Preferred Alternative Impact Assessment

Planning and Design Phase

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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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Planning and Design Phase

Receiving Environment: Legal System

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Legal Compliance	Protected Species	NPNCA, 2009/NFA, 1998/NEMBA 2004	**Impact:** Picking a protected, specially protected or indigenous* plant without the applicable permits and/or license constitutes an offence. * within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course. **Consequence:** - A person convicted of an offence in terms of this Act is liable to a fine, or to imprisonment for a period not exceeding 10 years, or to both a fine and such imprisonment (Section 67(1) of Northern Cape Nature Conservation Act, 2009 (Act No. 09 of 2009). - A person who is guilty of a first category offence (such as contravening the prohibition on picking any protected tree except under a license) may be sentenced to a fine or imprisonment for a period of up to 3 years, or to a fine and such imprisonment (S58(1) of NFA, 1998). - A person convicted of an offence is liable to a fine not exceeding R10 million, or an imprisonment for a period not exceeding ten years, or to both such a fine and such imprisonment (S102 read with 101 of NEMBA, 2004).	NA	01
Legal Compliance	Invasive Species	NEMBA, 2004	**Impact:** National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Section 73(2) "A person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity." **Consequence:** Non-compliance. A person who contravenes or fails to comply with a provision of Section 73(2) of NEMBA, 2004 is not guilty of an offence under Section 101 of the Act.	NA	01

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Legal Compliance	Water Care Work Registration	Water Act, 1956	**Impact:** Water Care Works must be registered with the Director-General of the Department of Water Affairs. **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	Water Use S21(c) and (i)	NWA, 1998	**Impact:** Any unauthorised activity within the Department's (DWS) regulated area of a watercourse constitutes an offence. Those activities associated with the development which require a S21(c) and (i) authorisation, include: 1. Repairing and rebuilding an access road including where applicable drainage structures across eight (8) watercourses and within 100 m of two earth dams; and 2. Installing underground water pipelines across the active channel of unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River), and an artificial wetland surrounding Solar Borehole No. 4 and No. 5. **Consequence:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	NA	01
Legal compliance	Water Use S21 (a)	NWA, 1998	**Impact:** Taking of water without a license for purposes other than reasonable domestic use and livestock watering, and which exceed the limits provided in the General Authorisation, constitutes an offence. **Consequence:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	NA	01

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Legal compliance	Water Use S21 (b)	NWA, 1998	**Impact:** Storing water without a license for purposes other than rainfall run-off from a roof, and which exceed the limits provided in the General Authorisation, constitutes an offence. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	NA	01
Legal Compliance	Water Use S21 (g)	NWA, 1998	**Impact:** The unauthorised disposal of waste in a manner which may detrimentally impact on a water resource, and storage of domestic and biodegradable industrial wastewater for the purpose of re-use, constitutes an offence. **Consequences:** - Any person who is guilty of an offence is liable, on the first conviction, to a fine or imprisonment for a period not exceeding five years, or to both a fine and such imprisonment and, in the case of a second or subsequent conviction, to a fine or imprisonment for a period not exceeding ten years or to both a fine and such imprisonment (S151 of NWA, 1998 as amended).	NA	01
Legal Compliance	Eskom 400 kV servitude (Line 1 and 2)	Servitude Agreement and Letter of Consent	**Impact:** Repairing and rebuilding the Burgerville District Road will impact Eskom's 400 kV powerline servitudes (Line 1 and Line 2). Construction without permission will constitute an offence in terms of the relevant legislation. **Consequence:** - The applicant can be fined and/or imprisoned as a result of damage to Eskom's apparatus (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994) - repealed by Electricity Regulation Act, 2006 (Act No. 4 of 2006) as amended.	NA	01
Legal Compliance	SANRAL	Permission	**Impact:** Any services that need to be constructed over or under a national road, (in this case the N10) or within 60 m measured from the road reserve fence will have an impact on SANRAL (pers. comm. Nicole Abrahams, Environmental Coordinator, Western Region, AbrahamsN@nra.co.za). **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	Department of Roads & Public Works	Permission	**Impact:** Permission may be required to repair and rebuild a rural (District) road that falls under the jurisdiction of a road authority/Consent may be necessary from the Northern Cape Department of Roads and Public Works under the Northern Cape	NA	01

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			Roads Ordinance, 19 of 1976 for the upgraded district access road, including a formal wayleave. **Consequence:** Fine and/or delays in construction.		
Legal Compliance	Department of Mineral Resources and Energy	Permission	**Impact:** Permission may be required from DMRE to use the land surface for an access road as the establishment of a formal servitude could detrimentally affect the mining of mineral resources on that parcel of land. **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	Department of Mineral Resources and Energy	Permission	**Impact:** Borrow pit licensing is classified as small-scale mining under the Mineral and Petroleum Resources Development Act, 28 of 2002 (Act No. 28 of 2002) and is administered by the Department of Minerals and Energy, through whom any permit applications must be lodged. **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	District and Local Municipality	Permission	**Impact:** Existing by-laws may regulate aspects of the project and require consent. **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	Emthanjeni Local Municipality	Permission	**Impact:** Permission may be required from Emthanjeni Local Municipality (ELM) to use water services from a source other than a water services provider nominated by the water services authority having jurisdiction in the area. **Consequence:** Fine and/or delays in construction.	NA	01
Legal Compliance	DALR&RD	Permission	**Impacts:** (1) Permits or exception may be required from the Department of Agriculture, Land Reform and Rural Development (DALR&RD) under provisions of the CARA Regulations including permission under regulation 2(2) of the CARA Regulations to construct an access road on virgin soil. (2) Permits or exception may be required from the Department of Agriculture, Land Reform and Rural Development (DALR&RD) under provisions of the CARA Regulations including permission under regulation 7(1) of the CARA Regulations for the drainage of a vlei, marsh or floodplain, relating to construction of access road within the floodplain of the Brak River. (3) Permits or exception may be required from the Department of Agriculture, Land Reform and Rural Development (DALR&RD) under provisions of the CARA Regulations including changing the flow pattern	NA	01

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			of runoff water (Regulation 8) related to the upgrades of the access road across the Brak River watercourse. **Consequence:** Fine and/or delays in construction.		
Layout and Design	Effluent Infrastructure (Sanitation)	Effluent disposal	**Impact:** Unsafe disposal - soil contamination and water pollution. **Consequence:** Health risks	NA	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 (Geographical Areas of Strategic Importance)

- The study area is within a Strategic Water Source Area.
- The study area is not located within a (REDZ).
- The proposed development which is the subject of this application does fall within a Strategic Transmission Corridor, specifically the "Central Corridor." - **but it does not trigger LA 9 of LN2 and is therefore not subject to the process to be followed for large scale electricity transmission and distribution facilities in terms of GN No. 113 in GG No. 41445 of 16 February 2018 and GN No. 383, GG No. 44504 of 29 April 2021**.
- Although the site area falls within an Astronomy Advantage Area (AAA) under the Astronomy Geographic Advantage (AGA) Act, 2007 (Act No. 21 of 2007), the South African Radio Astronomy Observatory (SARAO) undertook a high-level impact assessment and determined that the project represents a low risk of interference to the SKA radio telescope with a compliance surplus of 66.87 dBm/Hz. (*Response Letter from Mr Selaelo Matlhane, Spectrum & Telecommunication Manager of the South African Radio Astronomy Observatory (SARAO) and dated 15 March 2023*) – **no mitigation is required**.

Impact 01 (Protected Plants)

- According to the SIBIS database, a total of 407 plant species are found in the QDS 3024, of which only four red data-listed plant species are represented, Chasmatophyllum maninum and Chasmatophyllum rouxii (listed as DDD (data deficient, insufficient information)), Cynodon polevansii, which is listed DDT (Data Deficient – Taxonomically Problematic), and Rapanea melanophloeos, which is listed as Declining. The Chasmatophyllum species are associated with rocky flats and areas of exposed bedrock and Chasmatophyllum maninum is confirmed present at the site. Rapanea is associated with forest patches that usually occur around the base or in small kloofs of sandstone outcrops in vegetation types such as Besemkaree Koppies Shrubland and as it was not observed at the site and it is highly unlikely to be present.

- Other species of significance observed at the site include Stomatium pluridens and Euphorbia crassipes, which are regional endemics and provincially protected, while other protected species include Aloe broomii var. broomii, Aloe claviflora, Pachypodium succulentum, Ammocharis coranica, and Boscia albitrunca. *(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).*

Impact 01 (Listed Invasive Plants)

- 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).*
- Mexican Poppy *Argemone mexicana* was observed along the verge of the public road (*Site Sensitivity Verification report prepared by Ecoleges dated February 2023*).

Impact 01 (Water Uses)

- Water Uses requires in terms of Section 21 of NWA are (a), (b), (c), (g) and (i).
- Boreholes 13 (and 14), as well as the connecting ± 800 m long underground pipeline to an Overhead (water storage) tank on the Cluster 1 footprint is on Portion 1 of Kwanselaars Hoek 40C, and Portion 1 of Farm Riet Fountain 39C.
- Water from Boreholes No. 13 and/or No. 14 will be stored in a ± 36 m3 and overhead (OH) pressed steel tank.
- Solar Borehole No. 5 (30°53'3.90"S & 24°18'52.67"E) as well as the connecting 400 m long underground pipeline to a JOJO tank are located on Portion 4 of Farm Taaibosch Fontein 41C.
- Groundwater from Solar Boreholes No. 4 and No.5 will each be stored in one or more (up to 3) 5 m3 or 10 m3 JOJO (or similar) tanks.
- One additional tank (up to 10 m3) will be installed at the construction camp to supply domestic water to the offices and staff.
- No supporting infrastructure has been explicitly provided for Solar Borehole 4, but we have included this into the GA & IWULA
- The pump test data generated from BH13 in sub-catchment/HRU 4 indicates a total abstraction of 191.23 m3/8hr day, and the pump test data from Solar Borehole No. 5 in sub-catchment/HRU 5 indicates a total abstraction of 6.62 m3/day.

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- Consequently, cumulative water demand during construction of the access road should not exceed 197.85 m3/8hr day, unless there is another borehole to supplement water usage for other projects (limited to the surplus groundwater reserve in the respective sub-catchments; HRU4 and HRU5) or SAE staggers other construction projects, e.g., MTS, Dx and solar field, to reduce the total water demand on BH13 at any one time.
- It is estimated that approximately **211 m3/day** of groundwater will be required during construction of the access road. Water use during construction includes:
    - Road Stabilisation (118 m3/day),
    - Concrete mixing (watercourse crossings and MTS) (25 m3/day),
    - Domestic use for workers (drinking, washing hands, and sanitation) (2,25 m3/day), and
    - Dust suppression (spraying once per day and using a soil binding agent) (65,8 m3/day).
- The estimated demand (211 m3/day) exceeds the available groundwater yields (197.85 m3/8hr day), creating a potential deficit of 13,15 m3/day. Water saving strategies will need to implemented on site to ensure sufficient water during the construction of the access road.
- The use of on-site supplementary water sources such as grey water could reduce the Average Annual Daily Demand (AADD) requirement from the borehole water supply system (underground aquifer). The potential reduction in AADD to be supplied by the underground aquifer depends on the extent that such measures can be implemented for construction demand. Only one potential source of non-potable water that can be re-used for certain construction activities has been identified, namely wastewater generated by the washing of the concrete mixer trucks and/or in the production of concrete.
- "Domestic wastewater" means wastewater arising from domestic and commercial activities and premises, and may contain sewage (GA for Section 21(g), 2013).
- Assuming the estimated demand for potable water is **2,25 m3/day** during construction (45 staff and the provision of 50 litres of potable water per person per day) and the sewerage flow contribution as a percentage of Average Annual Daily Demand (AADD) for business, commercial, industrial land use categories is 80% (DHS Redbook, Section K, Table K.4), then ± 1,8 m3 of "domestic wastewater" shall be generated each day.
- During peak construction of Cluster 1, the labour force should reach 400 employees, thereby generating 16 m3 of "domestic wastewater" each day. However, the access road project will be completed within 6 to 8 weeks and will therefore not contribute towards (cumulative) wastewater generation during peak construction.

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- "On-site disposal" refers to the disposal of wastewater on individual properties not permanently linked to a central waste collection, treatment, and disposal systems, such as septic tank systems, conservancy tank systems, soakaway systems, french drains, pit latrines, some package plants and related activities (GA for Section 21(g), 2013).
- The sanitation system adopted by the contractor(s) at the construction camp will be a containerised system whereby domestic wastewater will be stored in a conservancy tank(s) for safe disposal elsewhere and/or a package plant for the on-site disposal, using a septic tank-soakaway system.
- *Storage for disposal (conservancy tank system)* - In terms of section 3.8 of the GA for Section 21(g) (2013), a person who lawfully occupies property registered in the Deeds Office or lawfully has access to land on which the use of water takes place, may store up to 10 000 m3 of domestic wastewater per property for the purpose of disposal if the storing of the wastewater does not impact on a water resource or on any other person's water use, property or land, and is not detrimental to the health and safety of the public in the vicinity of the activity.
- A person who stores wastewater in terms of the GA for Section 21(g) (2013) must submit a registration form for registration of the water use before commencement of storage if more than 1 000 m3 are stored for disposal. Given the unlikelihood of all contractors (combined) storing more than 1 000 m3 of domestic wastewater at the construction camp for disposal, this water use will not need to be registered, but is subject to the limits and conditions contained therein.
- Given the large volumes for storage above, DWS may interpret "storage" as wastewater storage dams, and not a conservancy tank system, particularly since a conservancy tank system is included in the definition of "on-site disposal."
- In other words, the storage of domestic wastewater using conservancy tanks for the purpose of disposal may not be permissible under the abovementioned section (3.8) of the General Authorisation, requiring an application for a Water Use License.
- *On-site Disposal (septic tank-soakaway system)* - Alternatively, section 3.9 of the same GA for Section 21(g) (2013), allows a person who lawfully occupies property registered in the Deeds Office or lawfully has access to land on which the use of water takes place, to dispose of domestic wastewater to a communal conservancy tank serving no more than 50 households or domestic wastewater generated by a single household not permanently linked to a central waste collection, treatment and disposal system to an on-site disposal facility.
- A person who disposes of wastewater in terms of the GA for Section 21(g) (2013) must submit a registration form for registration of the water use before the commencement of the disposal if more than 50 m3 of domestic wastewater is disposed of on any given day. Given the unlikelihood of all contractors (combined) disposing more than 50 m3 of domestic wastewater on any given day at the construction camp, this water use will not need to be registered. However, section 3.9 of the GA for Section 21(g) (2013) refers to a communal conservancy tank serving no more than **50 households** and domestic wastewater generated by **a single household**. Consequently, DWS may not consider domestic wastewater

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generated by 45 labourers for the road contractor (**± 1,8 m^3**), or by 400 labourers for all contractors combined during peak construction (**± 16 m^3**), permissible under the abovementioned section (3.9) of the General Authorisation, requiring an application for a Water Use License.

- Section 6 of the Water Services Act, 1997 (Act No. 108 of 1997) reads, "6. Access to water services through nominated water services provider (1) Subject to subsection (2), no person may use water services from a source other than a water services provider nominated by the water services authority having jurisdiction in the area in question, without the approval of that water services authority."
- Section 7 of the Water Services Act, 1997 (Act No. 108 of 1997) reads,"7. Industrial use of water (1) Subject to subsection (3), no person may obtain water for industrial use from any source other than the distribution system of a water services provider nominated by the water services authority having jurisdiction in the area in question, without the approval of that water services authority."
- A written approval is required from the Municipality which explicitly gives permission to SAE to supply water for sanitation services and industrial use under Sections 6 and 7 of the Water Services Act, 1997.
- This does not fall within the scope of this project as permission will be sought for the use of the Cluster 1 boreholes through that project.
- Regulation 2(b) reads, "The owner of a water care work to be put into operation after the date of commencement of these regulations shall apply for the registration of such work before it is commissioned."
- SAE cannot prescribe a Water Care Work (a sewerage treatment package plant), so it will be contractor's responsibility to register the Water Care Work.

Impact 01 (Conservation of Agriculture)

- Regulation 2 of the CARA Regulations (1984) reads, "2. Cultivation of virgin soil (1) Except on authority of a written permission by the executive officer, no land user shall cultivate any virgin soil: Provided that such authority shall not be required in respect of virgin land for which an approval has been granted in terms of section 4A of the Forest Act, 1972 (Act 68 of 1972).
- (2) An application for a permission referred to in subregulation (1) shall be made on a form obtainable from an extension office for this purpose.
- (3) Such application form shall be completed by the land user of the farm unit on which such virgin soil is situated and shall be lodged at the extension office for the area within which the farm unit concerned is situated at least three months prior to the intended date of cultivation."
- "cultivation", in relation to land, means any act by means of which the topsoil is disturbed mechanically; and "cultivate" has a corresponding meaning.

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- Regulation 8 of the CARA Regulations (1984) reads, "8. Regulating of the flow pattern of run-off water (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), no land user shall in any manner whatsoever divert any run-off water from a water course on his farm unit to any other water course, except on authority of a written permission by the executive officer."
- Regulation 7 of the CARA Regulations (1984) reads, "7. Utilisation and protection of vleis, marshes, water sponges and water courses (1) Subject to the provisions of the Water Act, 1956 (Act 54 of 1956), and subregulation (2) of this regulation, no land user shall utilise the vegetation in a vlei, marsh or water sponge or within the flood area of a water course or within 10 metres horizontally outside such flood area in a manner that causes or may cause the deterioration of or damage to the natural agricultural resources.
- (3) Except on authority of a written permission by the executive officer, no land user shall-
    - (a) drain or cultivate any vlei, marsh or water sponge or a portion thereof on his farm unit; or
    - (b) cultivate any land on his farm unit within the flood area of a water course or within 10 metres horizontally outside the flood area of a water course."

Impact 01 (Mining)

- **Road material or aggregate will be purchased from a licensed commercial source.**
- Section 53 of the MPRDA, reads *"53. Use of land surface rights contrary to objects of Act (1) Subject to subsection (2), any person who intends to use the surface of any land in any way which may be contrary to any object of this Act or which is likely to impede any such object must apply to the Minister for approval in the prescribed manner."*
  "Kindly note that if you want to apply for section 53, you can lodge your application online on the Department's website. Check for SAMRAD applications and follow the steps to create your profile. You must select land use application which is section 53." (*pers. comm. Mmboneni Mutheiwana, MMboneni.Mutheiwana@dmre.gov.za).*
- A Section 53 application was lodged via SAMRAD on 21 February 2023 (ref no: NC30/5/4/2/11505SU).

Impact 01 (Land Use)

- The properties are zoned as Agriculture 1.
- Please provide a formal application letter in your company letter head detailing the proposed work within our servitude. Furthermore, for road applications underneath Eskom Tx lines, please ensure to provide the following information;
    - 1. Need location of new road crossing, which line and towers affected.

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- 2. Need final designs for road, showing the final elevation and road surface level.
- 3. Need construction methodology for road
- 4. Need details on how surface will be made, graders, blasting etc.
- 5. Need timelines for road construction.
- 6. Need applicant to conduct survey to gather current conductor positions of line being crossed and current surface levels of servitude (pers. comm. Nomzamo Mdunyelwa ST(SA)0991, Senior Advisor Audit and Investigation, Servitude and Land Management, Asset Management - Transmission Division, Eskom (Tel: 053 830 5947, Mobile: 081 046 5341, Email:MdunyeNC@eskom.co.za))

- The District Road (2448) intersects the Remainder of Farm Blaauwbosch Kuilen Outspan 37C and the Remainder of Barends Kuilen 38C. Both farms are held by JC Venter Trust (No. IT23/2004) under Title Deed T000023608/2005. Portion 1 of the Farm Blaauwbosch Kuilen Outspan 37C was expropriated by SANRAL to establish the N10 (Deed of Transfer T000018192/2016). Ecoleges could not find a Deed of Transfer for the District Road.
- No permission is required from the landowner whose property the 'Burgerville' District Road runs, even though no formal sub-division or servitude registration has taken place (pers. comm. Jan Truter, south consulting Town & Regional Planning, jan@southcon.co.za)
- Sanral or the Department of Roads and Public Works Northern Cape are the road authorities of rural roads in the district, and you are advised to liaise with them. The District Municipality is no longer responsible for road maintenance since 2011 (pers. comm. Hennie Greeff, Senior Manager Infrastructure Development, Housing and Planning, Pixley ka Seme District Municipality, Private Bag X1012, 1 Culvert Road, De Aar, 7000).
- The road in question is a Divisional Road 2448 (DR2448). According to Roads Ordinance No. 19 of 1976, the statutory road reserve width for divisional road is 20 m (pers. comm. Rabele Matsoso, NCPG, r.matsoso@vodamail.co.za).
- It is assumed that the road authority for the 'Burgerville' District Road (DR2448) is the Department of Roads and Public Works Northern Cape.
- District and Local municipal by-laws may regulate aspects of the project.

Assessment without mitigation:

Legend

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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	NA	NA	NA	-I	NA	NA	NA	H	H	1
Reversibility	NA		**Irreplaceability**	NA		**Mitigatory Potential**	H			

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

- Construction may not commence without a water use license from the regional office of the Department of Water and Sanitation.
- The proposed activities do not include operational aspects. Consequently, the environmental authorization is required for development only, including the following phases: planning and design, pre-construction, construction, and post-construction (rehabilitation and monitoring).The validity period of the environmental authorisation shall be the maximum permissible period given the scale of the project, anticipated time to complete construction, and the uncertainty of when a water use license will be granted.

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

- Astronomy Geographic Advantage (AGA) Act (Act No. 21 of 2007)
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
- National Environmental Management: Biodiversity Act (Act No. 10 of 2004); Chapter 4 Threatened or Protected Ecosystems and Species
  - A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit issued in terms of Chapter 7 (S57(1)).
- National Forest Act, 1998 (Act No. 84 of 1998); Part 3 Protection of Trees

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  - No person may cut, disturb, damage or destroy any protected tree except under a license granted by the Minister (S15(1)(a)).
- Northern Cape Nature Conservation Act, 2009 (Act No. 9 of 2009); Section 51(1) "No person may, without a permit, pick an indigenous plant - (c) within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course."
  - "**pick**" includes to collect, to cut, to chop off, to take, to gather, to pluck, to uproot, to break, to damage or to destroy;
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004); Section 73(2) "A person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity."
- National Water Act, 1998 (Act No 36 of 1998) published in Government Notice No. 1091 of Gazette No. 19182 as amended, including Section 144 and Chapter 4: Use of water.
  - General Authorisation for S21(c) & (i) published in GN 509 of 26th August 2016 in GG No. 40229.
  - General Authorisation for S21(a) & (b) published in GN 538 of 02nd September 2016 in GG No. 40243
  - General Authorisations for S21(g) & (e) published in GN 665 of 06th September 2013 in GG No. 36820
- National Environmental Management Act, 1998 (Act No. 107 of 1998); Section 49A (1) A person is guilty of an offence if that person - (c) fails to comply with or contravenes a condition of an environmental authorisation granted for a listed activity or specified activity or an approved environmental management programme
- Scheme Regulations for Emthanjeni Municipality in terms of Sect. 36(1) of the Northern Cape Planning and Development Act (1998) (2004)
- Renewable Energy Generation Plant Setbacks to Eskom Infrastructure Revision 02 compiled on 15/09/2020 (Unique Identifier 240-65559775)
- Environmental Impact Assessment Regulations, 2014 as amended including EIA Regulations Listing Notice 1 (and 3) of 2014, as amended.
- DHS Redbook, Section K, Sanitation, The Neighbourhood Planning and Design Guide, Part II, Planning and design guidelines, developed by Department of Human Settlements, published by the South African Government ISBN: 978-0-6399283-2-6, version 1.1, printed January 2019.
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) Regulations (1984), as amended.
- Water Services Act, 1997 (Act No. 108 of 1997)
- Regulations for the Erection, Enlargement, Operation and Registration of Water Care Works made in GNR 2834 on 27 December 1985 in terms of section 26 read in conjunction with section 12A of the Water Act, 1956 (Act No. 54 of 1956). This section and provisions were not retracted in The National Water Act of 1998).
- Municipal By-Laws

Mitigations:

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Impact Management Outcome(s):

- Lawful activities involving any threatened or protected flora.
- Lawful activities involving any listed invasive species.
- Lawful Water Use S21(a), (b), (c), (g) and (i) NWA, 1998
- Compliance with MPRDA, 2002
- Compliance with Eskom requirements
- Compliance with Sanral requirements
- Compliance with road authority requirements
- Compliance with DMRE requirements
- Compliance with municipal requirements
- Compliance with DALR&RD requirements

Targets:

- A license under the NFA, 1998, a permit under NCNCA, 2009 and/or a permit under NEMBA, 2004.
- Notification in terms of NEMBA, 2004
- A registration certificate from the Director-General of the Department of Water Affairs.
- Water use license for section 21 (a), (b), (c), (g) and (i)
- Eskom 400 kV servitude (Line 1 and 2) Servitude Agreement and Letter of Consent
- Written permission from SANRAL prior to commencement of work within 60 m of the road reserve fence.
- Written permission from the Northern Cape Department of Roads and Public Works before repairing and rebuilding the district road.
- Written approval from the Minister of DMRE in terms of section 53.
- Written approval(s) where applicable from the Municipal Manager of the District and/or Local Municipalities.
- Written approval from the Municipal Manager of ELM.
- Written permissions from the executive officer (of the DALR&RD)

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
01	Legal Compliance	Picking a protected, specially protected or indigenous* plant without the applicable	Lawful activities involving any threatened	A license under the NFA, 1998, a permit under	Vegetation clearance may not commence without the applicable permit(s) and/or license to carry out a	SEO or ECO	Prior to commencement of clearing and grubbing.	Compliance to be verified by ECO and IEA.

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		permits and/or license constitutes an offence. * within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course.	or protected flora.	NCNCA, 2009 and/or a permit under NEMBA, 2004.	restricted activity involving, or cutting, disturbing, damaging or destroying any protected or specially protected plants, as well as picking indigenous plants on a public road, on land next to a public road within 100 m from the centre of the road, and within 100 m from the middle of a natural watercourse, whether wet or dry, on either side of the natural water course.			
01	Legal Compliance	Picking a protected, specially protected or indigenous* plant without the applicable permits and/or license constitutes an offence. * within an area bordering a natural water course, whether wet or dry, up to and within a distance of 100 metres from the middle of a river on either side of the natural water course.	Lawful activities involving any threatened or protected flora.	A license under the NFA, 1998, a permit under NCNCA, 2009 and/or a permit under NEMBA, 2004.	Only apply for permit(s) and/or a license to "pick" a threatened or protected plant if it is not possible to relocate the footprint.	Holder Landowner	Continuous	Compliance to be verified by ECO and IEA.
01	Legal Compliance	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) – Section 73(2) "A	Lawful activities involving any listed invasive species	Notification in terms of NEMBA, 2004	The holder of the Environmental Authorisation must notify the Minister (DFFE) and/or MEC (DAEARD&LR), in writing, of the listed	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.

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		person who is the owner of land on which a listed invasive species occurs must- (a) notify any relevant competent authority, in writing, of the listed invasive species occurring on that land; (b) take steps to control and eradicate the listed invasive species and to prevent it from spreading; and (c) take all the required steps to prevent or minimise harm to biodiversity."			invasive species occurring in the project area.			
01	Legal Compliance	Water Care Works must be registered with the Director-General of the Department of Water Affairs.	Compliance	A registration certificate from the Director-General of the Department of Water Affairs.	Apply for the registration of a Water Care Work (wastewater treatment plant) to the Director-General of the Department of Water Affairs on a form obtained from him before it is commissioned.	Holder	Prior to operation of Water Care Works	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Water Care Works must be registered with the Director-General of the Department of Water Affairs.	Compliance	A registration certificate from the Director-General of the Department of Water Affairs.	The owner of the Water Care Work must display in a prominent place on that work a copy of the certificate of registration.	Holder	Continuous	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
01	Legal Compliance	Water Care Works must be registered with the Director-General of the Department of Water Affairs.	Compliance	A registration certificate from the Director-General of the Department of Water Affairs.	The owner of the Water Care Work must employ the minimum number of persons of the classes prescribed in Schedule IV of the Regulations for the Erection, Enlargement, Operation & Registration of Water Care Works (1985), as amended.	Holder	Prior to operation of Water Care Works	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Water Care Works must be registered with the Director-General of the Department of Water Affairs.	Compliance	A registration certificate from the Director-General of the Department of Water Affairs.	The owner of the Water Care Work must notify the Director-General in writing during January of each year, of the employment of any person referred to in Schedule III of the Regulations for the Erection, Enlargement, Operation & Registration of Water Care Works (1985), as amended, during the past year.	Holder	January of each year	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Any unauthorised activity within the Department's (DWS) regulated area of a watercourse constitutes an offence. Those activities associated with the development which require a S21(c) and (i) authorisation, include:	Lawful Water Use S21(c) and (i) NWA, 1998	Water use license for section 21 (c) and (i)	Construction may not commence within the DWS regulated area without a water use authorisation (a General Authorisation or Water Use License) for Section 21(c) and (i) water uses.	Holder	Prior to commencement of those construction activities relating to S21 (c) and (i) water uses.	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
		1. Repairing and rebuilding an access road including where applicable drainage structures across eight (8) watercourses and within 100 m of two earth dams; and 2. Installing underground water pipelines across the active channel of unnamed FEPA drainage line D62D – 05610 SQ (a tributary of the Brak River), and an artificial wetland surrounding Solar Borehole No. 4 and No.5.						
01	Legal Compliance	Taking of water without a license for purposes other than reasonable domestic use and livestock watering, and which exceed the limits provided in the General Authorisation, constitutes an offence.	Lawful Water Use S21(a) NWA, 1998	Water Use License for section 21(a)	Abstraction of groundwater may not commence from identified boreholes without a water use authorisation (a General Authorisation or Water Use License) for Section 21(a) water use	Holder	Prior to commencement of those construction activities relating to a S21(a) water use, e.g., taking water for mixing concrete, dust suppression and potable water usage.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Storing water without a license for purposes other than rainfall run-	Lawful Water Use S21(b) NWA, 1998	Water Use License for section 21(b)	Storage of groundwater may not commence without a water use authorisation	Holder	Prior to commencement of those	Compliance to be verified by ECO and IEA.

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		off from a roof, and which exceed the limits provided in the General Authorisation, constitutes an offence.			(a General Authorisation or Water Use License) for Section 21(b) water use and only if the proposed storage tanks exceed the permissible storage volume for the property (in terms of the GA) when combined with existing storage on the same property.		construction activities relating to S21(b) water uses, e.g., installing storage tanks.	
01	Legal Compliance	The unauthorised disposal of waste in a manner which may detrimentally impact on a water resource, and storage of domestic and biodegradable industrial wastewater for the purpose of re-use, constitutes an offence.	Lawful Water Use S21(g) NWA, 1998	Water Use License for section 21(g)	The disposal and storage of wastewater may not commence without a water use authorisation (a General Authorisation or Water Use License) for Section 21(g) water use.	Holder	Prior to commencement of those construction activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks for treated effluent.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	The unauthorised disposal of waste in a manner which may detrimentally impact on a water resource, and storage of domestic and biodegradable industrial wastewater for the purpose of re-use, constitutes an offence.	Lawful Water Use S21(g) NWA, 1998	Water Use License for section 21(g)	Similarly, the storage of waste for reuse or disposal, e.g., untreated effluent, such as concrete slurry from concrete mixer trucks during construction and contaminated soil, may not commence without a water use authorisation (a General Authorisation or Water Use License) for Section 21(g) water use.	Holder	Prior to commencement of those construction activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks	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
							for treated effluent.	
01	Legal Compliance	The unauthorised disposal of waste in a manner which may detrimentally impact on a water resource, and storage of domestic and biodegradable industrial wastewater for the purpose of re-use, constitutes an offence.	Lawful Water Use S21(g) NWA, 1998	Water Use License for section 21(g)	If treated effluent (wastewater) will be used to supplement the demand for water to control dust, then it too may not commence without a water use authorisation (a General Authorisation or Water Use License) for Section 21(g) water use or other water use as determined by the Responsible Authority.	Holder	Prior to commencement of those construction activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks for treated effluent.	Compliance to be verified by ECO and IEA.
01	Layout and Design	Unsafe disposal - soil contamination and water pollution.	Lawful Water Use S21(g) NWA, 1998	Water Use License for section 21(g)	Any person who stores or disposes of domestic wastewater are subject to (must comply with) the limits and conditions set out in the General Authorisation for Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource published in GN No. 665 of Government Gazette No. 36820 on 06th September 2013 or alternatively, the conditions contained in the water use license.	Holder	Prior to commencement of those construction activities relating to S21(g) water uses, e.g., installing an on-site disposal facility and storage tanks for treated effluent.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Repairing and rebuilding the Burgerville District	Compliance with Eskom requirements	Eskom 400 kV servitude (Line 1 and 2)	The applicant must provide a formal application letter to Eskom on its company	Holder	At least 30 days before the intended date of	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
		Road will impact Eskom's 400 kV powerline servitudes (Line 1 and Line 2). Construction without permission will constitute an offence in terms of the relevant legislation. (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994) - repealed by Electricity Regulation Act, 2006 (Act No. 4 of 2006) as amended.		Servitude Agreement and Letter of Consent	letter head detailing the proposed work within Eskom's 400 kV overhead Hydra-Poseidon Transmission line servitudes (Line 1 and 2).		commencing with constriction within Eskom's servitude.	
01	Legal Compliance	Repairing and rebuilding the Burgerville District Road will impact Eskom's 400 kV powerline servitudes (Line 1 and Line 2). Construction without permission will constitute an offence in terms of the relevant legislation. (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994) - repealed by Electricity Regulation Act, 2006 (Act No. 4 of 2006) as amended.	Compliance with Eskom requirements	Eskom 400 kV servitude (Line 1 and 2) Servitude Agreement and Letter of Consent	Furthermore, for road applications underneath Eskom Tx lines, please ensure to provide the following information: 1. Need location of new road crossing, which line and towers affected. 2. Need final designs for road, showing the final elevation and road surface level. 3. Need construction methodology for road. 4. Need details on how surface will be made, graders, blasting etc.	Holder	At least 30 days before the intended date of commencing with constriction within Eskom's servitude.	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
					5. Need timelines for road construction. 6. Need applicant to conduct survey to gather current conductor positions of line being crossed and current surface levels of servitude.			
01	Legal Compliance	Repairing and rebuilding the Burgerville District Road will impact Eskom's 400 kV powerline servitudes (Line 1 and Line 2). Construction without permission will constitute an offence in terms of the relevant legislation. (Section 27(3) of Electricity Act, 1987 (Act No. 41 of 1987), as amended in 1994) - repealed by Electricity Regulation Act, 2006 (Act No. 4 of 2006) as amended.	Compliance with Eskom requirements	Eskom 400 kV servitude (Line 1 and 2) Servitude Agreement and Letter of Consent	The application should be submitted to Nomzamo Mdunyelwa ST(SA)0991, Senior Advisor Audit and Investigation, Servitude and Land Management, Asset Management - Transmission Division, Eskom (Tel: 053 830 5947, Mobile: 081 046 5341, Email:MdunyeNC@eskom.co.za) at least 30 days before the intended date of commencement to prevent any unnecessary delays.	Holder	At least 30 days before the intended date of commencing with constriction within Eskom's servitude.	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Any services that need to be constructed over or under a national road, (in this case the N10) or within 60 m measured from the road reserve fence	Compliance with Sanral requirements	Written permission from SANRAL prior to commencement of work within 60 m of	Apply for a written permission from South African National Roads Agency SOC Limited (SANRAL) before any work is carried out at the N10/Burgerville District Road intersection, and	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.

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		will have an impact on SANRAL *(pers. comm. Nicole Abrahams, Environmental Coordinator, Western Region, AbrahamsN@nra.co.za).*		the road reserve fence.	specifically within 60 m from the road reserve fence (wrstatutory@nra.co.za).			
01	Legal Compliance	Permission may be required to repair and rebuild a rural (District) road that falls under the jurisdiction of a road authority/Consent may be necessary from the Northern Cape Department of Roads and Public Works under the Northern Cape Roads Ordinance, 19 of 1976 for the upgraded district access road, including a formal wayleave.	Compliance with road authority requirements	Written permission from the Northern Cape Department of Roads and Public Works before repairing and rebuilding the district road.	Obtain written permission, including a formal wayleave, if necessary, from the Northern Cape Department of Roads and Public Works before any work is carried out on the 'Burgerville' District Road (DR2448.	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Permission may be required from DMRE to use the land surface for an access road as the establishment of a formal servitude could detrimentally affect the mining of mineral	Compliance with DMRE requirements	Written approval from the Minister of DMRE in terms of section 53.	Apply for a written approval from the Minister of the DMRE to use the surface of the land for an access road in terms of Section 53 of the MPRDA, 2002, before the commencement of construction, particularly on the private properties (e.g.,	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.

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		resources on that parcel of land.			not the district road section), Submit the application using the online application portal on the Department's website. Check for SAMRAD applications and follow the steps to create your profile. Select land use application which is section 53 (*pers. comm. Mmboneni Mutheiwana, MMboneni.Mutheiwana@dmre.gov.za*).			
01	Legal Compliance	Borrow pit licensing is classified as small-scale mining under the Mineral and Petroleum Resources Development Act, 28 of 2002 (Act No. 28 of 2002) and is administered by the Department of Minerals and Energy, through whom any permit applications must be lodged.	Compliance with MPRDA, 2002	Mining permit or license	Material (aggregate) for road construction will be imported from a licensed commercial source(s).	Holder, Engineer, Contractor	Continuous	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Existing by-laws may regulate aspects of the project and require consent.	Compliance	Written approval(s) where applicable from the Municipal Manager of the District	Obtain written approval(s) from the Municipal Manager of the District and/or Local Municipality to undertake any regulated activity that requires consent in terms of the applicable By-Law.	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.

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				and/or Local Municipalities.				
01	Legal Compliance	Permission may be required from Emthanjeni Local Municipality (ELM) to use water services from a source other than a water services provider nominated by the water services authority having jurisdiction in the area.	Compliance	Written approval from the Municipal Manager of ELM.	Obtain written approval from the Municipal Manager of the Emthanjeni Local Municipality to supply groundwater from permissible boreholes on Cluster 1 for sanitation services and industrial use under Sections 6 and 7 of the Water Services Act, 1997 before the intended use of that water for construction.	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.
01	Legal Compliance	Permits or exception may be required from the Department of Agriculture, Land Reform and Rural Development (DALR&RD) under provisions of the CARA Regulations including permission under regulation 2(2) of the CARA Regulations to construct an access road on virgin soil.	Compliance	Written permissions from the executive officer (of the DALR&RD)	Obtain, if necessary, a written permission from the executive officer (of the DALR&RD) to 'cultivate virgin soil' by expanding existing farm tracks and constructing a new road on virgin soil, in terms of CARA Regulation 2.	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.
01	Legal Compliance	• Permits or exception may be required from the Department of Agriculture, Land Reform and	Compliance	Written permissions from the executive officer (of the DALR&RD)	Obtain, if necessary, a written permission(s) from the executive officer (of the DALR&RD) to divert surface water run-off through designed	Holder	Prior to commencement	Compliance to be verified by ECO and IEA.

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		Rural Development (DALR&RD) under provisions of the CARA Regulations including permission under regulation 7(1) of the CARA Regulations for the drainage of a vlei, marsh or floodplain, relating to construction of access road within the floodplain of the Brak River. • Permits or exception may be required from the Department of Agriculture, Land Reform and Rural Development (DALR&RD) under provisions of the CARA Regulations including changing the flow pattern of runoff water (Regulation 8)			engineering structures, such as box culverts, drifts or other permissible designs at the identified watercourse crossings and where applicable alluvial floodplains in terms of CARA Regulations 7 and 8.			

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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
		related to the upgrades of the access road across the Brak River watercourse.						

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- The residual risk of undertaking unlawful activities (**01**) after mitigation is assumed to be Low.
- A person may feel compelled to commence with construction without a water use license if an environmental authorisation has been granted by the competent authority and the validity period requires the applicant to conclude the authorised activity within a restrictive timeframe that is limited to one dry season.

Receiving Environment: Terrestrial Fauna

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Commencement & Construction times	N/A	**Impact:** Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase. **Consequence:** Decrease in avifauna population (directly) due to loss of offspring/breeding pairs for generation (indirectly).	Quantity	02

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			Forced redistribution out of home ranges or territories can cause stress and conflict, leading to injury or death of individuals (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 threatened keystone species may alter the functioning of an ecosystem (direct).		
Layout and Design	Installing 19 m-wide servitude Fence and Access Control	Security	**Impact:** Tortoises and other animals become stuck against fences and are electrocuted to death. **Consequence:** Loss/injury to faunal species.	Quantity	02
Layout and Design	Installing 19 m-wide servitude Fence and Access Control	Terrestrial barrier	**Impact:** Bird mortalities during the operational phase due to vehicle collisions (directly) or vulnerable species foraging on verge side vegetation and passing vehicles causing subsequent fence collisions and/or entanglement (indirect). **Consequence:** Decrease in avifauna population.	Quantity	02
Layout and Design	Buffers	Specialist Assessment Reports	**Impact:** Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase. **Consequence:** Decrease in avifauna population (directly) due to loss of offspring/breeding pairs for generation (indirectly). Forced redistribution out of home ranges or territories can cause stress and conflict, leading to injury or death of individuals (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 threatened keystone species may alter the functioning of an ecosystem (direct).	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 (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

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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 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.
- The DFFE Screening Tool identified the site as having a high sensitivity for the animal species theme.

Impact 02 (Important Bird Area)

- The study area occurs in the Platberg-Karoo Conservancy (SA037) Important Bird and Biodiversity Area (IBA), covering c. 1 240 000 ha with a protected status of "Unprotected". The folding process has forged several large peaks and plateaus in this area. The IBA encompasses a continuous chain of mountains and includes several State forests, mountain catchment areas and provincial nature reserves. A total of 289 bird species have been recorded in the IBA during SABAP2 (Avifauna Final EIA Report prepared by Sam Laurence of Enviro-Insight cc, dated October 2022). Although this region appears typical of much of the upper Nama Karoo, this IBA contributes greatly to conservation by supporting populations of several red-listed species, many of which are collision-prone medium to large terrestrial birds (cranes, bustards, korhaans) and raptor species (Avi Faunal Specialists EIA Report in May 2017).
- 84 bird species were observed within and around the Combined Project Area out of an expected total of 104 species, based on previous surveys, the SABAP Pentad analysis and habitat suitability, based Probability of Occurrences.
- IBA trigger species are the Globally threatened Blue Crane, Ludwig's Bustard, Kori Bustard, Secretary bird, Martial Eagle, Blue Korhaan, Black Harrier and Denham's Bustard. Regionally threatened species are Black Stork, Lanner Falcon, Tawny Eagle, Karoo Korhaan and Verreauxs' Eagle (BirdLife website, 2015).

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- The most significant breeding habitat recorded during the survey were the active Verreaux's Eagle and Tawny Eagle nests. The nesting site is at this stage the highest sensitivity found within proximity of the study area. A portion of the preferred Alternative Route No. 1, specifically existing farm tracks that will be rebuilt to Eskom specification, are within the 1 km buffer of the Verreaux Eagle's nest (Avifauna Final EIA Report, 2022).
- Verreaux's Eagles breed with one partner for their entire life, and only replace a partner in the event of death. **Mating takes place all year round and egg-laying season is between April and July** (Verreaux's Eagle - SANBI, 2014).
- Essentially, all habitat attractants should be eliminated so that avifaunal populations will not embedded themselves within the infrastructure over time.
- Significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure.
- Average monthly rainfall peaks from October to May, whereas average monthly run-off peaks from December to April (Hydrology Assessment, 2023).
- Conservation Issues/Threats:
    - Habitat loss (including foraging and breeding) and fragmentation due to displacement (avoidance of disturbance). Habitat loss has the tendency to not only 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.
    - Disturbance due to noise such as, machinery movements and maintenance operations during the construction.
- Significant risks are associated with the likelihood of project vehicles flushing birds into fencing infrastructure. However, the servitude fence will be a low cattle fence not unlike the existing servitude and farm boundary fences within the area, typically 1.2 m high. Consequently, no mitigation, such as defined fence line setbacks from the shoulder of the access road and side/cut-off drain is required to limit any chance of fence collisions and/or entanglement.

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
02	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:

- Avifauna Specialist Assessment (Final) prepared by Enviro-Insight CC (Sam Laurence and A.E. van Wyk) dated October 2022).
- (BirdLife International (2022) Species factsheet: Neotis ludwigii. Downloaded from http://www.birdlife.org on 30/03/2022; http://datazone.birdlife.org/species/factsheet/ludwigs-bustard-neotis-ludwigii).
- Verreaux's Eagle - SANBI article prepared by Mandisa Kondlo and Thato Moeketsane of Walter Sisulu National Botanical Garden on September 2014.
- 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.
- Screening Assessment Reports.
- BirdLife website (https://www.birdlife.org.za/iba-directory/platberg-karoo-conservancy - page last updated Friday 13th February 2015)
- "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):

- No harm to wildlife.
- Ensure the protection of Aves.
- Ensure least impact on breeding, e.g., bird roosts and nests are not disturbed.

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Targets:

- Construction in watercourse crossings between May and August.
- No active construction within 1.5 km buffer from April to July, and preferably August.
- No animal mortalities from electrocution (fence).
- New roads are outside avifaunal-specific highly sensitive areas.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsibility	Timeframe / Frequency	Monitoring
02	Planning	Disturbance to breeding or destruction of bird roosts.	Ensure least impact on breeding, e.g., bird roosts and nests are not disturbed.	Construction in watercourse crossings between May and August.	As far as possible, limit construction within sensitive flood plains, watercourses and associated buffers to May, June, July, and August to avoid breeding periods of Avian species.	Holder, Engineer, Contractor.	Construction Phase	Compliance to be verified by ECO and IEA.
02	Planning	Disturbance to breeding or destruction of bird roosts.	Ensure least impact on breeding, e.g., bird roosts and nests are not disturbed.	No active construction within 1.5 km buffer from April to July, and preferably August.	As far as possible, schedule work in the vicinity of nests or roosts of species of conservation concern outside of the breeding season of the nesting bird; construction of that portion of the preferred Alternative Route No. 1 that is within the 1.5 km buffer of the Verreaux Eagle's nest must be completed outside its breeding season,	Contractor	Continuous during construction phase	SEO to monitor 1.5 km buffer. 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
					which is from April to July, and preferably August as well.			
02	Layout and Design	Tortoises and other animals become stuck against fences and are electrocuted to death.	No harm to wildlife.	No animal mortalities from electrocution.	If the road reserve is to be electrically fenced, then the live strands should be on the inside of the fence or more than 30 cm from the ground. Alternatively, a guard wire set at 20 cm can be used to keep larger tortoises away from the fence.	Holder, Contractor	Planning & Design Phase, and Construction Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Tortoises and other animals become stuck against fences and are electrocuted to death.	No harm to wildlife.	No animal mortalities from electrocution.	Where gates are installed in jackal proof fencing, a suitable reinforced concrete sill must be provided beneath the gate.	Holder, Contractor	Planning & Design Phase, and Construction Phase	Compliance to be verified by ECO and IEA.
02	Layout and Design	Tortoises and other animals become stuck against fences and are electrocuted to death.	No harm to wildlife.	No animal mortalities from electrocution.	Original tension must be maintained in the fence wires. only be erected with the permission of the landowner	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
02	Layout and Design	Tortoises and other animals become stuck against fences and are	No harm to wildlife.	No animal mortalities from electrocution.	Any temporary fencing to restrict the movement of livestock must only be erected with the	Holder, Contractor	Continuous	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
		electrocuted to death.			permission of the landowner			
02	Planning and Layout and design	Bird mortalities during the construction phase due to vehicle collisions or collisions with infrastructure. Disturbance to breeding or destruction of bird roosts during the construction phase.	Ensure the protection of Aves. Ensure least impact on breeding, e.g., bird roosts and nests are not disturbed.	New roads are outside avifaunal-specific highly sensitive areas.	Avoid the construction of new roads in avifaunal-specific highly sensitive areas and their associated buffers, such as within the 1 km buffer of the Verreaux Eagle's nest, as well as flood plains, watercourses (e.g., drainage lines and wetlands), large impoundments, borehole pans and rocky koppies.	Holder, Engineer, Contractor	Planning and Design and construction phase	SEO to monitor 1 km buffer. 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
02	L	L	L	-I	L	L	0	L	M	0

Residual Risk (feeds back into "Mitigations"):

- Sedentary or burrowing fauna, as well as ground nesting birds, may occupy the development site after their observed absence during the basic assessment process.
- Although the development footprint is small relative to animal home rages and territories, sound can travel further, beyond the boundaries of the footprint.

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- 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.
- Overall, the residual risk of loss of threatened terrestrial fauna (**02**) after mitigation is assumed to be Low.

Receiving Environment: Terrestrial Flora

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change Land Use	N/A	Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - Runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.	Quantity	03

*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 (Fire)

- The De Aar area falls within the Nama Karoo biome. Runaway fires could result in a decrease in grazing capacity.

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				

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+I/R	Positive Impact/Risk				

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:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)

Mitigations:

Impact Management Outcome(s):

- Fire management plan.

Targets:

- No run-away (uncontrolled) fires.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
03	Change in Land Use	Risk of veld fires caused by workers during the construction of the facility decreases grazing capacity	Fire management plan	No run-away (uncontrolled) fires - no open fires	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire	Holder	Planning and Design	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
					management plan accordingly.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of grazing material due to uncontrolled fires (**03**) after mitigation is assumed to be Low.

Receiving Environment: Soil and Rock

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and design	Installing 19 m-wide servitude Fence and Access Control	Surface water hydrology (run-off)	**Impact:** Run-off from road in dispersive soils can cause erosion. **Consequence:** Storm water and runoff from hard surfaces such as a road, need to be managed to prevent initiation of erosion. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that	Quantity	04

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			maintains other ecosystem services, so its harm can lead to ecosystem collapse.		
Layout and design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Supplying services via trenches in dispersive soils can cause tunnel erosion. **Consequence:** Trenches may be used to supply services such as water and electricity, however in dispersive soils, the increased porosity of repacked spoil within the trench can lead to tunnel erosion and damage to pipes and cables. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	04
Layout and Design	Roads, Crossings & Stormwater outlets	N/A	**Impact:** Constructing roads and culverts in dispersive soils can cause erosion. **Consequence:** Construction of roads on dispersive soils is difficult due to their low bearing capacity when wet. Concentrating water in roadside culverts and drains which have been excavated into dispersive soils often leads to erosion and collapse of the road batter adjacent embankments. Any degradation of the soil-terrain complex that undermines its capacity to function - from storing water and recycling nutrients to resisting erosion - will lead to a decline in primary production and diminish energy flow to higher trophic levels. Primary production is an ecosystem supporting service that maintains other ecosystem services, so its harm can lead to ecosystem collapse.	Quantity	04

*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)

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

Impact 04 (Soils)

- 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.
- It appears that the access road mostly runs through areas where the impact of the operations with Phase 1 should not have a major effect on the vegetation. However, the aerial view indicates that the access road intercepts a floodplain of approximately 1.7 km, just past the Staging area towards the MTS. It is important to mention that, among other things, a soil analysis was carried out at this flood plain. The finding was that the topsoil and subsoil samples have extremely high sodium (Na, SAR) concentrations that will inhibit plant growth. This might be an indication of poor drainage or lateral seepage of sodium.
- The soil profile is generally thin, less than 1m within the area and the nature of the bedrock is consistent across the footprint.
- The whole area is underlain by the same mudstone-siltstone formation and quaternary aeolian sand overburden, the only difference encountered is variable degrees of weathering within the mudstone-siltstone into.

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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Reg: 2006/023163/23

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
04	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:

- 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).
- 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).
- 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.
- 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.

Mitigations:

Impact Management Outcome(s):

- Minimise the risk of erosion on dispersive soils.

Targets:

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- No signs of soil or tunnel erosion.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
04	Layout and Design	Supplying services via trenches in dispersive soils can cause tunnel erosion.	Minimise the risk of tunnel erosion in dispersive soils.	No signs of tunnel erosion.	If trenching is to be undertaken in potentially dispersive soils (e.g., bare patches) then implement the 'Trenching in Dispersive Soils Protocol' (Appendix B1)	Contractor	Planning and Design	Compliance to be verified by ECO and IEA.
04	Layout and Design	Constructing roads and culverts in dispersive soils can cause erosion.	Minimise the risk of erosion on dispersive soils	No signs of soil erosion.	If roads and culverts are to be constructed in potentially dispersive soils (e.g., bare patches) then implement the 'Roads & Culverts in Dispersive Soils Protocol' (Appendix B2)	Contractor	Planning and Design	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	M	L	-I	M	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of soil erosion (**04**) after mitigation is assumed to be Low.

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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.
Change land use	N/A	Fires	**Impact:** Water demand for fighting wildfires may temporarily jeopardise available water reserves for development or operational requirements. **Consequence:** - Lower performance due to insufficient water to meet water demands during development or operation.	Quantity	05
Planning	Dust suppression	Water Usage	**Impact:** Using water as a form of dust control is an ineffective, wasteful, and short-term solution. **Consequences:** Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	05
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Increased demand for groundwater during construction for road stabilisation, dust control, and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished). **Consequence:** Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	05
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Impact on the aquifer reserve and borehole pump lifespan. **Consequence:** Less water in an underground aquifer means less water for other water users, including for reasonable domestic use and livestock watering (direct).	Quantity	05

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Layout and Design	Effluent Infrastructure (Sanitation)	Effluent disposal	**Impact:** Groundwater is vulnerable to pollution from on-site effluent disposal facilities **Consequences:** - Abstraction of polluted groundwater is harmful to human health.	Quality	06
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Groundwater is vulnerable to pollution **Consequences:** - Abstraction of polluted groundwater is harmful to human health.	Quality	06
Layout and Design	Commencement & Construction times	NA	**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	07
Layout and Design	Roads, Crossings & Stormwater outlets		**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	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 05 (Water quantity/use)

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- The Karoo is a dry plateau, experiencing periodic droughts which negatively affects the surrounding farming areas (Emathanjeni Local Municipality Final Integrated Development Plan 2021/2022). The average rainfall is 320 mm yr-1. Mean Annual Evaporation exceeds Mean Annual Participation by about 85%. The greater evaporative losses mean that non-perennial streams and rivers will only flow during flood events (Hydrological Assessment Report, January 2023). Consequently, De Aar is dependent on groundwater for agriculture and drinking water (District Municipality's Climate Change Response Plan). Not surprisingly, both Alternative Routes are located within a Strategic Water Source Area, meaning the groundwater capture zone (recharge area) must be protected to ensure the ongoing integrity of aquifers (quantity and quality).
- The largest risk of geohydrology is therefore the proposed groundwater abstraction activities. As groundwater is a very important resource for locals in the area, care should be taken not to overproduce from boreholes chosen for this project, and there is a limited impact on existing livestock/domestic watering already implemented (Geohydrological Assessment Report, 20th December 2022).
- Demand:
    - It is estimated that approximately 211 m3/day of groundwater will be required during construction of the 14.1 km-long access road. Water use during construction includes:
    - Road Stabilisation (118 m3/day),
    - Concrete mixing (watercourse crossings and MTS) (25 m3/day),
    - Domestic use for workers (drinking, washing hands, and sanitation) (2,25 m3/day), and
    - Dust suppression (spraying once per day and using a soil binding agent) (65,8 m3/day). The access road from the N10 to the Main Transmission Substation is approximately 14,1 km. However, it is assumed that dust control would only be required on two thirds of the access road at any one time during its construction. In total, dust control will be required on an estimated 9,4 km of 7 m-wide dirt road, covering a surface area of 65 800 m2. Outdoor dust control operations in typically dry areas require "about four litres of water on every square meter, every day." Applying this formula, a road roughly 14,1 km long and 7 m wide would require the use of roughly 263 200 L or 263 m3 of water for every spraying (https://blog.midwestind.com/water-is-a-poor-dust-control-method/).
    - The estimated demand* (211 m3/day) exceeds the available groundwater yields (197.85 m3/8hr day) from two selected boreholes, creating a potential deficit of 13,15 m3/day. Water saving strategies will need to be implemented on site to ensure sufficient water during the construction of the access road.
    - * The estimated demand was calculated using available data and assumptions where no data was provided, such findings may change at any time should any further information be made available.
- Yield:
    - The pump test data generated from BH13 in sub-catchment/HRU 4 indicates a total abstraction of 191.23 m3/8hr day, and the pump test data from Solar Borehole No. 5 in sub-catchment/HRU 5 indicates a total abstraction of 6.62 m3/day. Consequently, cumulative water demand during construction of the access road should not exceed 197.85 m3/8hr day, unless there is another borehole to supplement water usage for other projects (limited to the surplus groundwater reserve in the respective sub-catchments; HRU4 and

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HRU5) or SAE staggers other construction projects, e.g., MTS, Dx and solar field, to reduce the total water demand on BH13 and Solar BH5 at any one time.

- BH13 is in HRU4. So, assuming there is no Base Flow and Basic Human Needs are met by Existing Groundwater Abstraction, then there is a surplus amount of 98 450.63 m³/yr (269.73 m³/day) available, after the allocation of the proposed PU (which is the sustainable yield; 191,23 m3/day). Therefore, it is estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub-catchments they fall in (Geohydrological Assessment Report, 20th December 2022).
- Solar BH No. 5 is in HRU5. So, assuming there is no Existing Use, Basic Human Needs and Base Flow, then there is a surplus amount of 416 010.85 m³/yr (1 139.76 m³/day) available, after the allocation of the proposed PU (which is the sustainable yield; 6.62 m3/day). Therefore, it is estimated that there is enough groundwater available on a sub-catchment level to sustain the proposed 8-hour abstraction from the designated boreholes and the sub-catchments they fall in (Geohydrological Assessment Report, 20th December 2022).

- It is advised that water be pumped to dedicated storage tanks from the boreholes to build up a reserve, whereafter the boreholes are only used to top up the storage tanks. Allowing boreholes to rest and recover between pumping cycles will help to decrease the impact on the aquifer reserve.

Impact 06 (Water Quality)

- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Water hardness depends on whether it is caused by bicarbonate salts or non-bicarbonate salts, such as chloride, sulphate and nitrate. Bicarbonate salts of calcium and magnesium precipitate on heating and cause scaling in hot water systems and appliances, whereas the non-bicarbonate salts do not precipitate on heating. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. The resulting scums are unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines).
- According to the DWAF 1996 Target Water Quality Range (TWQR) for potable use, the groundwater from BH13 is suitable for domestic use, having a pH of 6.9. Only the EC of 75.5 mS/m and dissolved Calcium of 89 mg Ca/l exceed the DWAF TWQR (0 – 70 mS/m and 0 – 32 mg Ca/l, respectively).
- Similarly, the groundwater abstracted from Solar Borehole No. 5 is suitable for domestic use with a pH of 6.7. Four water quality parameters exceeded the DWAF TWQR, specifically EC (82.7 mS/m > 70 mS/m DWAF TWQR), TDS (466 mg/l > 450 mg/l DWAF TWQR), Dissolved Ca (94 mg Ca/l > 32 mg Ca/l DWAF TWQR) and Dissolved Mg (37 mg Ca/l > 30 mg Ca/l DWAF TWQR).
- The groundwater can be described as Ca-HCO3 and is typical of shallow fresh groundwater types or recently recharged groundwater. High EC indicates a high salt load (dominated by Ca, Mg, Cl, NO3 and HCO3 ions), which could result in scaling in piping exposed to heat, or in utensils

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used to boil water. Consequently, water softeners or deionisation plants will be required for the treatment of groundwater that will be used for domestic use or cleaning solar panels.

- Considering the District Municipality's Climate Change Response Plan highlighted the risk of reduced deterioration in (surface) water quality due to increased salt concentrations in dams, wetlands and soil/plant systems from enhanced evaporation rates, and the farmer has 'always' supplied his livestock with groundwater via boreholes, it is assumed that no further treatment is required for livestock production.
- Groundwater is vulnerable to pollution (DHS Redbook, Section J)
- Groundwater boreholes are generally situated within and downstream of the development areas, hence are potential receptors to pollution.

Impact 07 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report). Strategic Water Source Areas (SWSAs) are defined as areas of land that (a) supply a disproportionate (e.g., relatively large) quantity of mean annual surface water runoff in relation to their size and so are considered nationally important; and/or (b) have high groundwater recharge and where the groundwater forms a nationally important resource. **The protection and restoration of strategic water source areas is of direct benefit to all downstream users.** This dependence needs to be considered in decisions relating to these primary headwater catchments. **The protection of both water quantity (flows) and quality must be addressed. Any failure to address impacts on water quality or quantity will have impacts on the water security of all those depending on that water downstream.** Groundwater is the main or only source of water for numerous towns and settlements across the country so protecting the capture zone, specifically for municipal supply well-fields, the recharge area, and the integrity of the aquifers is important as well.
- The project area falls within quaternary catchment D62D and the Orange Water Management Area.
- The area falls within a summer rainfall area, receiving more rainfall in the high-sun half of the year (October through March). The average rainfall is in the order of 320 mm/yr. The MAE (2 000 to 2 150 mm/yr) far exceeds the MAP for the site, which implies greater evaporative losses when compared to incident rainfall. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (e.g., 1:2, 1:5, 1:50 and 1:100-year flood events). Runoff from natural (unmodified) catchments in Catchment D62D is 3.1 mm/yr, which is approximately 0.9% of the MAP and amounts to approximately 7.4 Mm^3/yr over the surface of the quaternary catchment. Average monthly rainfall peaks from October to May, whereas average monthly run-off peaks from December to April.
- Average rainfall over the combined surface of the sub-catchments is in the order of 192.47 Mm^3/yr (50% of the total water budget).
- Average runoff accounts for a volume in the order of 1.87 Mm^3/yr (0.5% of the total water budget).
- The average groundwater contribution to baseflow to rivers/wetlands/streams is in the order of 0 Mm^3/yr (0% of the total water budget).
- Evaporation accounts for a volume in the order of 182.69 Mm^3/yr (47.5% of the total water budget).

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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
05	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Alternative Site No. 1 (preferred)

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

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
07	H	M	M	-I	H	M	1	H	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:

- 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).
- District Municipality's Climate Change Response Plan
- Geohydrological Assessment Report Version – Final Rev 3/4 prepared by GCS Water and Environmental Consultants dated 20th December 2022 (GCS Project Number: 22-0401).
- General Authorisation for Section 21(g) Disposing of waste in a manner which may detrimentally impact on a water resource published in GN No. 665 of Government Gazette No. 36820 on 06th September 2013.
- Generic EMPrs published in GN No. 435 of 22 March 2019 in terms of Section 24(5) of NEMA, 1998

Mitigations:

Impact Management Outcome(s):

- Maintain the integrity of the groundwater reserve(s).
- Safe drinking water.
- Responsible disposal of domestic wastewater.
- Minimise ponding, erosion, and sedimentation of watercourses.

Targets:

- Minimise water usage.
- Water meters installed.
- Water storage tanks installed for a water reserve.
- Avoidance of groundwater pollution: Show compliance with Annexure A of SANS 10252-2 and National Building Regulations SANS 10400
- Avoidance of groundwater pollution: Show compliance with Guidelines for the Utilisation and Disposal of Wastewater Sludge.
- Avoidance of groundwater pollution: Sampling records
- Avoidance of groundwater pollution: A suitably qualified operator.

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- Avoidance of groundwater pollution: Grease traps are present in kitchens.
- FOG's no more than 10 mg/L.
- Avoidance of groundwater pollution.
- Construction during dry months.
- Protection and restoration of a Strategic Water Source Area.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
05	Change of land use	Water demand for fighting wildfires may temporarily jeopardise available water reserves for development or operational requirements.	Maintain the integrity of the groundwater reserve(s).	Minimise water usage.	Consider alternative firefighting technologies such as CAFS (Compressed Air Foam Systems), which can multiply water use efficiency by as much as 11 times (pers. comm. Stefan Schlimmer 072 474 3155).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
05	Planning	Using water as a form of dust control is an ineffective, wasteful, and short-term solution.	Maintain the integrity of the groundwater reserve(s).	Minimise water usage.	Reduce the need for dust suppression/control, particularly along the access road from the N10 to the MTS by providing construction staff (and employees) with a prearranged bus charter service.	Holder, Contractor	Planning and Design and Construction phase	Compliance to be verified by ECO and IEA.
05	Planning	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral	Minimise dust generation.	Construction during dry months.	The construction of linear infrastructure across parts of the ephemeral drainage system, should to the extent possible be restricted to the dry winter months (e.g., May to September),	Holder, Contractor	Planning and Design Phase and Dry months	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
		drainage line system.			that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.			
05	Layout and Design	Increased demand for groundwater during construction for road stabilisation, dust control, and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Maintain the integrity of the groundwater reserve(s).	Minimise water usage.	Reduce the quantity of groundwater and frequency of applications required for dust suppression on gravel access roads by adding environmentally friendly soil binding agents. This would require the necessary storage tanks complete with Programmable Logic Controller (PLC) and pump systems required for dosage purposes.	Holder, Contractor	Continuous	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	Layout and Design	Increased demand for groundwater during construction for road stabilisation, dust control, and provide staff with potable/drinking water, may stress groundwater reserves (exceed the rate at which reserves are naturally replenished).	Maintain the integrity of the groundwater reserve(s).	Water meters installed.	Install suitable water meters to ensure that the abstracted volumes are measured on a daily basis (DEA Generic EMPr).	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
05	Layout and Design	Impact on the aquifer reserve and borehole pump lifespan.	Maintain the integrity of the groundwater reserve(s).	Water storage tanks installed for a water reserve	Groundwater should be pumped from the boreholes to dedicated water storage tanks to build up a reserve, whereafter the boreholes are only used to top up the storage tanks.	Holder, Contractor	Continuous	Compliance to be verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with Annexure A of SANS 10252-2.	If a wastewater treatment package plant is installed at the construction camp, then: Comply with the National Standards on septic tank systems provided in SANS	Holder, Engineer	Planning and Design Phase Continuous	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
					10252-2 Water Supply and Drainage for Buildings: Part 2 Drainage installations for buildings (relevant information is included in Annexure A of SANS 10252-2.			
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with Guidelines for the Utilisation and Disposal of Wastewater Sludge.	If a wastewater treatment package plant is installed at the construction camp, then: Sludge from septic tanks should be disposed of in accordance with the "Guidelines for the Utilisation and Disposal of Wastewater Sludge: Volume 3: Requirements for the on-site and off-site disposal of sludge."	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Show compliance with National Building Regulations SANS 10400	If a wastewater treatment package plant is installed at the construction camp, then: The design of a soakaway must comply with the guidelines given in the National Building Regulations SANS 10400.	Holder, Engineer	Planning and Design Phase Continuous	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
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Sampling records	If a wastewater treatment package plant is installed at the construction camp, then: Treated effluent must be sampled and monitored at the points of ingress to the effluent plants and at the points of reuse or discharge.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: A suitably qualified operator.	If a wastewater treatment package plant is installed at the construction camp, then: The success of a wastewater treatment package plant is dependent on correct operation and maintenance. Therefore, a suitably qualified operator should be trained and/or appointed prior to commissioning.	Holder	Continuous	Compliance to be monitored by SEO and verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution from effluent disposal	Safe drinking water.	Avoidance of groundwater pollution: Grease traps are present in kitchens. FOG's no more than 10 mg/L	If a wastewater treatment package plant is installed at the construction camp, then: Fats, oils and greases (FOG's) should be treated at the source with grease/fat traps in the kitchens (during construction and	Holder, Engineer	Planning and Design Phase Continuous	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
					operation) and shall be no more than 10 mg/L before entering the effluent plant.			
06	Layout and Design	Unsafe disposal - soil contamination and water pollution	Responsible disposal of domestic wastewater.	Avoidance of groundwater pollution	Wastewater disposal sites, including conservancy tanks, must be located- (a) outside of a watercourse; (b) above the 1:100-year flood line or riparian habitat whichever is the greatest, or alternatively at least 100 m from a water resource whichever is the greatest or at least further than a 500 m radius from a borehole that is utilised for drinking water or stock watering; (c) at least outside a 500 m radius from the boundary of a wetland; and (d) on land that is not, or does not, overlie, a major aquifer (identification of a major aquifer will be provided by the responsible authority upon written request).	Holder, Engineer	Planning and Design	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
06	Layout and Design	Groundwater is vulnerable to pollution	Safe drinking water.	Avoidance of groundwater pollution	Boreholes for domestic use should be positioned at least 30 m to 50 m away from potential pollution sources, such as on-site toilets, and site-specific conditions should be considered to determine the appropriate distance. The direction of the aquifer flow is also an important consideration.	Holder	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution	Safe drinking water.	Avoidance of groundwater pollution	To prevent aquifer pollution, the installation of a sanitary seal is required.	Holder, Engineer	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
06	Layout and Design	Groundwater is vulnerable to pollution	Safe drinking water.	Avoidance of groundwater pollution	An employee should be trained to maintain the borehole and borehole pump and to alert management when major breakdowns occur.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Two ephemeral drainage line crossings, associated with the proposed road development can be considered critical	Minimise ponding, erosion, and sedimentation of watercourses.	Construction during dry months	Construction should to the extent possible take place during dry months, with a decreased probability of storm events.	Holder, Contractor	Planning and Design Phase	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
		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.						
07	Layout and Design	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	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	Culverts and stormwater outlets associated with any watercourse crossing should be designed in such a way so as not to 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.	Holder, Engineer	Planning and Design Phase	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
		rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.						
07	Layout and Design	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.	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	All storm water drainage discharge points should be provided with outlet structures, designed with adequate erosion protection, to ensure that storm water is discharged from formal structures onto the natural ground at a safe and acceptable velocity.	Engineer, Contractor	Planning and Design Phase and Construction Phase	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
07	Layout and Design	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.	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipate over a broad area covered by natural vegetation.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
07	Layout and Design	Two ephemeral drainage line crossings, associated with the proposed road development can be considered	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	Ensure stormwater systems are sized by a professional engineer to accommodate at least 1:100 yr flood events. Stormwater infrastructure, particularly Crossings C1 and C8, should be	Engineer, Contractor	Planning and Design Phase	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
		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.			sized to handle the minimum stormwater peak flow estimates (given in Table 6.2 of the Hydrological Assessment Report).			
07	Layout and Design	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	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	Crossing C1 (-30.85154438; 24.27633442) – Due to the size of the Brak River flood plain, and the predicted irregular flood generation it is proposed that a concrete drift crossing be developed to allow for overflow and passage through the river flood plain. Refer to Figure 6.1 "Typical plan of a drift crossing" and Figure 6.4 "Conceptual stormwater	Engineer, Contractor	Planning and Design Phase	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
		the rivers/streams, which could lead to sedimentation and erosion if storm events occur during the construction phase.			management system (Crossing 1 – Brak River)" of the Hydrological Assessment Report.			
07	Layout and Design	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	Minimise ponding, erosion, and sedimentation of watercourses.	Protection and restoration of a Strategic Water Source Area	Crossing C8 (-30.86251539; 24.23307474) – The road will cross an ephemeral drainage line, and hence, a permanent box culvert under the roadway will be required. Preliminary calculations suggest a rectangular culvert with a diameter of 3 m, design depth of 10 m and slope of 0.057 (m/m) should be able to handle a maximum flow volume of 207 m^3/sec (the calculated peak flows range from 90 to 105 m^3/sec), with a flow depth efficiency of 55%. The intakes should be stabilised by a reno mattress, and the outlet should have energy-dampening	Engineer, Contractor	Planning and Design Phase	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
		the construction phase.			systems in place. Refer to Figure 6.2 "Typical energy dampening for box culvert outlet" and Figure 6.3 "Conceptual stormwater management system (Crossing 8)" of the Hydrological Assessment Report.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

Alternative Site No. 1 (preferred)

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

Alternative Site No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

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- The estimated water demand (211 m3/day) exceeds the available groundwater yields (197.85 m3/8hr day), creating a potential deficit of 13,15 m3/day. Water saving strategies will need to be implemented on site to ensure sufficient water during the construction of the access road. The residual risk of abstracting groundwater on the underground aquifer (**05**) is Low if water saving strategies are in place.
- The residual risk of surface and groundwater pollution (**06**) after mitigation is assumed to be Low.
- The residual risk of erosion caused by changed surface water flow patterns (**07**) after mitigation is assumed to be Low.

Receiving Environment: Atmosphere

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Commencement & Construction times	NA	**Impact:** The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system. **Consequence:** Turbid waters reduce light penetration, decreasing photosynthesis and primary production, reducing food availability for aquatic organisms higher up the food chain. Suspended solids may interfere with the feeding mechanisms of filter-feeding organisms such as certain macroinvertebrates, and the gill functioning, foraging efficiency (due to visual disturbances) and growth of fish, leading to changes in invertebrate and fish assemblages. Suspended solids that settle out may cover spawning grounds (places to lay eggs), smother or abrade benthic plants and animals, resulting in changes to the nature of the substratum where invertebrates live, causing either change in the structure of the biotic community by the replacement of these organisms with organisms that burrow in soft sediments, or massive declines in fish populations. Sensitive species may be permanently eliminated if the source of the suspended solids is not removed. Alter feeding and breeding behaviour (lowering vigour and reproductivity), species composition and aquatic ecosystem functioning (indirect).	Quality	08

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*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 08 (Dust generation)

- The study area is not within an Air Quality Priority Area. According to the Emathanjeni Local Municipality Final Integrated Development Plan 2021 – 2022, the air quality within this municipality is in good condition compared to the other urban areas, but dust pollution does occur in the Karoo to some extent due to low variable rainfall and sparse vegetation.
- 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 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 construction activities 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).
- The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system (pers. comm. Sam Laurence). The recovery of a stream from sediment deposition is dependent on the elimination of the sediment source and the potential for the deposited material to be flushed out by stream flow.

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 Route No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
08	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

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

- Emathanjeni Local Municipality Final Integrated Development Plan 2021 – 2022
- 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:

- Construction during dry months.
- Mining to take place during wet summer season.

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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
08	Planning	The generation of excessive wind-blown dust could 'choke' the ecologically sensitive ephemeral drainage line system.	Minimise dust generation.	Construction during dry months.	The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.	Holder, Contractor	Planning and Design Phase and Dry months	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
08	L	L	L	-I	L	L	0	L	M	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of increased dust generation (**08**) with mitigation measures is considered to be "Low".

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Receiving Environment: Terrestrial and Avian Ecosystem

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Commencement & Construction times	N/A	**Impact:** Disturbed or exposed sites are vulnerable to erosion. **Consequence:** Erosion can cause terrestrial and aquatic ecosystem degradation/dysfunction.	Transformation	09
Planning	Space	Magnitude of physical disturbance	**Impact:** The construction equipment and materials needed to repair and rebuild the access road will require a substantial area for parking and storing resulting in a loss of habitat (direct). **Consequences:** - Loss of ecosystem - Loss of biodiversity and climate change resilience.	Quantity	10
Layout and Design	Installing 19 m-wide servitude Fence and Access Control	Terrestrial barrier	**Impact:** Fencing causes fragmentation of the landscape. **Consequences:** -Fragmentation reduces connectivity, interrupts ecological process pathways such as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands"). This can result in species extinction and biodiversity loss due to decreased colonization and population size.	Fragmentation	10
Layout and Design	Installing 19 m-wide servitude Fence and Access Control	Interfering with ecological processes and biodiversity pattern	**Impact:** The physical footprint of the access road will result in a loss of local terrestrial habitat. **Consequence:** - reduced habitat for terrestrial fauna and Aves (direct). - reduced productivity and carrying capacity (direct).	Quantity	10
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Loss of terrestrial habitat. **Consequence:** Loss of terrestrial habitat	Quantity	10
Layout and Design	Road Crossings and Stormwater outlets		**Impact:** Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Fragmentation	10a

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Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			Consequences: - Fragmentation reduces connectivity, interrupts ecological process pathways such as surface water and subterranean flows, as well as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands") (direct). This can result in species extinction and biodiversity loss due to decreased colonization and population size (indirect). - 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.		
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes). **Consequences:** - Fragmentation reduces connectivity, interrupts ecological process pathways such as surface water and subterranean flows, as well as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands") (direct). This can result in species extinction and biodiversity loss due to decreased colonization and population size (indirect). - 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	10a

*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 (Surface Water Hydrology)

- The project area falls within quaternary catchment D62D and the Orange Water Management Area.

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- The average rainfall is in the order of 320 mm/yr. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (i.e., 1:2, 1:5, 1:50 and 1:100-year flood events). Average monthly rainfall peaks from October (23 mm) to April (39.4 mm). Alternatively, the least rainfall falls between May (18.9 mm) and September (11.6 mm). Runoff from natural (unmodified) catchments in Catchment D62D is equivalent to 3.1 mm/yr over the surface area. This is equal to approximately 0.9% of the MAP and amounts to approximately 7.4 Mm^3/yr over the surface of the quaternary catchment. Runoff is directly related to rainfall intensity, and longer precipitation events. Peak runoff is from December (0.2 mm) to April (0.4 mm). Alternatively, the least runoff occurs between May (0.1 mm) and November (0.1 mm) (Hydrological Assessment prepared by Hendrik Botha and dated 10 January 2023).

Impact 10 (Terrestrial Biodiversity)

- The access road occurs within Ecological Support Areas while the eastern section of the road lies within CBA 1 and CBA 2 areas associated with the Brak Rivier. In terms of other broad-scale planning studies, the site does not fall within a National Protected Areas Expansion Strategy Focus Area (NPAES), indicating that the area has not been identified as an area of exceptional biodiversity or of significance for the long-term maintenance of broad-scale ecological processes and climate change buffering within the region.
- The combination of rocky hills and plains creates a diversity of habitats that is important for fauna and the diversity of these areas is higher than areas without open plains. There is a low ridge with runs through the area in the vicinity of the Main Transmission Station (MTS) of the site and which is not considered suitable for development as the hills are significant for biodiversity and ecological functioning.

Impact 10 (Vegetation Type)

- According to the national vegetation map (Mucina & Rutherford 2006), the entire site falls within a single vegetation type, Northern Upper Karoo. Northern Upper Karoo has not been significantly affected by transformation and is still approximately 96% intact and is classified as Least Threatened (Mucina & Rutherford 2006).
- 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).
- 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, and excluding up to 3 m for the side/cut-off drain, with 1 m on either side of the road for the verge to a fence line. However, temporary 30 m passing lanes will increase the 19 m-wide servitude from 19 m to 22 m to allow for passing should this be required during construction. The contractor will need an adjacent and parallel servitude width of 3 m for the movement of construction vehicles and/or providing a diversion lane for farm traffic.
- From the results of the site visit and the presence of the Brak River on the site, which clearly has a large floodplain area, it is evident that the VegMap provides an oversimplification of the vegetation of the site and there are at least three distinct vegetation types present on the site.

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The open plains of the site correspond with the Northern Upper Karoo vegetation type, but the dolerite hills and koppies present have vegetation more closely allied with Upper Karoo Hardeveld, while the floodplain of the Brak River is clearly characterised by an azonal vegetation type, allied with Upper Gariep Alluvial Vegetation. The floodplain has however been heavily modified by human activity with a lot of diversion walls and historical disturbance present (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017).

- At a broad level, the site consists of areas of contrasting sensitivity, which is driven by the presence of the Brak River system at the site and a series of dolerite outcrops which are considered high sensitivity in comparison with the open plains of the site which are comparatively low sensitivity. The major sensitive feature of the broader site is the Brak River system which has extensive silty floodplains that are occasionally inundated. There are also some dolerite ridges and outcrops which are considered sensitive and unsuitable for development (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017).

Impact 10a (Terrestrial Ecosystem Habitat types)

- Although the route alignment traverses different habitat types of varying ecological sensitivity, including the (Very High) Brak River, (High) Mesic Washes on either side of it, (High) Rocky Hill and (Medium to High) Dry Washes (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017), the route alignment follows existing farm tracks. The section of new road that will need to be built through virgin veld, outside the fenceline of the solar field to the MTS, will traverse the boundary of the relatively less sensitive (Medium to High) Dry Wash and (Medium to Low) Solar field footprint. The new road section will cross perpendicular to a low dolerite ridge classified as (High) Hills and Slopes. Given the alignment of the road relative the ridge, it should impact an area as wide as the servitude (19 m) and as wide the intersected width of the dolerite ridge/Hills and Slope habitat (± 16 m). This impact is assumed to be less significant compared to the alternative of routing the access road further to the south, beyond the ridgeline, thereby disturbing a greater area of (Medium to Low) virgin veld and increasing the risk of stormwater run-off impacts on the adjacent (Very High) River and (High) Mesic Wash habitat types.
- From the results of the site visit and the presence of the Brak River on the site, which clearly has a large floodplain area, it is evident that the VegMap provides an oversimplification of the vegetation of the site and there are at least three distinct vegetation types present on the site. The open plains of the site correspond with the Northern Upper Karoo vegetation type, but the dolerite hills and koppies present have vegetation more closely allied with Upper Karoo Hardeveld, while the floodplain of the Brak River is clearly characterised by an azonal vegetation type, allied with Upper Gariep Alluvial Vegetation. The floodplain has however been heavily modified by human activity with a lot of diversion walls and historical disturbance present (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017).
- At a broad level, the site consists of areas of contrasting sensitivity, which is driven by the presence of the Brak River system at the site and a series of dolerite outcrops which are considered high sensitivity in comparison with the open plains of the site which are comparatively low sensitivity. The major sensitive feature of the broader site is the Brak River system which has extensive silty floodplains that are occasionally inundated. There are also some dolerite ridges and outcrops which are considered sensitive and unsuitable for development (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017).

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- The water pipeline from Solar Borehole No. 5 intersects the (High sensitivity) dolerite ridge/Hills and Slope habitat for a distance of ± 63 m. The width of the trench will be 300 mm. The pipeline will be placed underground. The corridor will be rehabilitated (and habitat restored) once the pipeline has been buried.

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	H	1	M	H	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

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

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10a	M	L	H	-I	H	H	1	M	H	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):

- The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

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

- Hydrological Assessment, Version – Final 1, prepared by Hendrik Botha and dated 10 January 2023 (GCS Ref – 22 - 1054).
- 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):

- Minimise erosion of disturbed sites from storm water run-off.
- Minimise Fragmentation by fencing.
- Minimize habitat loss.
- Zero disturbance outside the existing District Road servitude.
- Preserve aquatic ecosystem structure and function as well as riparian habitat.
- Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as watercourses.
- Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as ridges.

Targets:

- Construction during dry months.
- Mining to take place during wet summer season
- Sun Central Cluster 1 Solar PV facility construction camp and staging area used.
- Construction camp location as per EA reference: 14/12/16/3/3/2/998 dated 16th April 2018 as amended.
- Staging area location as per EA reference: 14/12/16/3/3/2/998/AM4 dated 25th November 2022
- Servitude fence is a cattle fence.
- No razor wire.
- No observed construction creep.

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- Rehabilitation Plan
- No construction creep outside fenced servitude
- Existing farm roads have been incorporated into the route alignment.
- Minimise impact on low dolerite ridge classified as Hills and Slopes (High ecological sensitivity).
- Avoid fragmentation of surface water and groundwater pathways (and associated habitats).

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible Person(s)	Timeframe / Frequency	Monitoring
09	Planning	Disturbed or exposed sites are vulnerable to erosion.	Minimise erosion of disturbed sites from storm water run-off.	Construction during dry months.	The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September), that is commence with such activities as clearing or grading, excavating and importing material at the end of the wet season/beginning of the dry season whilst the soil is still moist to reduce dust and as far as is practical, be completed in, the dry winter months with a decreased probability of storm events.	Holder, Contractor	Planning and Design Phase and Dry months	Compliance to be verified by ECO and IEA.
10	Planning	The construction equipment and materials needed to repair and rebuild the access road will require a substantial area for parking and storing resulting	Minimize habitat loss	Sun Central Cluster 1 Solar PV facility construction camp and staging area used.	The contractor(s) appointed to rebuild and build the access road will use the same construction camp, and staging area as set aside for the authorised Sun Central Cluster 1 Solar PV facility.	Contractor	Planning and Design Phase and continuous	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
		in a loss of habitat.						
10	Planning	The construction equipment and materials needed to repair and rebuild the access road will require a substantial area for parking and storing resulting in a loss of habitat.	Minimize habitat loss	Construction camp location as per EA reference: 14/12/16/3/3/2/998 dated 16th April 2018 as amended.	The ± 4 ha construction camp footprint will be in the 'open' area(s) not earmarked for the solar field, around and between the Switching Station (Dx) and Main Transmission Substation (MTS), but within the low ecologically sensitive footprint of the authorised Sun Central Cluster 1 Solar PV facility (EA reference: 14/12/16/3/3/2/998 dated 16th April 2018 as amended).	Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10	Planning	The construction equipment and materials needed to repair and rebuild the access road will require a substantial area for parking and storing resulting in a loss of habitat.	Minimize habitat loss	Staging area location as per EA reference: 14/12/16/3/3/2/998/AM4 dated 25th November 2022	The authorised ± 1 ha staging area (EA reference: 14/12/16/3/3/2/998/AM4 dated 25th November 2022), adjoining the district road, but inside the farm boundary of Portion 1 of Farm Riet Fountain No. 39C (30°51'13,89''S & 24°15'57,88''E) may be used as an access control point as well as for parking plant, material/aggregate stockpiles and as a laydown area.	Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10	Layout and Design	Fencing causes fragmentation of the landscape	Minimise Fragmentation by fencing.	Working servitude fence is a cattle fence.	The servitude fence must be a cattle fence, not unlike existing farm fences in the	Contractor	Planning and Design Phase and	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
					surrounding farms.		continuous	
10	Layout and Design	Fencing causes fragmentation of the landscape	Minimise Fragmentation by fencing.	No razor wire.	The use of razor wire as fencing must be avoided.	Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10	Layout and Design	The physical footprint of the access road will result in a loss of local terrestrial habitat.	Minimize habitat loss.	No observed construction creep.	The clearance of indigenous vegetation shall be restricted to the physical footprint of the road and side/cut-off drain (with the exception of temporary clearance and/or disturbance associated with 'normal' construction-related activities).	Contractor	Continuous	Compliance to be verified by ECO and IEA.
10	Layout and Design	The physical footprint of the access road will result in a loss of local terrestrial habitat.	Minimize habitat loss.	Rehabilitation Plan	The clearance or disturbance of indigenous vegetation resulting from 'normal' construction-related activities shall be rehabilitated immediately upon the completion of those activities on the road verge, in accordance with a rehabilitation plan and/or the Bare Patch Restoration Protocol (Appendix C).	Holder, Contractor	Continuous	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	Layout and Design	Loss of terrestrial habitat.	Zero disturbance outside the existing District Road servitude.	No construction creep outside fenced servitude	All construction on the district road section, including access for the public, will remain within the 19 m-wide servitude.	Contractor	Continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Existing farm roads have been incorporated into the route alignment.	As far as possible utilize or upgrade existing farm roads as opposed to constructing new roads in undisturbed areas.	Engineer, Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Minimise impact on low dolerite ridge classified as Hills and Slopes (High ecological sensitivity).	Ensure the alignment of the new road section within the authorised solar field footprint is approximately perpendicular to the low dolerite ridge to minimise the physical extent of the Hills and Slopes habitat that will be disturbed.	Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as watercourses.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats).	The final design will be determined during the detailed design stage and shall be subject to compliance with the following requirements or outcomes: • Ensure that any dedicated stream crossings use road crossing designs, such as box culverts or concrete drifts with rock fill, which	Engineer	Planning and Design Phase	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
					spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow. • Road crossing designs, such as box culverts or concrete drifts with rock fill, should be sized to accommodate at least 1:100 yr flood events. • Road crossings and stormwater outlets associated with any watercourse crossing should be designed in such a way so as not to 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, especially at the downstream side to dissipate energy and reduce scour. • Pipe culvert road crossings are prohibited. • Road crossing designs, such as box culverts or concrete drifts with rock fill, shall spread the surface water into a broadly distributed sheet whilst			

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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
					maintaining unrestricted subterranean flow, across the width of the active channel(s).			
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats).	Avoid or minimise any restriction to subsurface water flow by constructing the surface of the road crossings at or above (not below) natural ground level (NGL) and, where applicable, retaining the in-situ topsoil with vegetation root mass (or mat). In the case of building road crossings above NGL, and if the natural vegetation is cleared, then ensure that the grader does not penetrate the abovementioned root mat and maintains a flat surface. Topsoil removed from other infrastructure placement sites can be added below the road surface to protect the vegetative binding below.	Engineer, Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences,	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats).	All road crossings must be engineered not to impede surface or subsurface flow in any way.	Engineer, Contractor	Planning and Design Phase	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
		and sub surface pipes).						
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats).	Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill to maintain the natural flow regimes of subsurface water.	Engineer, Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats).	It is preferable to eliminate fill roads and utilise raised bridges and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.	Engineer, Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (roads, fences, and sub surface pipes).	Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as ridges.	Avoid fragmentation of ecological pathways (and associated habitats).	Ensure the water pipeline from Solar Borehole No.4 and No. 5 takes the shortest route practically possible through the (High sensitivity) dolerite ridge/Hills and Slope habitat.	Engineer, Contractor	Planning and Design Phase and continuous	Compliance to be verified by ECO and IEA.
10a	Layout and Design	Loss and fragmentation of ecologically sensitive	Maintain the provision of supporting ecological	Avoid fragmentation of ecological pathways (and	Ensure the temporary passing lanes are not within the (High sensitivity)	Engineer, Contractor	Planning and Design Phase and	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
		habitats from infrastructure installation (roads, fences, and sub surface pipes).	processes along ecological process pathways, e.g., spatially explicit corridors, such as ridges.	associated habitats).	dolerite ridge/Hills and Slope habitat.		continuous	

Assessment with mitigation:

Alternative Site No. 1 (preferred)

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

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

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
10a	L	L	M	-I	M	L	0	L	M	0

Residual Risk (feeds back into "Mitigations"):

- The residual risk of lost biodiversity from erosion (**09**) after mitigation is assumed to be Low.
- The residual risk of losing terrestrial ecosystems (**10**), including through fragmentation (**10a**) after mitigation is assumed to be Low.

Receiving Environment: Aquatic Ecosystem
Description of potential impacts:

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Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Commencement & Construction times	N/A	**Impact:** Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground 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	11
Layout and Design	Installing servitude Fence and Access Control	Surface water hydrology (run-off)	**Impact:** Sedimentation in wetlands and watercourses. **Consequence:** Loss of riparian habitat.	Fragmentation	11
Layout and Design	Road/pipelines	Obstruction	**Impact:** Loss of riparian systems and disturbance of the alluvial water courses. **Consequence:** Loss of aquatic habitat.	Quantity	11
Layout and Design	Road/pipelines	Obstruction	**Impact:** Roads/pipelines can transform wetland areas altering hydrology and ecosystem **Consequence:** disturbance	Transformation	11
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground 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	11

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Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (underground pipelines). **Consequences:** - Fragmentation reduces connectivity, interrupts ecological process pathways such as surface water and subterranean flows, as well as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands") (direct). This can result in species extinction and biodiversity loss due to decreased colonization and population size (indirect). - 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	11
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Loss of riparian systems and disturbance of the alluvial water courses. **Consequence:** Loss of aquatic habitat	Quantity	11
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes). **Consequences:** - Fragmentation reduces connectivity, interrupts ecological process pathways such as surface water and subterranean flows, as well as local migration patterns of aquatic species effectively isolating fragmented patches (or "islands") (direct). This can result in species extinction and biodiversity loss due to decreased colonization and population size (indirect). - Destroy existing habitat but also displace bird species from large areas of natural habitat. This specifically has a	Fragmentation	11

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			greater impact on bird species restricted to a specific habitat and its requirements		
Layout and Design	Buffers	Specialist Assessment Reports	**Impact:** Erosion and sedimentation **Consequence:** Loss of aquatic habitat.	Transformation	12
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Water storage tanks can topple over, leak or overflow. **Consequences:** - Overflowing water storage tanks may cause erosion or degradation of the receiving environment.	Transformation	12
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Erosion and sedimentation **Consequence:** Loss of aquatic habitat.	Transformation	12

*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 11 (Aquatic Ecosystem Loss)

- The study area is not within an area identified in terms of an international convention, such as a RAMSAR site.
- The drainage systems are predominantly classified as ephemeral drainage lines and not wetlands.
- The project area contains National Freshwater Ecosystem Priority Areas (NFEPA) "Wetlands and Estuaries" and "Rivers", including the floodplain areas of the Brak River and its tributaries (non-perennial drainage streams).
- The Brak River and a tributary (unnamed FEPA drainage line D62D – 05610 SQ bounding the Sun Central 1 development) are the only recognised water courses impacted by Alternative Route No. 1 (Hydrology Assessment, 2023)
- The study area falls within a CBA1 because the Brak River has been identified as having FEPA River Ecosystem Type status according to the Freshwater Ecosystem Protected Areas (FEPA) map for the area (Phase 1 Aquatic Report October 2017) and all FEPA prioritised rivers and wetlands have a minimum category of CBA1. All FEPA prioritised wetland clusters have minimum category of CBA2, and natural non-FEPA wetlands and larger rivers have minimum category of ESA (Avifauna Final EIA Report prepared by Sam Laurence of Enviro-Insight cc, dated October 2022).
- At a broad level, the site consists of areas of contrasting sensitivity, which is driven by the presence of the Brak River system at the site and a series of dolerite outcrops which are considered high sensitivity in comparison with the open plains of the site which are comparatively low sensitivity. The major sensitive feature of the broader site is the Brak River system which has extensive silty floodplains that are occasionally inundated. There are also some dolerite ridges and outcrops which are considered sensitive and unsuitable for development (Environmental Impact Assessment prepared by Simon Todd Consulting dated May 2017).

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- The water pipeline from Solar Borehole No. 13 and/or 14 intersects the (Very High sensitivity) River and associated (High sensitivity) Mesic Wash habitats for a distance of ± 275 m. The width of the trench will be 300 mm. The pipeline will be placed underground. The corridor will be rehabilitated (and habitat restored) once the pipeline has been buried.
- Five distinct water resource types were recognised in the project area. Not all water resource types, specifically the alluvial floodplains, are technically a 'watercourse':
    - Brak River drainage system.
    - Large ephemeral tributaries.
    - Smaller ephemeral tributaries.
    - Alluvial floodplains:
        - Alluvial fans.
        - Braided channel: bar and swale topography.
        - Floodplain flats.
    - Headwater drainage lines
- 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.
- The more seasonal and ephemeral ecosystems provide aquatic habitat to a diverse array of faunal species that depend on brief periods of inundation for hatching, mating, feeding and refuge.
- A great number of other organisms are not confined to these temporary systems, but derive crucial benefits from them, like migratory birds and many invertebrates that migrate from permanent to temporary habitats on a regular basis.
- 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, and excluding up to 3 m for the side/cut-off drain, with 1 m on either side of the road for the verge to a fence line. However, temporary 30 m passing lanes will increase the servitude from 19 m to 22 m to allow for passing should this be required during construction. The contractor will need an adjacent and parallel servitude width of 3 m for the movement of construction vehicles and/or providing a diversion lane for farm traffic.

Impact 12 (Surface Water Hydrology)

- The project area is located within a Strategic Water Source Area (Screening Report).
- The average rainfall is in the order of 320 mm/yr. Due to evaporation being about 85% more than local rainfall, non-perennial streams and rivers will only have water when there are flooding events (i.e., 1:2, 1:5, 1:50 and 1:100-year flood events). Average monthly rainfall peaks from October (23 mm) to April (39.4 mm). Alternatively, the least rainfall falls between May (18.9 mm) and September (11.6 mm).

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- Runoff from natural (unmodified) catchments in Catchment D62D is equivalent to 3.1 mm/yr over the surface area. This is equal to approximately 0.9% of the MAP and amounts to approximately 7.4 Mm^3/yr over the surface of the quaternary catchment. Runoff is directly related to rainfall intensity, and longer precipitation events. Peak runoff is from December (0.2 mm) to April (0.4 mm). Alternatively, the least runoff occurs between May (0.1 mm) and November (0.1 mm) (Hydrological Assessment prepared by Hendrik Botha and dated 10 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). 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 Brak River drainage system and large ephemeral tributaries was classified as "High" (Aquatic Biodiversity Impact Assessment, January 2023).
- Those water resource types with "Moderate" and "Low" EISC (small ephemeral tributaries, alluvial floodplains and headwater drainage lines) are all low-lying areas where water ponding occurs and has softened the layer works to the point where deep rutting occurs due to wheel tracks from traffic on the roads. These road failures and associated impacts on the adjacent drainage systems must be addressed when the road is repaired and rebuilt. The engineers must decide what they could/should do the prevent the road from obstructing flow in the system (Aquatic Biodiversity Impact Assessment, January 2023).
- 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 Brak River drainage system and large ephemeral tributaries was classified as "High" (Aquatic Biodiversity Impact Assessment, January 2023).
- There are no significant wetlands present in the study area. The most conspicuous wetlands are small artificial permanent wetlands around watering points, such Solar Boreholes no. 4 and 5. Two seasonal wetlands are located within 100 m of the access road. The seasonal wetland (30°51'13.38"S, 24°15'51.07"E) located 55 to 60 m from the boundary of Farm Riet Fountain No. 39C is an old borrow pit located north and

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west of the fenced district road (Soil and wetland assessment, by Hennie van den Berg and Francois de Wet, February 2017) and requires no further mitigation(s).

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
11	M	L	M	-I	M	M	1	H	M	1
Reversibility	M	**Irreplaceability**	H	**Mitigatory Potential**	H					

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	M	M	H	-I	H	M	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):

- The construction of linear infrastructure across parts of the ephemeral drainage system, should be restricted to the dry winter months (e.g., May to September) when there is a decreased probability of storm events. Civils works should as far as is practical be completed before the next rainfall season.

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

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- Avifauna Final EIA Report 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 Report prepared by Dr Andrew Deacon dated August 2022.
- Aquatic Biodiversity Impact Assessment, Section 21(c) & (i) Risk Assessment and Wetland Delineation Verification, prepared by Dr Andrew Deacon and dated January 2023.
- 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).
- Soventix solar PV project in the Hanover district, Northern Cape (De Aar/Hanover Area), Soil and wetland assessment, by Hennie van den Berg and Francois de Wet, February 2017.

Mitigations:

Impact Management Outcome(s):

- Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as large ephemeral tributaries.
- Sensitive avifauna habitats are protected and maintained.
- Minimal sedimentation of watercourses
- Riparian systems and alluvial water courses are maintained as far as possible.
- Persistence of aquatic ecosystems in good ecological condition.
- Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.
- Sensitive avifauna habitats are protected and maintained.
- Riparian systems and alluvial water courses are maintained as far as possible.
- Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.
- Preserve aquatic ecosystem structure and function as well as riparian habitat.
- Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as watercourses.

Targets:

- Minimise impact on the large ephemeral tributary classified as River (Very High ecological sensitivity).

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- Avoid fragmentation of ecological pathways (and associated habitats).
- Construction during dry months
- Preserve river channel hydrological pattern.
- Limit transformation of aquatic ecosystem
- Avoid erosion from water storage tanks.
- Pipelines do not impede surface or subsurface flows.
- Limit transformation of aquatic ecosystem
- A 15 m buffer is implemented.
- Road crossings do not impede surface and sub-surface flow.
- Crossing structure designs include stormwater management and erosion control systems (where applicable).
- Existing farm roads have been incorporated into the route alignment.
- Avoid fragmentation of surface water and groundwater pathways (and associated habitats)

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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
11	Layout and Design	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Preserve river channel hydrological pattern	All storm water drainage discharge points should be provided with outlet structures, designed with adequate erosion protection, to ensure that storm water is discharged from formal structures onto the natural ground at a safe and acceptable velocity.	Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.
11	Layout and Design	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Preserve river channel hydrological pattern	Disturbance of the natural topography and vegetation cover should be minimised. The natural contours should be preserved as far as is practical in order to preserve the existing site drainage patterns as far as possible.	Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.
11	Layout and Design	Sedimentation in wetlands and watercourses.	Minimal sedimentation of watercourses	Preserve river channel hydrological pattern	Natural, dispersed, drainage should be encouraged, by maintaining the natural drainage characteristics of the land as far as possible, thereby minimising the concentration of flows and consequently the risk of erosion.	Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.

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11	Layout and Design	Loss of riparian systems and disturbance of the alluvial water courses.	Riparian systems and alluvial water courses are maintained as far as possible.	Preserve river channel hydrological pattern	Minimise the cumulative physical footprint of linear infrastructure crossings (roads, pipes) by as far as is possible coinciding/combining such infrastructure.	Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.
11	Layout and Design	Roads/pipelines can transform wetland areas altering hydrology and ecosystem	Persistence of aquatic ecosystems in good ecological condition.	Limit transformation of aquatic ecosystem	Wetlands must be avoided or, where wetland crossing is unavoidable, the road/pipeline should be routed over the narrowest part of the wetland.	Engineer, Contractor	Planning and Design Phase Construction	Compliance to be verified by ECO and IEA.
11	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, Water storage tanks are on a solid foundation, platform or stand.	Place water tanks on solid foundations, platforms or stands to ensure that they are level, will not fall over and are above the ground in order to build up the necessary water pressure for the outlet.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: Water storage tanks are fastened to the platform or stand.	The platform or stand for water storage tanks must be level and must have hooks onto which the tank can be anchored or fastened.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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11	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: Water pipes are visibly secured.	The pipes leading to and from the water storage tanks should also be anchored to prevent them from breaking, cracking and leaking.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, Design includes an overflow pipe to a soakaway.	Each water storage tank or series of water storage tanks should have an overflow pipe to prevent water being forced out of the inlet when the tank is full. The overflow pipe should be diverted to a soakaway.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Overflow from water storage tanks can cause erosion of receiving environment.	Protection and Restoration of a Strategic Water Source Area/ Preservation of aquatic ecosystem, composition, structure, and function.	Avoid erosion from water storage tanks: no muds, puddles or signs of erosion around water storage tanks.	If water storage tanks are placed on a raised platform or stand, then a layer of gravel should be placed around and/or under the platform or stand to ensure good drainage and to prevent forming mud and puddles.	Holder, Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Layout and Design	Loss of riparian systems and disturbance of the alluvial water courses.	Riparian systems and alluvial water courses are maintained as far as possible.	Limit transformation of aquatic ecosystem	The 3 m wide passing lanes must be further than 32 m from the edge of a watercourse.	Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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11	Layout and Design	Loss and fragmentation of ecologically sensitive habitats from infrastructure installation (underground pipelines).	Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as large ephemeral tributaries.	Minimise impact on the large ephemeral tributary classified as River (Very High ecological sensitivity). Avoid fragmentation of ecological pathways (and associated habitats).	Ensure the water pipeline from Solar Borehole No. 13 and/or 14 takes the shortest route practically possible through the (Very High sensitivity) River and associated (High sensitivity) Mesic Wash habitats	Holder, Contractor	Planning and Design Phase Dry season	Compliance to be verified by ECO and IEA.
11	Planning	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained	Construction during dry months	Schedule the road and pipeline construction during the season least damaging to the stream or wetland system (e.g., dry season).	Holder, Contractor	Planning and Design Phase Dry season	Compliance to be verified by ECO and IEA.
11	Planning	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Pipelines do not impede surface or subsurface flows	All underground pipelines bisecting sensitive habitats must be placed below the subsurface flow of the ephemeral wetlands with the linear construction pits subjected to full rehabilitation to maintain normal subsurface flow.	Engineer, Contractor	Planning and Design Phase and Construction	Compliance to be verified by ECO and IEA.

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11	Planning	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Pipelines do not impede surface or subsurface flows	All pipeline crossings must be engineered not to impede surface or subsurface flow in any way.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.
11	Planning	Habitat loss and fragmentation of watercourse areas due to displacement because of infrastructure installation (underground pipelines).	Sensitive avifauna habitats are protected and maintained.	Construction during dry season	Schedule pipeline construction during the season least damaging to the stream or wetland system (e.g., dry season).	Contractor	Planning and Design Phase Dry season	Compliance to be verified by ECO and IEA.
11	Planning	Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Existing farm roads have been incorporated into the route alignment.	As far as possible utilize or upgrade existing farm roads as opposed to constructing new roads in undisturbed areas.	Engineer, Contractor	Planning and Design Phase And continuous	Compliance to be verified by ECO and IEA.

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11	Planning	Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats	The final design will be determined during the detailed design stage and shall be subject to compliance with the following requirements or outcomes: • Ensure that any dedicated stream crossings use road crossing designs, such as box culverts or concrete drifts with rock fill, which spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow. • Road crossing designs, such as box culverts or concrete drifts with rock fill, should be sized to accommodate at least 1:100 yr flood events. • Road crossings and stormwater outlets associated with any watercourse crossing should be designed in such a way so as not to cause erosion of the bed or banks by incorporating such stabilisation mechanisms as terracing, boulder and rock placement, minor	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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					gabion basket work construction, reno mattresses and/or rock pitching, especially at the downstream side to dissipate energy and reduce scour. • Pipe culvert road crossings are prohibited. • Road crossing designs, such as box culverts or concrete drifts with rock fill, shall spread the surface water into a broadly distributed sheet whilst maintaining unrestricted subterranean flow, across the width of the active channel(s).			

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11	Planning	Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes).	Preserve aquatic ecosystem structure and function as well as riparian habitat.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats	Avoid or minimise any restriction to subsurface water flow by constructing the surface of the road crossings at or above (not below) natural ground level (NGL) and, where applicable, retaining the in-situ topsoil with vegetation root mass (or mat). In the case of building road crossings above NGL, and if the natural vegetation is cleared, then ensure that the grader does not penetrate the abovementioned root mat and maintains a flat surface. Topsoil removed from other infrastructure placement sites can be added below the road surface to protect the vegetative binding below.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.

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11	Planning	Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes).	Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as watercourses.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats	Limit or restrict the construction of fill roads. All fill roads must use a permeable fill material (such as gravel or crushed rock) for at least the first layer of fill to maintain the natural flow regimes of subsurface water.	Engineer, Contractor	Planning and Design Phase And construction	Compliance to be verified by ECO and IEA.
11	Planning	Habitat loss and fragmentation due to displacement because of infrastructure installation (roads, fences, and sub surface pipes).	Maintain the provision of supporting ecological processes along ecological process pathways, e.g., spatially explicit corridors, such as watercourses.	Avoid fragmentation of surface water and groundwater pathways (and associated habitats	It is preferable to eliminate fill roads and utilise raised bridges and culverts with adequate sizing and spacing of water crossing structures, proper choice of the type of crossing structure, and installation of drainage structures at a depth adequate to pass subsurface flow.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	A 15 m buffer is implemented.	The Brak River drainage system (Section 2.2: 30°51'6.74"S 24°16'32.57"E and 30°51'9.48"S 24°16'48.11"E) and large ephemeral tributaries (Section 1.3: 30 51 42.6 S; 24 14 00.5 E, Section 1.5: 30 51 25.7 S; 24 14 12.3 E and 30 51 25.8 S; 24 14 47.1 E, including their buffers, are no-go areas except for linear infrastructure crossings, e.g., access roads, pipelines, and cables. A 15 m-wide buffer is required on both sides of the delineated Brak River drainage system and large ephemeral tributaries during the construction and operational phases to protect their current condition from any degradation.	Holder, Engineer, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	A 15 m buffer is implemented.	This buffer width is conditional upon ensuring (1) the least possible flow impediment due to the low water drift structure, and (2) the management of surface water runoff (e.g., storm water management system) from the crossings within the Brak River drainage system and large ephemeral tributaries.	Engineer, Contractor	Planning and Design Phase and Continuous	Compliance to be verified by ECO and IEA.
12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Road crossings do not impede flow.	Where new watercourse crossings are required, the engineering team must provide an effective means to minimise the potential up- and downstream effect of erosion and sedimentation (erosion protection) as well as minimise the loss of riparian vegetation (reduce footprint as much as possible).	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Crossing structure designs include stormwater management and erosion control systems (where applicable).	Where diversion berms create concentrated flows, particularly in steep and/or sensitive areas, the use of swales, silt fences or other effective erosion control measures is recommended to attenuate runoff.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.
12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Crossing structure designs include stormwater management and erosion control systems (where applicable).	The Brak River Drainage System (synonymous with Crossing C1 in the Hydrological Assessment Report) will require a concrete (or similar) drift crossing.	Engineer, Contractor	Planning and Design Phase And construction	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Road crossings do not impede flow.	The large ephemeral tributaries crossed by the access road, specifically Section 1.3 (synonymous with Crossing C8 in the Hydrological Assessment Report) and Section 1.5 require permanent box culverts (there is already an existing pipe culvert crossing at Section 1.5). All crossings must not impede flow within the large ephemeral tributaries and should be constructed perpendicular to the channels.	Engineer, Contractor	Planning and Design Phase And construction.	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Road crossings do not impede surface and sub-surface flow. Crossing structure designs include stormwater management and erosion control systems (where applicable).	The small ephemeral tributaries, alluvial floodplains, headwater drainage lines and seasonal wetland (30°51'22.09"; 24°17'24.76"E) can rely on free drainage. However, these low-lying areas are prone to ponding to the point where softening and deep rutting occurs. These road failures and associated impacts on the adjacent drainage systems must be addressed when the road is repaired and rebuilt. The engineers must decide on the nature of the drainage design (e.g., using riprap, gabion mattresses, and/or other permeable material) that is needed to prevent the elevated road from (1) obstructing surface and sub-surface flow through the system, and (2) prevent pooling on the upstream edge of the road.	Engineer	Planning and Design Phase	Compliance to be verified by ECO and IEA.

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12	Layout and Design	Erosion and sedimentation	Maintain the Present Ecological State of the Brak River drainage system, large ephemeral tributaries, small ephemeral tributaries, alluvial floodplains, and headwater drainage lines by ensuring connectivity and avoiding fragmentation.	Road crossings do not impede flow.	All road crossing designs must not lead to the concentration of surface flow, by, where possible, designing structures, such as culverts, that span the entire width of surface aquatic ecosystems, ensuring connectivity and avoiding fragmentation.	Engineer	Planning and Design Phase	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
11	L	L	L	neutral	L	L	0	L	L	0

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
12	L	L	H	neutral	H	L	0	L	M	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.

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- The residual risk of transformation or fragmentation of the aquatic ecosystem (**11**) and alterations to surface water hydrology (**12**) after mitigation is assumed to be Low to zero.

Receiving Environment: Economical

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change Land Use	Repair and rebuilding District Gravel Road	Congestion and delays to local farmers and residents.	**Impacts:** Potential congestion and delays on the road network. Damage to vehicles. **Consequence:** Disruptions and delays to residents and local farmers in the area due to increase traffic volumes, resulting in longer time periods for transportation of goods. Increased maintenance costs.	N/A	13
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Unstable roadbed and wearing course. **Consequence:** Soil erosion, sedimentation of watercourses, damage to road infrastructure.	N/A	13
Layout and Design	Quarry		**Impact:** Haulage of imported materials incur a cost relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability. **Consequence:** Financial feasibility of project. The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	N/A	14

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Layout and Design	Quarry		**Impact:** The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability. **Consequence:** The usage of poor-quality aggregate is unsafe and will increase the costs of maintenance.	N/A	14
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** High Electroconductivity levels of abstracted borehole water reflects a high salt content. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. Corrosive water may lead to corrosion of the pipelines, fittings and storage tanks. High salt content in washing water can leave watermarks on the surface of the solar modules. **Consequence:** - Scaling in hot water systems and appliances results in less efficient use of electrical power and any other fuel used for heating purposes, and the partial obstruction of pipes with adverse economic implications. - Resulting scums are unaesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. - Aggressive attack of pipework will result in costly maintenance. - Watermarks can reduce electrical output with considerable economic implications.	N/A	15

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Layout and Design	Water infrastructure (Supply) Roads, Crossings & Stormwater outlets Floodlines	Groundwater abstraction, pipeline, purification and storage	**Impact:** Construction in flood occurrence zones could lead to damage to property. **Consequence:** Damage to property reduces operational efficiency and increases maintenance costs.	N/A	16

*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 13 (Transport and Roads)

- There are low-lying areas where water ponding occurs and has softened the layer works to the point where deep rutting occurs due to wheel tracks from traffic on the roads (Traffic Impact Assessment prepared by Sturgeon Consulting (Pty) Ltd dated February 2023).
- The existing road network has sufficient capacity to accommodate the additional trips during the construction and operational stages. A two-lane road such as the N10 in the vicinity of the site can accommodate approximately 2000 vehicles per hour. Once construction is completed, the day-to-day operation of the proposed substation will generate no to very little traffic which can easily be accommodated by the current road surface. It is anticipated that the proposed Main Transmission Substation and associated Eskom grid (network) integration infrastructure will add an additional 28 vehicles a day (±3 vehicles per hour) during the construction stage and 0 vehicles during the operational stage which is far less than the current capacity of the two-lane road (2 000 vehicles per hour).

Impact 14 (Quarry – Sourcing material)

- **Road material or aggregate will be purchased from a licensed commercial source.**
- The potential construction materials available on the farm and in the area consists of sandy transported soils, weathered siltstone, sandstone and dolerite. The gravelly siltstone occurs generally in thin beds overlying or underlying a sandstone member and are relative thin, generally less than 1.0m in thickness. It is however quite expansive with the gravel beds that can cover an area of a 200 to 300 square meters. Considering the construction materials required for the project it will consist of different classes of coarse aggregate for pioneer layer, yard stone as well as course and fine aggregate for concrete production. In the Karoo the best available hard aggregate that can be used for yard stone and concrete aggregate is fresh dolerite (G1 material) of which there are no significant deposits on the farm or in the immediate surrounding areas concrete. The closest commercial supplier is De Aar Stone Crushers which is located approximately 32km from the N10

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turnoff. There is a second dolerite quarry along the N1 towards Richmond (44km) from the N10 turn-off. This quarry is currently dormant, but it may be re-opened soon depending on SANRAL upgrades along the N1 in the area (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).

The borrow areas close to the property consist of two types of material: weathered siltstone and weathered dolerite. The dolerite borrow pit is located on the eastern slope of the hill close to the N10 turn-off (Borrow Area E in Figure 16 of the 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.). Borrow Area F on the other side of the hill facing the N10 is a weathered siltstone borrow area. The other siltstone borrow areas (Borrow areas B to D) are all constrained by a upper and lower competent layer resulting in a large area that have to be disturbed to gain sufficient material for aggregate. None of these areas are currently licensed as borrow areas (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).

- Brink (1983) cautions against the use of mudstone from the Karoo Supergroup for use as construction materials – particularly for use as concrete aggregate and to a limited extent also for road layer materials (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).

Impact 15 (Water Quality)

- According to the DWAF 1996 Target Water Quality Range (TWQR) for potable use, the groundwater from BH13 is suitable for domestic use, having a pH of 6.9. Only the EC of 75.5 mS/m and dissolved Calcium of 89 mg Ca/l exceed the DWAF TWQR (0 – 30 mS/m and 0 – 32 mg Ca/l, respectively). Similarly, the groundwater abstracted from Solar Borehole No. 5 is suitable for domestic use with a pH of 6.7. Four water quality parameters exceeded the DWAF TWQR, specifically EC (82.7 mS/m > 70 mS/m DWAF TWQR), TDS (466 mg/l > 450 mg/l DWAF TWQR), Dissolved Ca (94 mg Ca/l > 32 mg Ca/l DWAF TWQR) and Dissolved Mg (37 mg Ca/l > 30 mg Ca/l DWAF TWQR). The groundwater can be described as Ca-HCO3 and is typical of shallow fresh groundwater types or recently recharged groundwater. High EC indicates a high salt load (dominated by Ca, Mg, Cl, NO3 and HCO3 ions), which could result in scaling in piping exposed to heat, or in utensils used to boil water. (Geohydrological Assessment Report, 31st January 2023).
- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Water hardness depends on whether it is caused by bicarbonate salts or non-bicarbonate salts, such as chloride, sulphate and nitrate. Bicarbonate salts of calcium and magnesium precipitate on heating and cause scaling in hot water systems and appliances, whereas the non-bicarbonate salts do not precipitate on heating. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. The resulting scums are unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines).

Impact 16 (Damage to Property/Vehicles)

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- The flood lines suggest a low flooding risk associated with the project area, as no clearly defined drainage lines occur. Micro-sub catchment sheet flow towards lower laying areas within the non-perennial river flood plains is likely to dominate flood propagation, and isolated flooded areas are predicted to occur. As such, no clearly defined exclusion zones/protection buffer areas could be mapped.

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
13	M	L	M	-I	M	H	1	M	H	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

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

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

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Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
16	M	L	M	-I	M	H	1	M	H	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):

- Road material or aggregate will be purchased from a licensed commercial source.

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

- Hydrological Assessment, Version – Final 1, prepared by Hendrik Botha and dated 10 January 2023 (GCS Ref – 22 - 1054).
- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.
- Geohydrological Assessment Report Version – Final 1 prepared by GCS Water and Environmental Consultants dated 31st January 2023 (GCS Project Number: 22-0401).
- 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.
- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)

Mitigations:

Impact Management Outcome(s):

- Minimise risk of congestion and delays to local residents and farmers.
- Good road condition
- Maintain financial feasibility of the project.
- Good quality aggregate material
- Prolong the lifespan of pipes, appliances, etc.
- Groundwater for domestic use falls within DWAF's TWQR (1996).
- Minimize damage to property.

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Targets:

- Stagger traffic movements
- Passing lanes
- Stop and Goes
- Good passing lane condition
- Minimal corrugations and potholes
- Subgrade and subbase reconstruction of the road
- Supplement commercial sources with local if required
- Dolerite rock and/or sandstones and mudstone/shale which have been baked by dolerite intrusions are used as construction material.
- G5 is sourced from external suppliers.
- Water alkalinity and hardness results
- Water abstraction from Borehole No. 13, 14 and/or 5
- Deionisation plant
- Flood protection measures in place.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
13	Change Land use	Potential congestion and delays on the road network. Damage to vehicles.	Minimise risk of congestion and delays to local residents and farmers.	Stagger traffic movements	Stagger and schedule peak construction periods with an expected increase in vehicle movement outside of the peak traffic periods.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
13	Change Land use	Potential congestion and delays on the road network. Damage to vehicles.	Minimise risk of congestion and delays to local residents and farmers.	Passing lanes	Ensure adequate passing lanes (inside the road servitude) for local farmers and residents.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
13	Change Land use	Potential congestion and delays on the road network.	Minimise risk of congestion and delays to local	Stop and Goes	Implement "Stop and Goes".	Contractor	Continuous	Compliance to be 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
		Damage to vehicles.	residents and farmers.					ECO and IEA.
13	Change Land use	Potential congestion and delays on the road network. Damage to vehicles.	Minimise risk of congestion and delays to local residents and farmers.	Good passing lane condition	The applicant shall maintain any deterioration to the passing lanes. being reported).	Holder Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
13	Change Land use	Potential congestion and delays on the road network. Damage to vehicles.	Minimise risk of congestion and delays to local residents and farmers.	Minimal corrugations	Corrugations shall be removed as soon as is reasonably practical (e.g., within 5 working days of being reported).	Contractor	Continuous	Compliance to be verified by ECO and IEA.
13	Change Land use	Potential congestion and delays on the road network. Damage to vehicles.	Minimise risk of congestion and delays to local residents and farmers.	Minimal potholes	Potholes and puddles will be filled in and compacted as soon as is reasonably practical (e.g., within 5 working days of being reported).	Contractor	Continuous	Compliance to be verified by ECO and IEA.
13	Layout and Design	Unstable roadbed and wearing course	Good road condition	Subgrade and subbase reconstruction of the road	It is proposed that the length of the gravel road will require subgrade and subbase reconstruction in all areas where stormwater runoff needs to be improved. The balance of the road may only require top layer reconstruction.	Engineer, Contractor	Planning and Design And Continuous	Compliance to be verified by ECO and IEA.
14	Layout and Design	Haulage of imported materials incur a cost	Maintain financial feasibility of the	Supplement commercial sources with local	On the farm De Bad (See Figure 15 of the Geotechnical	Holder, Landowner, Contractor	Planning and Design And	Compliance to be 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
		relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	project. Good quality aggregate material	borrow pits if possible.	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.) there is a quarry where material for the construction of the N10 were sourced. The rock is a competent sandstone, but the flakiness index makes it less suitable for use as concrete aggregate than the dolerite. It can however be suitable for pioneering layers and as well as G2 and G3 material. This quarry can be used to upgrade and repair roads that intersects the same property. Sections of road that does not intersect properties where existing quarries with suitable material, will need to be repaired/upgraded with material sourced from commercial suppliers.		Continuous	ECO and IEA.
14	Layout and Design	Haulage of imported materials incur a cost	Maintain financial feasibility of the	Supplement commercial sources with local	The aggregates available in the area is suitable for construction. The fresh	Contractor	Planning and Design	Compliance to be 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
		relating to distance travelled and time. The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	project. Good quality aggregate material	borrow pits if possible.	dolerite (borrow pit is located on the eastern slope of the hill close to the N10 turn-off – see Borrow Area E in Figure 16 of the 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.) can be used for coarse and fine aggregate for concrete production as well as yard stone. The weathered dolerite as exposed in borrow area E is suitable for wearing course material. The volumes of material remaining at this borrow pit will not be sufficient and the borrow area is currently not licensed. These borrow pits can be used to upgrade and repair roads that intersects the same property. Sections of road that does not intersect properties where existing borrow pits with suitable material, will need to be		And Continuous	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
					repaired/upgraded with material sourced from commercial suppliers.			
14	Layout and Design	The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Good quality aggregate material.	G5 is sourced from external suppliers. Dolerite rock and/or sandstones and mudstone/shale which have been baked by dolerite intrusions are used as construction material.	It is recommended that the material (G5) for the wearing course be sourced from commercial suppliers.	Contractor	Planning and Design And Continuous	Compliance to be verified by ECO and IEA.
14	Layout and Design	The usage of mudstone from the Karoo Supergroup for use as concrete aggregate or road layers may reduce the quality of concrete and/or roads due to its instability.	Good quality aggregate material.	G5 is sourced from external suppliers. Dolerite rock and/or sandstones and mudstone/shale which have been baked by dolerite intrusions are used as construction material.	Preference should be given to the use of dolerite rock as construction material; however, sedimentary rock may be used with caution for the lower road layers – especially the sandstones and mudstone/shale which have been baked by dolerite intrusions.	Contractor	Planning and Design And Continuous	Compliance to be verified by ECO and IEA.
15	Layout and Design	High Electroconductivity levels of abstracted borehole water reflects a high salt content.	Groundwater for domestic use falls within DWAF's TWQR (1996). Prolong the lifespan of pipes, appliances, etc.	Water alkalinity and hardness results	Determine the alkalinity and hardness of new water sources as these aspects have an effect on the treatability of the water, as well as on infrastructure. Typical concerns relate to pH stability and whether the water will lead to	Holder, Contractor	Planning and Design	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
					excessive scaling in or aggressive attack of pipework.			
15	Layout and Design	High Electroconductivity levels of abstracted borehole water reflects a high salt content.	Groundwater for domestic use falls within DWAF's TWQR (1996).	Water abstraction from Borehole No. 13, 14 and/or 5	Potable water will be supplied by the contractor(s) from a commercial source or permissible boreholes: Borehole No. 13, Borehole No. 14 Solar Borehole No.4 and/or Solar Borehole No. 5.	Engineer, Landowner, Contractor	Planning and Design And Continuous	Compliance to be verified by ECO and IEA.
15	Layout and Design	High Electroconductivity levels of abstracted borehole water reflects a high salt content.	Groundwater for domestic use falls within DWAF's TWQR (1996). Prolong the lifespan of pipes, appliances, etc.	Deionisation plant	Treat the groundwater abstracted from boreholes with a deionisation (or other suitable) treatment plant if it is to be used for domestic use and/or cleaning solar panels. Groundwater need not be treated if it will only be used for road construction, e.g., road stabilisation or dust suppression.	Engineer, Contractor	Planning and Design And Continuous	Compliance to be verified by ECO and IEA.
16	Layout and Design	Construction in flood occurrence zones could lead to damage to property.	Minimize damage to property	Flood protection measures in place.	Care should be taken in areas where development does take place within the likely flooding zones. For these areas, proper flooding protocols (e.g., ensure drainage and stormwater systems are put in place to minimize flooding	Engineer, Contractor	Planning and Design And Continuous	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
					potential) and erosion prevention measures should be implemented.			

Assessment with mitigation:

Alternative Site No. 1 (preferred)

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
13	L	L	L	+I	L	L	0	L	L	0

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

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

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

Residual Risk (feeds back into "Mitigations"):

- Despite the mitigations to avoid damage to property during floods, strong flows or a flash flood during summer could still result in some damage to property.

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Receiving Environment: Social

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Commencement & Construction times	NA	**Impact:** Noise increase at the boundary of the project footprint and at the abutting houses during construction activities. **Consequence:** Decrease in sense of place. Disturbance to local farmsteads.	N/A	17
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Decrease in the "sense of place" as it relates to noise, visual and light pollution. **Consequence:** Lower aesthetic values enjoyed by the community.	N/A	17

*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 17 (Social aspect)

- The project area is located in Ward 6 of the Emthanjeni Local Municipality that is located in the Pixley Ka Seme District Municipality in the Northern Cape province. The towns in the area are small and the proposed site is located between the towns of Hanover and De Aar. About 74% of the people in Ward 6 live in urban areas while the remaining 26% (one quarter) live on farms. There are no areas under traditional leadership in the district and the site is surrounded by commercial farms. (Social Impact Report)
- At a local municipal level, the number of households increased (between 2011 and 2016) along with population density (per km^2), but the average household size has decreased (more households but with fewer members) possibly due to children leaving home and starting families of their own. Almost half the population in Ward 6 and the local municipality is 24 years or younger. Such a young population places a lot of pressure on resources and infrastructure of the area, and a great demand for future infrastructure as well as the creation of livelihoods can be expected. (Social Impact Report)
- The intensity of poverty and the poverty headcount is used to calculate the SAMPI score. A higher score indicates a very poor community that is deprived on many indicators. Despite a slight decrease in poverty intensity (average proportion of indicators in which poor households are deprived), the increased poverty headcount (the proportion of households that can be defined as multidimensionally poor) at a local municipal level, has effectively doubled the SAMPI score from 0,01 in 2011 to 0,02 in 2016. This means that more households are deprived on a number of dimensions that mostly relate to access to basic services. Education levels are low (About two fifths (17,8%) of the people in Ward 6 aged 20 years or older have no schooling or only some primary education). In Ward 6, 45,3% of people aged between 15 – 65 years are employed, with

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about half of those people in the formal sector. Ward 6 has the lowest proportion of people (6,7%) with no annual household income. There are very few employment opportunities. (Social Impact Report)

- The South African Multidimensional Poverty Index (SAMPI) (Statistics South Africa, 2014) assess poverty on the dimensions of health, education, standard of living and economic activity using the indicators child mortality, years of schooling, school attendance, fuel for heating, lighting, and cooking, water access, sanitation, dwelling type, asset ownership and unemployment. (Social Impact Report).
- 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).
- 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.

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
17	M	M	L	-I	M	M	1	H	M	1

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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:

- SolarAfrica Sun Central – Access Road Study Rev 0.1 (Document Reference: SAE-PD-DA-Access Road Study 0.1 FS).
- 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 noise disturbance to noise receptors/farmhouses.
- Minimize change in sense of place.

Targets:

- Construction during daytime only.
- Existing roads used as far as possible.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
17	Planning	Noise increase at the boundary of the project footprint and at the abutting houses during	Minimize noise disturbance to noise receptors/farmhouses.	Construction during daytime only.	Topsoil stripping and construction activities should be limited to daytime only.	Contractor	Planning and Design Phase 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
		construction activities.						
17	Layout and Design	Decrease in the "sense of place" as it relates to noise, visual and light pollution.	Minimize change in sense of place.	Existing roads used as far as possible.	Construction of new roads should be minimised, and existing roads should be used where possible.	Engineer, Contractor	Planning and Design Phase 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
17	L	L	L	neutral	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

Receiving Environment: Property

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change Land Use		Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:**	N/A	18

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Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
			- damage to property (direct) - runaway fires on neighbouring properties will result in a loss of grazing for livestock and/or wild game, increasing the running costs to provide supplementary feed.		

*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 18 (Fire)

- The risk of runaway fires caused by construction workers and damage to property or loss of grazing has been adequately assessed and mitigated under the "Receiving Environment: Economical" and therefore **does not need to be repeated here.**

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
18	L	M	L	-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:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)

Mitigations:

Impact Management Outcome(s):

- Fire management plan.

Targets:

- No run-away (uncontrolled) fires - no open fires.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
18	Change in Land Use	Risk of veld fires caused by workers during the construction of the facility decreases grazing capacity	Fire management plan	No run-away (uncontrolled) fires - no open fires	Undertake a risk analysis to determine inter alia the probability and frequency of a wildfire during construction and operation and prepare a fire management plan accordingly.	Holder	Planning and Design	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
18	L	M	L	-I	M	L	0	L	L	0

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Residual Risk (feeds back into "Mitigations"):

- The residual risk of loss of grazing material due to uncontrolled fires (**18**) after mitigation is assumed to be Low.

Receiving Environment: Health and Safety

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change Land Use		Fires	**Impact:** Risk of veld fires caused by workers during the construction of the facility. **Consequence:** - loss of life (direct)	N/A	18
Layout and Design	Water infrastructure (Supply)	Groundwater abstraction, pipeline, purification and storage	**Impact:** Groundwater may be unfit for human consumption. **Consequence:** - Poor quality water may be harmful to human health.	N/A	19
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Collapse of the road section crossing the Brak River due to poor stormwater management. **Consequence:** Significant financial costs and safety issues.	N/A	20
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Unstable roadbed and wearing course, development of standing water on the roads causing potholes over time. **Consequence:** Decrease in road condition, increased travel times and damage to vehicles/machinery.	N/A	20

*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 18

- The risk of injury or loss of life and/or damage to property caused by runaway fires started by construction workers has been **adequately assessed and mitigated other "receiving environments".**

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Impact 19 (Groundwater Quality)

- The natural hardness of water is influenced by the geology of the catchment and the presence of soluble calcium and magnesium minerals. Water hardness depends on whether it is caused by bicarbonate salts or non-bicarbonate salts, such as chloride, sulphate and nitrate. Bicarbonate salts of calcium and magnesium precipitate on heating and cause scaling in hot water systems and appliances, whereas the non-bicarbonate salts do not precipitate on heating. Excessive hardness in water forms scale on heat exchange surfaces such as cooking utensils, hot water pipes, kettles and geysers, and results in an increase in soap required to produce a lather when bathing and in household cleaning. The resulting scums are unesthetic, leading in the long term to the marking of enamel surfaces of baths and handbasins. Total hardness for domestic use should be limited to between 50 - 100 mg/• as $CaCO_3$, where possible. (DWAF Water Quality Guidelines).
- According to the DWAF 1996 Target Water Quality Range (TWQR) for potable use, the groundwater from BH13 is suitable for domestic use, having a pH of 6.9. Only the EC of 75.5 mS/m and dissolved Calcium of 89 mg Ca/l exceed the DWAF TWQR (0 – 70 mS/m and 0 – 32 mg Ca/l, respectively).
- Similarly, the groundwater abstracted from Solar Borehole No. 5 is suitable for domestic use with a pH of 6.7. Four water quality parameters exceeded the DWAF TWQR, specifically EC (82.7 mS/m > 70 mS/m DWAF TWQR), TDS (466 mg/l > 450 mg/l DWAF TWQR), Dissolved Ca (94 mg Ca/l > 32 mg Ca/l DWAF TWQR) and Dissolved Mg (37 mg Ca/l > 30 mg Ca/l DWAF TWQR).
- The groundwater can be described as Ca-HCO3 and is typical of shallow fresh groundwater types or recently recharged groundwater. High EC indicates a high salt load (dominated by Ca, Mg, Cl, NO3 and HCO3 ions), which could result in scaling in piping exposed to heat, or in utensils used to boil water. Consequently, water softeners or deionisation plants will be required for the treatment of groundwater that will be used for domestic use or cleaning solar panels.

Impact 20 (Road condition)

- Section 3 of the road alignment (see Figure 13 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) is located on Profile 1 and 2 where the overburden layer range in thickness from less than 300 mm to up to 1000 mm. In general, the siltstone bedrock is good founding for the road layer works (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).
  The road sections underlain by Profile 3 where the thicker 0.6 to 4.2 m thick transported soil layers overlie the siltstone bedrock settlement and erosion can be expected of the road foundation as well as culverts and level crossings (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).
- The section of the road underlain by Profile 3, the transported fluvial deposits within the drainage and floodplain area (Brak River), is likely to exhibit settlement and collapse settlement behaviour. The area is known for flash floods every few years. Without adequate drainage the roads will be damaged and delivery of supplies to the project will be negatively impacted while the roads dry off (Geotechnical Investigation Report prepared by Bare Rock Consulting (Pty) Ltd dated December 2022).
  Reference: 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.

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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
19	L	M	L	-I	M	M	1	M	M	1
Reversibility	H	**Irreplaceability**	H	**Mitigatory Potential**	H					

Impact	Intensity	Spatial	Duration	Status	Nature	Prob.	MAGNITUDE	Accept.	Prob.	IMPORTANCE
20	H	L	H	-I	H	H	1	H	H	1
Reversibility	M	**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:

- National Veld and Forest Fire Act, 1998 (Act No. 101 of 1998)
- 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.

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- 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):

- Safe drinking water.
- Good road conditions.

Targets:

- Potable water is treated to standard:
- Total hardness preferably 50 - 100 mg/ as CaCO3
- Potable water is treated to standard: Water quality results compare favourably with standard.
- Potable water is treated to standard: Appropriate treatment technology is adopted.
- A pioneer layer within the drainage and floodplain area of the Brak River.
- Pioneering layer added to deeper sand in Section 3 of the road alignment (on Profiles 1 and 2).
- Pioneering layer and foundations in the road sections underlain by Profile 3 where the thicker 0.6 to 4.2 m thick transported soil layers overlie the siltstone bedrock.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
19	Layout and Design	Groundwater may be unfit for human consumption.	Safe drinking water.	Potable water is treated to standard: Total hardness preferably 50 - 100 mg/• as $CaCO_3$	Test the quality of any water source that is to be used for potable water.	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
19	Layout and Design	Groundwater may be unfit for human consumption.	Safe drinking water.	Potable water is treated to standard: Water quality results compare	Potable water must comply with SANS 241-1 (water used in sanitation systems does not have to), which prescribes	Holder, Engineer	Planning and Design Phase.	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
				favourably with standard.	health-based water quality requirements.			
19	Layout and Design	Groundwater may be unfit for human consumption.	Safe drinking water.	Potable water is treated to standard: Water quality results compared with standard.	The raw water quality data should be compared against the potable water quality standards to determine the overall treatment requirements.	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
19	Layout and Design	Groundwater may be unfit for human consumption.	Safe drinking water.	Potable water is treated to standard: Appropriate treatment technology is adopted.	The treatment technologies selected should focus on those specific parameters in the raw water that do not meet the potable water quality standards (SANS 241-1).	Holder, Engineer	Planning and Design Phase.	Compliance to be verified by ECO and IEA.
20	Layout and Design	Collapse of the road section crossing the Brak River due to poor stormwater management.	Good road condition.	A pioneer layer within the drainage and floodplain area of the Brak River.	It is recommended that a pioneer layer of G2/G3 material be placed along the section underlain by Profile 3, the transported fluvial deposits within the drainage and floodplain area (Brak River). The pioneer layer must be placed before the foundation and the layer works of the road and culverts are constructed.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.
20	Layout and Design	Collapse of the road section crossing the Brak River due	Good road condition.	A pioneer layer within the drainage and floodplain area	Culverts and stormwater control measures must be above the pioneer	Engineer, Contractor	Planning and Design Phase and 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
		to poor stormwater management.		of the Brak River.	layer.			
20	Layout and Design	Collapse of the road section crossing the Brak River due to poor stormwater management.	Good road condition.	A pioneer layer within the drainage and floodplain area of the Brak River.	The road layer works should be placed and compacted so that the road alignment is above the 1:50 year flood elevation.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.
20	Layout and Design	Collapse of the road section crossing the Brak River due to poor stormwater management.	Good road condition.	A pioneer layer within the drainage and floodplain area of the Brak River.	Where the road cross level ground provision for adequate drainage on both sides of the road should be provided.	Engineer, Contractor	Planning and Design Phase and construction	Compliance to be verified by ECO and IEA.
20	Layout and Design	Unstable roadbed and wearing course, development of standing water on the roads causing potholes over time.	Good road condition.	Pioneering layer added to deeper sand in Section 3 of the road alignment (on Profiles 1 and 2).	When grading the invert for the road layer works, the areas where deeper sand is encountered, in Section 3 of the road alignment on Profiles 1 and 2 (see Figure 13 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), can be cut a bit deeper and a	Engineer, Contractor	Planning and Design Phase and 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
					pioneering layer added and compacted.			
20	Layout and Design	Unstable roadbed and wearing course, development of standing water on the roads causing potholes over time.	Good road condition.	Pioneering layer and foundations in the road sections underlain by Profile 3 where the thicker 0.6 to 4.2 m thick transported soil layers overlie the siltstone bedrock.	Pioneering layer and foundations are essential in the road sections underlain by Profile 3 where the thicker 0.6 to 4.2 m thick transported soil layers overlie the siltstone bedrock (see Figure 13 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).	Engineer, Contractor	Planning and Design Phase and 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
19	L	L	L	neutral	M	L	0	L	L	0

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

Residual Risk (feeds back into "Mitigations"):

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- None.

Receiving Environment: Security

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Planning	Labour	Job Creation	**Impact:** An influx of job seekers and construction workers into the area could increase the potential for criminal activity, including stock theft, game poaching, property theft, emotional and/or physical harm to victims, etc. **Consequences:** - Loss of farming revenue - Injury or loss of life	N/A	21
Layout and Design	Installing servitude Fence and Access Control	Security	**Impact:** Increased potential for criminal activity, including theft of and damage to infrastructure. **Consequence:** Undermining the economic feasibility of the development.	N/A	21

*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 21 (Crime and Security)

- Farm safety is a concern in the rural areas of South Africa. Although there is a low incidence of farm attacks in the Karoo, farmers and farm workers are soft targets due to the isolation on farms and distance from emergency services. More people moving around in the area will make it easier for opportunistic criminals to enter the area without being noticed. Stock theft is a problem in the area, and one farmer reported that during the times that Transnet contractors work in the area they lose up to ten sheep a week. Farmers are concerned that the presence of the construction workers in the area will cause an increase in stock theft, due to people becoming aware of where the stock are kept. There is also a possibility that petty theft or opportunistic crimes can take place. The municipality indicated that general crime levels increased during the

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construction phases of the renewable developments around the town. The municipality reported that once the construction teams left, they perceive that there is an increase in local petty crimes such as housebreaking which they attribute to loss of income amongst some community members. There will be less people in the area during the operational phase and fewer permanent workers onsite.

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
21	M	M	L	-I	M	M	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:

- Social Impact Assessment Report prepared by Ilse Aucamp of Equispectives Research & Consulting Services dated August 2022.
- Access Road and Part 2 Amendment Addendum to Social Impact Assessment Report prepared by Equispectives Research & Consulting Services dated January 2023.

Mitigations:

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Impact Management Outcome(s):

- A safe local farming community
- A secure construction area

Targets:

- Reduce risk of criminal activity.

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
21	Planning	An influx of job seekers and construction workers into the area could increase the potential for criminal activity.	A safe local farming community	Reduce risk of criminal activity	No accommodation shall be provided for contractors, sub-contractors, and their workers on the construction site.	Holder, Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Planning	An influx of job seekers and construction workers into the area could increase the potential for criminal activity.	A secure construction area.	Reduce risk of criminal activity	Security during construction will be mitigated by erecting the servitude fence at the onset of construction to prevent any movement out of the development footprint.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	Security shall be appointed throughout construction to discourage criminal elements. Site security will be required at all times.	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft	A secure construction area.	Reduce risk of criminal activity	Use existing gates provided to gain access to all parts of the area authorised for	Contractor	Planning and Design Phase Continuous	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
		of and damage to infrastructure.			development, where possible			
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	Existing and new gates to be recorded and documented in photographic record	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity:	All gates must be fitted with locks and be kept locked at all times during the development phase, unless otherwise agreed with the landowner	Contractor, Landowner	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	Care must be taken that the gates must be so erected that there is a gap of no more than 100 mm between the bottom of the gate and the ground	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	All demarcation fencing and barriers must be maintained in good working order for the duration of the development activities	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage	A secure construction area.	Reduce risk of criminal activity	Fencing must be erected around the camp, batching plants, hazardous storage	Contractor	Planning and Design Phase Continuous	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
		to infrastructure.			areas, and all designated access restricted areas, where applicable			
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	All fencing must be developed of high-quality material bearing the SABS mark	Contractor	Planning and Design Phase Continuous	Compliance to be verified by ECO and IEA.
21	Layout and Design	Increased potential for criminal activity, including theft of and damage to infrastructure.	A secure construction area.	Reduce risk of criminal activity	Fenced areas with gate access must remain locked after hours, during weekends and on holidays if staff is away from site. Site security will be required at all times	Contractor	Planning and Design Phase Continuous	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
21	L	L	L	-R	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

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Receiving Environment: Public Services

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Change Land Use	Repair and rebuilding District Gravel Road	Congestion and delays to local farmers and residents.	**Impact:** Increased traffic can result in corrugations and potholes on roads. **Consequence:** Decrease in condition of gravel roads, increase in travel times.	N/A	22
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Transport of abnormal roads could be delayed. **Consequence:** Delays in construction.	N/A	22

*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 22 (Transport and Traffic)

- The main gravel road, Burgerville Road, is in a fair to poor condition. The main surfaced road, the N10, in the vicinity of the proposed development is in a good condition except for the N10 between the Middelburg turn off and Hanover which was noted to be in a poor condition and dangerously potholed as a result of the frequent trips by manganese haulers (Traffic Impact Assessment prepared by Sturgeon Consulting (Pty) Ltd dated February 2023).
- Transformers will be transported by abnormal load trucks for which a permit will need to be applied for in terms of Section 81 of the National Road Traffic Act and authorisation needs to be obtained from the relevant road authorities to modify the road reserve to accommodate turning movements at intersections.
- Depending on the type, weight and length of the load an abnormal load permit may be required with a transport management plan indicating the route and possible limitations on travel.

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
22	M	M	L	-I	M	M	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:

- Traffic Impact Assessment for the upgrading & development of an access road from the N10/'Burgerville' district road (2448) turn-off to the Main Transmission Substation (MTS) as well as the construction of a loop-in loop-out from the MTS to the 400 kV Hydraposeidon Tx overhead line (line 1), and other projects on the Sun Central Cluster 1 (300 MW) solar PV footprint between De Aar and Hanover, Northern Cape province (project No.: STUR0375) prepared by Sturgeon Consulting (Pty) Ltd dated February 2023.

Mitigations:

Impact Management Outcome(s):

- Good road conditions.
- Safe (unobstructed) delivery of abnormal loads to site.

Targets:

- No corrugations or potholes in access road.

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- Investigation

Impact No.	Mgt Category	Identified Impacts and Risks	Impact Management Outcomes	Targets & Indicators	Management Actions & Mitigation Measures	Responsible person(s)	Timeframe / Frequency	Monitoring
22	Change land use	Increased traffic can result in corrugations and potholes on roads.	Good road conditions.	No corrugations or potholes in access road.	Construction of the N10/Burgerville Road intersection; and upgrading of Burgerville Road up to the access point (approximately 5.2 km) at Farm Riet Fountain No. 39C.	Engineer, Contractor	Planning and Design Phase	Compliance to be verified by ECO and IEA.
22	Layout and Design	Transport of abnormal roads could be delayed.	Safe (unobstructed) delivery of abnormal loads to site.	Investigation	The appointed engineers should investigate the route to the site to ensure that the abnormal loads are not obstructed at any point by geometric, height and width limitations along the route.	Engineer	Planning and Design Phase	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
22	L	L	L	-R	L	L	0	L	L	0

Residual Risk (feeds back into "Mitigations"):

- None.

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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Receiving Environment: Heritage and Culture

Description of potential impacts:

Management Category	Sub-activity	Environmental Aspect	Impact-Consequence	Change	Impact No.
Layout and Design	Roads, Crossings & Stormwater outlets		**Impact:** Disturbance to or destruction of sites 19, 20 and 21 during construction. **Consequence:** Loss/damage of heritage resource.	NA	23

*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 23 (Heritage)

- The Archaeological and Cultural Heritage theme for Alternative Route No. 1 is Low according to the Screening Assessment Reports. However, previous archaeological and heritage assessments (2017 & 2021) for Phase 1 (now referred to as Sun Central Cluster 1) recorded a fairly large number of cultural heritage (archaeological & historical) resources of varying extent and significance in the area. These include scatters of open-air surface Stone Age sites, rock engravings, later agro-pastoralist stone-walled sites, as well as historical Anglo-Boer War (18990-1902) sites. These findings are clear evidence of the intrinsic heritage value of the area, but none of the cultural heritage resources identified and recorded during these assessments were Grade I or II sites (National or Provincial Heritage Sites). Nonetheless, some of the sites recorded in 2017 and 2021 are located in relative close proximity to, but outside the access road servitude (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).
- The palaeosensitivity of the 'broader' project area has been provisionally rated as Very High by the DFFE Screening Tool. However, previous palaeontological site visits to the same area indicate that this region is generally of LOW palaeosensitivity, despite being underlain at depth by potentially fossiliferous continental sediments of the Adelaide Subgroup (Beaufort Group, Karoo Supergroup) of Middle Permian age, as well as small, reworked blocks of petrified wood and low diversity trace fossil assemblages of low scientific interest being recorded from older alluvial deposits and bedrocks in the area. No High Sensitivity fossil sites have been recorded within any of the Soventix Phase 1 to Phase 3 solar project areas (including all associated infrastructure such as grid connections, substations, access roads, etc.). The low overall palaeosensitivity is probably largely due to rarity of well-preserved fossil remains within the bedrocks concerned, the generally very poor levels of bedrock exposure (especially in flat-lying regions), extensive baking of the sedimentary bedrocks by dolerite intrusions in the region as well as the generally low sensitivity of the superficial deposits in the region. The construction phase of the proposed additional infrastructure is very unlikely

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to cause significant negative impacts on local palaeontological heritage resources (Palaeontological Heritage Comment prepared by John E. Almond (PhD) of Natura Viva cc and 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
23	L	L	L	neutral	L	L	0	M	H	1
Reversibility	L	**Irreplaceability**	L	**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:

- Screening Assessment Reports
- *A Heritage Scoping Report Impact Assessment related to the Development of the Sun Central Cluster 1, 300 MW, Solar PV Facility additional activities on various Farm Portions between De Aar & Hanover, Emthanjeni Local Municipality, Pixley Ka Seme District Municipality, Northern Cape Province, South Africa (Report: APAC023/12) prepared by APelser Archaeological Consulting cc (APAC) dated February 2023*

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- Palaeontological Heritage Comment, Access Road Basic Assessment and Transmission Line Part 2 Amendment for the Sun Central Cluster 1 between De Aar & Hanover, Pixley Ka Seme District Municipality, Northern Cape Province, prepared by John E. Almond (PhD) of Natura Viva cc, and dated January 2023.
- National Heritage Resources Act, 1999 (Act No. 25 of 1999)
    - *Structures*
        - No person may alter or demolish any structure or part of a structure, which is older than 60 years without a permit issued by the HRA (Section 34(1) of NHRA).
    - *Archaeological Sites and Remains*
        - In terms of Section 35(3) of the NHRA, any person who discovers archaeological or palaeontological objects or material or a meteorite during development or an agricultural activity must **immediately report the find** to the HRA.
        - In terms of Section 35(4) of the NHRA, **no person may without a permit** issued by the HRA destroy, damage, excavate, alter, deface, or otherwise disturb any archaeological or palaeontological site or any meteorite, or remove from its original position any archaeological, or palaeontological material or object or any meteorite.
    - *Graves*
        - In terms of Section 36(6) any person who during development discovers the location of a grave **must immediately cease such activity and report the discovery** to the HRA. The HRA must then, in co-operation with the SAPS, carry out an investigation.
        - In terms of Section 36(3) of the NHRA, **no person may, without a permit** issued by HRA, destroy, damage, alter, exhume, or remove from its original position or otherwise disturb the grave of a victim of conflict, any burial ground or part thereof which contains such graves, or any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority (Section 36(3) of NHRA).

Mitigations:

Impact Management Outcome(s):

- Protection and preservation of heritage resources.

Targets:

- 30 m buffer from Heritage Sites.

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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
23	Layout and Design	Disturbance to or destruction of sites 19, 20 and 21 during construction.	Protection and preservation of heritage resources.	30 m buffer from Heritage Sites	The access road must be aligned in such a way that the outside edge (fence) of the 19 m-wide servitude remains outside the 30 m buffer from Heritage Sites 19, 20 and 21 [GPS Coordinates: S30.89076 E24.31306 (19); S30.89010 E24.31322 (20) & S30.88885 E24.31347 (21)]. (2) Heritage sites 19 (S30.89076 E24.31306), 20 (S30.89010 E24.31322) & 21 (S30.88885 E24.31347) and their 30 m buffers are no-go areas for the purposes of this project.	Engineer, Contractor	Planning and Design And Construction.	Compliance to be monitored by the SEO and verified by ECO and IEA.

Assessment with mitigation:

Alternative Route No. 1 (preferred)

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

Residual Risk (feeds back into "Mitigations"):

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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- Previous archaeological and heritage assessments for Cluster 1 (preferred Alternative Route No. 1) recorded a fairly large number of cultural heritage (archaeological & historical) resources of varying extent and significance in the area. These include scatters of open-air surface Stone Age sites, rock engravings, later agro-pastoralist stone-walled sites, as well as historical Anglo-Boer War (18990-1902) sites. These findings are clear evidence of the intrinsic heritage value of the area (A Heritage Scoping Report Impact Assessment prepared by APelser Archaeological Consulting cc (APAC) dated February 2023).
- The potential for rare, largely unpredictable fossil sites of High Palaeosensitivity within the Permian bedrocks or associated with older alluvial and pan deposits hidden in the subsurface cannot be entirely discounted. Consequently, **a Chance Fossil Finds Protocol shall be included within the EMPr** in case any fossiliferous deposits are exposed by surface clearance or excavations during the construction phase of the development (Palaeontological Heritage Comment prepared by John E. Almond (PhD) of Natura Viva cc and dated January 2023).

MEMBERS: J.A. Bowers (M Tech, Pr.Sci.Nat.) & S.D. MacGregor (M.Sc., Pr.Sci.Nat.)
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