KLIPKRAAL WIND ENERGY FACILITY 1 (PTY) LTD

KLIPKRAAL WIND ENERGY FACILITY 1

Transportation Study

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Document Title:	**Klipkraal Wind Energy Facility 1** Transportation Study	
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For:	KLIPKRAAL WIND ENERGY FACILITY 1 (PTY) LTD	

Confidentiality Statement

EXECUTIVE SUMMARY

Objective

Klipkraal Wind Energy Facility 1 (Pty) Ltd proposes constructing and operating the Klipkraal Wind Energy Facility 1 and associated grid infrastructure approximately 29 km southeast of Fraserburg, Northern Cape Province. The proposed facilities will have a combined maximum generating capacity of 300MW. The objective is to generate electricity through renewable energy technology, capturing wind energy to feed into the national grid.

The main objective of the 'Transportation Study' is to determine the impact/s of the proposed development on the immediate and greater area concerning transportation. The assessment will comprise a site assessment and include preliminary transportation-related matters arising during the construction phase, through the operation & maintenance phase, up to and including the decommissioning phase of the development. The assessment of these phases will consider the transportation of normal and abnormal vehicles, which are made up of, among others; - WEF components, construction materials, equipment, construction workers and employees.

Key Findings

We don't foresee any significant risks concerning the proposed development and therefore include our recommendations below to take note of before and during the detailed design and construction stages. It should however be noted that several recommendations were highlighted and therefore noted as important.

The development is in close proximity to an existing road network with minor upgrades proposed on the gravel roads between Fraserburg and the development. The current access point on Road DR2312 has an insufficient sight distance of 240 m; therefore, we propose the access position be moved towards the east at Km 89.55. Before work commences, external road upgrades require approval and a wayleave application from the Northern Cape Department of Public Works & Roads (NCdr&pw).

The construction / balance of plant phase of this development will typically generate the highest number of additional vehicles. However, it will be temporary, and impacts are considered nominal.

Abnormal loads have been presumed from the Port of Saldanha through Moorreesburg, Wolseley and Worcester towards Matjiesfontein on the N001 Freeway. The section from Matjiesfontein to Fraserburg would require passing over the Theekloofpas and could pose problems for the transportation of rotor blades. Our recommendation is to route through Sutherland with minor deviations in places; however, a more comprehensive route analysis will be required before construction better to understand the required works and the potential risks.

Several mitigation measures are proposed to accommodate the development and reduce the impact on the surrounding road network.

Recommendation

Concerning this report, associated assessment and the findings made within, it is SiVEST's opinion that the Klipkraal WEF 1 and associated grid infrastructure will have a nominal impact on the existing traffic network. The project is therefore deemed acceptable from a transport perspective, provided the recommendations and mitigation measures in this report are implemented. Hence, Environmental Authorisation (EA) should be granted for the EIA application.

DECLARATION BY SPECIALIST

I, NTUTHUKO HLANGUZA, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of Specialist: 

Name of Company: SiVEST SA (PTY) Ltd

Date: 03 February 2023

NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 1998) AND ENVIRONMENTAL IMPACT REGULATIONS, 2014 (AS AMENDED) – REQUIREMENTS FOR SPECIALIST REPORTS (APPENDIX 6)

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	Section of Report
300. (1) A specialist report prepared in terms of these Regulations must contain- a) details of- i. the specialist who prepared the report; and ii. the expertise of that specialist to compile a specialist report including a curriculum vitae;	Refer Section **Error! Reference source not found.** and Appendix A
b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Refer above
c) an indication of the scope of, and the purpose for which, the report was prepared;	Refer Section **Error! Reference source not found.**
(cA) an indication of the quality and age of base data used for the specialist report;	Refer Section **Error! Reference source not found.**
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Refer Section **Error! Reference source not found.** Refer Section **Error! Reference source not found.**
d) the date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Refer Section **Error! Reference source not found.**
e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Refer Section **Error! Reference source not found.**
f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Refer Section 12
g) an identification of any areas to be avoided, including buffers;	N/A
h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Refer **Error! Reference source not found.**
i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Refer Section 5
j) a description of the findings and potential implications of such findings on the impact of the proposed activity, (including identified alternatives on the environment) or activities;	Refer Section 7 Refer Section **Error! Reference source not found.**
k) any mitigation measures for inclusion in the EMPr;	Refer Section **Error! Reference source not found.**
l) any conditions for inclusion in the environmental authorisation;	Refer Section **Error! Reference source not found.**
m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Refer Section **Error! Reference source not found.**

n) a reasoned opinion- i. (as to) whether the proposed activity, activities or portions thereof should be authorised; (iA) regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be approx.6ed, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	Refer Section **Error! Reference source not found.**
o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	Refer Section 0
p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
q) any other information requested by the competent authority.	N/A
2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	N/A

KLIKRAAL WIND ENERGY FACILITY 1 (PTY) LTD

KLIPKRAAL WIND ENERGY FACILITY 1

TRANSPORTATION STUDY

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1. INTRODUCTION

SiVEST Civil Engineering Division has been appointed by Klipkraal Wind Energy Facility 1 (Pty) Ltd (hereafter referred to as “Klipkraal 1” or “Klipkraal Facility 1’’) to complete Transportation Studies for five (5) proposed wind energy facilities (WEF) and associated grid infrastructure combined known as the Klipkraal Wind Energy Facility (hereafter the “proposed facility / facilities”). The Klipkraal Wind Energy Facility is situated ±29 km southeast of Fraserburg in the Northern Cape Province and is within the Karoo Hoogland Local Municipality.

The proposed facility and associated grid infrastructure between Fraserburg & Beaufort West are located between the Komsberg or Beaufort West Renewable Energy Development Zones (REDZ) and does not fall within a REDZ zone.

The proposed Klipkraal WEF forms part of a cluster development with five (5) phases forming part of the development, each phase having separate EIA applications. Although this report only focuses on Klipkraal WEF 1 of the Klipkraal WEF cluster, all five phases will be considered and analysed as a combined assessment as they share common access points from Road DR02312.

2. WIND ENERGY FACILITY COMPONENTS

The WEF will consist of the following:

2.1 Wind Turbine Generators (WTG’s)

Table 2.1 Klipkraal WEF Development

Phase	Capacity	No of Turbines
Klipkraal WEF 1	300 MW	60
Klipkraal WEF 2	300 MW	60
Klipkraal WEF 3	300 MW	60
Klipkraal WEF 4	300 MW	60
Klipkraal WEF 5	300 MW	60

- ±60 turbines per wind farm, each between 5MW and 8MW, with a maximum export capacity of up to approximately 300MW for each wind farm.
- Each wind turbine will have a maximum hub height of up to approximately 200m;
- Each wind turbine will have a maximum rotor diameter of up to approximately 200m;
- Permanent compacted hardstanding areas / platforms (also known as crane pads) of approximately 100m x 100m (total footprint of approx. 10000 m^2) per wind turbine during construction and for ongoing maintenance purposes for the lifetime of the proposed wind farm projects. This will however, depend on the physical size of the wind turbine;
- Each wind turbine will consist of a foundation (i.e. foundation rings) which may vary in depth, from approximately 3 m and up to 10 m or greater, depending on the physical size of each wind turbine. It should be noted that the foundation can be up to as much as approximately 700 m^3.

2.2 Electrical Transformers

- Electrical transformers will be constructed near the foot of each respective wind turbine to increase the voltage to 66 kV.

- The typical footprint of the electrical transformers is up to approximately 10 m x 10 m but can be up to 20 m x 20 m at specific locations.

2.3 Step-Up / Collector Substations

- New 11-66/132-400 kV step-up / collector substations, each occupying an area of up to approximately 1.5 ha, for each proposed wind farm [i.e. one (1) substation per phase].
- The proposed substations will include Eskom and Independent Power Producer (IPP) portions. Hence the substations have been included in each respective wind farm EIA and in the grid connection infrastructure BA (substations, switching stations and power lines) to allow for handover to Eskom.
- Following construction, the substations will be owned and managed by Eskom. The current applicant will retain control of the medium voltage components (i.e. 33 kV components) of the substations, while the high voltage components (i.e. 132 kV components) of these substations will likely be ceded to Eskom shortly after the completion of construction.

2.4 Main Transmission Substations (MTS)

- Two (2) new 132/400 kV Main Transmission Substations (MTS) are being proposed, occupying an area of up to approximately up to 120 ha each.
- The proposed substations will include Eskom and Independent Power Producer (IPP) portions. Hence the substations have been included in each respective wind farm EIA and in the grid connection infrastructure BA (substations, switching stations and power lines) to allow for handover to Eskom.
- Following construction, the substations will be owned and managed by Eskom. The current applicant will retain control of the 132-400 kV and lower voltage components of each MTS, while the 132/400 kV voltage components of each MTS will likely be ceded to Eskom shortly after the completion of construction;

2.5 Electrical Infrastructure

- The wind turbines will be connected to the proposed substations via medium voltage (i.e. 33 kV) cables.
- These cables will be buried along access roads wherever technically feasible; however, the cables can also be overhead (if required).
- Each WEF will connect to the MTS via an up to 400KV line.

2.6 Battery Energy Storage System (BESS)

- A Battery Energy Storage System (BESS) will be constructed for each respective wind farm [i.e. one (1) BESS per phase] and will be located next to the 33-66/132-400 kV step-up / collector substations which form part of the respective wind farms, or in between the wind turbines.
- It is anticipated that the type of technology will be either Lithium Ion or Sodium-Sulphur (or as determined prior to construction).
- These batteries are not considered hazardous goods as they will be storing 'energy'.
- The size, storage capacity and type of technology will be determined / confirmed prior to construction. This information will be provided to I&AP's prior to the commencement of construction.

2.7 Roads

- Internal roads with a width of up to approximately 15m will provide access to each wind turbine. Roads will be rehabilitated back to 8 m once construction has been completed.
- Existing site roads will be used wherever possible, although new site roads will be constructed where necessary.
- Existing site roads may also be upgraded using temporary concrete stones to accommodate heavy loads.
- Turns will have a radius of up to 50 m for abnormal loads (especially turbine blades) to access the various wind turbine positions.

2.8 Site Access

- The proposed wind farm application sites will be accessed via existing gravel roads from the R353 Regional Route.

2.9 Temporary Staging Areas

- Temporary staging areas will be required for each wind farm and will be located both at the foot of each wind turbine and at the storage facility (i.e. turbine development area) to allow for working requirements.
- One (1) temporary staging area per wind turbine / range of wind turbines will be required for each wind farm (i.e. for each phase).
- Temporary staging areas will cover an area of up to approximately 100m x 100m (10 000m2 / 1ha) each.

2.10 Temporary Construction Camps

- Temporary construction camps will be required during the construction phase. One (1) temporary construction camp per wind farm is being proposed [i.e. one (1) per phase].
- This area will be used as a permanent maintenance area during the operational phase. One (1) permanent Maintenance Area will be required per wind farm [i.e. one (1) per phase].
- Each combined Temporary Construction Camp / Permanent Maintenance Area will cover an area of up to approximately 2.25 ha.
- A cement batching plant and a chemical storage area will fall within each Temporary Construction Camp and Permanent Maintenance Area.
- Each Temporary Construction Camp and Permanent Maintenance Area will be strategically placed around the proposed wind farm sites and will avoid all high sensitivity and/or 'no-go' areas;

2.11 Offices, Accommodation, Visitors Centre and O&M Buildings

- Offices (including ablution facilities), Accommodation (including ablution facilities), a Visitors' Centre and Operation & Maintenance (O&M) buildings will be required and will occupy areas of up to approximately 100 m x 100 m (i.e., 1 ha).
- Each wind farm (i.e., each phase) will have its O&M building and Office; however, the Accommodation and Visitors' Centre will be centralised locations which will be shared between certain wind farm projects (i.e., shared between certain phases, which will be confirmed at a later stage).

2.12 Septic Tank & Soak Away

- Each wind farm will consist of septic tank and soak-away systems.
- This will be required for construction as well as long-term use.
- Septic tanks and soak-away systems will be placed 100 m or more from water resources (which includes boreholes).

2.13 Wind Measuring Lattice Masts

- Two (2) wind measuring lattice masts (approximately 120 m in height) have already been strategically placed within the wind farm application sites in order to collect data on wind conditions.
- Two (2) additional wind-measuring lattice masts may be installed within the wind farm application sites. This will be confirmed at a later stage, prior to the respective application forms being submitted.

2.14 Fencing

- Fencing will be required and will surround each respective wind farm.
- A maximum height of 3 m for the fencing is proposed. The area the fencing will cover will be confirmed during the detailed design phase before construction commences. Palisade or diamond/clear view/ mesh. Fences will, however, be constructed according to specifications recommended by the Ecologist and Avifauna specialist (as per the EMPr).

2.15 Temporary Infrastructure to Obtain Water from Available Sources

- Temporary infrastructure to obtain water from available local sources will be required. Water may also be obtained from on-site boreholes and the town of Fraserburg.
- New or existing boreholes are being proposed, including a potential temporary above-ground pipeline (approximately 50 cm in diameter) for each wind farm to feed water to the sites.
- Water will potentially be stored in temporary water storage tanks.

2.16 Temporary Containers

- Temporary containers of up to approximately 80 m^3 will be required for fuel storage on-site during the construction phase of each wind farm.
- As mentioned, a chemical storage area will fall within the Temporary Construction Camp and permanent Maintenance Area.

3. OBJECTIVES AND SCOPE OF WORK

The main objective of the 'Transportation Study' is to determine the impact/s of the proposed development on the immediate and greater area concerning transportation. The assessment will comprise a site assessment and include preliminary transportation-related matters arising during the construction phase, through the operation & maintenance phase, up to and including the decommissioning phase of the development. The assessment of these phases will take into account the transportation of normal and abnormal vehicles, which are made up of, among others; - WEF components, construction materials, equipment, construction workers and employees.

The scope of work consists of the following:

a) A site investigation (Completed on the 23rd September 2021).

b) Consultations with the relevant authorities and / or stakeholders include collecting traffic data and information.

c) Desktop analysis of traffic data and information from the various authorities and / or stakeholders. The analysis includes the evaluation of the road network's capacity (if required).

d) Evaluate the impact of the proposed development on the existing road network / traffic volumes and populate a suitable 'Impact Rating System'.

e) Determine specific traffic needs during the different phases of implementation.

f) Conclude & propose possible mitigation measures.

g) Identify the position and suitability of the preferred access road alternatives.

h) Confirm the required clearances for the necessary equipment to be transported from the point of delivery to the various sites.

i) Confirm freight and transport requirements during construction, operation and maintenance period.

j) Propose origins and destinations of equipment.

k) Determine Abnormal load requirements (if any).

l) Seasonal impacts do not affect the assessment.

3.1 Legal Requirement & Guidelines

Key legal requirements and guidelines for the proposed facilities are as follows:

- Government Notice 509 (GN509), as published in Government Gazette 40229 of 2016 and refers to the National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA)
- National Water Act, 1998 (Act No 36 of 1998) (NWA)
- Road Safety Act (Act No 93 of 1996)
- National Road Traffic Regulations, 2000

4. SPECIALIST CREDENTIALS

This Transportation Study has been compiled by Merchandt Le Maitre and Ntuthuko Hlanguza from SiVEST Consulting Engineers. Ntuthuko is a professionally registered civil engineer with a BSc.Eng (Civil) qualification and post-graduate certificate in Energy Efficiency and Sustainability. He has over 7 years of experience in a wide range of civil engineering applications including specialist studies in the renewable energy sector. His experience in the different facets of Civil Engineering means he can advise clients in the renewable energy sector on transportation studies, access and internal road layouts and designs, glint and glare assessments, water demand and stormwater management. A full Curriculum Vitae is included in 'Appendix A.'

Table 4.1 Specialist Credentials & Experience

Company	SiVEST (Pty) Ltd
Contact Details	ntuthukoh@sivest.co.za
Qualifications	BSc.Eng (Civil) (UKZN) Cert. Energy Efficiency & Sustainability (UCT)
Professional Registrations & Memberships	• Pr. Eng – Engineering Council of South Africa • MSAICE – Member of South African Institute of Civil Engineers
Expertise to carry out the Transportation Study	• Karee WEF • Droogfontein 3 PV • Mierdam PV • Patatskloof WEF • Platsjambok West PV • Platsjambok East PV • Kraaltjies WEF

5. ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations are to be noted:

- The analysis is based on the information Klipkraal WEF 1 and its representatives.
- Digital Terrain Model: 25 m DEM from NGI (2014) & 2 m DEM from GeoSmart (2016:3121DC / 3121DD / 3221BA / 3221BB)
- Technical Specifications for the facility include:

Table 5.1 Technical Specification for Klipkraal WEF 1

Technical Component	Dimensions
Number of Turbines	Maximum of 60
Capacity	≤ 300 MWac
Hub Height	≤ 200 m
Rotor Diameter	≤ 200 m
Construction Period (assumed)	± 30 months (TBC)
Expected Lifespan	20 - 25 years (TBC)
Road Width	Up to 8 m
Length of Internal Roads	≤ 30 km (TBC)

- Traffic Station Data / Counts and trip generation calculations are for one direction only and do not include return trips unless indicated.
- Peak Hour Trip Generations:
    - Weekday AM peak hour - 07:00 to 08:00
    - Weekday Midday peak hour - 11:00 to 14:00
    - Weekday PM peak hour - 16:00 to 17:00
- This assessment is limited to the impact of the development traffic on the network, not the broader impacts known as background traffic. Such impacts can only be addressed in a detailed Traffic Impact Study, which considers actual traffic counts undertaken during the peak periods.

- The information provided in this report is an informed estimate. Construction-related traffic may vary and be different to the information provided during construction phases because of supplier delivery schedule changes.
- Some of the figures provided are indicative as many of the components are still at a design stage and will only be confirmed closer to construction.

6. PROJECT DESCRIPTION

6.1 Locality

Klipkraal WEF and associated infrastructure is located ±29 km southeast of Fraserburg in the Northern Cape Province. Road DR02312 bisects the facility, a District Road between Fraserburg and Beaufort West (Refer

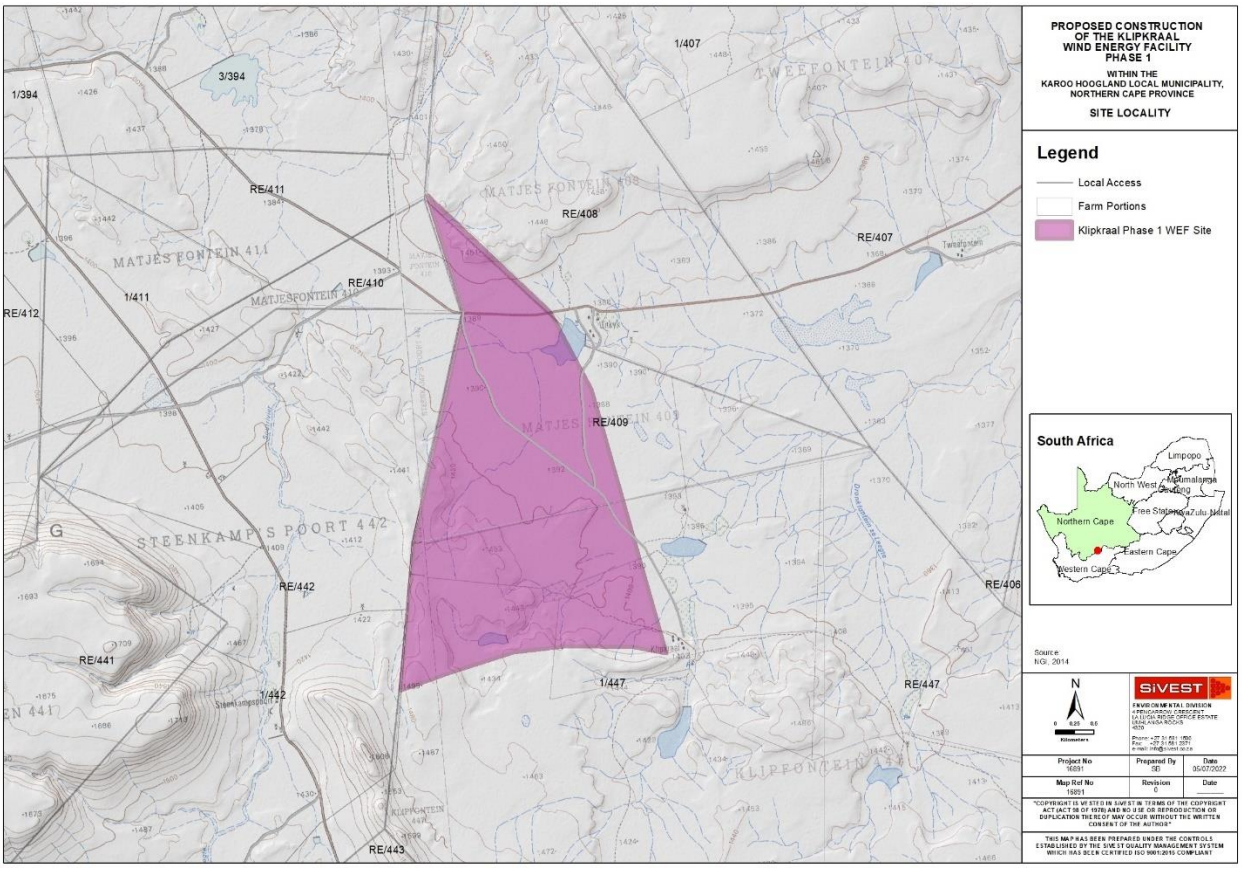

Figure 6-2) in the Karoo Hoogland Local Municipality and greater Namakwa District Municipality indicated in

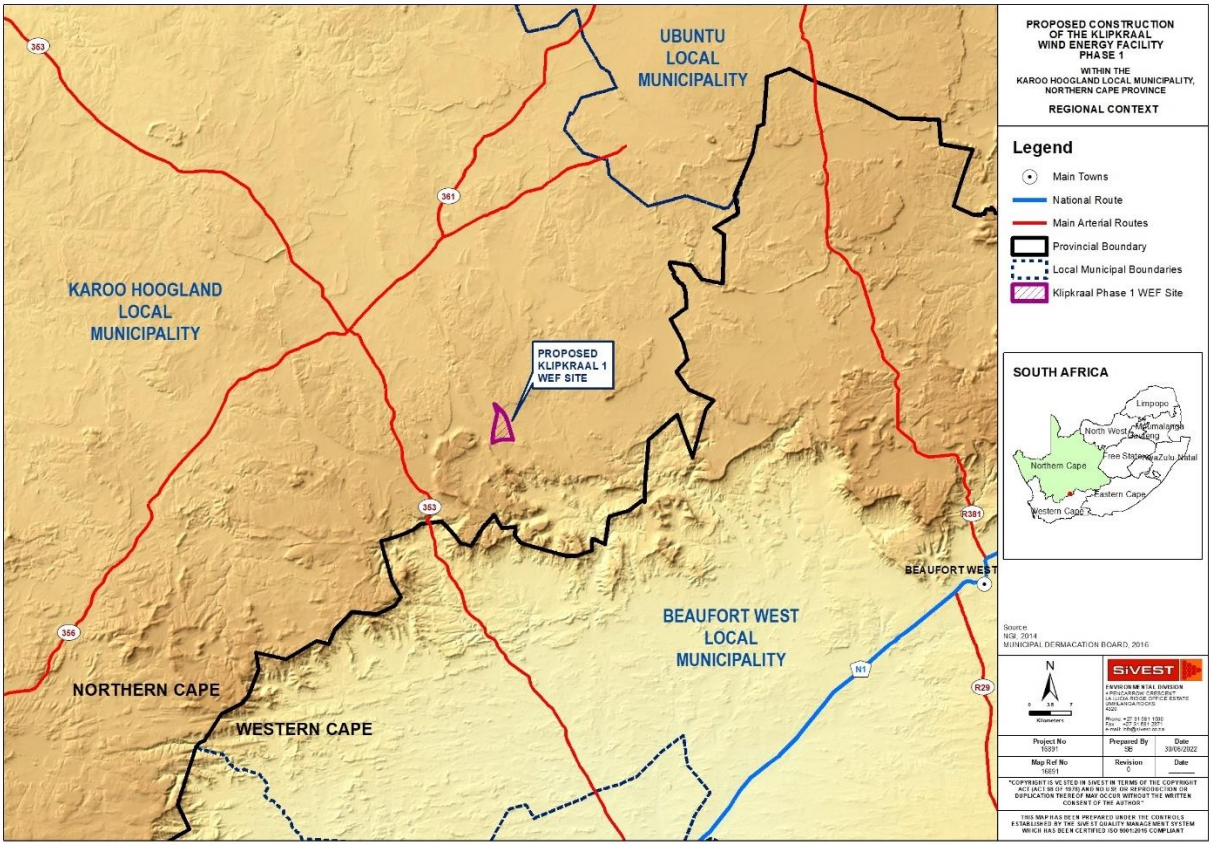

Figure 6-1.

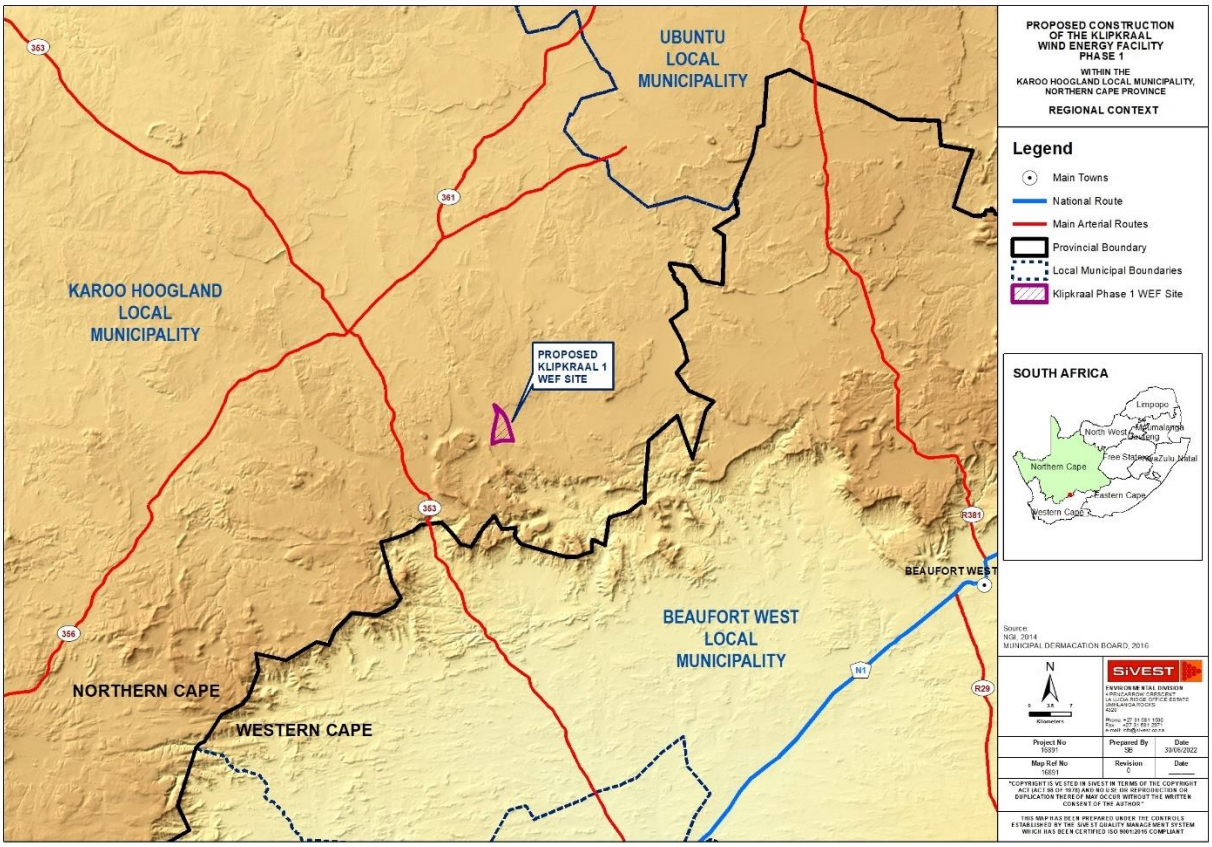

Figure 6-1 Klipkraal WEF 1 - Regional Context

The closest urban nodes to the Klipkraal WEF 1 are:

Table 6.1 Klipkraal WEF 1 – Closest Urban Nodes

Urban Nodes	Distance	Estimated Travel Time
Fraserburg	±32 km	27min
Loxton	±108 km	1hr 29min
Carnarvon	±169 km	2hr 20min
Williston	±125 km	1hr 33min
Sutherland	±139 km	1hr 55min
Leeu Gamka	±108 km	1hr 13min
Beaufort West	±111 km	1hr 32min

** Distance and Travel times according to Google Maps*

Klipkraal WEF 1 are located on the following properties (Refer Error! Reference source not found.):

- Remainder of the Farm Matjes Fontein No. 409
- Portion 1 of the Farm Klipfontein No. 447

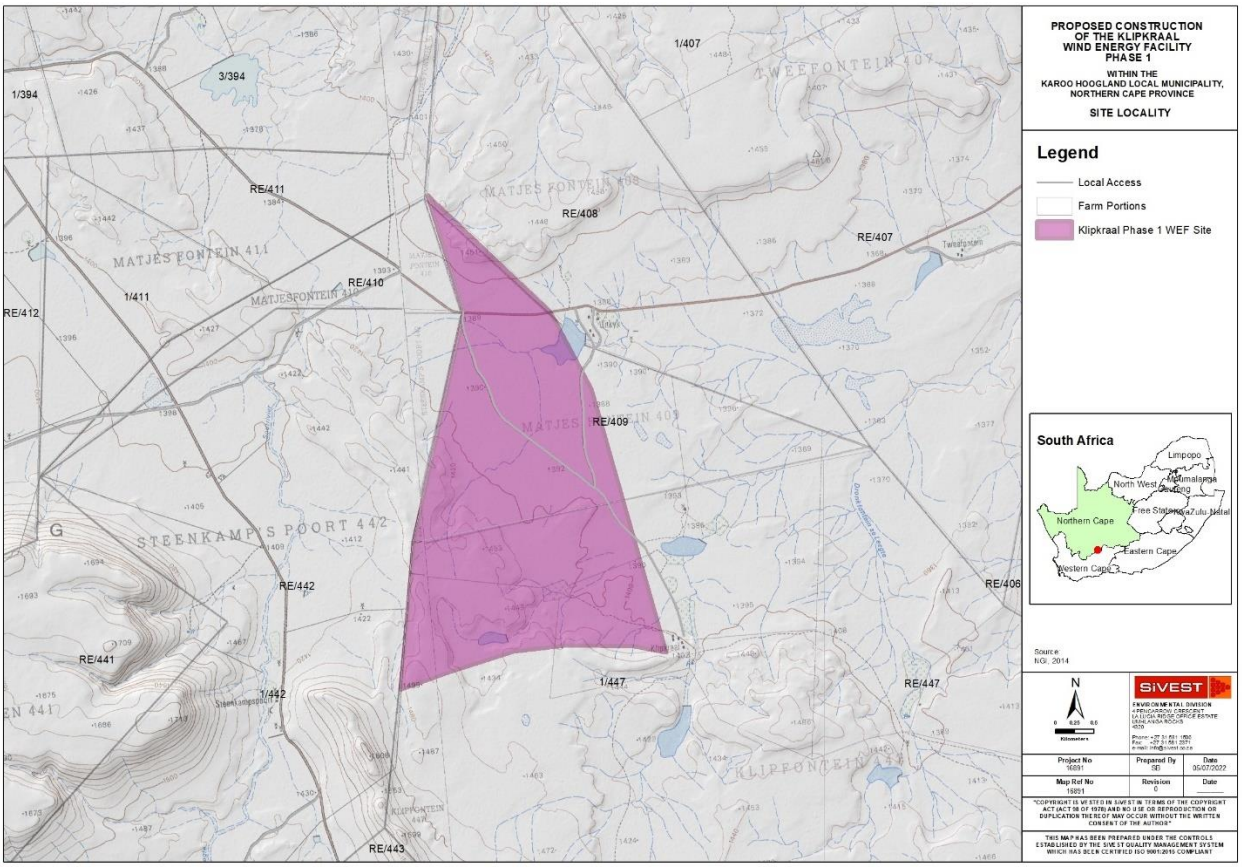

Figure 6-2 Klipkraal WEF 1 - Site Locality

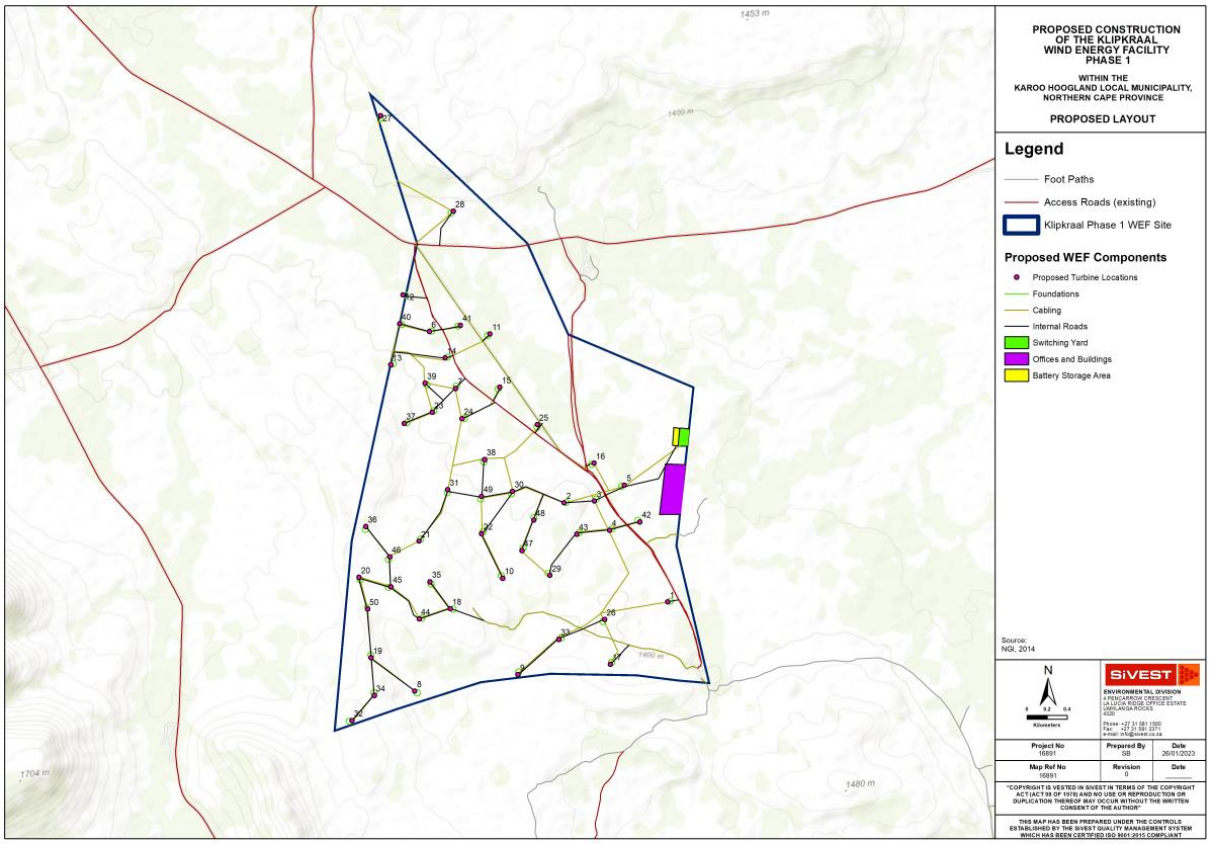

Figure 6-3 Proposed Layout

7. TRANSPORTATION

Road DR2312 bisects Klipkraal WEF with existing farm access positions linking the proposed development to the surrounding road network. The future development and adjusted land use will require access upgrades and / or new access positions to accommodate the proposed development.

Road DR2312 is a District Road and falls under the jurisdiction of the Northern Cape Department of Roads & Public Works (NCdr&pw).

The site, respective access points and internal layouts will be discussed in more detail in the sections below. However, this report only focuses on Phase 1 of the Klipkraal WEF; however, all five phases will be considered and analysed as a combined assessment as they share common access points from Road DR2312.

7.1 Existing Road Network

The existing road network surrounding the proposed development is well established and provides a high degree of mobility and access. The mobility roads join the major centres and towns with each other, while access roads provide access roads to serve smaller nodes and individual properties.

The Northern Cape is the largest province in South Africa, covering 31% of the country's surface area in a semi-desert climate. However, the Northern Cape only has 2.2% of the country's population, resulting in the province with a low population density and low vehicle ownership. The existing road networks are predominantly mobility roads; in most cases, the arterials and collector roads are gravel roads. The gravel roads are generally in a fair to good condition as the low rainfall in the semi-desert climate requires less maintenance. This development is located 141 km from the N1 Freeway in Leeu Gamka, while only 30 km of this section is a gravel surface.

Roads which impact this development have been summarised in **Table 7.1** below and indicated in

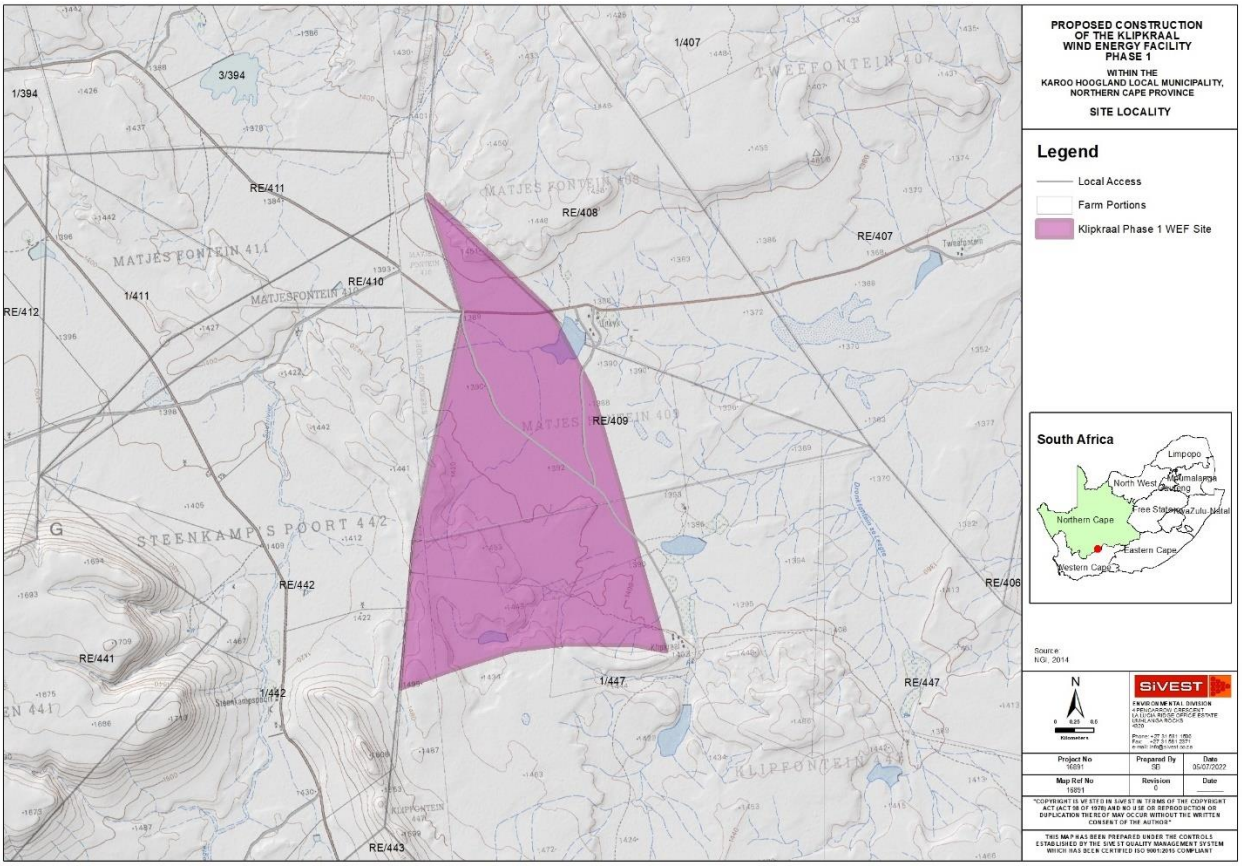

Figure 6-2 above.

Table 7.1 Existing Road Network

Route	Surface	RCAM Class	Section	Jurisdiction
NR00107 (N1)	Asphalt	R1	Laingsburg – Beaufort West	SANRAL
TR07301 (R353)	Asphalt	R2	Leeu Gamka - Fraserburg	WCtpw NCdr&pw
MR00319 (R356)	Gravel	R3	Fraserburg - Loxton	NCdr&pw
TR05801 (R381)	Gravel / Asphalt	R2	Beaufort West - Loxton	WCtpw NCdr&pw
MR00584 (P584)	Gravel	R4	Beaufort West - Fraserburg	WCtpw NCdr&pw
P02312	Gravel	R4	TR05801 – MR00584	NCdr&pw

7.2 Existing Traffic Conditions

Existing traffic data for Road N001 was obtained from the SANRAL and indicated the highest vehicles per hour (vph) rates for routes from Cape Town. The figures noted in the table below are well below the capacity of a typical two-lane two-roads of 2500 vph per lane.

Table 7.2 Traffic counts on the N001 Freeway

Route (Section)	Site ID	Distance (Km)	Location	Traffic Stream (TS) to		Lanes	Light Vehicles	Heavy Vehicles (ADTT)	Total Vehicles (ADT)	Highest Vol (Time of Day)	
				TS1	TS2					TS1	TS2
N001 (06)	1229	0.02	North of Prince Albert Rd	Bloemfontein	Cape Town	2	2202	1712	3914	728 (05:00)	369 (02:00)
N001 (05)	18021	4.50	Laingsburg & Pofadder	Beaufort West	Laingsburg	2	1819	1808	3627	334 (10:00)	238 (14:00)
N001 (04)	18020	66.60	R354 Sutherland T/O & Laingsburg	Laingsburg	R354 T/O	2	1943	1896	3839	348 (10:00)	260 (14:00)
N001 (04)	306	9.000	Touwsriver and Laingsburg	Laingsburg	Touwsriver	2	2403	1829	4323	894 (01:00)	559 (06:00)
N001 (03)	18019	66.20	Touwsriver & R46 T/O	Touwsriver	Worcester	2	2472	1999	4471	347 (23:00)	300 (16:00)
N001 (03)	18018	65.10	R318 Montagu T/O & R46 Ceres T/O	Touwsriver	Worcester	2	2401	1800	4201	332 (23:00)	293 (15:00)
N001 (03)	18017	50.400	De Doorns & R318 Montagu T/O	Touwsriver	Worcester	2	2403	1840	4243	350 (23:00)	306 (14:00)
N001 (03)	1206	38.00	De Doorns & Touwsriver	Touwsriver	De Doorns	2	2432	1682	4114	327 (22:00)	304 (14:00)
N001 (03)	18015	23.80	Sandhills & De Doorns	Touwsriver	Worcester	3	3701	2117	5808	265 (22:00)	251 (16:00)
N001 (03)	1458	16.40	Worcester & De Doorns	De Doorns	Worcester	3	5168	2114	7282	919 (01:00)	512 (07:00)
N001 (03)	109	6.70	Worcester & De Doorns	De Doorns	Worcester	2	4980	1990	6970	350 (16:00)	315 (15:00)
N001 (03)	18074	2.60	Roux Rd & R60 Worcester T/O	De Doorns	Paarl	4	5484	2613	8098	439 (16:00)	439 (15:00)
N001 (03)	18013	0.40	Between R43 & R60	De Doorns	Rawsonville	4	10980	3222	14202	719 (08:00)	801 (17:00)
N001 (02)	1457	28.00	Western Side of R43 I/C	De Doorns	Cape Town	6	28144	7719	35863	793 (16:00)	815 (16:00)
N001 (02)	18012	25.90	R101 Rawsonville T/O & R43 Ceres T/O	Ceres	Rawsonville	4	9137	3196	12333	766 (17:00)	906 (16:00)

Table 7.3 Traffic counts on the TR7301

Route (Section)	Site ID	Distance (Km)	Location	Traffic Stream (TS) to		Lanes	Light Vehicles	Heavy Vehicles (ADTT)	Total Vehicles (ADT)	Highest Vol (Time of Day)	
				TS1	TS2					TS1	TS2
TR7301	2158C	73.57	Provincial border	Fraserburg	Leeu Gamka	2	55	8	63	8 (15:00)	
TR7301	2157C	43.79	DR2308 T/O	Fraserburg	Leeu Gamka	2	67	13	80	12 (10:00)	
TR7301	2156C	23.44	DR2306 T/O	Fraserburg	Leeu Gamka	2	64	9	73	7 (10:00)	
TR7301	2155C	23.44	NR00107 I/C	Fraserburg	Leeu Gamka	2	552	24	581	39 (15:00)	

Based on typical traffic data for remote areas in the Northern Cape Province, it can be concluded that the existing peak traffic on the N001 section of the road is in the morning at 07:00 (AM) and afternoon at 17:00 (PM). In contrast, on lower order roads, the peak would occur midday between 11:00 – 14:00.

Therefore, we recommend the transportation of material and abnormal loads on the N001 Freeway be completed in the off-peak periods 09:00 – 15:00. In contrast, we recommend transporting staff from Fraserburg to Klipkraal WEF 1 on Road MR0584 and DR2312 be completed in the mornings before 09:00 and the afternoons after 15:00.

7.3 Additional Traffic Generation

The construction / BOP phase will typically generate the highest number of trips for the proposed facility. Construction will typically involve access roads, foundations, Wind Turbine Generators (WTG), electrical cables / transformers / switch gears / substations / BESS installations and the delivery of these materials / equipment / abnormal loads on the public road network.

It is assumed that no staff or labour will reside on the construction site besides security; therefore, all will reside in the nearby town of Fraserburg or nearby hostels.

7.3.1 Construction Phase

Based on calculations and our experience from previous WEF developments, we confirm that the BOP construction phase will generate the greatest additional traffic to the surrounding road network. The impact will be on the surrounding road network, increasing dust generation, noise and road maintenance.

Referring to **Table 7.4** below, the civil construction period for WEF developments typically takes place between 2 – 18 months on a development of this size. This development will generate a maximum of ±95 additional vehicle trips per day on the surrounding road network (external). Of these vehicle trips, ±82 vehicle trips will occur at the peak of the construction phase transporting staff and labour. Typically, these trips will be in the morning between 6:00 – 7:00 and the afternoons between 17:00 – 18:00. These trips will occur before and after the 'morning' & 'afternoon' peak periods, respectively.

The delivery of construction material and abnormal loads will equate to ±15 vehicle trips and will occur during the 'weekday midday' period. The abnormal loads, however, account for five (5) trips per day of the construction phase and are elaborated further in **Section 7.3.1.1** below. Assuming a 9hr work day, the ±15 vehicles during 'weekday midday' will equate to ±2 vehicle trips / hour. The resultant impact of this development on the surrounding road network during the construction period is therefore seen as nominal.

The specific traffic needs for this phase of the development.

- Reduction in vehicle speed
- Reduction in dust generation
- Adequate law enforcement
- Appropriate, timely and high-quality maintenance of gravel roads
- Implementation of pedestrian safety initiatives
- Regular maintenance of farm fences and access cattle grids
- Continuous engagement with the Northern Cape Department of Roads & Public Works (NCdr&pw).

Table 7.4 Typical Monthly Trip Generation Sheet for 60 WTG's

		Month																													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Construction Phase																															
1	**Balance of Plant Construction**																														
1.1	Civil Balance of Plant																														
1.1.1	- Site Establishment	1																						1						1	
1.1.2	- Transport - Skilled		19	21	22	22	22	22	22	21	19	18	16	14	12	10	8	7	6	4	3	3	2	2	1	1	1	1	1	1	
1.1.3	- Transport - Semi Skilled			12	12	13	13	13	13	13	12	12	11	10	8	7	6	5	4	3	3	2	2	1	1	1	1	1	1	1	
1.1.4	- Transport - Unskilled			3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	2	2	2	2	1	1	1	1	1	
1.1.5	- Construction - Foundation (External)		3	4	4	4	5	5	5	5	5	5	5	5	5	5	4	4	4												
1.1.6	- Construction - Foundation (Local)		75	82	88	93	96	99	99	99	96	93	88	82	75	68	60	53	46												
1.1.7	- Construction - Road & Platform (External)		6	6	7	7	7	7	7	7	7	7	7	6	6	5	5	4	4												
1.1.8	- Construction - Road & Platform (Local)		6	7	7	7	8	8	8	8	8	7	7	7	6	6	5	4	4												
1.2	Electrical Balance of Plant																														
1.2.1	- Site Establishment							1																				1			
1.2.2	- Transport - Skilled								12	12	13	14	14	14	14	14	14	14	13	12	12	11	10	9	8	7	6	5	4	4	
1.2.3	- Transport - Semi Skilled								9	10	10	11	11	11	11	11	11	11	10	10	9	8	8	7	6	5	5	4	3	3	
1.2.4	- Transport - Unskilled								2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	1	1	1	
1.2.5	- Construction - MV Collector																														
1.2.6	- Construction - Substation									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
1.2.7	- Construction - HV Transmission																														
2	**Wind Turbine Generator Assembly (Steel Towers)**																														
2.1	Delivery - Bolt Cage			1																											
2.2	Delivery - WTG															4	4	4	4	4	4	4	4	4	4						
2.3	Site Establishment														1																1
2.4	Install / Assemble / Erect																														
2..4.1	- Transport - Skilled															16	17	18	20	21	22	22	22	22	22	22	21	20	18	17	16
2..4.2	- Transport - Semi Skilled																	18	20	21	22	22	22	22	22	22	21	20	18		
2..4.3	- Transport - Unskilled																	3	3	4	4	4	4	4	4	4	4	3	3		
	TOTAL	**1**	**109**	**136**	**144**	**150**	**155**	**159**	**181**	**182**	**177**	**174**	**166**	**156**	**145**	**153**	**141**	**152**	**144**	**85**	**85**	**81**	**79**	**76**	**72**	**65**	**62**	**58**	**50**	**29**	**17**

7.3.1.1 *Abnormal Loads*

Abnormal loads are described as loads that, for all practical purposes, cannot be transported on a vehicle or vehicle without exceeding the limitations described in the 'National Road Traffic Regulations (2000)'.

These vehicles exceed the limitations as a result of one of the following.

- Dimension Abnormality
    - Length
    - Width
    - Height
    - Overhangs
    - Load Projections
    - Wheelbase
- Mass Abnormality

The delivery of WTG's in South Africa is primarily from two ports, Port of Saldanha and Ngqura. Both ports are uniquely positioned to accommodate the unique project cargo / abnormal loads of WTG's and are the only ports in South Africa that are not city-locked. The distance between the proposed facility and each port is indicated in **Table 7.5** below.

Table 7.5 Klipkraal WEF – Port Distances

Port	Distance
Port of Saldanha	540 km
Port of Ngqura	584 km

For this development, the transportation of abnormal loads for WTG's from their origin (ports) to the proposed facility has been assumed primarily from the Port of Saldanha. Examples of the transportation methods for the Tower Sections (**Figure 7-1**), Nacelle (**Figure 7-2),** Rotor Hub (**Figure 7-3**Error! Reference source not found.), and Rotor Blade (**Figure 7-4**) is included below. The transportation of abnormal loads for electrical transformers is assumed to be from Gauteng.

Figure 7-1 Example of Tower Sections Transport (*Nooteboom*)

Figure 7-2 Example of Nacelle Transport *(Recharge News)*

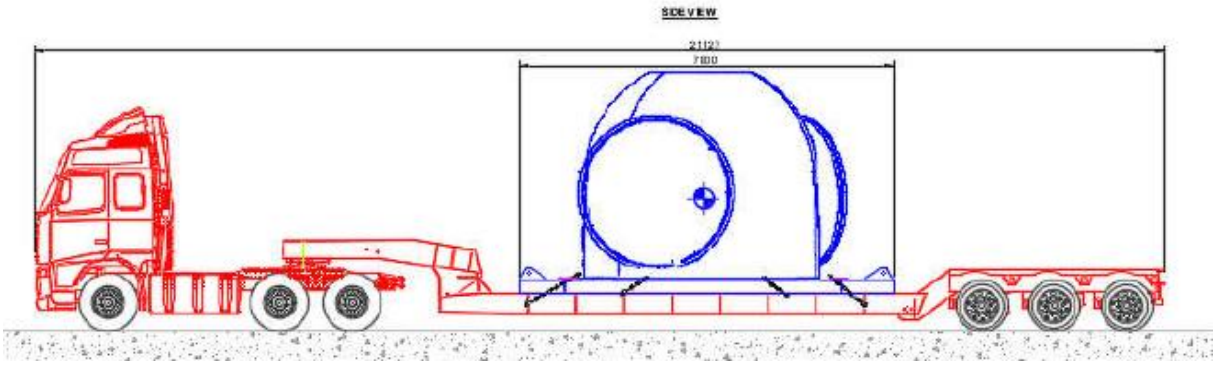

Figure 7-3 Example of Hub

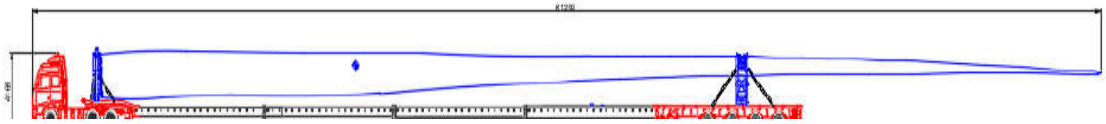

Figure 7-4 Example of Rotor Blades

The Geometric clearance requirements associated with these abnormal loads transporting the equipment types are shown in **Table 7.6**. However, we should note that the figures above and the table below are indicative as many of the components are still at a design stage and will only be confirmed closer to the construction.

Table 7.6 Abnormal Load Dimensions

Description of Load	No. per WTG	Typical Dimensions (m)		
		Length	Width	Height
Tower Sections	8	<31	<4.5	<4.5
Nacelle	1	7	<4	3.8
Drive Train	1	6.6	3.5	3.3
Rotor Blades	3	95	4.4	3.9
Rotor Hub	1	4.8	4.4	4.0

Table 7.7 Abnormal Load Trips

Proposed WTG Delivery Schedule	Month (Period)			Origin
	1-14	15-24	25-30	
Tower Sections	0	4	0	Saldanha
Nacelle				Saldanha
Drive Train				Saldanha
Rotor Blades				Saldanha
Rotor Hub				Saldanha
Trips/Day for period	**0**	**4**	**0**	

* *Please note the values above are estimates based on data currently available*

Before any Abnormal Load conveying equipment to the facility, approval must be obtained through a permit from the Department of Transport (DoT). The permit application will be completed by specialists in the transportation of Abnormal loads and will conform to 'The Road Traffic Act, 1996 (Act No 93 of 1996)'. The application includes route clearances from Telkom and Eskom, after which the application is submitted to DoT. They, in turn, consult with the SANRAL and each Local Municipality and Provincial Authority travelling through before issuing a permit.

7.3.1.2 *Permitting for Abnormal Loads– General Rules*

The limits recommended in *TRH 11 - Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads* are intended to serve as a guide to the Permit Issuing Authorities. It must be noted that each Administration has the right to refuse a permit application or modify the conditions under which a permit is granted. It is understood that:

- A permit is issued at the sole discretion of the Issuing Authority. The permit may be refused because of the condition of the road, the culverts and bridges, the nature of other traffic on the road, and abnormally heavy traffic during specific periods or for any other reason.
- A permit can be withdrawn if the vehicle is found unsuitable to be operated upon inspection.
- During specific periods, such as school holidays or long weekends, an embargo may be placed on the issuing of permits. Embargo lists are compiled annually and are obtainable from the Issuing Authorities.

7.3.1.3 *Proposed Normal & Abnormal Load Routes*

The transportation of Normal & Abnormal goods has been indicated in Figure 7:3 below and will be primarily from the Port of Saldanha / Cape Town and Gauteng

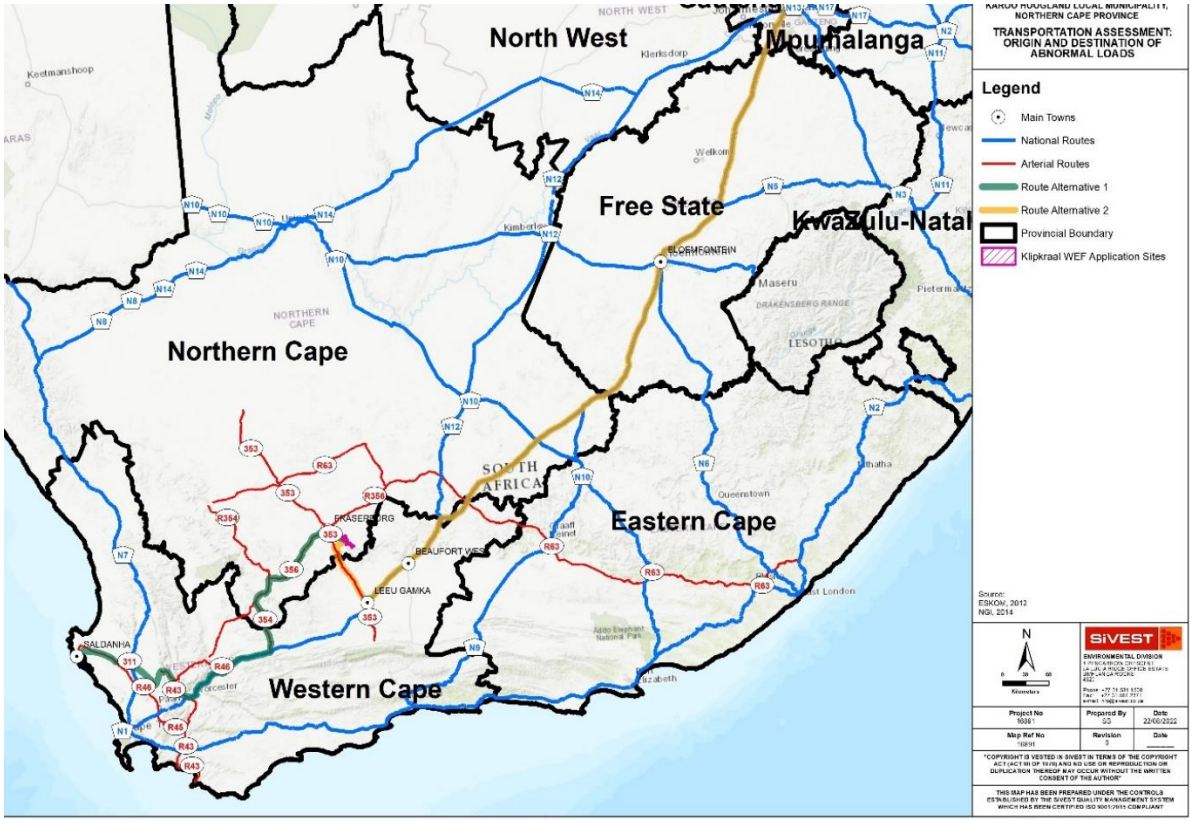

Figure 7-5 Normal & Abnormal Load Transport Route

An approved Abnormal Load route exists between the Port of Saldanha and the northern section of the Komsberg REDZ. The Klipkraal WEF is, however, located ±67 km northeast of the Komsberg REDZ. Therefore, the abnormal load route following the N1 Freeway will extend past Road OP06142 (R354), the Matjiesfontein - Sutherland road up to Leeu Gamka and continue north towards Fraserburg on the TR07301 (R353).

The approved abnormal load route leaves the Port of Saldanha on the R45 towards Moorreesburg via the R311. Leaving Moorreesburg will continue on a short section of the N7 Freeway and back onto the R311 towards Riebeeck Kasteel and the R46 towards Hermon. From Hermon the abnormal load will continue north on the R46 towards Ceres and continue on the R43 through Wolseley, ultimately onto the N1 Freeway in Worcester.

Two options exist from Worcester to the Klipkraal WEF; the direct route is on the N1 up to Leeu Gamka and north on the TR07301 (R353) towards Fraserburg turning east on Road P584 and ultimately on the P02312 towards the development. This route, however, crosses the Teekloofpas, and based on our visual inspection; however, nacelles, drivetrains, hubs, and tower sections would still be able to negate the pass.

The alternative route through Sutherland should be considered for turbine blades if the Teekloofpas route is impossible. A portion of this alternative route was recently used in the construction of the Roggeveld WEF and continues from the N1 in Matjiesfontein towards Sutherland on the R354. From Sutherland, the route deviates east on the R356 towards Fraserburg on a section of surfaced road, which later becomes gravel. This route crosses several low-level bridges and causeways, and the width of these will need to be confirmed. Through Fraserburg, the route deviates south onto the R353 turning east on Road P584 and ultimately on the P02312 towards the development.

Route alternatives are proposed through Sutherland in **Figure 7-6** and Fraserburg in **Figure 7-7**.

We recommend completing a more comprehensive route analysis before construction to understand better the works required and the potential risks.

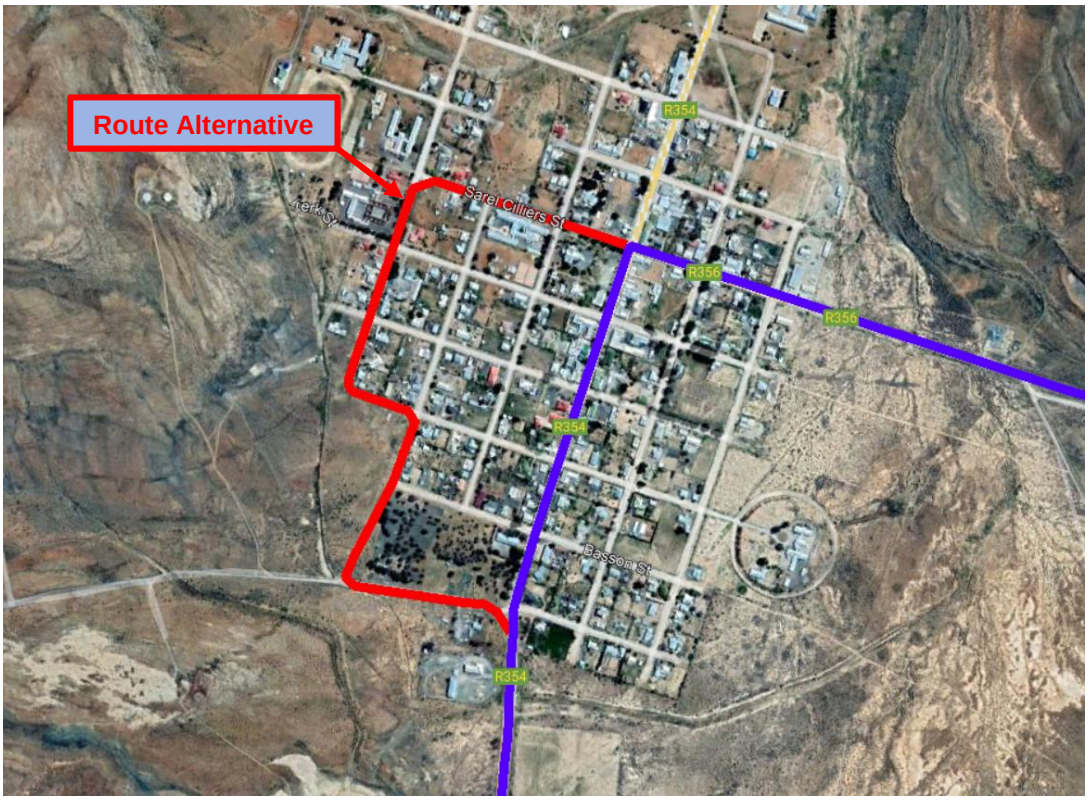

Figure 7-6 Sutherland Route Diversion

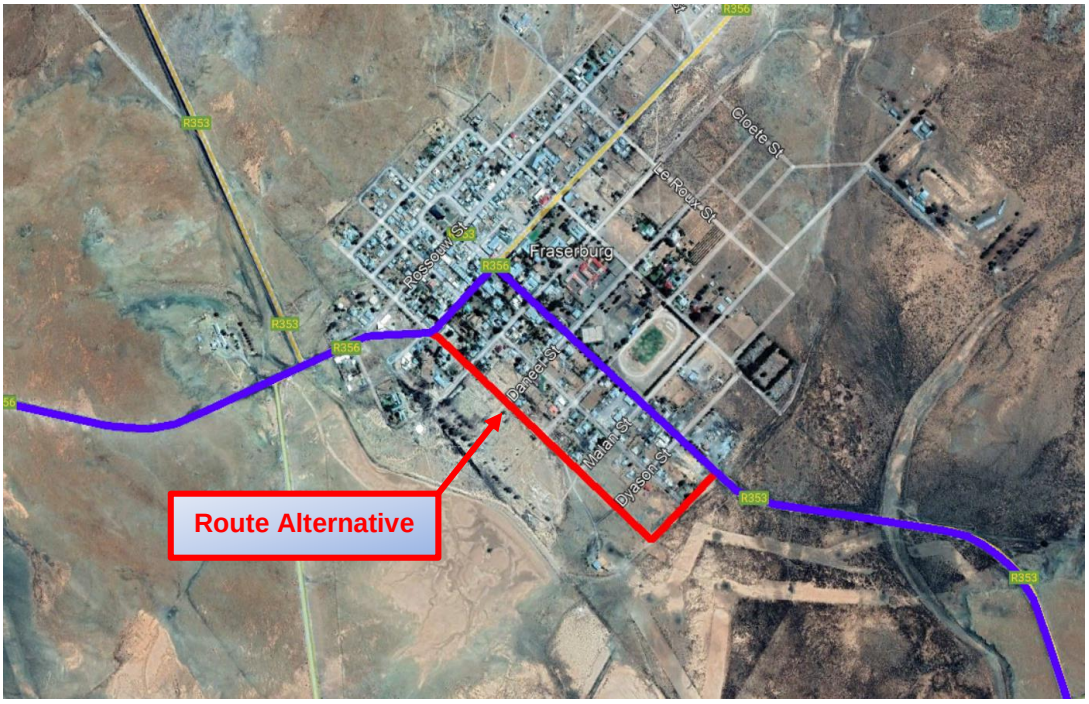

Figure 7-7 Fraserburg Route Diversion

7.3.2 Operation & Maintenance Phase (O&M)

The Klipkraal WEF 1 has been designed with a 20 – 25 year lifespan and could be increased if financially viable. The O&M during the 20 – 25 year period will typically be in the form of a small general maintenance team during the O&M period. Any maintenance required, including a new transformer or switch gears, will be classified as an abnormal load, and the traffic generated by this will be negligible in the greater scheme of the development. Therefore, this phase's most significant traffic contributor will only comprise employees commuting to and from the site.

We assume a maximum number of ±30 employees will be employed during the project's 20 – 25 year life span. Therefore, the assumption is that the employees will commute together; hence, a total of ±15 additional trips will be added to the existing road network during the morning and afternoon. In addition to the staff, commuting will be the collection of waste and sanitation. These are assumed to generate an additional ±2 vehicles / week onto the existing road network; therefore, the sum of this phase will have a low to negligible impact.

The specific traffic needs for this phase of the development.

- Reduction in vehicle speed.
- Reduction in dust generated.
- Adequate law enforcement.
- Appropriate, timely and high-quality maintenance of gravel roads.
- Implementation of pedestrian safety initiatives.
- Regular maintenance of farm fences and access cattle grids; and
- Continuous engagement with the Northern Cape Department of Roads & Public Works (NCdr&pw).

7.3.3 Decommissioning Phase

Decommissioning the Klipkraal WEF will generate considerably fewer trips than the construction phase. It is estimated that the decommissioning phase will generate an additional ± 10 vehicles / day over 12 – 18 months. The material removed will be transported back to a suitable recycling depot. The impact of this phase will therefore be low.

The specific traffic needs for this phase of the development.

- Reduction in vehicle speed.
- Reduction in dust generated.
- Adequate law enforcement.
- Appropriate, timely and high-quality maintenance of gravel roads.
- Implementation of pedestrian safety initiatives.
- Regular maintenance of farm fences and access cattle grids; and
- Continuous engagement with the Northern Cape Department of Roads & Public Works (NCdr&pw).

Table 7.8 Typical Hourly Trip Generation Sheet for 60 WTG's

Activity	Vehicles / hour (vph) Affected Roads			Affected Roads
	06:00 to 07:00	11:00 to 14:00	16:00 to 17:00	
Construction Phase				
Civil Balance of Plant				
Transport - Skilled	22		22	MR00584 / DR2312
Transport – Semi & Unskilled	17		17	TR0301 / MR0584 / DR2312
Construction (External)		2		NR00107 / TR0301 / MR0584 / DR2312
Construction (Local)		12		DR2312
Electrical Balance of Plant				
Transport - Skilled	14		14	MR00584 / DR2312
Transport – Semi & Unskilled	13		13	TR0301 / MR0584 / DR2312
Construction (External)		1		NR00107 / TR0301 / MR0584 / DR2312
Construction (Local)		1		DR2312
Wind Turbine Generator Assembly (Steel Towers)				
Abnormal Loads (WTG Delivery)		1		NR00107 / TR0301 / MR0584 / DR2312
Transport - Skilled	22		22	MR00584 / DR2312
Transport – Semi & Unskilled	26		26	TR0301 / MR0584 / DR2312
Construction (External)		1		NR00107 / TR0301 / MR0584 / DR2312
Construction (Local)		1		DR2312
Operation & Maintenance Phase				
WEF Employees	15		15	NR00107 / TR0301 / MR0584 / DR2312
Decommissioning Phase				
Management & Labour	4		4	TR0301 / MR0584 / DR2312
Transport		6		NR00107 / TR0301 / MR0584 / DR2312

7.4 External Access

Klipkraal WEF 1 and associated grid infrastructure will be located on a portion of two farms, REM of the Farm Matjes Fontein No. 409 and PTN 1 of the Farm Klipfontein No. 447. Klipkraal WEF 2 and 3 will also be located on these farms, including the REM of the Farm Klipfontein No. 447. All three 3 developments will share a common access point from Road DR02312, bisecting the northern quadrant of the Farm Matjes Fontein No. 409.

Road DR02312 is classified as a Class R4 in the RCAM Classification – Rural Collector Road with an average road reserve width of 20m, a gravel surface of ±6m wide, and an average speed of 80 km/h.

The Farm Matjes Fontein No. 409 has one (1) existing access point emanating from Road DR02312 at Km 82.51. The access point is located on Road DR02312 within the first 10 m as the road enters the

farm, travelling west to east. An image of Road DR02312 and the existing access point to the right (south) is included in **Figure 7-8** Road DR02312 and the existing access to the Klipkraal Farm

Table 7.9 Existing Access Positions

Access No.	Road Number	Road Chainage	Latitude	Longitude
Existing 1	DR02312	Km 82.51	32° 3'21.33"S	21°45'26.16"E

Figure 7-8 Road DR02312 and the existing access to the Klipkraal Farm

The current access position located at Km 82.51 does not have the recommended sight distance to the west of 240 m; therefore, we recommend that the new access position be considered 320 m to the east at Km 82.19. The new access position will be a priority-controlled intersection with Road DR02312 being free-flowing with a sight distance of 240 m on both the east and western approaches. Refer to **Figure 7-9** below.

Upgrades to the new access position at Km 82.19 will be required, and approval will need to be obtained from the NCdr&pw.

West Approaching

East Approaching

Access to the South

Access to North

Figure 7-9 Proposed Access on Road DR02312 to Klipkraal WEF 1 – 3

Table 7.10 Proposed Access Position

Access No.	Road Number	Road Position	Access Status	Latitude	Longitude
Proposed 1	DR02312	Km 82.19	New Gravel	32° 3'22.52"S	21°45'37.57"E

7.5 External Road Upgrades

Most of the additional traffic generated from the Klipkraal WEF and associated grid infrastructure can be accommodated on the existing road network and include both normal and abnormal vehicles with minor modifications.

Road MR0584 and DR2312 are in reasonably good condition, with minor areas requiring upgrading or remedial action. The majority of both roads require remedial action in the form of light blading and reshaping of side drains, and mitre drains.

In almost all cases, the vertical alignment of the sag curves through minor drainage lines will result in problem areas for Abnormal Loads. Abnormal Loads require a minimum vertical curve of 400m with an arc length of 30m. The same minimum requirements would apply to crest curves, in particular the curve at Km 89.55 on Road DR2312 (Refer to **Figure 7-10**), where upgrades are required to increase the curve length and vertical curvature.

Figure 7-10 Vertical Curve at Km 89.55 on Road DR2312 with a vehicle in the background

7.6 Design Considerations

Based on our recent discussions with the NCdr&pw, new Land Use applications must be sent to their departments for approval with the proposed new / upgraded access position. As part of the application, the expected traffic during construction and the O&M phase, available sight distances including photographs and the affected stormwater structures are to be included. The OEM's and the NCdr&pw minimum requirements will need to be considered during the design stage.

The access points from Road DR2312 fall within the jurisdiction of NCdr&pw; their standard access requirement is based on TRH 17, TRH 4 and TRH 26. An example of the Western Cape Department of Transport and Public Works – Typical Farm Access Detail is included in **Figure 7-11** and stormwater drainage in **Figure 7-12** below.

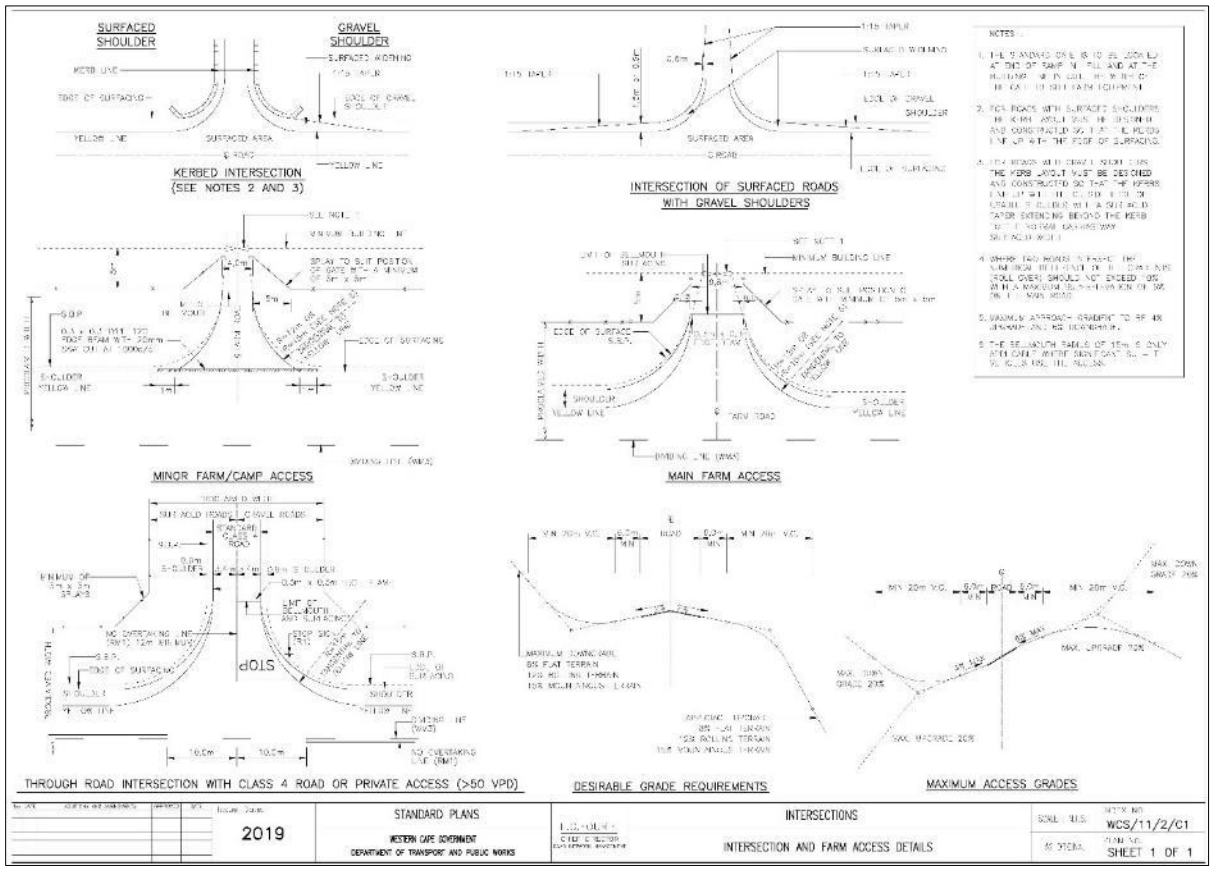

Figure 7-11 Typical Intersection and Farm Access Detail

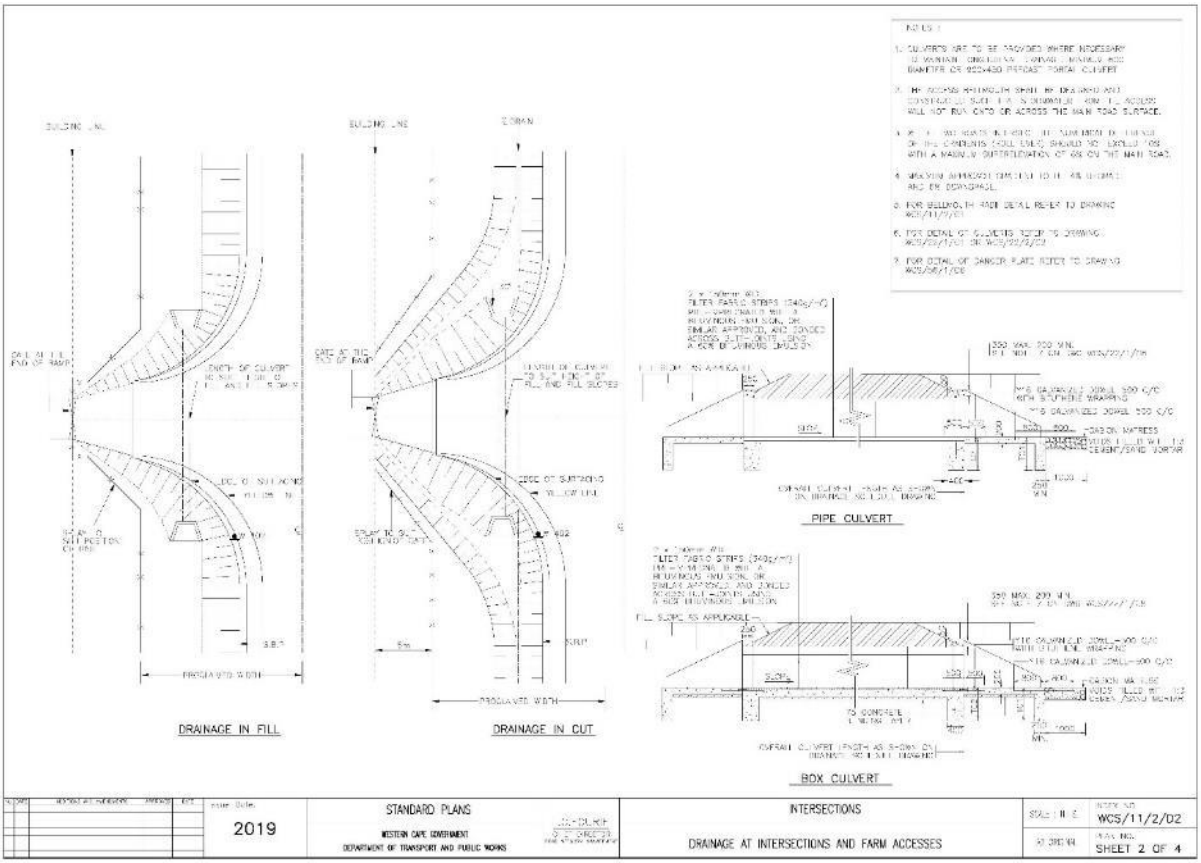

Figure 7-12 Typical Drainage at Intersections and Farm Access

Typical cross sections for gravel roads have been indicated in **Figure 7-13** below and need to take into account the minimum requirements from OEM's.

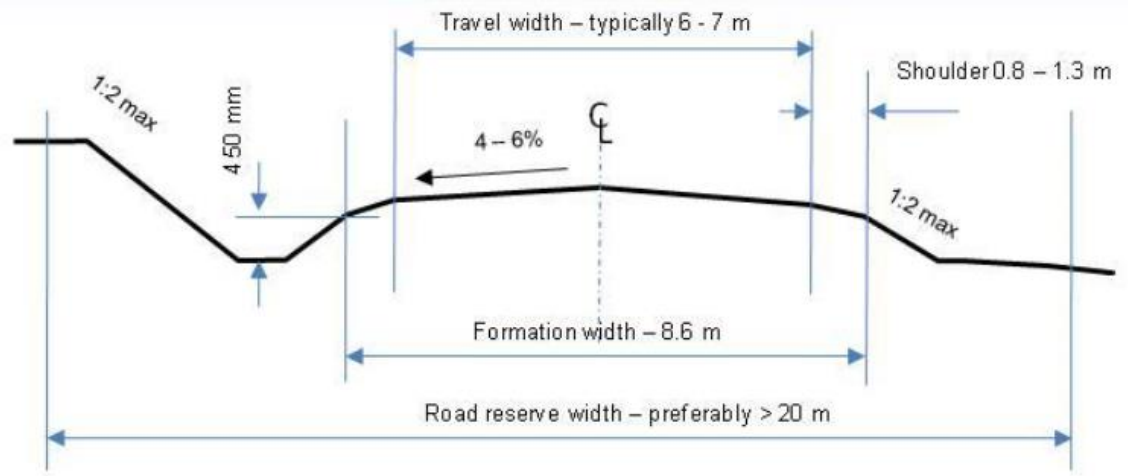

Figure 7-13 Typical Provincial Gravel Road Cross Section

The location and angles of intersections should preferably meet at 90° or nearly at right angles. Angles between 60° and 120° produce only a small reduction in visibility for drivers of passenger vehicles. However, for trucks, the range between 60° and 75° should be avoided because the driver entering the intersection from a minor road to his left would find his view obstructed. The maximum deviations have therefore been included below in **Figure 7-14**.

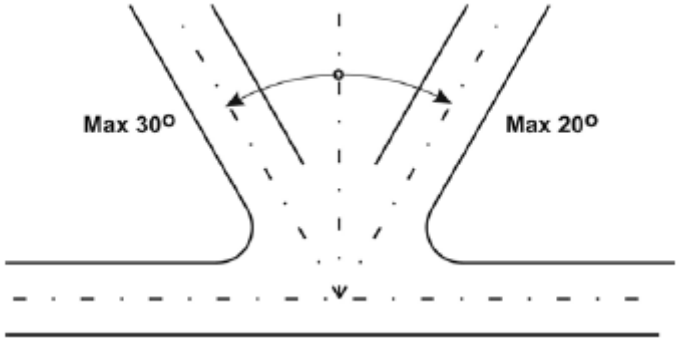

Figure 7-14 Angle of intersection deviation

The specific design considerations for this development are:

- Reduction in vehicle speed.
- Adequate law enforcement.
- Implementation of pedestrian safety initiatives.
- Regular maintenance of farm fence, access cattle grids.
- Adequate road signage as per the South African Road Traffic Sign Manual (SARTSM) latest edition.
- Possible use of an approved dust suppressant techniques.
- Appropriate, timely and high-quality maintenance of existing gravel roads in terms of TRH20.

- Design and construction of new gravel roads in terms of TRH20.
- Continuous engagement with OEM and Abnormal Load specialist; and
- Constant engagement with the Northern Cape Department of Public Works & Roads (NCdr&pw).

However, we should note that the figures indicated above are indicative as many of the components are still at the design stage and will only be confirmed closer to the construction time.

8. INTERNAL LAYOUTS

The layout of the internal infrastructure is such that the environmental impact is kept to a minimum. Therefore proposed access positions have been kept to a minimum and all temporary and permanent buildings and infrastructure are lcoated close to the access point. Refer **Figure 8-1** for the proposed access points.

All internal access roads should be designed to have a minimal impact on the environment and thus are, in most cases, parallel to the contours to keep drainage line crossings to a minimum. Using roads perpendicular to the contours for long sections should be avoided, as the risk of possible erosion is increased. Existing gravel roads should be considered in order to reduce the environmental impact.

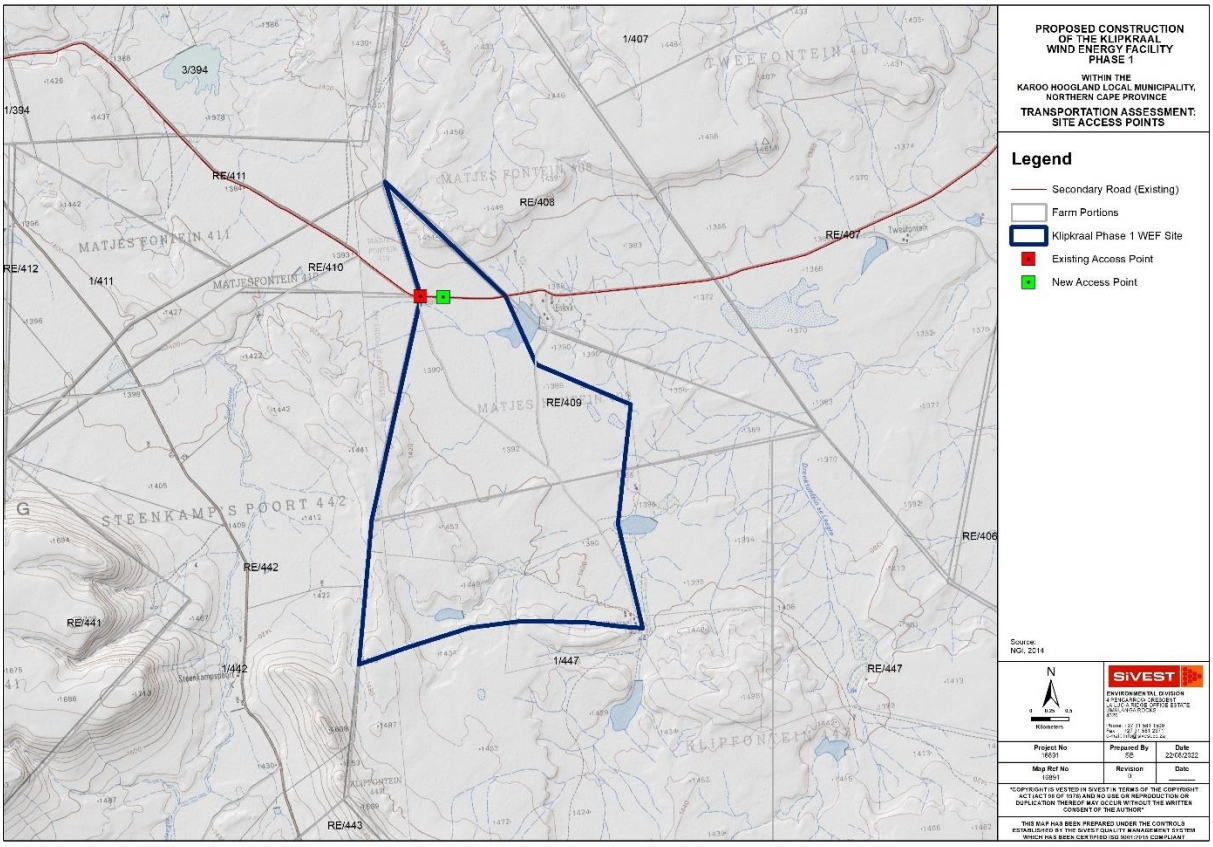

Figure 8-1 Klipkraal WEF 1 - Internal Layouts, also showing site access point

An internal network of minimum 5 m wide gravel roads will connect all the WTG and ancillary equipment to each other. The roads will have a horizontal and vertical alignment to accommodate vehicles and more specifically abnormal vehicles intended to use these roads for the delivery of the WTG equipment. A typical intersection and horizontal alignment would consist of radii and clearances similar to the requirements in **Figure 8-2Error! Reference source not found.**. We note that the larger WTG's are planned for these facilities and will need to be simulated once additional information becomes available.

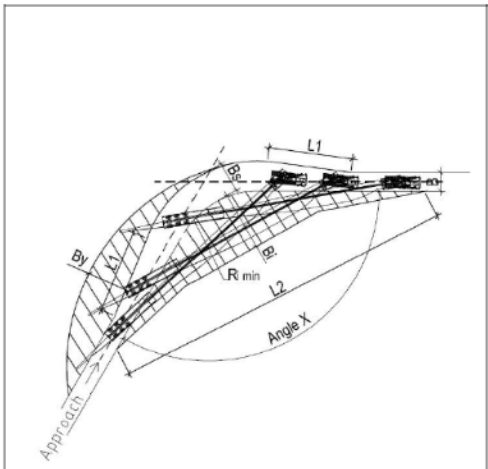

Figure 3a: Example of road curve

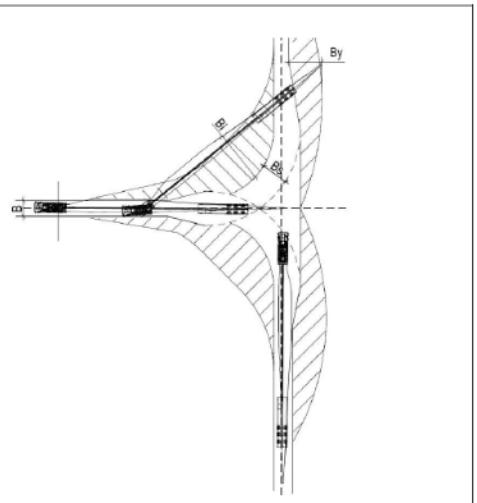

Figure 3b: Example of T-junction

The hatched areas on the figure are areas that the Employer shall clear of obstacles and level to allow overhang.

Angle X	$R_{i\,min}$	B_y	B_s	B_i	L_1	L_2
160°	14 m	4 m	4,5 m	3 m	10 m	35 m
120°	28 m	6 m	5 m	5 m	12 m	40 m
90°	38 m	7 m	7 m	6 m	18 m	52 m

Figure 8-2 Typical Horizontal Design Standards for a 101 m Rotor Diameter

We recommend that all internal access roads take the WEF stormwater management plan into account, where possible and applicable, to reduce potential erosion risks.

In addition, we recommend that all internal access roads are constructed according to *TRH20 – Unsealed Roads: Design Construction and Maintenance.* For this assessment, we have assumed that the in-situ material below the topsoil is of 'G7' quality and can be used as a suitable road subgrade material, followed by an imported 'Gravel Wearing Course' material.

A suitable geotechnical study will however be required at predesign stage to understand better the design limitations on the development, followed by a preliminary design to 'value' Engineer the project.

9. GRID CONNECTION

The proposed grid connection infrastructure to evacuate the power from Klipkraal WEF 1 will be completed in a separate Integrated Grid Basic Assessment Reports (BAR).

10. IMPACT RATING ASSESSMENT

The 'Impact Rating System' takes into account the nature, scale and duration of the effects on the environment whether such effects are positive (beneficial) or negative (detrimental). Each issue / impact is also assessed according to the project stages:

- Planning
- Construction
- Operation
- Decommissioning

A rating points-based system is applied to the potential environmental impacts and includes objective evaluations of the impact mitigation. These impacts can be found in **Table 10.2** below.

In summary, all impacts were classified as 'Medium to Low' with a large majority of the impacts changing to 'Low' after implementing suitable mitigation measures. This rating applies to all alternatives considered.

10.1 Rating System Used to Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the possible mitigation of the impact. Impacts have been consolidated into one (1) rating. In assessing the significance of each issue the following criteria (including an allocated point system) are used:

Table 10.1 Rating of Impacts Criteria

ENVIRONMENTAL PARAMETER		
A brief description of the environmental aspect likely to be affected by the proposed activity (e.g. Surface Water).		
ISSUE / IMPACT / ENVIRONMENTAL EFFECT / NATURE		
Include a brief description of the impact of the environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted by a particular action or activity (e.g., an oil spill in surface water).		
EXTENT (E)		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country
PROBABILITY (P)		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	The impact will certainly occur (With greater than a 75% chance of occurrence).
REVERSIBILITY (R)		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with the implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.

4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES (L)		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resources.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in a significant loss of resources.
4	Complete loss of resources	The impact results in a complete loss of all resources.
DURATION (D)		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity.		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through a natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a period that the impact can be considered transient (Indefinite).
INTENSITY / MAGNITUDE (I / M)		
Describes the severity of an impact (i.e. whether the impact can alter the functionality or quality of a system permanently or temporarily).		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but the system / component continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	The impact affects the continued viability of the system/component, and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.

4	Very high	The impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation are often impossible. If possible rehabilitation and remediation are often unfeasible due to the extremely high costs of rehabilitation and remediation.

SIGNIFICANCE (S)

Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula:

Significance = (Extent + probability + reversibility + irreplaceability + duration) x magnitude/intensity.

The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
5 to 23	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
5 to 23	Positive Low impact	The anticipated impact will have minor positive effects.
24 to 42	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
24 to 42	Positive Medium impact	The anticipated impact will have moderately positive effects.
43 to 61	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
43 to 61	Positive High impact	The anticipated impact will have significant positive effects.
62 to 80	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
62 to 80	Positive Very high impact	The anticipated impact will have highly significant positive effects.

Table 10.2 Klipkraal WEF 1 & Grid Connection – Impact Rating Table

KLIPKRAAL WEF 1																					
ENVIRONMENTAL PARAMETER	**ISSUE / IMPACT / ENVIRONMENTAL EFFECT/ NATURE**	**ENVIRONMENTAL SIGNIFICANCE BEFORE MITIGATION**									**RECOMMENDED MITIGATION MEASURES**	**ENVIRONMENTAL SIGNIFICANCE AFTER MITIGATION**								
		E	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**		**E**	**P**	**R**	**L**	**D**	**I / M**	**TOTAL**	**STATUS (+ OR -)**	**S**
Construction Phase																					
Additional Traffic Generation	Increase in Traffic	2	4	1	2	1	3	30	-	Medium	• Ensure staff transport is done in the 'off peak' periods and by bus, if possible • Stagger material, component, and abnormal loads delivery. •Construction of an on-site batching plant and tower construction to reduce trips.	2	4	1	2	1	2	20	-	Low
	Increase of Incidents with pedestrians and livestock	2	3	2	4	1	2	24	-	Medium	• Upgrade of existing / new access points. • Reduction in the speed of vehicles. • Adequate enforcement of the law. • Implementation of pedestrian safety initiatives. • Regular maintenance of farm fences & access cattle grids. • Construction of an on-site batching plant and tower construction to reduce trips.	2	3	2	4	1	1	12	-	Low
	Increase in dust from gravel roads	2	3	2	2	1	2	20	-	Low	• Upgrade of existing / new access point. • Reduction in the speed of the vehicles. • Construction of gravel roads in terms of TRH20. • Implement a road maintenance program under the auspices of the respective transport department. • Possible use of approved dust suppressant techniques. • Construction of an on-site batching plant and tower construction to reduce trips.	2	3	2	2	1	2	20	-	Low
	Increase in Road Maintenance	2	3	2	2	2	2	22	-	Low	• Implement a road maintenance program under the auspices of the respective transport department. • Construction of an on-site batching plant to reduce trips.	2	3	2	2	1	2	20	-	Low
Abnormal Loads	Additional Abnormal Loads	3	3	1	2	1	1	10	-	Low	• Ensure abnormal vehicles travel to and from the proposed development in the 'off peak' periods or stagger delivery. • Adequate enforcement of the law.	3	2	1	2	1	1	9	-	Low
Internal Access Roads	Increase in dust from gravel roads	1	4	1	1	1	2	16	-	Low	• Enforce a maximum speed limit on the development. • Appropriate, timely and high-quality maintenance required in terms of TRH20. • Possible use of approved dust suppressant techniques.	1	3	1	1	1	2	14	-	Low
	New / Larger Access points	1	4	1	2	1	1	9	-	Low	• Adequate road signage according to the SARTSM. • Approval from the respective roads department.	1	4	1	2	1	1	9	-	Low

Operational Phase																				
Additional Traffic Generation	Increase in Traffic	2	1	1	2	3	1	9	-	Low	• The increase in traffic for this phase of the development is negligible and will not have a significant impact.	2	1	1	2	3	1	9	-	Low
	Increase of Incidents with pedestrians and livestock	2	1	1	2	3	1	9	-	Low	• The increase in traffic for this phase of the development is negligible and will not have a significant impact.	2	1	1	2	3	1	9	-	Low
	Increase in dust from gravel roads	2	1	1	2	3	1	9	-	Low	• The increase in traffic for this phase of the development is negligible and will not have a significant impact.	2	1	1	2	3	1	9	-	Low
	Increase in Road Maintenance	2	1	1	2	3	1	9	-	Low	• The increase in traffic for this phase of the development is negligible and will not have a significant impact.	2	1	1	2	3	1	9	-	Low
Abnormal Loads	Additional Abnormal Loads	3	1	1	2	3	1	10	-	Low	• The increase in traffic for this phase of the development is negligible and will not have a significant impact.	3	1	1	2	3	1	10	-	Low
Internal Access Roads	New / Larger Access points	1	1	1	2	3	1	8	-	Low	• Adequate road signage according to the SARTSM. • Approval from the respective roads department.	1	1	1	2	3	1	8	-	Low
Decommissioning Phase																				
Additional Traffic Generation	Increase in Traffic	2	4	1	2	1	3	30	-	Medium	• Ensure staff transport is done in the 'off peak' periods and by bus. • Stagger material, component, and abnormal loads removal. •Construction of an on-site sorter and pressing machine to reduce trips.	2	4	1	2	1	2	20	-	Low
	Increase of Incidents with pedestrians and livestock	2	3	2	4	1	2	24	-	Medium	• Reduction in the speed of vehicles. • Adequate enforcement of the law. • Implementation of pedestrian safety initiatives • Regular maintenance of farm fences & access cattle grids.	2	3	2	4	1	1	12	-	Low
	Increase in dust from gravel roads	2	3	2	2	1	2	20	-	Low	• Reduction in the speed of the vehicles. • Appropriate, timely and high-quality maintenance required in terms of TRH20. • Possible use of approved dust suppressant techniques. • Implement a road maintenance program under the auspices of the respective transport department. •Construction of an on-site sorter and pressing machine to reduce trips.	2	3	2	2	1	2	20	-	Low
	Increase in Road Maintenance	2	3	2	2	2	2	22	-	Low	• Implement a road maintenance program under the auspices of the respective transport department.	2	3	2	2	1	2	20	-	Low
Abnormal Loads	Additional Abnormal Loads	3	2	1	2	1	1	9	-	Low	• Ensure abnormal vehicles travel to and from the proposed development in the 'off peak' periods or stagger delivery. • Adequate enforcement of the law.	3	2	1	2	1	1	9	-	Low
Internal Access Roads	Increase in dust from gravel roads	1	4	1	1	1	1	8	-	Low	• Enforce a maximum speed limit on the development.• Appropriate, timely and high-quality maintenance required in terms of TRH20.• Possible use of approved dust suppressant techniques.	1	3	1	1	1	2	14	-	Low
	New / Larger Access points	1	4	1	2	1	1	9	-	Low	• Adequate road signage according to the SARTSM.	1	4	1	2	1	1	9	-	Low

											• Approval from the respective roads department.										
Cumulative																					
Additional Traffic Generation	Increase in Traffic	2	4	1	2	1	4	40	-	Medium	• Ensure a large portion of vehicles travelling to and from the proposed development travels in the 'off peak' periods or by bus. • Construction of an on-site batching plant and tower construction to reduce trips. • Coordination between all developers in the area.	2	4	1	2	1	3	30	-	Medium
	Increase of Incidents with pedestrians and livestock	2	3	2	4	1	3	36	-	Medium	• Reduction in the speed of vehicles. • Adequate enforcement of the law. • Implementation of pedestrian safety initiatives. • Regular maintenance of farm fences, and access cattle grids. • Construction of an on-site batching plant and tower construction to reduce trips. • Coordination between all developers in the area.	2	3	2	4	1	2	24	-	Medium
	Increase in dust from gravel roads	2	3	2	2	1	4	40	-	Medium	• Reduction in the speed of the vehicles. • Construction of gravel roads in terms of TRH20. • Implement a road maintenance program under the auspices of the respective transport department. • Possible use of approved dust suppressant techniques. • Construction of an on-site batching plant and tower construction to reduce trips. • Coordination between all developers in the area.	2	3	2	2	1	2	20	-	Low
	Increase in Road Maintenance	2	3	2	2	2	2	22	-	Low	• Implement a road maintenance program under the auspices of the respective transport department. • Construction of an on-site batching plant and tower construction to reduce trips. • Coordination between all developers in the area.	2	3	2	2	2	2	22	-	Low
Abnormal Loads	Additional Abnormal Loads	3	3	1	2	1	4	40	-	Medium	• Ensure abnormal vehicles travel to and from the proposed development in the 'off peak' periods. • Adequate enforcement of the law. • Coordination between all developers in the area.	3	2	1	2	1	2	18	-	Low
Internal Access Roads	Increase in dust from gravel roads	1	4	1	1	1	3	24	-	Medium	• Enforce a maximum speed limit on the development. • Appropriate, timely and high-quality maintenance required in terms of TRH20. • Possible use of approved dust suppressant techniques.	1	3	1	1	1	2	14	-	Low
	New / Larger Access points	1	4	1	2	1	2	18	-	Low	• Adequate road signage according to the SARTSM. • Approval from the respective roads department.	1	4	1	2	1	1	9	-	Low

11. CUMULATIVE IMPACT ASSESSMENT

SiVEST undertook every effort to obtain the information (including specialist studies, BA / EIA / Scoping and EMPr Reports) for the surrounding developments within 35 km of the proposed WEF facility and associated grid infrastructure; however, many of the documents are not currently, publicly available. To this extent, the information obtained from the surrounding, planned renewable energy developments were considered part of the cumulative impact assessment. Five (5) renewable energy projects were identified within a 35 km radius of the proposed development, as shown in **Table 11.1** below. The renewable energy developments considered as part of this Transportation Study are as follows:

Table 11.1 Proposed Renewable Energy developments within a 35 km radius.

Applicant	Project	Technology	Capacity	Status of Application / Development
Klipkraal Wind Energy Facility 1 (Pty) Ltd	Klipkraal Wind Energy Facility 1	Wind	300MW	EIA Process underway
Klipkraal Wind Energy Facility 2 (Pty) Ltd	Klipkraal Wind Energy Facility 2	Wind	300MW	EIA Process underway
Klipkraal Wind Energy Facility 3 (Pty) Ltd	Klipkraal Wind Energy Facility 3	Wind	300MW	EIA Process underway
Klipkraal Wind Energy Facility 4 (Pty) Ltd	Klipkraal Wind Energy Facility 4	Wind	300MW	EIA Process underway
Klipkraal Wind Energy Facility 5 (Pty) Ltd	Klipkraal Wind Energy Facility 5	Wind	300MW	EIA Process underway

The information obtained for other planned renewable energy developments in the surroundings are indicated in

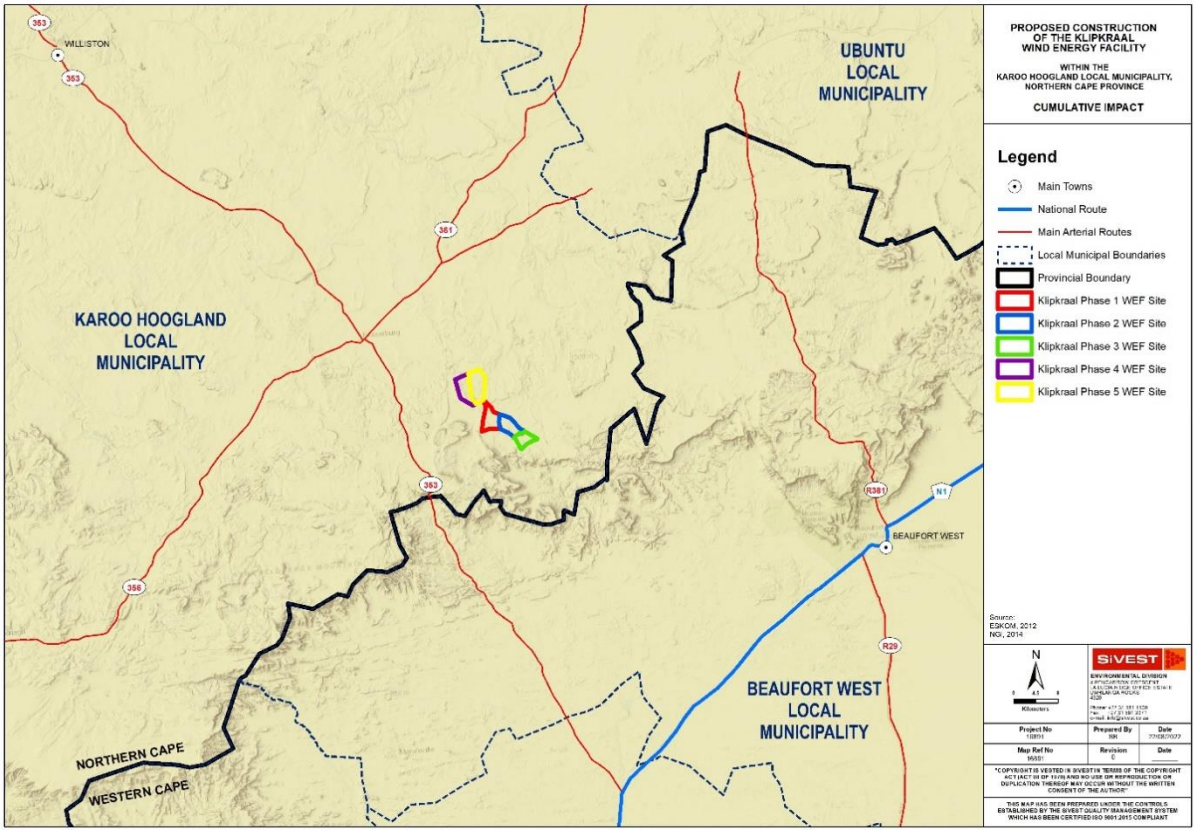

Figure 11-1 below.

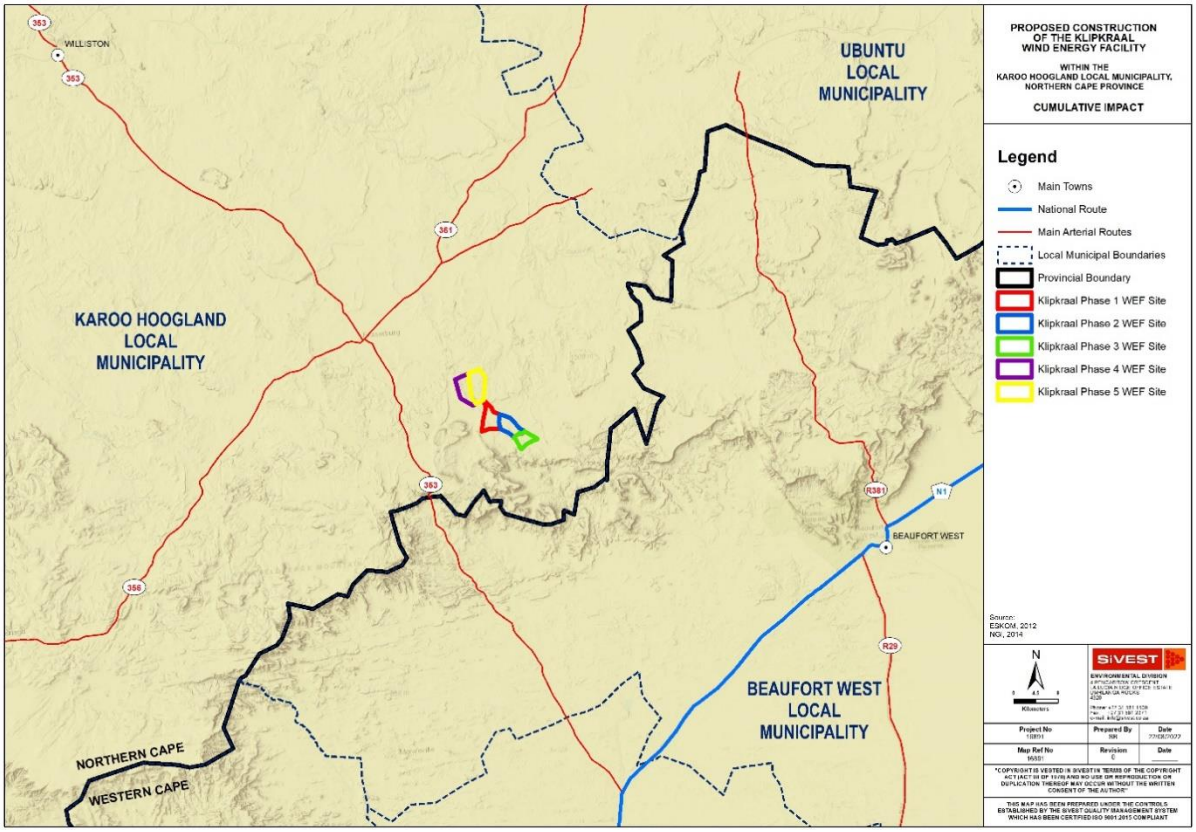

Figure 11-1 Proposed Renewable Energy Developments within a 35 km radius

Based on the above, this Transportation Study has considered the cumulative impacts, which were further assessed in **Section 10** above.

12. COMPARATIVE ASSESSMENT OF ALTERNATIVES

No alternative options were provided.

13. CONCLUSIONS AND IMPACT STATEMENT

The main objective of the 'Transportation Study' is to determine the impact/s the proposed Klipkraal WEF 1 development and associated grid infrastructure will have on the immediate and greater area concerning transportation. The proposed development is located in a rural part of the Northern Cape Province, with the existing road network providing access to the development. Several other renewable energy developments have already been completed or are in the process of being completed in the immediate area.

The construction phase for this development will typically generate the highest number of additional vehicles. Of these additional vehicles, ±82 trips / hour will occur in the morning and afternoon outside of the peak period, while ±2 trips / hour will occur during the midday peak for construction material and abnormal loads. The impact will, however, be temporary and is considered to be nominal if adequately mitigated. During the operation phase, it is expected that the facility will accommodate ±30 employees and generate an additional ±15 trips / day in the morning and afternoon peak period. This impact is considered to be nominal.

- In conclusion;

- The Klipkraal WEF 1 consists of one EIA application, while the Grid connection infrastructure will be undertaken as a separate Basic Assessment application.
- The proposed access point on Road DR2312 has sufficient sight distance of >350 m and is not located within and / or near any drainage lines.
- Access upgrades are required at the proposed access point.
- The access road requires vertical alignment upgrades through minor drainage lines.
- The access road requires vertical alignment upgrades over the crest curve at Km 89.55 on Road DR2312.
- Before work commences, all external road upgrades require approval and a wayleave application from the Northern Cape Department of Public Works & Roads (NCdr&pw).
- Mitigation measures to be included in the construction phase:
  - Ensure staff transport is done in the 'Off Peak' period and by bus to reduce impact in the peak periods.
  - Stagger material, component, and abnormal loads deliveries.
  - Adequate road signage on all external roads carrying development traffic according to the South African Road Traffic Sign Manual (SARTSM).
  - Reduction in the speed of vehicles.
  - Adequate enforcement of the law.
  - Implementation of pedestrian safety initiatives.
  - Regular maintenance of farm fences & access cattle grids.
  - Construction of gravel roads in terms of Technical Recommendations for Highways (TRH20).
  - Implement a road maintenance program under the auspices of the respective transport department; and
  - Possible use of approved dust suppressant techniques.
- A more comprehensive route analysis should be completed before construction to better understand the works required and the potential risks.
- The 'No Go' alternative would result in no transportation impacts.
- No fatal flaws or preferences were identified for any proposed site alternatives, construction laydown areas, substation locations or Power line routes.
- No environmentally sensitive areas have been identified; therefore, no areas are to be avoided from a Transportation perspective.

- Impact Statement;
  - Concerning this report, associated assessment and the findings made within, it is SiVEST's opinion that the Klipkraal WEF 1 and associated grid infrastructure will have a nominal impact on the existing traffic network. The project is therefore deemed acceptable from a transport perspective, provided the recommendations and mitigation measures in this report are implemented. Hence, Environmental Authorisation (EA) should be granted for the EIA application.

14. REFERENCES

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Technical Recommendations for Highways (TRH17) – *Geometric Design of Rural Roads (1988)*

Technical Recommendations for Highways (DRAFT-TRH20) – *Unsealed Roads: Design, Construction and Maintenance (2013)*

Technical Recommendations for Highways (TRH26) – *South African Road Classification and Access Management Manual (2012)*

APPENDIX A: SPECIALIST CURRICULUM VITAE

CURRICULUM VITAE

Name	Ntuthuko Hlanguza
Profession	Professional Civil Engineer
Name of Firm	SiVEST SA (Pty) Ltd
Present Appointment	Senior Civil Engineer SiVEST Civil Engineering Division
Years with Firm	8 years
Nationality	South African

Education

- Maritzburg College (2004): Grade 12 with Distinction

Professional Qualifications

- BSc.Eng (Civil) - University of KwaZulu-Natal (2014)
- Post Graduate Certificate in Energy Efficiency and Sustainability – University of Cape Town (2020)
- Professional Engineer (ECSA) – Registration No. 202202263

Membership in Professional Societies

- Engineering Council of South Africa (ECSA) – Pr Eng (Reg No. 202202263)
- South African Institution of Civil Engineering (SAICE)

Employment Record

Feb 2015 – current	SiVEST SA (Pty) Ltd – Civil Engineer
Dec 2013 – Jan 2014	Naidu Consulting, Durban – Student Engineer

Experience Overview

Ntuthuko is a Professional Civil Engineer with key experience in engineering feasibility studies, roads and transportation, water, sanitation, earthworks and construction monitoring. His achievements include SI instructor to junior students at UKZN and chairperson of UKZN's student chapter of the South African Institution for Civil Engineering (SAICE-UKZN).

Fields of Specialisation

- Engineering Feasibility Studies
- Road Geometrics and Pavement Design
- Stormwater Management
- Water Supply and Reticulation
- Sewer Reticulation
- Bulk Earthworks
- Construction Monitoring and Administration

Project Experience (by Sector)

RENEWABLE ENERGY

- Glint & Glare Assessments for Proposed Solar and Wind Energy Facilities
  - Renewstable Swakopmund Project
  - Suikerbekkie Solar Facility
- Transportation Studies for Proposed Solar and Wind Energy Facilities
- Stormwater Management Plans for Proposed Solar and Wind Energy Facilities

ROADS AND STORMWATER

- Traffic Planning, Design and Contract Administration of Urban Roads (Class 3-5 roads)
- Traffic Planning, Design and Contract Administration of Internal Roads, Access Roads and Intersections of Large-Scale Residential Developments
- Design and Construction Monitoring of Bulk Stormwater Infrastructure
- Planning and Design of Storm Attenuation Features
- Undertaking of Flood Risk Assessments and Stormwater Management Plans

WATER AND SANITATION

- Feasibility Studies, Planning and Design of Community Water Supply Schemes
- Feasibility Studies, Planning and Design of Bulk Water Transfer Schemes
- Design of Water and Sanitation Services for Education Facilities
- Design of Water and Sanitation Services for Provincial Hospitals
- Design of Water and Sanitation Services for Residential, Commercial and Industrial Developments

APPENDIX B: SPECIALIST DECLARATION

SiVEST Civil Engineering Division

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