Springhare Pedetes capensis, Namaqua Rock Mouse Aethomys

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namaquensis, Black-backed Jackal Canis mesomelas, Bat-eared Fox Otocyon megalotis, Yellow Mongoose Cynictis penicillata and African Wild Cat Felis silvestris.

- Impacts on mammals are likely to be restricted largely to disturbance during the construction phase and habitat loss during the operational phase. Although this is relatively low in the context of the landscape, impacts on habitat fragmentation and landscape connectivity are likely to be increasingly significant as the landscape becomes increasingly transformed as a result of the large number of the developments in the area. The Brak River is likely of significance in terms of landscape connectivity for fauna and it would be important to maintain this clear of development to ensure that it retains this function.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	M	M	M	-I	M	H	1	H	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

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- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.

Mitigations:

Impact Management Outcome(s):

- Restoration of ecological functioning or biodiversity pattern.

Targets:

- No temporary structures left on site
- Fence uprights removed completely
- Closed access routes are re-vegetated

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
01	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species.	Restoration of ecological functioning or biodiversity pattern.	No temporary structures left on site	Remove all temporary man-made structures and infrastructure including buildings, fences, barriers, and other demarcations, e.g., danger tape, associated with the construction site.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
01	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the	Restoration of ecological functioning or biodiversity pattern.	Fence uprights removed completely	The contractor must ensure that all fence uprights are appropriately removed, ensuring that no uprights are cut at ground level	Contractor	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
		habitat to the benefit or detriment of various faunal species.			but rather removed completely.			
01	Rehabilitation	The retention of temporary structures and infrastructure (including roads) will change the habitat to the benefit or detriment of various faunal species.	Restoration of ecological functioning or biodiversity pattern.	Closed access routes are re-vegetated	Any access route deviation from that in the written agreement must be closed and re-vegetated immediately, at the contractor's expense.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Route No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
01	L	L	L	-I	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Although the development footprint is small relative to animal home rages and territories, sound can travel further, beyond the boundaries of the footprint.
- Although sedentary animals pose a higher risk of harm than active animals, both types of animals are susceptible to harm when construction vehicles are driven at speed.

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Receiving Environment: Terrestrial Flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Rehabilitation with non-local plants will change the local Karoo ecosystem structure, function and resilience. **Consequence:** Altered ecosystem function.	quantity	02
Rehabilitation	Disturbed areas - terrestrial	Overgrazing	**Impact:** New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover. **Consequence:** - Reduced productivity and carrying capacity (direct). - Reduced plant cover increases erosion leading to ecosystem degradation and dysfunction (indirect).	quantity	02

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 02 (Ecosystem rehabilitation)

- The vegetation consists of shrubland dominated by dwarf Karoo shrubs, grasses and Acacia mellifera subsp. detinens, and other low trees particularly on the sandy soils. The vegetation is flat to gently sloping with isolated hills of Upper Karoo Hardeveld in the south and Vaalbos Rocky Shrubland in the northeast and with many interspersed pans (Mucina & Rutherford 2006).
- It is known that the total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).

Assessment without mitigation:

Legend		
Criteria	**Reversibility, Irreplaceability, & Mitigatory Potential**	**Significance (Impact Magnitude & Impact Importance**

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Abbreviation	Description	Abbreviation	Description	Abbreviation	Description
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.

Mitigations:

Impact Management Outcome(s):

- Rehabilitation with non-local plants will change the local Karoo ecosystem structure, function and resilience.
- New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover.

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Targets:

- Locally indigenous plant species are used in rehabilitation.
- Re-vegetation areas are protected from grazers
- No livestock in rehabilitation areas for 1 year after rehabilitation commenced

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
02	Rehabilitation	Rehabilitation with non-local plants will change the local Karoo ecosystem structure, function and resilience.	Preserve locally indigenous vegetation.	Locally indigenous plant species are used in rehabilitation.	All cleared areas should be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	Contractor, SEO, ECO	Post-construction and Continuous	Compliance to be verified by ECO and IEA.
02	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control.	Re-vegetation areas are protected from grazers	Protect vegetation recruitment from grazers by packing brush from legitimate bush clearing operations onto topsoiled and/or reseeded areas.	Contractor, SEO	Post-construction and Continuous	Compliance to be verified by ECO and IEA.
02	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its	Restoration of provisioning services, particularly food or grazing for livestock, and	No livestock in rehabilitation areas for 1 year after rehabilitation commenced	Domestic livestock should be excluded from areas under rehabilitation for at least the first year of recovery. Do not allow sheep into	Holder, Landowner	Post-construction and the first-year post rehabilitation	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		capacity to recover.	regulating services such as erosion control.		rehabilitated areas during the first growing season.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
02	L	M	L	-I	M	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Aquatic flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - aquatic	Bare ground	**Impact:** Rehabilitation with non-local plants will change the local Karoo ecosystem structure, function and resilience. **Consequence:** Altered ecosystem function.	quantity	03
Rehabilitation	Disturbed areas - aquatic	Overgrazing	**Impact:** New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover. A direct loss of local aquatic plants by construction activities in a watercourse. **Consequence:** - Reduced productivity and carrying capacity (direct).	quantity	03

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			- Reduced plant cover increases erosion leading to ecosystem degradation and dysfunction (indirect). - The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). - The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct).		

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 03 (Aquatic flora)

- The common reed Phragmites australis dominates the instream habitat along the Brak River, while there is very little discernible riparian vegetation. The ephemeral streams have no visible aquatic vegetation. Phragmites australis reeds grow in the beds of several of the ephemeral rivers.
- It is known that the total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.
- Environmental Impact Assessment for the proposed Soventix Solar Pv Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.

Mitigations:

Impact Management Outcome(s):

- Preserve locally indigenous vegetation.
- Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control.
- Reinstate the 'riparian' habitat.

Targets:

- Locally indigenous plant species are used in rehabilitation.

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- Rehabilitated area is cordoned off
- Re-vegetation areas are protected from grazers
- No livestock in rehabilitation areas for 1 year after rehabilitation commenced

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
03	Rehabilitation	Rehabilitation with non-local plants will change the local Karoo ecosystem structure, function and resilience.	Preserve locally indigenous vegetation.	Locally indigenous plant species are used in rehabilitation.	All cleared areas should be revegetated with indigenous perennial grasses from the local area. These can be cut when dry and placed on the cleared areas if natural recovery is slow.	Contractor, SEO	Post-Construction	Compliance to be verified by ECO and IEA.
03	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover. A direct loss of local aquatic plants by construction activities in a watercourse.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control. Reinstate the 'riparian' habitat.	Rehabilitated area is cordoned off	Cordon off areas under rehabilitation as "no-go areas" to prevent vehicular, pedestrian and livestock access.	Contractor, SEO, ECO	Post-Construction	Compliance to be verified by ECO and IEA.
03	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating	Re-vegetation areas are protected from grazers	Protect vegetation recruitment from grazers by packing brush from legitimate bush clearing operations onto topsoiled and/or reseeded areas.	Contractor, SEO	Post-Construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		A direct loss of local aquatic plants by construction activities in a watercourse.	services such as erosion control. Reinstate the 'riparian' habitat.					
03	Rehabilitation	New growth will be selected for by grazers resulting in overgrazing, which can weaken plant vigour or its capacity to recover. A direct loss of local aquatic plants by construction activities in a watercourse.	Restoration of provisioning services, particularly food or grazing for livestock, and regulating services such as erosion control. Reinstate the 'riparian' habitat.	No livestock in rehabilitation areas for 1 year after rehabilitation commenced	Domestic livestock should be excluded from areas under rehabilitation for at least the first year of recovery. Do not allow sheep into rehabilitated areas during the first growing season.	Holder, Landowner	Post-construction and the first-year post rehabilitation	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
03	L	L	L	-I	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

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Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - terrestrial	Compaction	**Impact:** The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion. **Consequence**: Degraded or dysfunctional terrestrial ecosystem (direct).	quantity	04
Rehabilitation	Disturbed areas - terrestrial	Compromised topsoil	**Impact:** Insufficient topsoil **Consequence:** Degraded or dysfunctional terrestrial ecosystem (direct).	quantity	04
Rehabilitation	Disturbed areas - aquatic	Compromised topsoil	**Impact:** Insufficient topsoil **Consequence:** Degraded or dysfunctional terrestrial ecosystem (direct).	quantity	04
Maintenance and Monitoring	NA	Erosion	**Impact:** Erosion of rehabilitated areas. **Consequence:** Degraded or dysfunctional ecosystem (direct).	quantity	04
Maintenance and Monitoring	NA	Compromised topsoil	**Impact:** Natural revegetation may not be sufficient to bind and protect the topsoil from erosion. **Consequence:** Degraded or dysfunctional ecosystem (indirect).	quantity	04
Rehabilitation	Disturbed areas - terrestrial	Compromised topsoil	**Impact:** Topsoil that has been stockpiled for too long may lose its viability. **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	quality	05
Rehabilitation	Disturbed areas - aquatic	Soil contamination (hydrocarbon spills)	**Impact:** Hydrocarbon spills can contaminate soil resulting in soil pollution **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	quality	05
Rehabilitation	Disturbed areas - terrestrial	Soil contamination (hydrocarbon spills)	**Impact:** Hydrocarbon spills can contaminate soil resulting in soil pollution **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	quality	05

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Rehabilitation	Disturbed areas - aquatic	Compromised topsoil	**Impact:** Topsoil that has been stockpiled for too long may lose its viability. **Consequence:** Reduced soil viability interferes with supporting services (nutrient cycle, microbial decomposition, etc.) necessary for sustaining healthy ecosystems (direct).	quality	05

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 04 (Soil Quantity)

- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.
- From a grassland ecological and soil erosion perspective, the opinion is that the current planned development (and the cumulative effect of 30km from other PV-projects), will not have a significant impact on the current veld condition and potential grazing potential.
- The proposed widening and sealing of the existing access road and new sections of the road (13.7 km in total), the construction of the two parallel 400 kV transmission lines (3,7 km) and the water pipelines (1 km) should have a very limited effect in the long term on soil erosion and rangeland potential.
- Erosion and sedimentation are only likely to take place during severe storm events (e.g., 1:2 to 1:100y events). Incidental rainfall will likely not cause sedimentation.

Impact 05 (Soil contamination)

- During the rainy season terrain mobility on high clay soils in low lying areas with drainage lines will be difficult and might increase soil erosion when drainage lines are disturbed.
- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		

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-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	M	L	M	-I	M	M	1	H	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	M	L	M	-I	M	M	1	H	M	1
Reversibility	M		**Irreplaceability**	M		**Mitigatory Potential**	H			

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Geotechnical Investigation Report for Sun Central PV project near De Aar, Northern Cape Province – BRC/RP/31/2022 prepared by Bare Rock Consulting (Pty) Ltd dated December 2022.
- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.
- Hardie M. (2009), "Dispersive Soils and their Management, Technical Reference Manual." Department of Primary Industries and Water, State of Tasmania, Australia (ISBN 978-0-7246-6774-1).
- Environmental Impact Assessment for the proposed Soventix Solar Pv Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.

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Mitigations:

Impact Management Outcome(s):

- Preserve topsoil, control erosion.
- Restoration of ecological functioning or ecosystem services.
- Good quality soil for reinstatement.

Targets:

- No compacted soil. Areas are ripped
- Topsoil reinstated.
- Erosion control measures
- Brushpacking stockpiled mulch
- Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.
- No erosion in rehabilitated areas. Erosion is repaired
- Responsible stormwater management and erosion control
- Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.
- No signs of pollution on site. No waste on site
- Stockpile test results and ameliorated

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Rehabilitation	The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion.	Restoration of ecological functioning or ecosystem services.	No compacted soil.	Break the crust on bare compacted areas to enhance vegetation establishment.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Rehabilitation	The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion.	Restoration of ecological functioning or ecosystem services.	Areas are ripped	All compacted surfaces from construction activities must be ripped to a minimum depth of 250 mm in two directions at right angles.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
04	Rehabilitation	The driving and parking of vehicles, for example, will compact the ground increasing surface water run-off and erosion.	Restoration of ecological functioning or ecosystem services.	Areas are ripped	Alternatively, smaller compacted or bare areas can be tilled using a hand-held hoe to a depth of 150 – 200 mm, and perpendicular to the prevailing slope.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
04	Rehabilitation	Insufficient topsoil	Restoration of ecological functioning or ecosystem services.	Ripped areas	All ripped areas must be left rough to facilitate binding of topsoil.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.
04	Rehabilitation	Insufficient topsoil	Restoration of ecological functioning or ecosystem services.	Topsoil reinstated	Reinstate 150mm – 200mm of topsoil on the ripped subsoil.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.
04	Rehabilitation	Insufficient topsoil	Restoration of ecological functioning or ecosystem services.	Erosion control measures	Topsoil replaced on steep slopes that are particularly susceptible to erosion must be stabilised with erosion control fabric, mats, netting, or blankets	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					made of natural fibres (proper installation is critical to success).			
04	Rehabilitation	Insufficient topsoil	Restoration of ecological functioning or ecosystem services.	Brushpacking stockpiled mulch	Reinstated topsoil must be stabilised by brushpacking the stockpiled mulch from the clearing operations (good mulch-to-soil contact is critical to success).	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.
04	Maintenance and Monitoring	Natural revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services.	Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.	Rehabilitated areas are to be re-seeded by hand with locally indigenous plants if sufficient aerial cover has not been achieved after the first growing season.	Contractor, SEO, ECO	Post-construction and first growing season	Compliance to be verified by ECO and IEA.
04	Maintenance and Monitoring	Erosion of rehabilitated areas.	Preserve topsoil, control erosion	No erosion in rehabilitated areas	Regularly monitor rehabilitated areas for signs of erosion in the form of visual inspections, especially watercourse crossings after intense rainfall and runoff events.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.
04	Maintenance and Monitoring	Erosion of rehabilitated areas.	Preserve topsoil, control erosion	Erosion is repaired	Any erosion problems observed on-site should be rectified as soon as possible using the appropriate stormwater management and erosion control measures.	Contractor,	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Maintenance and Monitoring	Erosion of rehabilitated areas.	Preserve topsoil, control erosion	Responsible stormwater management and erosion control	Stormwater management and erosion control measures shall adhere to the following principles: (a) Identify and control the source of the erosion. (b) Diffuse any concentrated flows. (c) Encourage infiltration of surface water runoff (e.g., good mulch-to-soil contact). (d) Avoid releasing stormwater directly into a watercourse. (e) Repair and stabilise the site of erosion.	Contractor	Post-construction	Compliance to be verified by ECO and IEA.
04	Maintenance and Monitoring	Natural revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services.	Revegetated areas must achieve at least 75% of the aerial cover of adjacent undisturbed areas within the first growing season.	Rehabilitated areas are to be re-seeded by hand with locally indigenous plants if sufficient aerial cover has not been achieved after the first growing season.	Holder, Contractor	Post-construction after first growing season	Compliance to be verified by ECO and IEA.
05	Rehabilitation	Hydrocarbon spills can contaminate soil resulting in soil pollution	Good quality soil for reinstatement.	No signs of pollution on site	Remove all signs of pollution from site, e.g., hydrocarbon spills, slurry, concrete hardpan layers, etc. to the depth of penetration for disposal at an appropriate licensed landfill.	Contractor	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
05	Rehabilitation	Hydrocarbon spills can contaminate soil resulting in soil pollution	Good quality soil for reinstatement.	No waste on site	Remove all waste from site, e.g., litter, concrete debris or rubble, used oil, etc. for collection by a registered collector and/or disposal at an appropriate licensed landfill.	Contractor	Post-construction	Compliance to be verified by ECO and IEA.
05	Rehabilitation	Topsoil that has been stockpiled for too long may lose its viability.	Restoration of ecosystem services.	Stockpile test results and ameliorated	If the topsoil has been stockpiled for two or more growing seasons, then it shall be tested for pH, nutrients, colloidal matter, microbes, etc. to determine its viability, and ameliorated accordingly, prior to its reinstatement on disturbed areas.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	L	L	L	neutral	L	L	0	L	L	0

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
05	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

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Receiving Environment: Ground and Surface Water

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - terrestrial	Surface water hydrology (run-off)	**Impact:** Altered surface water flow pattern causing ponding or erosion. **Consequence:** Altered or degraded terrestrial ecosystem function (direct)	Behaviour	06
Rehabilitation	Disturbed areas - terrestrial	Surface water hydrology (run-off)	**Impact:** Change the visual aesthetics of the Nama Karoo. **Consequence:** Loss of cultural services, negatively impacting on human well-being.	Behaviour	06
Rehabilitation	Disturbed areas - aquatic	Temporary structures and infrastructure	**Impact:** The retention of foreign temporary structures and materials could alter river or stream channel hydraulics during high flows. **Consequence:** Causing sedimentation and/or excessive bank erosion, undercutting of property and loss of riparian vegetation (indirect).	Behaviour	06
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Reshaping could alter river or stream channel hydraulics during high flows. **Consequence:** Causing sedimentation and/or excessive bank erosion, undercutting of property and loss of riparian vegetation (indirect).	Behaviour	06
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** Increased turbidity and siltation in watercourses.	Behaviour	06

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Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase. **Consequence:** Alteration of natural drainage lines may lead to ponding or increased runoff patterns (i.e., may cause stagnant water levels or increase erosion).	Behaviour	06
Maintenance and Monitoring	NA	Erosion	**Impact:** Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase. **Consequence:** Alteration of natural drainage lines may lead to ponding or increased runoff patterns (i.e., may cause stagnant water levels or increase erosion).	Behaviour	06

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 06 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report).
- The project area falls within quaternary catchment D62D and the Orange Water Management Area.
- Available rainfall data suggest a MAP ranging from 112.4 (30th percentile) to 738.9 (90th percentile) mm/yr, based on a historical record of 69 years (e.g., 1920 to 1989). The average rainfall is in the order of 320 mm/yr.
- Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows, and naturally less turbid freshwater systems (Aquatic Biodiversity Impact Assessment, January 2023).

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Although the presence of the buffer zone seems futile as the upgrading of the access road is permissible linear infrastructure activities that will take place in in a broad strip (or corridor) through the watercourses and associated buffers, the intention of the buffer is to emphasize the importance and sensitivity of the applicable drainage systems. That is why the area included between the buffer zones should have explicit and very strict biodiversity conservation management measures and the operating teams should be aware of this. A level of best practices will be imposed in the riverine environment when the proposed construction gets under way and the process will be overseen by the project management (Aquatic Biodiversity Impact Assessment, January 2023).

- The Ecological Importance and Sensitivity Category (EISC) of the smaller ephemeral tributaries, alluvial floodplains, and headwater drainage lines was classified as "Low to Medium" (Aquatic Biodiversity Impact Assessment, January 2023).
- The unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River) is in a good condition despite some weirs and diversion walls in the catchment. The field assessment revealed that the unnamed drainage line D62D – 05610 SQ is discernible only as a slightly shallow depression with no clear associated vegetation and slightly clayey soils. Dwarf karroid scrub and tufted grass are the only vegetation present in this drainage area. It is in a good condition despite some weirs and diversion walls in the catchment. The ephemeral or intermittent drainage line is surrounded by alluvial floodplains, washes, and fans. These alluvial fans are usually bare soil flats or conduits, with dwarf karroid scrub and tufted grass colonising higher lying portions of ground (Aquatic Assessment prepared by Andrew Deacon, October 2017).
- These non-perennial drainage lines are prone to exhibiting ponded flood occurrence zones, in the absence of clearly defined drainage channels or streams. This is due to the micro-catchment style drainage associated with the project area. Sheet flow from micro-sub catchments towards lower topographical areas or isolated depressions form temporarily flooded areas. Irregular occurrences of ponded water were visible across the project area, even in areas with no defined drainage lines or stream channels.

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

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Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	M	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Hydrological Assessment for additional listed activities and water uses relating to the development of the Sun Central Cluster 1 300 MW Solar PV facility (previously known as Phase 1) in the Northern Cape", Version – Final 1, prepared by Hendrik Botha and dated 09 January 2023 (GCS Ref – 22 - 1054).

Mitigations:

Impact Management Outcome(s):

- Preserve river channel hydrological pattern.
- Minimize loss of topsoil
- Preserve stream or river channel hydrological pattern.
- Retain aesthetic values and sense of place or restore ecosystem cultural services.
- Preserve landscape hydrological pattern.
- Minimise ponding, erosion, and sedimentation of watercourses.

Targets:

- No open excavations or unrehabilitated areas
- No signs of exposed erosions channels
- No structures left on site
- Shaped to natural forms indicative of the site's location within the landscape (catena).
- Stormwater management systems are inspected annually

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
06	Rehabilitation	Reshaping could alter river or stream channel hydraulics during high flows.	Preserve river channel hydrological pattern.	Shaped to natural forms.	The final grading of the disturbed areas within the bed and banks should not significantly alter the flow characteristics of the river during periods of high flows, e.g., shaped to natural forms that blend in with pre-construction topography.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	Reshaping could alter river or stream channel hydraulics during high flows.	Preserve river channel hydrological pattern.	Shaped to natural forms.	Culverts or stormwater outlets associated with any watercourse crossing shall not cause erosion of the bed or banks by incorporating such stabilisation mechanisms as terracing, boulder and rock placement, minor gabion basket work construction, reno mattresses and/or rock pitching.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could	Minimise ponding, erosion, and sedimentation of watercourses.	No open excavations or unrehabilitated areas	Don't leave excavations open or the area unrehabilitated before a rainfall month occurs.	Contractor, SEO	Post-construction (before rainfall season)	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		alter the natural conditions of the rivers/streams.						
06	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil. Consequence: Increased turbidity and siltation in watercourses.	Minimize loss of topsoil	No signs of exposed erosions channels	Any erosion channels developing after the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition similar to the condition before the erosion occurred.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	Areas cleared or disturbed around site might be affected by erosion of topsoil. Consequence: Increased turbidity and siltation in watercourses.	Minimize loss of topsoil	Shaped to natural forms.	Site rehabilitation should as far as is feasible aim to restore surface draining patterns, natural soil and vegetation.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	The retention of foreign temporary structures and materials could alter river or stream channel hydraulics during high flows.	Preserve stream or river channel hydrological pattern.	No structures left on site	Remove all temporary man-made structures, e.g., river diversion works and materials, e.g., sandbags, plastic sheets, etc. from within the watercourse.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	Change the visual aesthetics of the Nama Karoo.	Retain aesthetic values and sense of place or restore ecosystem	Shaped to natural forms indicative of the site's location within	All disturbed areas must be reshaped to blend in with the natural surrounding landforms.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
			cultural services.	the landscape (catena).				
06	Rehabilitation	Altered surface water flow pattern causing ponding or erosion.	Preserve landscape hydrological pattern.	Shaped to natural forms indicative of the site's location within the landscape (catena).	All disturbed areas should be reshaped to retain landscape hydrological pattern, that is the natural functioning of the site (as a source, transfer, sink or any combination of these) relating to the redistribution of surface water and sediment.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Rehabilitation	Altered surface water flow pattern causing ponding or erosion.	Preserve landscape hydrological pattern.	Shaped to natural forms indicative of the site's location within the landscape (catena).	Revegetate denuded areas as soon as possible to maintain ground cover across the site. (Hydrology Assessment)	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
06	Maintenance and Monitoring	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical stormwater management areas, where there will be an activity that could alter the natural conditions of the rivers/streams.	Minimise ponding, erosion, and sedimentation of watercourses.	Stormwater management systems are inspected annually	Stormwater management systems must be inspected annually to ensure they are operating as per the design criteria.	Holder	Annually	Compliance to be verified by ECO and IEA.

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Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
06	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Atmosphere
Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Maintenance and Monitoring	NA	Dust	**Impact:** Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) or dust fallout emitted from vehicle entrainment **Consequence:** Respiratory problems. Nuisance effects of PM, e.g., settling on houses, deposition on and discolouration of buildings, and reduction in visibility.	quality	07

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist).

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 07 (Dust generation)

- The predicted dust fallout is low and well below the limit value for acceptable dust fallout in non-residential areas. Consequently, the significance of the impact of dust fallout resulting during construction of the Access Road is also low. This assessment considers the current

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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dust control measures, e.g., spraying the Access Road once a day with water. It is however recommended that these are expanded to reduce the emission and ensure that the significance of the impact remains low (Air Quality Impact Assessment, January 2023). For the uncontrolled scenario the predicted ambient PM10 concentrations exceed the annual average and 24-hour NAAQS for PM10 up to 1 500 m from the Access Road. For the controlled scenario the predicted ambient PM10 concentrations are below the annual average NAAQS for PM10 but exceed the 24-hour NAAQS for PM10 up to 300 m from the Access Road. Sensitive receptors have been noted within these zones. The significance of the impact of operations on air quality is therefore medium. This assessment considers the dust control measures of watering once per day. These however need to be expanded to reduce the emission and lower the impact significance to low with mitigation (Air Quality Impact Assessment, January 2023).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Route No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	-I	L	M	0	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

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References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Air Quality Impact Assessment for the Proposed Development of the Sun Central Cluster 300 MW Solar PV Facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province", Version – Final, prepared by Mark Zunckel of uMoya-NILU and dated January 2023 (Report number: uMN192-22).

Mitigations:

Impact Management Outcome(s):

- Minimise dust generation.

Targets:

- Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3).
- Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas.

Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
07	Maintenance and Monitoring	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) or dust fallout emitted from vehicle entrainment	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da)	Implement a dust monitoring programme for the access road.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				and residential (600 mg/m2/day) areas				
07	Maintenance and Monitoring	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) or dust fallout emitted from vehicle entrainment	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10 concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas	Increase frequency of road wetting during times of high expected traffic loads.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
07	Maintenance and Monitoring	Increase in ambient PM10 concentrations, Total Suspended Particulate (TSP) or dust fallout emitted from vehicle entrainment	Minimise dust generation.	Avoid exceeding NAAQS annual ambient PM10 concentrations (40 µg/m3) and 24-hour ambient PM10	Reduce vehicle speeds.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category No.	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
				concentrations (75 µg/m3). Avoid exceeding the National Dust Standard for non-residential (1 200 mg/m2/da) and residential (600 mg/m2/day) areas				

Assessment with mitigation:

Alternative Route No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	L	L	L	-I	L	L	0	L	M	0

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.

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Rehabilitation	Disturbed areas - terrestrial	Surface water hydrology (run-off)	**Impact:** Loss of terrestrial habitat. **Consequence:** Loss of terrestrial habitat	quantity	08
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion. **Consequence:** Erosion leads to dysfunctional landscapes and reduced agricultural potential.	quantity	08
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Disturbed areas and Overgrazing. **Consequence:** Degraded or dysfunctional terrestrial ecosystem and loss of agricultural potential. Overgrazing negatively impacts on veld condition, specifically reducing plant vigour, primary production and increasing soil erosion and sedimentation.	Transformation	08
Maintenance and Monitoring	NA	Revegetation	**Impact:** Revegetation may not be sufficient to bind and protect the topsoil from erosion. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience	quantity	08
Maintenance and Monitoring	NA	Alien plant recruitment	**Impact:** Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience (indirect).	Transformation	08

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist).

<u>Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts</u>

Impact 08 (Biodiversity)

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- The access road will be rebuilt and built to a width of 8 m, allowing for the roadbed preparation including the surface of the road and its shoulders, plus up to 3 m for the side/cut-off drain, wand 4 m on either side of the road for the verge to a fence line. The contractor will need an adjacent and parallel working servitude width of 3 m within the 19 m-wide fenced servitude for the movement of construction vehicles and/or providing a diversion lane for farm traffic.
- Keeping as much of the original vegetation intact should be a high priority during all phases. The project area is situated on Karoo sediments that are known for high sodium and magnesium content in the soil. Sodic soils are highly dispersive, that is susceptible to soil capping and erosion.
- It is known that the total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).
- The disturbance created during construction is likely to encourage the invasion of the disturbed areas by alien species. Although there were not a lot of alien species present in the area, problem species such as Prosopis are present in the area and it is possible that such species will colonise the disturbed areas if given the opportunity (Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	M	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Environmental Impact Assessment for the proposed Soventix Solar PV Project, De Aar, Northern Cape: Fauna & Flora Specialist EIA Report prepared by Simon Todd Consulting dated May 2017.
- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.

Mitigations:

Impact Management Outcome(s):

- Ameliorate poor soil conditions.
- Improve surface water infiltration and minimise erosion.
- Minimise ecological degradation.
- Restoration of ecological functioning or ecosystem services.
- Preserve topsoil, control erosion
- Reduce invasive alien plant recruitment.

Targets:

- Restore veld to at least good veld condition classes.
- Revegetation and Rehabilitation Plan
- Active rehabilitation
- Stored sods use in rehabilitation and watered weekly
- Restore ecological function to degraded sites.
- Successful rehabilitation

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- Annual vegetation surveys and vegetation survey results
- Vegetation cover
- No alien invasive plants on site. No chemical drift. Working for Water approved herbicides are used

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	The following intervention is recommended for the rehabilitation of bare (e.g., where topsoil has eroded) and disturbed areas within the terrestrial environment: • The stored topsoil must be used to cover the landscaped area once construction in that area is complete. • Soil pH is satisfactory, and no lime application is recommended. • Broadcast 150 kg/ha 3:2:0(32) +Zn directly before planting and work in 5cm. • Topdress 120 kg/ha LAN six weeks after planting. • Organic matter in the form of manure and/or humic products can be used with the chemical fertilisers to ameliorate the soil and improve soil health. These potential actions must be coordinated with the	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					grazing recommendations.			
08	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	Revegetate bare (e.g., where topsoil has eroded) and disturbed areas whether treated or not. The fenced servitude will give the rehabilitated plants a chance to establish. Once established, further restoration can be achieved through kraaling (see below).	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	The above potential actions should as far as is practical be coordinated with the following grazing recommendations: • Apply kraaling with sheep to severely degraded areas (e.g., where grass cover is poor and to areas where topsoil has already been eroded) for a night only. Grazers are removed to natural grazing areas after each kraaling period. • In areas where kraaling by sheep cannot be done, reseeding must be with locally indigenous species, especially	Contractor, SEO, ECO	Post-construction (Kraaled area is afterwards temporary excluded from grazing for two years)	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					grasses. • The kraaled area is afterwards temporary excluded from grazing for two years, to enable seed depositied through dung to germinate and for grass to develop roots. • Thereafter, a holistic approach must be followed in terms of veld management where a balance must be found between planned rest and grazing rather than excluding grazing. A grazing management plan should be prepared, specifically for the vegetated verges along access road servitude.			
08	Rehabilitation	Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion.	Improve surface water infiltration and minimise erosion.	Revegetation and Rehabilitation Plan	Develop a revegetation and rehabilitation plan	Holder, Contractor	Prior to Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
08	Rehabilitation	Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion.	Improve surface water infiltration and minimise erosion.	Active rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan or implement the Bare Patch Protocol (Appendix C) that will restore the natural vegetation to what it was prior to the construction of, for example, underground pipeline and cable routes, so that the long-term impact could be negligible.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Rehabilitation	Bare patches (or areas where the original vegetation was cleared or severely disturbed) are susceptible to erosion.	Improve surface water infiltration and minimise erosion.	Stored sods use in rehabilitation and watered weekly	Once construction is completed, those sods that were removed during the clearing operation and stored, should be used to rehabilitate the disturbed areas from where they were removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.	Contractor, SEO, ECO	Post-construction (watering at least twice over 2 weeks)	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Rehabilitation	Loss of terrestrial habitat.	Minimise ecological degradation.	Restore ecological function to degraded sites.	Where new roads need to be constructed, the existing road infrastructure should be rehabilitated, and any unnecessary roads	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					decommissioned and rehabilitated.			ECO and IEA.
08	Rehabilitation	Loss of terrestrial habitat.	Minimise ecological degradation.	Restore ecological function to degraded sites.	All temporary passing lanes inside the 19 m-wide road servitude must be rehabilitated.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services. Preserve topsoil, control erosion	Successful rehabilitation	Monitor the effectiveness of revegetation on the rehabilitated areas, and if necessary, implement appropriate corrective measures.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services. Preserve topsoil, control erosion	Annual vegetation surveys	Monitoring should include annual vegetation surveys, measuring at least plant density, species composition and richness, vegetation cover and growth stage (seedling, vegetative and reproductive).	Holder, SEO	Annual	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services. Preserve topsoil, control erosion	Vegetation survey results	The results of the vegetation surveys should inform the need for and nature of any further interventions, which may include bringing in additional topsoil, reseeding, mulching and/or additional brush packing depending on the	Holder, Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
					reasons for the failure of the original re-vegetation methods.			
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services. Preserve topsoil, control erosion	Vegetation cover	A vegetation cover that at least matches the natural, pre-development cover, should be maintained at all times along the road verge and rehabilitated pipeline trenches.	Holder, Contractor, SEO, ECO	Continuous	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Revegetation may not be sufficient to bind and protect the topsoil from erosion.	Restoration of ecological functioning or ecosystem services. Preserve topsoil, control erosion	Restored areas	Interventions and vegetation surveys may cease once the site has been restored to the same or a better condition than the adjacent remnant vegetation, e.g., species richness, vegetation cover and plant density are comparable or better, and seedling, vegetative and reproductive growth stages of all species are recorded.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer	Reduce invasive alien plant recruitment.	No alien invasive plants on site	The rehabilitated construction site must be monitored regularly for the presence of alien invasive plant species.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.						
08	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	No alien invasive plants on site	Immediately control alien invasive plants upon being identified, using preferably mechanical control methods.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
08	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and	Reduce invasive alien plant recruitment.	No chemical drift	Do not apply foliar hand spray chemical applications under conditions where chemical drift may impact non-targeted species (as indicated on the manufacturer's directions for use on the	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
		alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.			herbicide label)			
08	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	Working for Water approved herbicides are used	Use Working for Water guidelines for approved herbicides.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	L	L	L	-I	L	L	0	L	L	0

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Residual Risk (feeds back into "Mitigations"):

- None

Receiving Environment: Aquatic Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Rehabilitation	Disturbed areas - terrestrial	Surface water hydrology (run-off)	**Impact:** Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	09
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion. **Consequence:** Erosion will lead to sedimentation or siltation and an increase in turbidity of watercourses.	Transformation	09
Rehabilitation	Disturbed areas - aquatic	Reshaped bed and banks	**Impact:** Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines). **Consequences:** Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a greater impact on bird species restricted to a specific habitat and its requirements.	Fragmentation	09
Rehabilitation	Disturbed areas - aquatic	Bare ground	**Impact:** A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil. **Consequence:** The loss of threatened (Red Data) species may result in a loss of biodiversity and ecosystem resilience to climate change (direct). The loss of a threatened keystone species may alter the functioning of the aquatic ecosystem (direct). Increased turbidity and siltation in watercourses.	quantity	09

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Rehabilitation	Disturbed areas - aquatic	Bare ground	**Impact:** Disturbed areas and Overgrazing. **Consequence:** Degraded or dysfunctional aquatic ecosystem and loss of agricultural potential. Overgrazing negatively impacts on veld condition, specifically reducing plant vigour, primary production and increasing soil erosion and sedimentation.	Transformation	09
Maintenance and Monitoring	NA	Revegetation	**Impact:** Disturbed areas and Overgrazing. **Consequence:** Degraded or dysfunctional terrestrial ecosystem and loss of agricultural potential. Overgrazing negatively impacts on veld condition, specifically reducing plant vigour, primary production and increasing soil erosion and sedimentation.	Transformation	09
Maintenance and Monitoring	NA	Alien plant recruitment	**Impact:** Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems. **Consequence:** - reduced productivity and carrying capacity (direct). - altered or dysfunctional ecosystem (indirect). - loss of biodiversity and climate change resilience (indirect).	Transformation	09

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 09 (Aquatic Ecosystem)

- It is known that the total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).
- The alluvial floodplain around the Brak River exhibits an accumulation of silt and clay as well as base cations like Magnesium (Mg) and Sodium (Na). These elements have dispersive properties. Soil pH is very high and indicative of sodic conditions. This might be an indication of poor drainage or lateral seepage of sodium (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F.

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Botha dated 20 January 2023).

The floodplains are areas where there is evidence of extensive soil erosion, and the vegetation cover is in general very low. It is acknowledged that these "degraded" floodplains are typical of the Karoo area and a function of the geology of the area. The proposed developments are so small in terms of the wider floodplain areas that the impacts should be insignificant in the wider picture (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).

It is known that the total exclusion of grazers in such environments will be detrimental to maintaining important ecological processes such as the energy cycle, mineral cycle, and water cycle (Agro-ecosystem specialist assessment prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023).

- Erosion and sedimentation are important ecological processes in the Karoo. Loss and fragmentation of habitat disrupt these processes. Erosion is a particularly high risk on steep slopes, and in drainage lines that lack channel features and are naturally adapted to lower energy runoff with dispersed surface flows, and naturally less turbid freshwater systems (Aquatic Biodiversity Impact Assessment, January 2023).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	M	L	M	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

None.

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Solar-Africa Energy project in the Hanover District, Northern Cape (De Aar/Hanover area) agro-ecosystem specialist assessment for: Upgrading & development of an access road from the N10/'Burgerville' District Road (2448) turn-off into the Farm Riet Fountain No. 39C and to the switching station and main transmission substation on Sun Central Cluster 1 (300 MW) solar PV facility between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape province, South Africa prepared by D. V. F. Arnoldi, H. M. van den Berg and F. Botha dated 20 January 2023.
- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Reinstate the 'riparian' habitat.
- Minimize loss of topsoil
- Sensitive avifauna habitats are restored.
- Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.
- Reduce invasive alien plant recruitment.
- Ameliorate poor soil conditions and restore veld to at least good veld condition classes.

Targets:

- Replanting at the end of the dry season
- Sowing of grass seeds with chemical and mechanical water infiltration
- Active rehabilitation
- Stored sods are used and watered weekly
- New plant material is provided if rehabilitation was unsuccessful

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- Rehabilitation Plan
- Clear topsoil in the dry season
- Wetlands shaped to natural forms
- Regeneration of native species within two growing seasons
- No artificial seeding
- Rehabilitation is underway where applicable.
- Rehabilitated sites conform to the plan, surrounding landforms and plant communities.
- No alien invasive plants on site. No chemical drift. Working for Water approved herbicides are used
- Restore veld to at least good veld condition classes. A record of VCAs

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
09	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil.	Reinstate the 'riparian' habitat. Minimize loss of topsoil	Replanting at the end of the dry season	Replanting activities should be undertaken at the end of the dry season (middle to end September) to ensure optimal conditions for germination and rapid vegetation establishment.	Contractor, SEO, ECO	Post-construction (end of dry season)	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil.	Reinstate the 'riparian' habitat. Minimize loss of topsoil	Sowing of grass seeds with chemical and mechanical water infiltration	The sowing of grass seeds in combination with the chemical and mechanical water infiltration improvement measures should also be considered for highly degraded areas.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil.	Reinstate the 'riparian' habitat. Minimize loss of topsoil	Active rehabilitation	Conduct active rehabilitation during the construction activities according to a rehabilitation plan or implement the Bare Patch Protocol (Appendix C) that will restore the natural vegetation to what it was prior to the construction of, for example, underground pipeline and cable routes, so that the long-term impact could be negligible.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil.	Reinstate the 'riparian' habitat. Minimize loss of topsoil	Stored sods are used and watered weekly	Once construction is completed, those sods that were removed during the clearing operation and stored, should be used to rehabilitate the disturbed areas from where they were removed. In the absence of timely rainfall, the sods should be watered well after planting and at least twice more over the next 2 weeks.	Contractor, SEO, ECO	Post-construction (watering at least twice over 2 weeks)	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Rehabilitation	A direct loss of local aquatic plants by construction activities in a watercourse Areas cleared or disturbed around site might be affected by erosion of topsoil.	Reinstate the 'riparian' habitat. Minimize loss of topsoil	New plant material is provided if rehabilitation was unsuccessful	Should plants not successfully establish within two growing seasons after the first planting, new plant material should be provided.	Holder, Contractor, SEO, ECO	Post-construction after two growing seasons	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	Rehabilitation Plan	A rehabilitation plan for all watercourse crossings (roads and pipelines) must be commissioned before construction commences.	Holder, Contractor, SEO, ECO	Pre-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	Clear topsoil in the dry season	All topsoil harvesting must take place in the dry season.	Contractor, SEO, ECO	Post-construction (dry season)	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	Wetlands shaped to natural forms	Returning the wetlands to their original grade must take place as minor differences in the final surface elevation can produce significant impacts on the type of vegetation that re-establishes itself (alien invasive species).	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Rehabilitation	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	Regeneration of native species within two growing seasons	When topsoil is salvaged and returned, it is anticipated without reseeding so that dense vegetative communities of native species can regenerate within two growing seasons.	Contractor, SEO, ECO	Post-construction after two growing seasons	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Habitat loss and fragmentation of watercourse areas because of infrastructure installation (roads, fences and sub surface pipelines).	Sensitive avifauna habitats are restored.	No artificial seeding	As emergent wetlands will recover more quickly than others, artificial seeding is not advised as it creates competition for reestablishment of native facultative and obligate wetland vegetation.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Rehabilitation is underway where applicable.	Any areas disturbed during the construction phase should be rehabilitated as fast and effective as possible.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Rehabilitation	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Rehabilitation is underway where applicable.	Any erosion channels developing during or after the construction period should be appropriately backfilled (and compacted where relevant) and the areas restored to a condition like the condition before the erosion occurred.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Rehabilitation is underway where applicable.	A vegetation rehabilitation plan should be prepared and implemented for areas where the original vegetation was cleared or severely disturbed.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Rehabilitation	Vegetation clearance of the project footprint for the access road and underground pipelines close to watercourses will be subject to erosion.	Maintain the Present Ecological State of the Brak River drainage system, large and small ephemeral tributaries, alluvial floodplains, and headwater drainage lines.	Rehabilitated sites conform to the plan, surrounding landforms and plant communities.	Site rehabilitation should as far as feasible aim to restore surface draining patterns, natural soil, and vegetation to what it was prior to construction.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	The following intervention is recommended for the rehabilitation of bare (e.g., where topsoil has eroded) and disturbed areas within the alluvial floodplains. The stored topsoil must be used to cover the landscaped area once construction in that area is complete. Undertake top and subsurface soil samples in alluvial floodplain areas that are to be rehabilitated and analyse for soil sodicity. If severe sodic conditions (high Na & SAR) potentially inhibit plant growth, then: • Apply 2 ton/ha gypsum and work in 15 cm two weeks before planting (good drainage is a requirement for gypsum treatment). • It is recommended that these soils should be allowed to drain and sodium leached out of the soil profile. • Rip against contour, cut-off drains, and artificial drains might be needed. • Broadcast 200 kg/ha Superphosphate and 200 kg/ha Ammonium sulphate directly before planting and work in 5 cm.	Contractor, SEO, ECO	Post-construction	Compliance to be verified by ECO and IEA.

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					• Organic matter in the form of manure and/or humic products can be used with the chemical fertilisers to ameliorate the soil and improve soil health.			
09	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	Revegetate bare (e.g., where topsoil has eroded) and disturbed areas whether treated or not. The fenced servitude will give the rehabilitated plants a chance to establish. Once established, further restoration can be achieved through kraaling (see below).	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

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09	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions.	Restore veld to at least good veld condition classes.	The above actions should as far as is practical be coordinated with the following grazing recommendations: • Apply kraaling with sheep to severely degraded areas (e.g., where grass cover is poor and to areas where topsoil has already been eroded) for a night only. Grazers are removed to natural grazing areas after each kraaling period. • The kraaled area is afterwards temporary excluded from grazing for two years, to enable seed deposited through dung to germinate and for grass to develop roots. • Thereafter, a holistic approach must be followed in terms of veld management where a balance must be found between planned rest and grazing rather than excluding grazing. A grazing management plan should be prepared, specifically for the vegetated verges along access road servitude.	Contractor, SEO, ECO	Post-construction (Kraaled area is afterwards temporary excluded from grazing for two years)	Compliance to be verified by ECO and IEA.

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09	Rehabilitation	Disturbed areas and Overgrazing.	Ameliorate poor soil conditions and restore veld to at least good veld condition classes.	A record of VCAs	Follow-up grazing assessments and annual monitoring of veld condition is recommended to determine the progress of the recovery process on the disturbed and rehabilitated areas. Veld Condition Assessment (VCA) points are especially recommended in the sensitive floodplains and drainage lines affected by the rehabilitated access road servitude and pipeline corridors.	Holder	Follow-up grazing assessments and annual monitoring.	Compliance to be verified by ECO and IEA.
09	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	No alien invasive plants on site	The rehabilitated construction site must be monitored regularly for the presence of alien invasive plant species.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	No alien invasive plants on site	Immediately control alien invasive plants upon being identified, using preferably mechanical control methods.	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.
09	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	No chemical drift	Do not apply foliar hand spray chemical applications under conditions where chemical drift may impact non-targeted species (as indicated on the manufacturer's directions for use on the herbicide label)	Contractor, SEO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

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09	Maintenance and Monitoring	Recruitment of alien invasive plants. Disturbance can favour the recruitment of pioneer species and alien invasive plants, threatening habitats and alter the composition, structure and functioning of ecosystems.	Reduce invasive alien plant recruitment.	Working for Water approved herbicides are used	Use Working for Water guidelines for approved herbicides.	Contractor, SEO, ECO	Post-construction	Compliance to be monitored by the SEO and verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
09	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- Despite the mitigations to avoid significant suspended sediment in the river, strong flows or a flash flood during summer would render any river diversion works futile.

Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.

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Rehabilitation	Disturbed areas - terrestrial	Temporary structures and infrastructure	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	10
Rehabilitation	Disturbed areas - terrestrial	Temporary structures and infrastructure	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	NA	10
Rehabilitation	Disturbed areas - terrestrial	Bare ground	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	10
Rehabilitation	Disturbed areas - aquatic	Temporary structures and infrastructure	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	10
Rehabilitation	Disturbed areas - aquatic	Temporary structures and infrastructure	**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	NA	10
Rehabilitation	Disturbed areas - aquatic	Bare ground	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	NA	10

*The source of information used in identifying the impact is either the Leipold Matrix (Matrix), Interested and Affected Parties (I&APs) and/or Specialist studies (Specialist)

Any assumptions, uncertainties & limitations, or gaps in knowledge with predicting the impacts

Impact 10 (Social aspect)

- The social impacts do not occur on the sites, but in the communities around the sites and in the towns closest to the sites. Although municipal services are not currently under pressure, the development of a few renewable facilities within a short period of each other may cause pressure on these services in future. The municipalities depend on borehole water, which may run out and is only available when

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there is electricity available to run the water pumps. There is a current shortage of housing which will get worse should the area are exposed to a boom cycle of development. It must be acknowledged that it is almost impossible for the proponent to control the cumulative social impacts in the neighbouring towns. Therefore, it is important that the proponent have a good working relationship with the local authorities, and that they mitigate the impacts that they can control, as suggested in the Social Impact Management Plan (SIMP).

- The large variations in the meteorological conditions and the geographical relations between the traffic noise and the noise sensitive receptors allow for the decrease in the noise as it propagates from the gravel road.
- The potential noise impact from the proposed gravel road will be low.
- It is inevitable that the visual impact during the construction phase will be affected by dust, increase in vehicle traffic and other construction activities. Potential visual impacts caused by construction activities will include the visual changes brought about by clearance of vegetation for the solar arrays, ancillary buildings, and laydown areas; visual disturbance caused by construction of roads, buildings, energy collectors, power lines, increased traffic (and number of large vehicles), worker presence and activity, and dust emissions. Other visual disturbances may include soil stockpiles (from excavation for building foundations and other structures), soil scars, as well as potential for invasive plant species to develop on disturbed soils and soil stockpiles, which may contrast with existing vegetation (Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023).

Assessment without mitigation:

Legend					
Criteria		**Reversibility, Irreplaceability, & Mitigatory Potential**		**Significance (Impact Magnitude & Impact Importance**	
Abbreviation	**Description**	**Abbreviation**	**Description**	**Abbreviation**	**Description**
H	High	L	Low	0	Non-significant
M	Medium	M	Moderate	1	Significant
L	Low	H	High		
-I/R	Negative Impact/Risk				
+I/R	Positive Impact/Risk				

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	M	-I	M	M	0	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Any aspects which were conditional to the findings of the assessment (to be included as conditions of authorisation):

- None

References (legal, scientific, social, or other criteria) used for the assessment and mitigations:

- Environmental Basic Assessment for the proposed Gravel Road Construction to the approved Phase 1 Project prepared by dBAcoustics dated 21 January 2023.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.

Mitigations:

Impact Management Outcome(s):

- Minimize change in sense of place.
- Minimize noise disturbance to noise receptors/farmhouses

Targets:

- Successful rehabilitation
- Rehabilitation undertaken during daytime only.
- No excessively noisy machinery on site.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
10	Rehabilitation	Decrease in the "sense of place" as it relates to noise, visual and light pollution	Minimize change in sense of place.	Successful rehabilitation	Sense of place is a personal experience, but successful rehabilitation will go a long way in recreating a rural sense of place.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.

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Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
10	Rehabilitation	Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning.	Minimize noise disturbance to noise receptors/farmhouses	Rehabilitation undertaken during daytime only.	Removal of infra-structure and replanting of vegetation should be limited to daytime only.	Contractor, SEO	Post-construction	Compliance to be verified by ECO and IEA.
10	Rehabilitation	Noise increase at the boundary of the project footprint and at the abutting houses during decommissioning.	Minimize noise disturbance to noise receptors/farmhouses	No excessively noisy machinery on site.	Equipment and/or machinery which will be used must comply with the manufacturer's specifications on acceptable noise levels and during daytime only.	Contractor	Post-construction	Compliance to be verified by ECO and IEA.

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

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