LOXTON WIND FACILITY 2

TRAFFIC IMPACT ASSESSMENT

Report prepared for:

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1 EXECUTIVE SUMMARY

The Project Developer proposes developing three commercial wind energy facilities and associated infrastructure, in the vicinity of Loxton within the Ubuntu Local Municipality of the Pixley Ka Seme District Municipality, within the Northern Cape Province of South Africa.

The proposed wind energy facilities, consists of

- *Loxton Wind Facility 1 (Pty) Ltd (hereafter referred to as Loxton WEF 1),*
- *Loxton Wind Facility 2 (Pty) Ltd (hereafter referred to as Loxton WEF 2) and*
- *Loxton Wind Facility 3 (Pty) Ltd (hereafter referred to as Loxton WEF 3),*

Collectively referred to as the Loxton Wind Energy Facilities (hereafter referred to as Loxton WEFs).

This Traffic Impact Assessment is conducted for Loxton WEF 2, hereafter referred to as the proposed development. The two other wind energy facilities are concurrently being considered on the surrounding properties and are assessed by way of separate impact assessment processes contained in the 2014 Environmental Impact Assessment Regulations (GN No. R982, as amended) for listed activities contained in Listing Notices 1, 2 and 3 (GN R983, R984 and R985, as amended).

A preferred project site with an extent of approximately 58 000 ha has been identified as a technically suitable area for the development of the three WEF projects. Loxton WEF 1 will comprise of up to 38 turbines, and Loxton WEF 3 will comprise of up to 41 turbines, both will have a contracted capacity of up to 240 MW with a permanent footprint of up to 65 ha, whereas Loxton WEF 2 will comprise of up to 63 turbines with a contracted capacity of up to 480 MW and permanent footprint of up to 110 ha.

Mr A. Schwarz compiled this Traffic Impact Assessment, in line with guidelines for technical appraisal of the traffic impact of the proposed developments on the existing road network within a study area, during the construction, operation and decommissioning phases of the Loxton WEFs. A site visit was conducted in late February 2023 after provisionally finalising the position of the WTG, which dictated the layout of the access roads and access points onto the public road network.

Besides for Loxton WEF 1 and Loxton WEF 3, there are several other renewable energy projects earmarked for development in the adjacent area of the proposed developments. These include the Hoogland WEF (Northern Cluster), Taaibos WEF Cluster, and Soutriver WEF Cluster.

The public road network within the study area, servicing the proposed development is well-established. Majority of these public roads are surfaced roads. While the minor / private access roads to the proposed development from the main roads are gravel roads.

Traffic generation estimates used in this assessment is based on the experience of similar projects. Due to the location of the proposed development, there are more than one route to transport material and equipment to the proposed development from various commercial centres in South Africa. Thus, for analysis purposes the estimated traffic volume for a specific activity is applied to all possible routes to the proposed development, resulting in a worst-case scenario. The most significant hourly increase in traffic volumes on the roads within the study area stems from the transportation of material and equipment to and from the proposed development. The

maximum projected cumulative hourly increase in traffic volume is in the order of 62 vehicles per hour, which is greater than the threshold, of 50 vehicles per hour, stipulated in the South African Traffic Impact and Site Traffic Assessment Manual (2012), thus necessitating the requirement for a Traffic Impact Assessment.

There will be a notable increase in traffic volumes on the public road network within the study area, during the construction phase of the proposed development and less conspicuous traffic volumes during the operational phase. This report has assessed the cumulative impact of the additional traffic on the road network within the study area and found that the level of service on these roads is still acceptable.

The increase in traffic volumes on the roads will lead to significant wear and tear, especially during the construction phase of the proposed developments. Due to budgetary constraints within various spheres of government, only minor maintenance is undertaken on the road network. To this end, it is strongly suggested that the Project Developer contributes towards the ongoing maintenance of the road network associated with the various phases of the proposed development, especially in the rainy seasons when more degradation of the road network can be expected.

There are several concerns regarding the access points from the proposed development onto the public road network, that will have to be addressed in the design phase of the project. As all access points onto the proposed development shall be design in accordance with standard geometric requirements.

Traffic delivering material and equipment, including abnormal loads, to the proposed development shall be from the TR 01606 (via access point A), and DR 02329 (via access point B), as detailed below.

It should be noted that it is not possible to determine the expected traffic volumes generated during the decommissioning phase. It can be assumed that these volumes will be lower than during the construction phase as much of the infrastructure (e.g., roads, platforms, etc.) will be retained by the landowners. As part of the decommissioning process, a separate traffic impact assessment should be undertaken since many of the characteristics related to the traffic impact assessment, i.e., access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development.

A range of management and mitigation strategies are identified for implementation during the construction and operation phases of the development to minimise traffic impacts, reduce community disruption and the risk of traffic incidents.

Thus, from a traffic and transportation perspective, there are no constraints or notable impacts that would jeopardise the implementation of the proposed development.

2 PROJECT SPECIFICATIONS

A synopsis of the project specification for the proposed development is provided in Table 1.

Table 1 - Synopsis of Project Specifications

Project Components Description	***Specifications & Footprint areas***
Location	*The proposed development and associated infrastructure on a site located approximately 30 km North of Loxton within the Ubuntu Local Municipality of the Pixley Ka Seme District Municipality in the Northern Cape Province.*
Access	*Access to the proposed development shall be from the TR 01606 (via Access Point A) and DR 02329 (via Access point B).*

Project Components Description	Specifications & Footprint areas
Land Use	The land use of the site and surrounding properties comprise low-density livestock farming (grazing).
Extent	The total area of the site being considered for the proposed development is in the order of 7 200 hectares
Number of wind turbines and generation capacity	Up to a maximum of 63 wind turbines will be developed. The targeted generation capacity for the proposed development is in the order of 480 MW
Wind Turbines	The specifications for the proposed Wind Turbine are as follows: • Rotor diameter: up to 200 m • Hub height: 160 m • Rotor top tip height: up to 260 m • Rotor bottom tip height: minimum of 45 m (and not lower). • Generation capacity: up to a maximum of 8 MW output per turbine.
Turbine Foundations	Each turbine will have a circular foundation with a diameter of up to 32 m.
Turbine Hardstands and Laydown Area	Adjacent to each turbine will be a hardstand area of 70 m x 45 m.
	An additional 25 m x 80 m of temporary hardstand area will also be required near each of the crane pads. Further, a blade laydown area of 104 m x 20 m and an additional embankment area (where necessary due to slopes) of approximately 104 m x 5 m will be required. A temporary crane boom assembly area of 120 x 15 m will also be accommodated. Temporary areas are up to a maximum of a maximum of 5,200 m^2 per turbine
Cabling	Turbines to be connected to on-site substation via up to 33 kV cables. Cables to be laid underground in trenches mainly adjacent to proposed wind farm roads (as part of the temporary impact of 'Site roads' below) but in some instances the cables will deviate from the road.
	Where it has been possible, cables have been routed along existing local roads. Note that cables running next to public roads will not be able to run within the road reserve, but as close as possible to the road reserve in the adjacent private owned land.
Internal WEF overhead powerlines	In limited instances, overhead monopole lines will be used where burying is not possible due to technical, geological, environmental, or topographical constraints. Up to 33 kV overhead power lines supported by 132 kV monopole style pylons of up to 32 m high will be required, as well as tracks for access to the pylons.
	Where possible, to reduce areas of new impact, sections of overhead line have been routed next to proposed Eskom overhead lines
Site roads	The total road network for each wind farm is as follows:
	Permanent roads will be 6 m wide and over above this may require side drains on one or both sides depending on the topography. Many roads will have underground cables running next to them.
	An up to 15 m wide road corridor may be temporarily impacted during construction and rehabilitated to allow for a 6 m road surface after construction
Wind farm Substations	The proposed development will have a 2 hectares substation yard that will include an Operation and Maintenance (O&M) building, Substation building and a High Voltage Gantry
Battery energy storage system (BESS)	The proposed development will also have a ±10 hectares area for a battery energy storage system (BESS) which may be adjacent or slightly removed from the substation depending on the local constraints. The BESS may either be connected to the wind farm substation by an underground or overhead cable or may require its own substation which would be located within the BESS footprint and would be connected directly to the Eskom switching station via a short 132 kV overhead line
Operations and maintenance (O&M) area	The O&M area will include all offices, stores, workshops and laydown area. The substation building will be housed in the substation yard.
Security	Security gate and hut to be installed at most entrances to each wind farm site (estimated as 4 entrances each at 20 m^2). No fencing around individual turbines, existing fencing shall remain around perimeter of properties. Temporary and permanent yard areas to be enclosed (with access control) with an up to 2.4 m high fence.
Temporary areas required for the construction / decommissioning phase	The proposed development have the following temporary construction areas: • Temporary site camp/s areas: 1 hectare • Batching plant area of approximately 1 hectare • Each wind farm will have a bunded fuel & lubricants storage facility on-site in fixed tanks not exceeding 80 m^3 (situated at the site camp).
	Individual turbine temporary laydown areas, including crane boom laydown areas, blade laydown areas and other potential temporary areas, will be up to a maximum of 1 hectares.
Social and Employment	The envisaged employment opportunities that each of the proposed development will create are as follows:

Project Components Description	Specifications & Footprint areas
	Approximately 520 employees during the peak construction phase comprise approximately 90% low-skilled and semi-skilled individuals and 10% highly skilled individuals.
	Approximately 40 employees during the operational phase, comprising approximately 90% low-skilled and semi-skilled individuals and 10% highly skilled individuals.-
	Employees for the proposed development will commute daily from the surrounding towns.
Other shared infrastructure	Stream crossings upgrades Road realignment requirements

3 ABBREVIATIONS

The following abbreviations have been used in this document.

Table 2 - List of Abbreviations

Abbreviation	Meaning
AADT	Average Annual Daily Traffic
ADT	Average Daily Traffic
BA	Basic Assessment
BESS	Battery Energy Storage System
COTO	Committee of Transport Officials
DFFE	Department of Forestry, Fisheries and the Environment
EIA	Environmental Impact Assessment
EPCM	Engineering, Procurement, Construction and Management
IAP	Interested and Affected Parties
km/h	Kilometre per hour
LOS	Level of Service
MW	Megawatt
NEMA	National Environmental Management Act
O&M	Operation and Maintenance
PDP	Professional Driving Permit
RCAM	Road Classification Asset Management system
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RNIS	Road Network Information System
SANRAL	South African National Roads Agency SOC Ltd
TMP	Traffic Management Plan
vpd	Vehicles per day
vph	Vehicle per hour
v/km	Vehicle per kilometre
WEF	Wind Energy Facility
WTG	Wind Turbine Generator

4 GLOSSARY

The following definitions apply to these words, which have been used in this document.

Table 3 - Definitions

Word/Phrase	Definitions
Average Annual Daily Traffic	An Average Annual Daily Traffic is the total traffic volume (in both directions) generated in a year, including school and public holidays and weekends, divided by the number of days in the year.
Average Daily Traffic	An Average Daily Traffic is the total traffic (in both directions) generated in a twenty-four-hour period on a typical working weekday.
Diurnal	Diurnal means happening or active during the daytime.
Follower density	Follower density is defined as the number of vehicles per kilometre per lane

Word/Phrase	Definitions
Level of Service	The level of service in this document is based on the follower density and expressed as LOS A to LOS F.
Peak Traffic	Traffic at the time it is most busy.
Return Trip	A Return Trip is defined as a bidirectional movement of a vehicle, from an originating point to a destination, and from the destination back to the originating point.
Traffic Volume	Traffic Volume is the number of vehicles passing a specific point in a given time, expressed in vehicles per hour.
Trip	A Trip is defined as a single (one-directional) movement of vehicles, with either the destination or the origin at the proposed development.

5 INTRODUCTION

5.1 PROJECT DESCRIPTION

The Project Developer proposes developing three commercial wind energy facilities and associated infrastructure, in the vicinity of Loxton within the Ubuntu Local Municipality of the Pixley Ka Seme District Municipality, within the Northern Cape Province of South Africa.

*This TIA is limited to Loxton WEF 2, hereafter referred to as the '**proposed development**'. Based on the latest available information, the proposed development will consist of up to a maximum of 63 wind turbine generator units, with a total maximum generating capacity in the order of 480 MW, this will be finalised once the turbine supplier has been appointed.*

The extent of the proposed development is shown in Figure 1, together with the access points A and B, and the properties on which the proposed development is to be constructed, which include:

- *Remaining Extent, Portions 2 and 3, of the Farm Yzervarkspoort No. 139*
- *Remaining Extent, Portions 4, 11 and 12, of the Farm Rietfontein No. 572*
- *Remaining Extent of the Farm No. 573*
- *Remaining Extent of the Farm Saaidam No. 574*
- *Remaining Extent of the Farm No. 582*

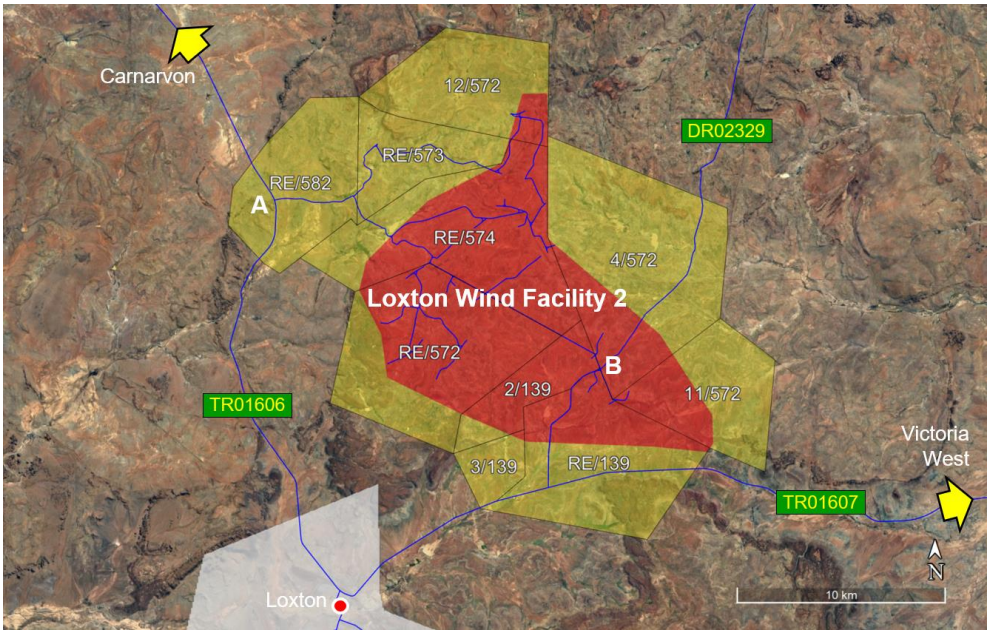

Figure 1 - Loxton Wind Facility 2 Project

This TIA forms an integral part of the supporting documentation required for the Environmental Authorisation application to the Department of Forestry, Fisheries, and the Environment (DFFE).

5.2 TERMS OF REFERENCE

Loxton Wind Facility 2 (Pty) Ltd appointed Mr A. Schwarz to provide a Traffic Impact Assessment (TIA) for the proposed development.

5.3 SCOPE AND OBJECTIVES

5.3.1 Scope

The proposed development shall consist of up to a maximum of 63 WTG, selected from the potential turbine locations identified.

The scope of this report includes, inter alia:

- *Identify the potential road network that could be affected by the proposed development;*
- *Determine a traffic baseline against which the potential traffic impacts are to be measured;*
- *Identify potential impacts and cumulative impacts that may occur during the construction, operational and decommissioning phases of the proposed development;*
- *Determine mitigation and/or management measures which could be implemented to, as far as possible, reduce the effect of negative impacts; and*
- *Incorporate and address all issues and concerns raised by Interested and Affected Parties (if and when applicable).*

5.3.2 Objectives

This report aims to determine the potential traffic impact the proposed development will have on the existing road network.

5.4 LEGISLATION AND PERMIT REQUIREMENTS

The overarching environmental legislation for managing the environment in South Africa is the National Environmental Management Act, 1998 (Act 107 of 1998 "NEMA"). Its preamble states that sustainable development requires the integration of social, economic, and environmental factors in the planning, implementation and evaluation of environmental decisions to ensure that the development serves present and future generations.

The DFFE Screening Tool and Report that was generated for the site (as per Regulation 16(1)(v) of the Environmental Impact Assessment Regulations 2014, as amended) concluded that based on the selected classification of activity along with the environmental sensitivities of the proposed development footprint, a traffic impact assessment is identified for inclusion in the assessment report.

5.4.1 Roads

The relevant legislation associated with the road (infrastructure), transportation and traffic include, inter alia:

- *National Water Act (Act 36 of 1998), with regards to all crossings of watercourses;*

- *National Road Traffic Act (Act 93 of 1996);*
- *Advertising on Road and Ribbon Development Act (Act 21 of 1940):*
  - *Regulates the display of advertisements outside some urban regions at places visible from public roads, and the depositing or leaving of disused machinery or refuse and the erection, construction or laying of structures and other things near certain public roads, and the access to certain land from such roads;*
  - *Section 9: Prohibition of the erection of structures near-certain roads;*
  - *Section 9A: Prohibition of the erection of structures or construction of other things near intersections of certain roads;*
  - *Section 10: Restriction of access to land through a fence, etc., along certain roads.*
- *Roads Ordinance Number 19 of 1976:*
  - *Consolidate and amend the law relating to public roads and public paths and to provide for matters incidental thereto;*
  - *Section 13: Erection of gates across public roads and public paths;*
  - *Section 17: Erection of structures on or near public roads;*
  - *Section 18: Access to and exit from certain public roads and public paths.*

5.4.2 Vehicle Dimensions

Regulations 221 to 230 of the National Road Traffic Act relates to vehicle dimensions, the most salient points are summarised below.

Regulation 221: Defines the legislation requirements regarding the overall length of vehicles, and is summarised as follows:

- *a rigid vehicle shall not exceed 12.5 m;*
- *articulated motor vehicle and semi-trailers shall not exceed 18.5 m;*
- *other combinations of motor vehicles (including interlinks, multiple trailers, etc.) shall not exceed 22.0 m;*

Regulation 223: Defines the legislation requirements regarding the overall width of vehicles with a gross mass of 12 000 kilograms or more, shall not exceed 2.6 m.

Regulation 224: Defines the legislative requirements regarding the overall height of a vehicle and transported load, which shall not exceed 4.3 m.

Regulation 225: Defines the legislation requirements regarding the maximum turning radius and wheelbase, which shall not exceed 13.1 m or 10.0 m (for a semi-trailer), respectively.

5.4.3 Vehicle Loads

Regulations 231 to 249 of the National Road Traffic Act relates to vehicles loads. The most salient points are summarised below.

Regulation 240: Defines the legislation requirements regarding the mass load carrying capacity on roads. The most relevant points are summarised below:

- *The mass load of a wheel fitted to a steering axle shall not exceed 3 850 kg, and others shall not exceed 4 000 kg;*
- *The mass load of an axle fitted with two wheels, which is the steering axle, shall not exceed 7 700 kg, others shall not exceed 8 000 kg;*

- *The mass load of an axle fitted with four wheels shall not exceed 9 000 kg;*
- *The mass load of an axle unit, which consists of two axles, each of which are fitted with two wheels, acting as a steering axle unit shall not exceed 15 400 kg, and other axle units shall not exceed 16 000 kg;*
- *The mass load of an axle unit, which consists of two axles, each of which are fitted with four wheels, shall not exceed 18 000 kg;*
- *The mass load of an axle unit, which consists of three or more axles, each of which are fitted with two wheels, acting as a steering axle unit shall not exceed 23 100 kg, and other axle units shall not exceed 24 000 kg;*
- *The mass load of an axle unit, which consists of three or more axles, each of which are fitted with four wheels, shall not exceed 24 000 kg;*
- *The axle mass load of an axle unit consists of two axles, one of which is a drive axle with four wheels and the other is an axle with two wheels, the sum of the two axles shall not exceed 18 200 kg.*

Regulation 241: Defines the legislation requirements regarding the mass load-carrying capacity of bridges.

5.4.4 Abnormal Loads

The National Road Traffic Act (Act 93 of 1996) and the National Road Traffic Regulations (2000) prescribe certain limitations on vehicle dimensions and axle and vehicle masses that a vehicle using a public road must comply with. Where the prescribed limits are exceeded, these loads are classified as abnormal loads. Provision for such abnormal vehicles and loads are made in Section 81 of the National Road Traffic Act, as substituted by Section 23 of the National Road Traffic Amendment Act (Act 64 of 2008).

The requirements and procedures for transporting abnormal loads are contained in the following two documents:

- *"TRH 11 - Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles"; and*
- *"Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads".*

5.5 METHODOLOGY

The South African Traffic Impact and Site Traffic Assessment Standards (2014), and the Manual for Traffic Impact Studies (1995), form the basis for this traffic impact assessment.

The methodology adopted in the compilation of this report includes, inter alia:

- *Identify the road network, within the study area, which will be used by vehicles associated with the proposed development and other developments in the area;*
- *Establish the number of vehicle trips generated during the construction, operation and decommissioning of the proposed development;*
- *Determine the mode of transport, vehicle type and size for each trip or category of trip generated during the construction, operational and decommissioning of the proposed development;*
- *Establish peak-hour vehicle trip rate generated during the construction, operation and decommissioning of the proposed development;*

- *Identify and assess the significance and severity of development-related traffic on the existing road network. Where possible comparing the existing traffic volumes on the roads with the traffic generated by the proposed development;*
- *Propose practical measures to mitigate the impacts of development-related traffic on the existing road network.*

5.6 ASSUMPTIONS

The compiling of this report is based on the following assumptions:

Project

- *The project consists of three WEFs, and Grid Connection;*
- *Each WEF shall include Collector Substation, BESS, Operational and Maintenance facilities;*
- *A project duration of 24 months is expected for the three WEF and associated infrastructure. However, an active construction phase of 18 months has been assumed, providing six months for site establishment and final commissioning of the proposed developments;*
- *The tower sections for the WTG can be fabricated from either concrete or steel. The tower section for the proposed development is assumed to be steel elements;*

Substations

- *There is to be a substation constructed on each WEF;*
- *Expansion to the existing Gamma substation will be required. The envisaged work includes the construction of receiving bays and integration into the substation. The expected duration of this work is assumed to be in the order of six months. Which is the subject of a standalone Grid Connection report.*

Manpower

- *The manpower complement for the proposed development during the peak construction phase is assumed not to exceed 520 individuals;*
- *The expected manpower complement for the construction of the Gamma Grid Connection is expected to be in the order of 60 individuals;*
- *The expected manpower complement for the expansion work at the Gamma Substation is expected to be in the order of 40 individuals;*
- *A combined manpower complement for the construction phase of the three Loxton Wind Facilities and associated infrastructure is assumed to be in the order of 1 260 individuals;*
- *The manpower complement for each of the proposed WEF during the operational phase is assumed to be in the order of 40 individuals;*
- *A combined manpower complement for the operational phase of the three Loxton Wind Facilities is assumed to be in the order of 120 individuals.*

Workforce Distribution

- *No accommodation will be provided on-site;*
- *The workforce for the proposed development will be drawn from various towns within 100 km, and include Carnarvon, Loxton, and Victoria West;*

- *The workforce for the western portion of the proposed Grid Connection will be drawn from Loxton and Victoria West. While the workforce for the eastern portion of the proposed Grid Connection is drawn from Hutchinson, Murraysburg, Richmond and Victoria West;*
- *The distribution of the workforce is based on the working-age population in each town modified by the weighting factor relating to the distance the various towns are from the proposed development;*
- *The number of specialists deployed to the area for the proposed development is assumed to be nominal and will not adversely affect the distribution as described above.*

Traffic

- *The access from the public road network to the proposed development is from the TR 01606 via Access Point A (described in Section 6.2), and DR 02329 via Access Point B (described in Section 6.2);*
- *Delivery routes of equipment and materials to the proposed developments from various commercial centres within South Africa will follow well-established road networks;*
- *Where the proposed development is serviced by more than one route, the same traffic volumes shall be applied to all available routes;*
- *Although the tower section of the WTG components could be manufactured in South Africa, for the purpose of this report it is assumed that all the WTG components are imported into South Africa via one of two terminals, either at Ngqura (close to Gqeberha) or Saldanha Terminals. Both routes are addressed in this report;*
- *The final route selection is subject to the limitations specified in the transport permits and the available vehicles to be used by the appointed logistics company;*
- *For analysis purposes the shortest route to the proposed developments will be adopted;*
- *Construction equipment and materials (other than aggregates) for the proposed development will be transported from the various commercial centres within South Africa;*
- *The supply of raw materials for the manufacture of concrete and road construction, as a worst-case scenario, will be sourced from commercial sources outside the proposed development;*
- *The maximum payload of general-purpose vehicles used to transport equipment and material to the site is assumed to be in the order of 20 000 kg;*
- *The transportation of personnel shall be provided by either double cab bakkie (4 Pax), minibuses (16 Pax), or Buses (35, 45 and 55 Pax), all vehicles shall be retained on-site during the day;*
- *Concrete for the foundations of the wind towers is envisaged to be mixed at an on-site batching plant;*
- *A single batching plant will be provided for each of the proposed developments. This is based on the assumption that each development will be a separate entity constructed by different contractors. However, it is more probable that a single contractor will be appointed to construct all the proposed developments. In this case, a single batching plant might be provided for the batching and mixing of all*

the concrete to be used on-site. To avoid the potential interaction with the general public on the public road network during the casting of the WTG foundations, it is strongly recommended that separate batching plants be provided for each WEF.

Cumulative Impact

- *The cumulative traffic impact is based on the simultaneous construction of the following developments:*
  - *All three Loxton WEF and associated Grid Connection;*
  - *Hoogland WEF (Northern Cluster) and associated Grid Connection;*
  - *Soutriver WEF Cluster; and*
  - *Taaibos WEF Cluster.*
- *Soutriver WEF and Taaibos WEF are both proposing to accommodate personnel on site in a construction compound, the reducing the number of vehicles on the road network during the morning and afternoon peak;*
- *Soutriver WEF and Taaibos WEF are both proposing to use concrete tower sections which are to be manufactured on-site. This will reduce the number of abnormal loads to the development but will increase the number of deliveries to the development of raw materials;*
- *Access to the both the Soutriver WEF and Taaibos WEF is assumed to be from the DR 02324 via the N12, thus negating the traffic impact on the proposed development.*

5.7 LIMITATIONS

This report excludes the following:

- *Traffic Management Plan for the development, as this will depend on the construction process adopted by the contractor that is still to be appointed;*
- *Site Development Plan of the infrastructure, including roads, stormwater drainage, amenities, batching plant, etc. within the site boundary that does not affect the public road network;*
- *The geometric details of intersections and entrances onto the site from the public road network, as this will be finalised during the detailed design phase, which will require approval from the relevant roads authorities;*
- *Assessment of risks and impacts associated with loading or off-loading of the vehicles at the site or associated facilities are not addressed since these will be addressed in the Standard Operating Procedures developed by the Engineering, Procurement, Construction and Management (EPCM) contractor for the construction and decommissioning of the development;*
- *The suitability of the minor roads for the delivery and transportation and commuting of personnel will need to be assessed at the time of implementation, as the road conditions could have changed. It must be noted that not all the roads included in this report were evaluated during the site visit.*
- *The transportation route from the Port Terminals or Commercial Centres to the proposed development is the responsibility of the logistics company that will be appointed;*

It should be noted that none of these exclusions is expected to affect the findings of this assessment.

5.8 SOURCE OF INFORMATION

Information used in compiling this report was drawn from the following sources:

- *Manual for Traffic Impact Studies, Department of Transport, RR 93/635, 1995;*
- *TMH 16, Volume 1 - South African Traffic Impact and Site Traffic Assessment Manual, COTO 2012;*
- *TMH 16, Volume 2 - South African Traffic Impact and Site Traffic Assessment Standards and Requirements Manual, COTO 2014;*
- *TMH 17 - The South African Trip Data Manual, COTO 2012;*
- *TRH 4 - Structural Design of Flexible Pavements for Interurban and Rural Roads, 1996;*
- *TRH 26 - South African Road Classification and Access Management Manual, 2012;*
- *Strip Charts for selected roads within the Northern Cape were obtained from Mr R Matsoso, Chief Roads Engineer for the Northern Cape;*
- *The number of working-age was obtained from the Department of Statistics South Africa (http://www.statssa.gov.za/?page_id=964);*
- *Distance and estimated travelling times were obtained using Garmin BaseCamp software (version 4.7.4);*
- *Satellite imagery of the site available on Google Earth was also used for evaluation;*
- *Many of the photographs used in this report were extracted from Google Earth.*

6 DESCRIPTION OF THE STUDY AREA

6.1 ROAD NETWORK

The existing road network adjacent to the proposed development is well established, consisting of a combination of national roads, first, second and third-order roads, which provides accessibility to the proposed development from the local towns and the major commercial centres within South Africa.

The most relevant roads in the study area, which provide access to the various portions of the proposed developments from the surrounding towns, are shown in Figure 2 and are delineated below.

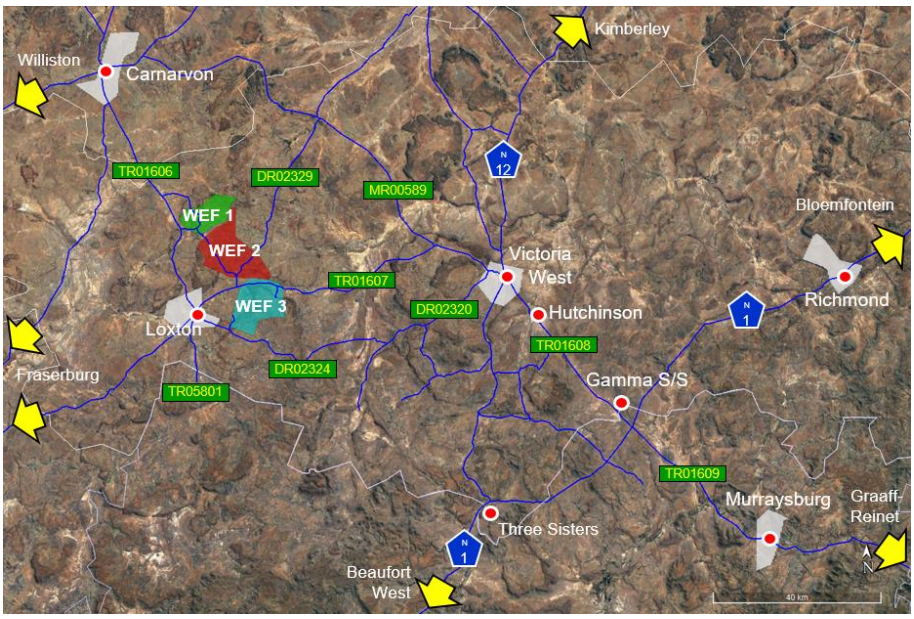

Figure 2 - Road Network

6.1.1 National Routes

National Routes are primary rural roads linking the commercial centres in South Africa, they provide high mobility between provinces, regions and towns, and are under the jurisdiction of the South African National Road Agency. A national route can be a national road or a trunk road

NR 001 (N1)

The NR 001 starts at the M6 (Western Boulevard) in Cape Town and ends at Beit Bridge Border Post at the Zimbabwe border, passing through the Western Cape, Northern Cape, Free State, Gauteng and ends in Limpopo. The N1 and N12 merge approximately seven kilometres west of Beaufort West before splitting again at Three Sisters.

The NR 001 is a Class 1 road, generally consisting of a single paved carriageway, with one lane in each direction and paved shoulders, as shown in Figure 3. Climbing lanes are provided along various sections of the road, and there are turning lanes at major intersections. In many cases, the shoulder is wide enough to allow yellow-line driving. The road is in good condition with a speed limit of 120 km/h.

Figure 3 - N1 - East of Beaufort West

NR 012 (N12)

The NR 012 starts at the NR 002/NR 009 (Kraaibosch Interchange) approximately 5 km south of George and ends at eMalahleni, passing through the Western Cape, Northern Cape, North West and ends in Gauteng. The NR 001 and NR 012 merge approximately seven kilometres west of Beaufort West before splitting again at Three Sisters.

This Class 2 road generally consists of a single paved carriageway, with one lane in each direction and a combination of paved, as shown in Figure 4, and gravel shoulders. Climbing lanes are provided along various sections of the road, and there are turning lanes at major intersections. In many cases, the paved shoulders are wide enough to allow yellow-line driving. The road is in good condition with a speed limit of 120 km/h.

Figure 4 - N12

6.1.2 Trunk Roads

Trunk roads are second order roads, proclaimed under provincial ordinance, providing mobility between provinces, regions, and towns. The management and maintenance of these roads fall under the jurisdiction of the Provincial Roads Department, in which the roads are located. Trunk roads have a statutory 30m reserve width, or such other width as directed by circumstances.

Only those truck roads affected by the proposed development are delineated below.

TR 0160# (R63)

The TR 016 (R63) starts at the R27 approximately 23 km east of Calvinia and ends at N2 north of East London. The overall length of the road is split into serval sections. TR 01606 represents section 6 of TR 016, which lies between Carnarvon and Loxton, while TR 01607 represents section 7 of TR 016, which lies between Loxton and Victoria West.

According to the Western Cape Road Information System, the Functional Class of section 9 of the TR 016 (R63), the road is a Class 2, with RCAM classification of R2c. The road is situated in a 30 m wide servitude consisting of a single paved carriageway, 6.8 m wide, with one lane in each direction and gravel shoulders, as shown in Figure 5. The road is in fair condition with a speed limit of 120 km/h.

Figure 5 - TR 01607 - East of Loxton

6.1.3 Main Road

Main roads are third order roads, within a 25 m wide servitude, providing mobility between regions, and towns. The management and maintenance of these roads fall under the jurisdiction of the Provincial Roads Department, in which the roads are located.

Only the main roads affected by the proposed development are delineated below.

MR 00589

The TR 00589 starts at the TR 01607, approximately 19 km west of Victoria West, and end at the MR 00768, approximately 11 km east of Carnarvon. The road is approximately 95 km long, and consists of a gravel carriageway, as shown in Figure 6. The condition of the road appears to be adequate and allows for dual-directional traffic at speed.

Figure 6 - MR 00589

6.1.4 District Roads

The district roads in the area are level 4 roads and are classified as Resident Access Collector roads, providing accessibility to nearby towns and main roads. The management and maintenance of this road fall under the jurisdiction of the Provincial Roads Department, in which the roads are located. The minimum required level of service on these roads is a LOS C.

Most of these roads consist of a gravel carriageway, approximately 7 m wide, within a 20 m wide servitude. As a result of the width, road users have to reduce speed when passing oncoming vehicles. Although most of these roads are suitable for light vehicles, the use of these roads by heavy vehicles is not recommended.

The condition of these roads are not consistent and vary from very poor to satisfactory. However, several sections of these roads are very stony, which could result in mechanical damage to vehicles.

DR 02320

The DR 02320, starts at the TR 01607, approximately 3.6 km west of Victoria West, and end at the DR 02318, the road is approximately 34.3 km long, and connects with the DR 02314 at chainage 31.6 km. The road is in an extremely poor condition, as shown in Figure 7, and is not conducive to be used as an access route for heavy vehicles.

Figure 7 - DR 02320

DR 02324

The DR 02324 starts at the TR 05801, approximately 0.9 km south of Loxton, and end at the intersection with the DR 02320. The road is approximately 53.5 km long, a drift crosses the road at chainage 3.0 km, as shown in Figure 8, and provides access to Loxton WEF 3 at chainage 11.2 km. The western portion of this road is more conducive to heavy traffic than the eastern portion of this road, due to the numerous cattle grids, drifts and sharp bends.

Figure 8 - DR 02324

DR 02329

The DR 02329 starts at the TR 01607, approximately 11.6 km east of Loxton, and end at the intersection with the MR 00589. The road is approximately 46.5 km long, and provides access to Loxton WEF 2 at chainage 7.0 km. The road appears to be well utilised (as shown in Figure 9) and show signs degradation due to the recent rains.

Figure 9 - DR 02329

6.1.5 Minor and Private Roads

Minor roads in the area, are proclaimed roads in terms of the Roads Ordinance 19 of 1976, within a 20 m wide servitude. These minor roads have a functional classification of level 5, and are categorised as a local access road, providing direct access to properties. The management and maintenance of this road fall under the jurisdiction of the Provincial Roads Department, in which the roads are located. The minimum required level of service on these roads is a LOS C.

Private roads and unproclaimed roads which pass over private property, the maintenance of these roads is the responsibility of the landowner and / or users of the roads.

6.2 SITE ACCESS

After provisionally finalising the position of the WTG, the internal road network layout was developed for each of the developments, which dictated the position of the proposed access points from the public road network.

The proposed access points to the proposed developments are shown in Figure 10.

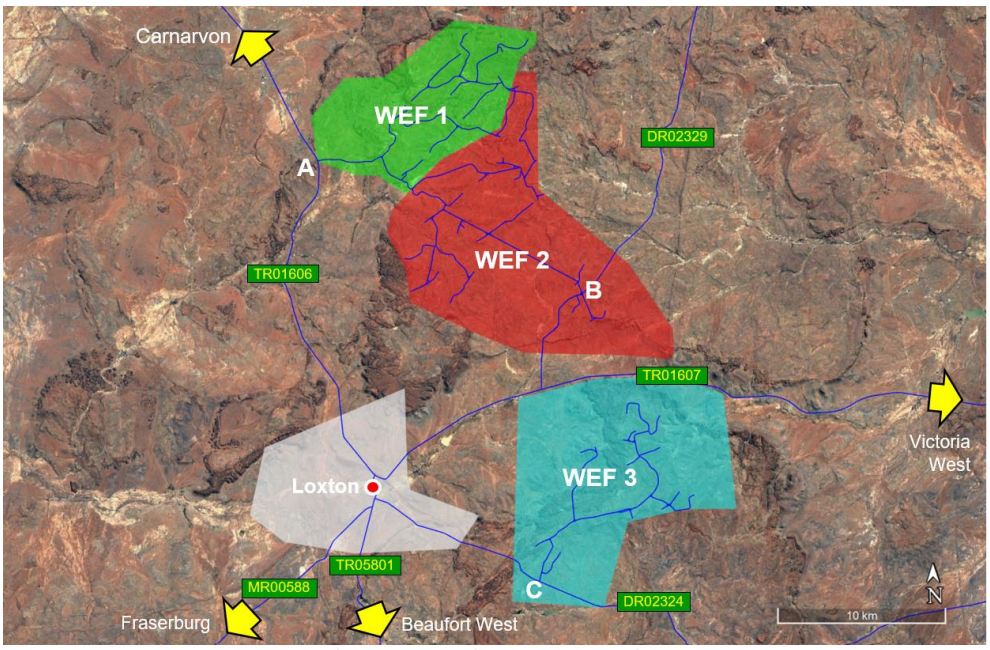

Figure 10 - Site Access Points

It must be stressed that although the proposed access points for the proposed developments are considered technically feasible, the access points will only be finalised during the design phase of the project.

Access Point A

This access point provides access to Loxton WEF 1, and Loxton WEF 2, it is an existing farm entrance, at chainage 42.3 km from Carnarvon, on the TR 01606, and is shown in Figure 11.

Figure 11 - Access Point A

The sighting distance to the north of Access Point A, is shown in Figure 12.

Figure 12 - Access Point A (North)

The sighting distance to the south of Access Point A, is shown in Figure 13.

Figure 13 - Access Point A (South)

As shown above the sighting distances in both directions of the Access Point A appears compromised, especially for heavy vehicles travelling to and from the south.

However, the suitability of utilising this access point during the construction and operational phases of the proposed development will have to be assessed, during the design phase of the project.

Access Point B

The proposed access point to the western portion of Loxton WEF 2, is a new intersection that is still to be developed. This point is on the DR 02329, approximately 7 km north of the TR 01607.

The sighting distance to the north of Access Point B, is shown in Figure 14.

Figure 14 - Access Point B (North)

The sighting distance to the south of Access Point B, is shown in Figure 15.

Figure 15 - Access Point B (South)

As shown above the sighting distances to the north appears acceptable for vehicles accessing the eastern portion of Loxton WEF 2. However, the sighting distance to the south appears to be compromised, as the proposed access point is located on a blind rise.

However, the suitability of utilising this access point during the construction and operational phases of the proposed developments will have to be assessed, during the design phase of the project.

Access Point C

The proposed access point to Loxton WEF 3, is via an existing entrance. This point is on the DR 02314, approximately 11 km east of the TR 05801, as shown in Figure 16.

Figure 16 – Access Point C

The sighting distance to the east of Access Point C, is shown in Figure 17.

Figure 17 - Access Point C (East)

The sighting distance to the west of Access Point C, is shown in Figure 18.

Figure 18 - Access Point C (West)

As shown above the sighting distances in both direction of the DR 02324 at the proposed access point to Loxton WEF 3 appears acceptable.

However, the suitability of utilising this access point during the construction and operational phases of the proposed developments will have to be assessed, during the design phase of the project.

6.3 TRANSPORTATION ROUTES

6.3.1 Commuter Routes

The towns in this part of the country are few and far apart. There are several towns within a 100 km radius of the proposed development from which the workforce is to be drawn for the proposed development, which include Carnarvon, Loxton, and Victoria West. The anticipated routes to the proposed development from the surrounding towns are indicated in magenta, in Figure 19.

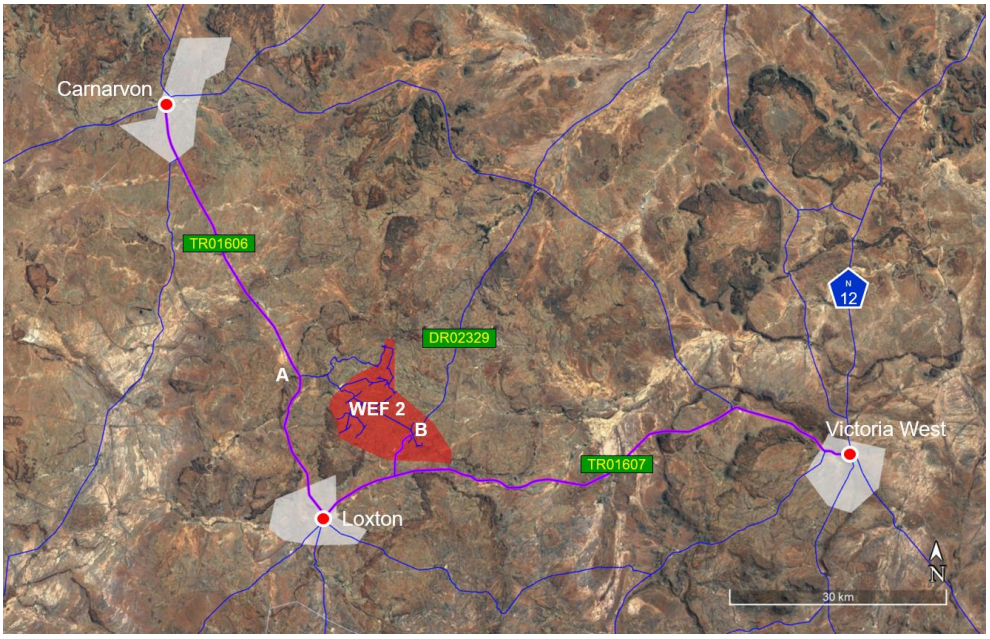

Figure 19 - Surrounding Towns

The commuting routes to the proposed development from the surrounding towns are as follows

Via Access Point A

- *Carnarvon – travel approximately 43 km south on the TR 01606, enter the proposed development via Access Point A.*
- *Loxton – travel approximately 20 km north on the TR 01606, enter the proposed development via Access Point A.*
- *Victoria West – travel approximately 102 km west on the TR 01606/7, enter the proposed development via Access Point A.*

Via Access Point B

- *Carnarvon – travel approximately 75 km on the TR 01606/7, towards Victoria West, turn left onto DR 02329, continue for approximately 7 km, enter the proposed development via Access Point B.*

- *Loxton – travel approximately 12 km on the TR 01607, towards Victoria West, turn left onto DR 02329, continue for approximately 7 km, enter the proposed development via Access Point B.*
- *Victoria West – travel approximately 69 km on the TR 01606/7, towards Loxton, turn right onto DR 02329, continue for approximately 7 km, enter the proposed development via Access Point B.*

The proportionality of the workforce from the surrounding towns is based on a 'working-age' population, modified by a 'weighting factor', calculated based on the distance travelled to the proposed development from the relevant towns. The expected proportion of the workforce from the surrounding communities is depicted in Table 4.

Table 4 - Distance to Surrounding Towns

Town	Population	Travel Distance	Proportion (%)
Carnarvon	*4107*	*42 km*	*46%*
Loxton	*604*	*18 km*	*16%*
Victoria West	*4978*	*69 km*	*38%*

6.3.2 Freight Routes

Container Terminals

Transnet Port Terminals is a division of Transnet SOC Limited, South Africa's state-owned freight transport company, which owns and operates the terminal at several Ports in South African. Operations are divided into the major market sectors: containers, bulk, breakbulk, and automotive, organised into three geographical regions – Eastern Cape, Western Cape, and Kwa-Zulu Natal.

The port of entry into South Africa for all import WTG components is limited to Ngqura (located close to Gqeberha) or Saldanha Terminals. The possible routes from these terminals to the proposed development is via Victoria West as shown in Figure 20.

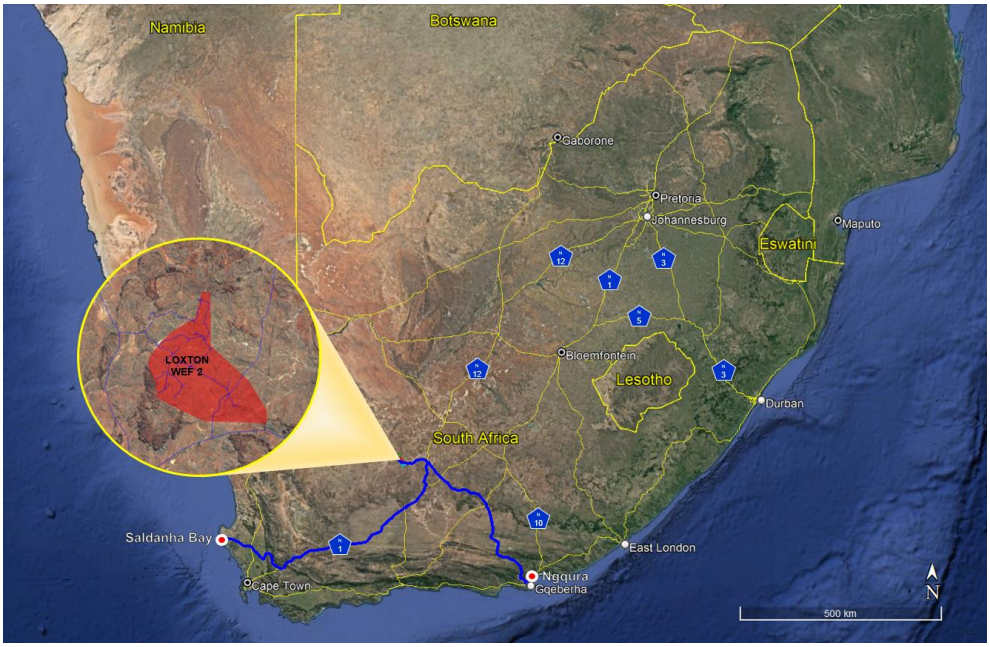

Figure 20 - Freight Routes - Port Terminals

The potential transportation routes from the various Port Terminals in South Africa, with the capability to import wind turbine components, to the proposed development, are detailed in Table 5.

Table 5 - Distance - Port Terminals

Container Terminals	Distance
Ngqura	538 km
Saldanha	771 km

The closest terminal to the proposed development is the Ngqura Port Terminal (close to Gqeberha) based on the information provided above.

However, the length and weight of the various WTG components will only be available once the turbine supplier has been appointed. There is a strong possibility that the length of the blades for the WTG units could exceed 95 m.

Each of the proposed transportation routes has challenges that the logistics company appointed will need to address. In some cases, the challenges can be easily overcome, and for others, alternative routes will have to be considered.

The preferred transportation route would ultimately be identified by the logistic company appointed to transport the various WTG components from the port of entry to the proposed development.

Commercial Centres

The most likely transportation routes for domestically supplied and manufactured components from the major commercial centres to the proposed development are either Cape Town or Johannesburg (or any supplier along these routes), as shown in Figure 21.

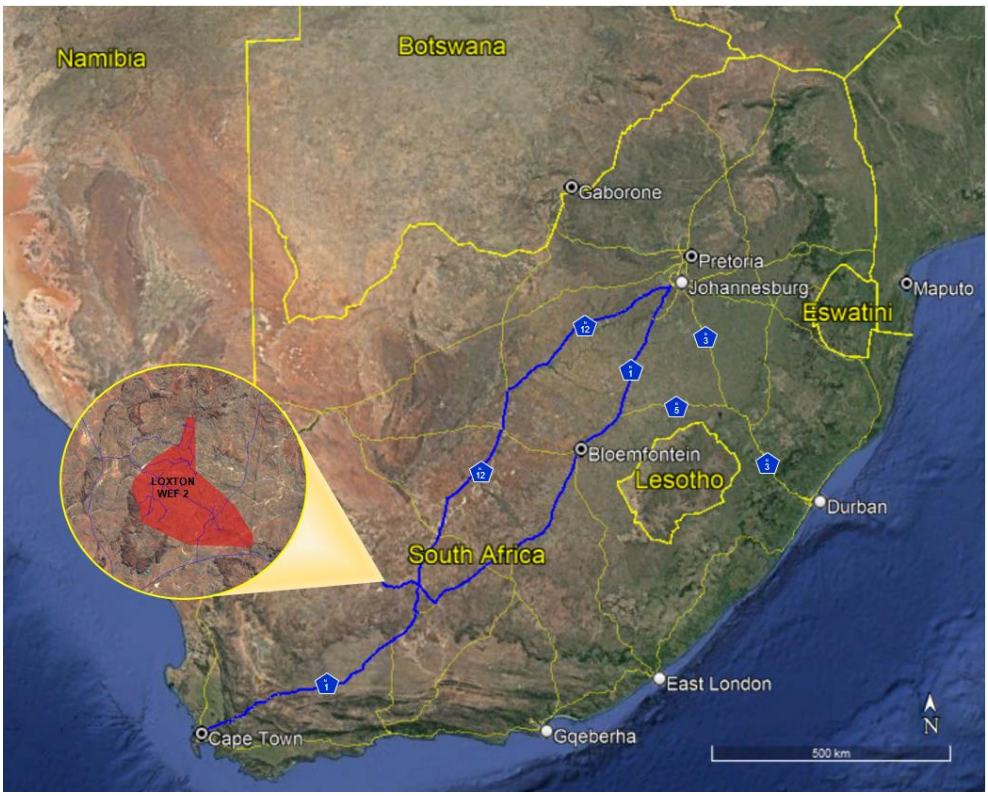

Figure 21 - Freight Routes - Commercial Centres

The distances from the proposed development to the major commercial centres in South Africa are shown in Table 6.

Table 6 - Distance - Major Commercial Centres

Commercial Centres	Distance
Cape Town	681 km
Johannesburg (via N1)	940 km
Johannesburg (via N12)	908 km

Although the closest major commercial centre to the proposed development is located in the greater Cape Town area, many components will be fabricated in Johannesburg and transported to the proposed development.

6.4 RENEWABLE DEVELOPMENTS

According to the Screening Tool provided by the Project Developer, for the proposed development, there are no other renewable developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed development.

However, besides for Loxton WEF 2 and Loxton WEF 3, there are several other renewable energy projects earmarked for development in the adjacent area of the proposed development. These include the Hoogland WEF (Northern Cluster), Taaibos WEF Cluster, and Soutriver WEF Cluster, as shown in Figure 22.

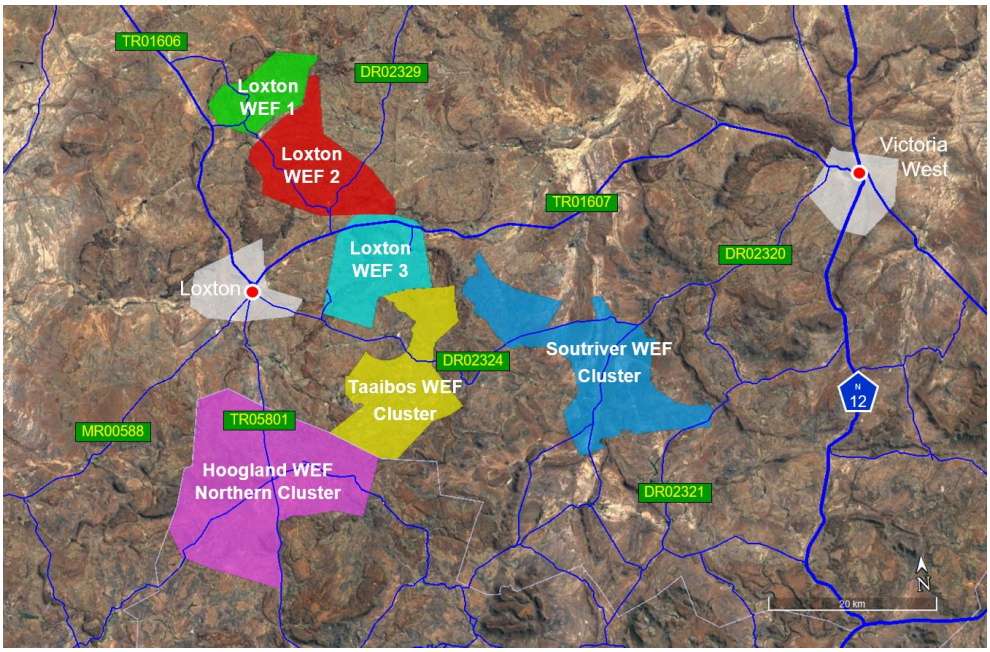

Figure 22 - Adjacent Proposed Renewable Energy Project

The Hoogland WEF Northern cluster comprises of two WEF, these are the Hoogland WEF 1 and Hoogland WEF 2, each WEF consisting of up to 60 WTG.

The Soutriver WEF cluster comprises of three separate WEF, these are Soutriver North WEF, Soutriver Central WEF and Soutriver South WEF, the number of WTG of each WEF are 31, 32 and 35 respectively. The Taaibos WEF cluster comprises of two separate WEF, these are Taaibos North WEF and Taaibos South WEF, the number of WTG of each WEF are 40 and 36 respectively.

Each WEF on both Soutriver and Taaibos will include a Battery Energy Storage System (BESS), temporary and permanent laydown areas, an IPP Substation (SS), a Concrete Tower Manufacturing Facility (CTMF), access roads and a construction compound (CC) area. The temporary laydown areas, CTMF and CC areas will be

converted to the BESS facility post-construction phase. Thus, significantly reducing the number of vehicles on the road network during the morning and afternoon peaks.

7 TRAFFIC VOLUMES

The South African Trip Data Manual (TMH 17), as provided by COTO, does not make provision for expected trip generation for the construction, operation, and decommissioning phases of a wind farm. Thus, the traffic trip generation for the construction, operation and decommissioning phrases used in this document is based on data provided by the Project Developer and obtained for similar projects. The estimated traffic generation detailed below represents a worst-case scenario.

7.1 STATUS QUO

The traffic volumes on the public road network in the Northern Cape is not that freely available and is obtained on a case-by-case bases.

The information used in this assessment was obtained from Mr R Matsoso, Chief Roads Engineer for the Northern Cape. The information provided is in the form of strip charts for selected roads.

7.1.1 Strip Charts

Due to the unavailability of traffic volume data on the public road network in the Northern Cape not all the required Strip Charts were obtained for the roads in the study area.

TR 01606

A copy of the Strip Chart for the TR 01606, between Carnarvon and Loxton is provided in Figure 23.

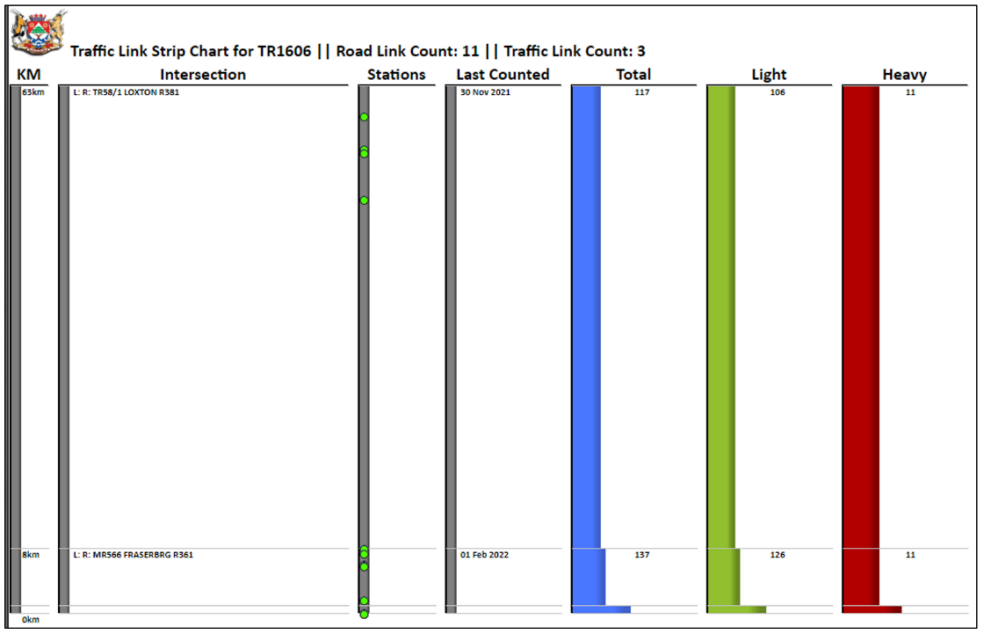

Figure 23 - TR 01606 - Strip Chart

TR 01607

The Strip Chart for the TR 01607, between Loxton and Victoria West is provided in Figure 24.

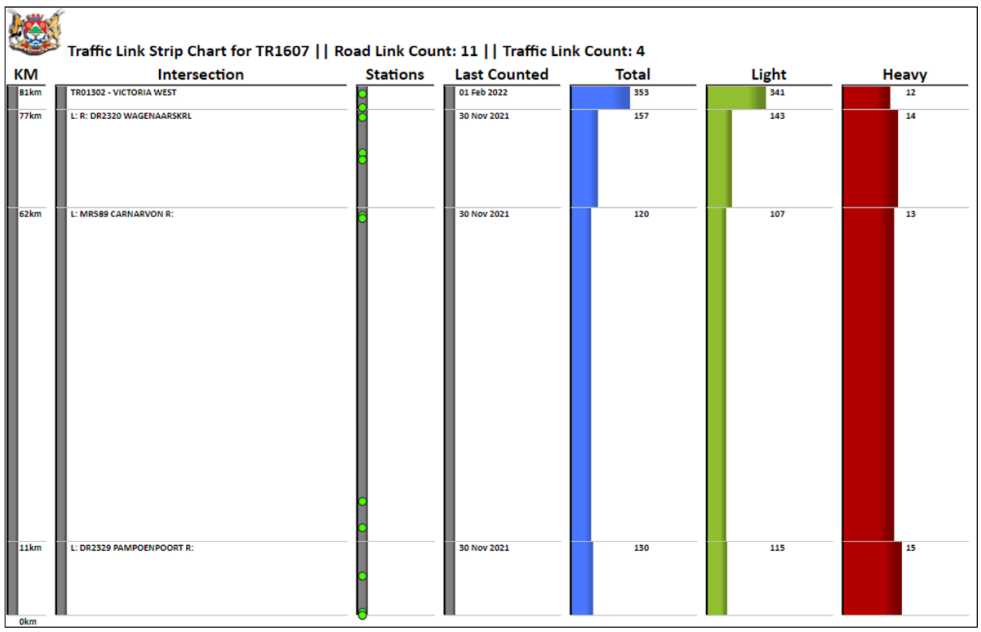

Figure 24 - TR 01607 - Strip Chart

DR 02324

A copy of the Strip Chart for the DR 02324, between Loxton and the junction with the DR 02321 is provided in Figure 25.

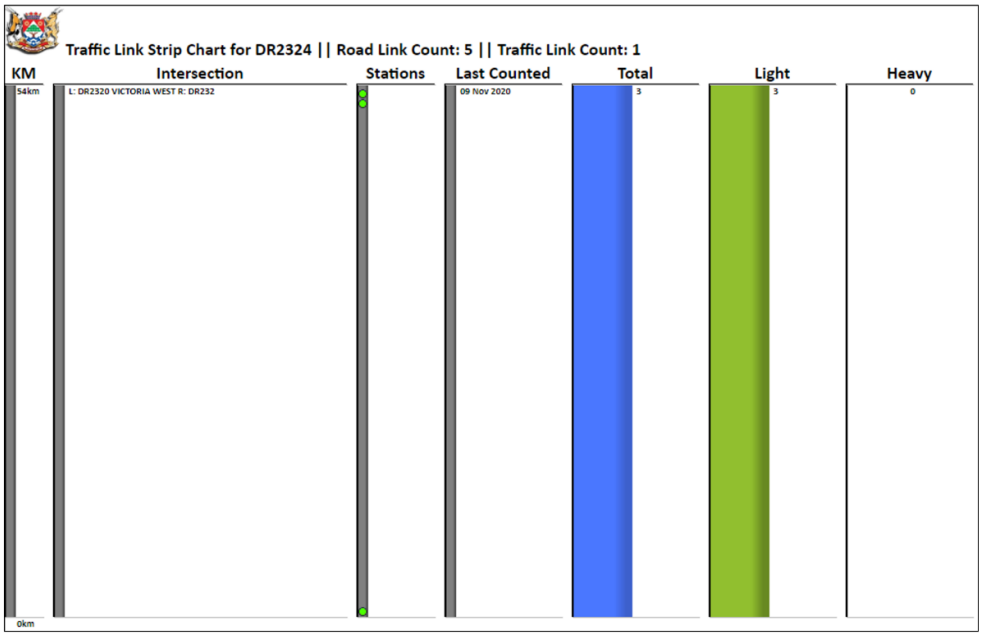

Figure 25 - DR 02324 - Strip Chart

DR 02329

A copy of the Strip Chart for the DR 02329, between junction on the TR 01607 and junction with the MR 00589, is provided in Figure 26.

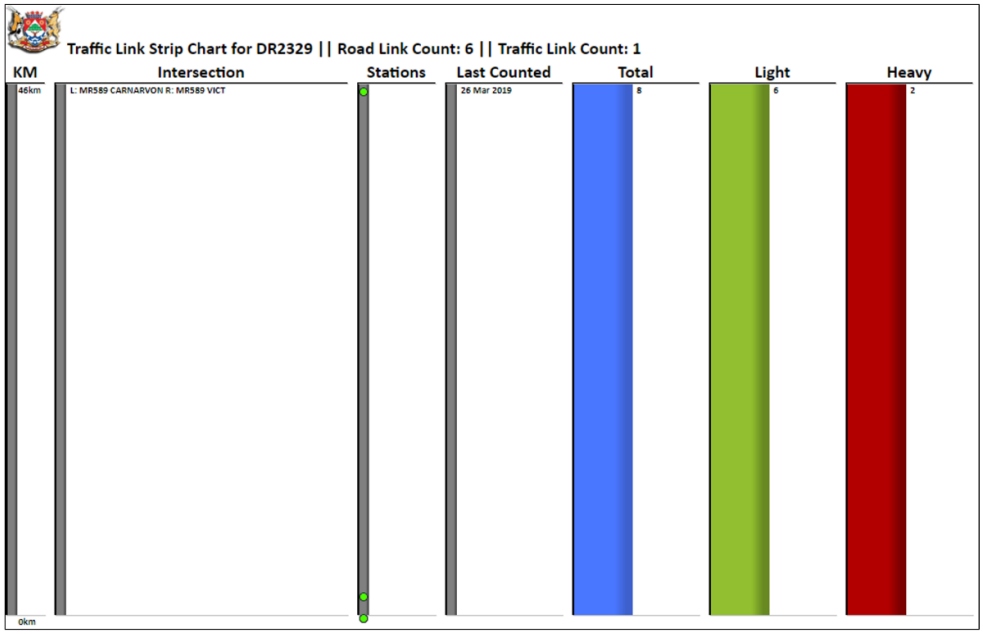

Figure 26 - DR 02329 - Strip Chart

7.1.2 Baseline Traffic Volumes

The baseline traffic volumes for the road network within the study area is based on the values extracted from the strip charts provided. Where no information is available, none has been assumed and the cells in the tables are left blank.

7.2 ROAD NETWORK MODEL

The road network adjacent to the proposed development has been comprehensively delineated in section 6.1 above

A road network model, as shown in Figure 27, has been developed for analysis purposes and is the primary reference for the balance of this report.

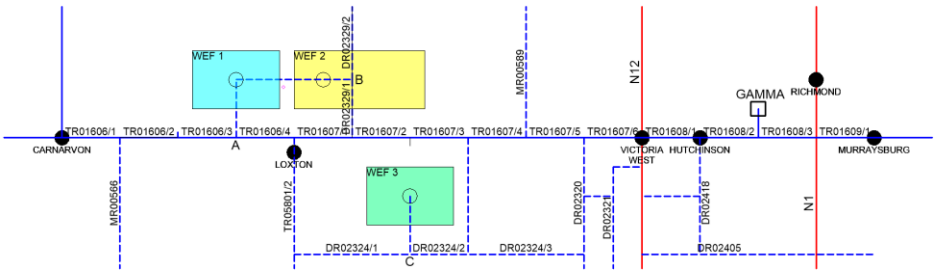

Figure 27 - Road Network Model

7.3 CONSTRUCTION PHASE

The construction phase of the proposed development will generate the most significant increase in traffic volumes on the local road network. Construction traffic will include vehicles transporting equipment, material, and personnel. The trips will

include the delivery of abnormal and oversized components such as rotor blades, tower sections, transformers, and generators.

A construction period of 24 months is anticipated for developing the proposed development. The construction activities and duration will vary according to the construction schedule.

The two most significant activities, that impact traffic volumes during the construction phase, are:

- *The commuting of personnel, to and from the proposed development; and*
- *The delivery of equipment and material to the proposed development.*

The simultaneous occurrence of these two activities is improbable.

The commuting of personnel to and from the proposed development are two different activities, one occurring at the beginning of the working day (constituting the morning peak) and the other occurring at the end of the working day (constituting the afternoon peak). These activities contribute to Peak Traffic. Traffic movement statistics have shown a noticeable difference between morning and afternoon traffic peaks. Although the same number of trips are generated during these peaks, the morning peak is more concentrated, and the afternoon peak is spread over a longer period. Thus, for analysis purposes, the morning traffic shall be adopted for both morning and afternoon peaks to demonstrate a worst-case scenario.

The delivery of equipment and materials to the proposed development is envisaged to occur during normal working hours throughout the day. No night deliveries are anticipated and are strongly discouraged. Given the distance from the origin of the material and components and the development, it is assumed that most deliveries will only start arriving at the proposed development an hour or two after work on site commences and will stop an hour or two before work on site concludes for the day. These activities contribute to Diurnal Traffic.

The envisaged timeframes for these activities, as adopted in this document, are:

- *Morning Peak Traffic - between 6:30 to 7:30;*
- *Diurnal Traffic - between 7:30 to 16:30;*
- *Afternoon Peak Traffic - between 16:30 to 17:30.*

7.3.1 Peak Traffic

It has been estimated that a total workforce complement of approximately 300 personnel will be required during the peak construction for the proposed development. Since no accommodation is provided on-site, the personnel will have to be accommodated in the surrounding towns and commute to the proposed development. As identified in section 6.3.1, all the personnel on the proposed development will be drawn from surrounding towns.

Based on the project specification for each of the proposed development, the anticipated breakdown of the site personnel is as follows:

- *Senior Staff, consisting of Construction managers, supervisors, and other key staff, constitute 10% of the site personnel, equating to approximately 30 persons. It is assumed that senior staff will reside within the community and will commute to the site, using double cab bakkies. A fleet of 10 vehicles is envisaged.*

- *The workforce, consisting of semi-skilled and unskilled workers, will constitute 90% of the site personnel, equating to 270 persons. It is assumed that the workforce will reside within the community and will commute to the site using approximately 11 various-size buses.*

It is assumed that the transport vehicles will remain on-site during the workday.

The maximum traffic volumes on the road network during the Peak Traffic of the proposed development is depicted in Table 7.

Table 7 - Construction Phase - Peak Traffic

Road	Number of Vehicles
TR 01606/1 – TR 01606/4	16 vph
TR 01607/1	22 vph
TR 01607/2 – TR 01607/6	9 vph
DR 02329/1	31 vph
Access Point A and B	31 vph

Based on the information provided above, the maximum number of vehicles on any one section of the public road network during the Peak Traffic is in the order of 31 vph, on the DR 02329/1.

7.3.2 Diurnal Traffic

The construction phase of the proposed development consists of several activities, and some occur sequentially while others occur concurrently. Thus, not all the traffic volumes estimated in this document for the various activities are cumulative.

The envisaged construction phase activities, which will increase the traffic volumes include, inter alia:

- *Site establishment: the initial activity of the development, the increase in traffic volumes resulting from this activity is not cumulative;*
- *Delivery of material and equipment to site: the traffic volumes resulting from these activities are cumulative and include the delivery of;*
  - *gravel for the construction of the roads, terraces, battery storage facility and substation platforms;*
  - *raw material (i.e. cement, sand, stone) for batching of concrete;*
  - *construction material (i.e. scaffolding, formwork, reinforcing steel, brick, roof sheeting, fencing, etc.);*
  - *construction vehicles and equipment (i.e. earthmoving equipment, batching plant, etc.)*
  - *substation components (i.e. steel gantries, transformers, switchgear, cables, circuit breakers, surge arresters, lightning conductor masts, etc.)*
  - *components for the battery storage facility (i.e. containers and equipment such as Lithium-ion batteries, inverters, transformers, HVAC equipment, switchgear, etc.)*
- *Delivery of the WTG components are cumulative (i.e. tower sections, blades, nacelle, gearbox, generator, nose cone, hub, etc.). Due to the physical characteristics of most of these components, they will be transported as abnormal loads.*

Transportation of equipment and material to the proposed development is assumed to use Access Point C from the TR 01607 via Victoria West. However, depending on the commercial source of the raw materials this could be supplied from the TR 01606 via Carnarvon.

The traffic volumes generated by the proposed development through the various construction activities are delineated below.

Construction Equipment and Materials

Once the site has been established, the delivery of construction equipment and materials will commence. Equipment, such as tools, machinery, scaffolding, formwork, etc., will be delivered to the proposed development at the commencement of the construction and will be gradually removed from the proposed development as construction draws to an end. Materials, such as reinforcing steel, brick, roof sheeting, fencing, transformers, switchgear, cables, etc., will be delivered to the proposed development as an ongoing activity. These deliveries will start increasing during the early stages of the construction phase, ramping up to maximum deliveries, before tapering off again close to the end of the construction phase

Various types of vehicles will be used to deliver the construction equipment and materials to the site. The increase in traffic volume for this activity is conservatively estimated to be in the order of eight return trips per day, which equates to approximately 2 vph.

Due to the origin of the vehicles delivering the construction equipment and material, the most likely route for the majority of these deliveries to the proposed development will be on the TR 01607 via Victoria West, although there is a slight chance that deliveries could use the TR 01606 via Carnarvon.

Earthworks

The construction of the sub-station platforms, battery storage area, roads and hardstand platforms adjacent to the WTG units will be constructed from suitable gravels. To minimise the unnecessary importing of suitable material, cut and fill operations shall be adopted as far as possible for these elements. It is envisaged that material excavated from the WTG foundations will also be used to augment any potential shortfall of material required for the earthworks.

However, provision has been made to source approximately 150 000 m^3 of suitable material from commercial quarries outside the study area. The gravel is assumed to be delivered to the proposed development in 20 m^3 articulated rear tippers, over a period of 18 months. The increase in traffic volume for this activity is estimated to be in the order of 21 return trips per day, which equates to 5.25 vph.

Due to the origin of the vehicles delivering the construction equipment and material, the most likely route for the majority of these deliveries to the proposed development will be on the TR 01607 via Victoria West, although there is a slight chance that deliveries could use the TR 01606 via Carnarvon.

Raw Material – Concrete

It is estimated that approximately 92 000 m^3 of concrete will be mixed and placed on the proposed development, over a period of 18 months. The majority will be for the WTG foundations and the balance for the sub-stations and battery storage facilities.

The raw material for the concrete is to be delivered for each of the proposed development from commercial sources and includes 32 000 tonnes of cement, 55 000 m^3 of sand, and 64 000 m^3 of stone.

The cement is assumed to be delivered to the proposed development using pneumatic bulkers, with a 40 m^3 tridem semi (payload 32 000 kg) and 15 m^3 pup (payload of 10 000 kg).

The aggregate is assumed to be delivered to the proposed development in 20 m^3 articulated rear tippers.

The increase in traffic volume resulting from this activity is estimated to be in the order of 14 return trips per day. Over an eight-hour day, this equates to 3.5 vph.

Due to the origin of the vehicles delivering the construction equipment and material, the most likely route for majority of these deliveries to the proposed development will be on the TR 01607 via Victoria West, although there is a slight chance that deliveries could use the TR 01606 via Carnarvon.

WTG Components

The type and number of WTG components to be transported to the proposed development for each WTG are listed in Table 8.

Table 8 - Components per Wind Turbine

Components	Size	Weight	Number
Nacelle	13 × 4.3 × 4 m	± 120 000 kg	1
Blades	90 m (length)	± 25 000 kg	3
Tower Section (Steel)	4.2 m Ø × 30 m (length)	± 51 500 kg	5
Hub/Nose Cone	20' ICC Container	± 40 000 kg	1
Cables	40' IAA Container	max 32 500 kg	1
Generator	40' IAA Container	max 32 500 kg	1
Foundation Insert	4.7 m Ø × 2.5 m (length)	± 27 500 kg	1
Sundries	40' IAA Container	max 32 500 kg	1

The information provided in Table 8, is based on steel tower section. The number of tower sections could increase in concrete tower sections are used.

Approximately 14 components are to be transported to the proposed development for each WTG to be installed. Of these 14 components, only nine are considered abnormal loads, and the rest are deemed normal loads. It must be noted that this information is generic as the details of the WTG components will only be available once the supplier has been appointed.

Based on the information provided in Table 1, 38 WTG are to be installed on the proposed development over a period of 24 months. The increase in traffic volume resulting from this activity is estimated to be in the order of less than three return trips per day. Over an eight-hour day, this equates to just over 0.5 vph.

Due to the origin of the vehicles delivering the construction equipment and material, the most likely route for majority of these deliveries to the proposed development will be on the TR 01607 via Victoria West.

Battery Energy Storage System

A Battery Energy Storage System (BESS) is to be constructed as part of the proposed development. The facility takes excess power generated by the wind farm, converts and stores it in batteries. The BESS technology may be either Lithium Ion or Redox

Flow, as a worst-case in terms of deliveries, Lithium-Ion has been assumed. In this case, the BESS consists mainly of purpose-made steel containers, in which the batteries are stored and managed, together with inverters and transformers.

Since very little information is available regarding the number of trips generated for installing this equipment, the number of trips is based on how many containers can fit in the allocated area, considering fire and access requirements. Approximately 2 700 trips will be required over a period of five months. The increase in traffic volume resulting from this activity is estimated to be in the order of 27 return trips per day. Over an eight-hour day, this equates to approximately 7 vph.

Due to the origin of the vehicles delivering the construction equipment and material, the most likely route for the majority of these deliveries to the proposed development will be on the TR 01607 via Victoria West.

Concrete

Due to the location of the WEF on the proposed development, concrete truck will have to cross the DR 02329 when casting the WTG foundation, which will result in the interactions with public road users. This will need to be verified design phase of the project.

Summary

Based on the above information, a summary of the expected Diurnal Traffic on the various roads for the proposed development are provided in Table 9.

Table 9 - Construction Phase - Diurnal Traffic

Road	Number of Vehicles
TR 01606/1 - TR 01606/4	9 vph
TR 01607/1	9 vph
TR 01607/2 - TR 01607/6	20 vph
TR 01608/1 - TR 01608/3	20 vph
DR 02329/1 & Road C1	20 vph
N1 & N12	20 vph

Table 9, excludes the movement of concrete delivery trucks on the public road network during the casting of the WTG foundations.

An argument could be made that all earthwork activities would be complete by the time the BESS is installed. However, as a worst-case scenario, it shall be assumed that these activities occur concurrently.

The information provided above is an informed estimate. Construction-related traffic may vary and be different from the information provided above due to the availability of contractors' resources and schedules.

7.4 OPERATIONAL PHASE

The operational life of the proposed development is expected to be approximately 20 years. The proposed development will operate but not manned) on a 24-hour basis, except when there is a mechanical breakdown, extreme weather conditions or maintenance activities. Wind turbines will be subject to regular maintenance and inspection (i.e. routine servicing) to ensure the optimum performance of the turbine components.

The only on-site activities related to the development will be monitoring, routine servicing and unscheduled maintenance of the WTG units.

7.4.1 Peak Traffic

It is envisaged that the proposed development is maintained and operated by a team of approximately 40 personnel.

Thus, the envisaged peak traffic volumes on the various public roads for the proposed development are depicted in Table 10.

Table 10 - Operational Phase - Peak Traffic

Road	Number of Vehicles
TR 01606/1 - TR 01606/4	2 vph
TR 01607/1	3 vph
TR 01607/2 - TR 01607/6	2 vph
TR 05801/1	1 vph
DR 02329/1	5 vph
Access Point A and B	5 vph

Peak traffic is generated by commuting personnel to and from the proposed development in the morning and afternoon. The maximum number of additional vehicles on the public road network in any given hour is not expected to exceed five.

7.4.2 Diurnal Traffic

Diurnal Traffic on the public roads resulting from the proposed development is limited to deliveries and servicing, and the occasion visitors to the proposed development.

All traffic involved with the servicing of the proposed development is assumed to originate from Carnarvon, at a rate of one return vehicle per day, which equates to 0.25 vph. All deliveries and visitors to the proposed development are assumed to originate from Victoria West, at a rate on one return vehicle per day, which equates to 0.25 vph.

None of the daily activities conducted by the operational personnel on the proposed development will need to access the public road network as the proposed development is set-back from the public road network.

Based on the information provided above, of the public road network (not necessary in the same direction) would not be more than two.

Thus, the envisaged traffic volumes on the various sections of the public road network during the operational phase for the proposed development, is detailed in Table 11.

Table 11 - Operational Phase - Diurnal Traffic

Road	Number of Vehicles/Hour
TR 01606/1 - TR 01606/3	0.25 vph
TR 01607/1 - TR 01607/6	0.25 vph
DR 02329/1	0.50 vph
Access Points A and B	0.50 vph

Based on the information provided above, the maximum number of vehicles on the road network contributing to the Diurnal Traffic is in the order of 0.50 vph, which equates to two return trips per day.

7.5 DECOMMISSIONING PHASE

At the end of the operational phase, the development may be decommissioned, or its continued economic viability may be investigated. If the development is still deemed economically viable, the development could be re-engineered, and the operational life may be extended. If the development is not financially viable, then the development shall be decommissioned. The components will be disassembled, reused, recycled or disposed of in accordance with the relevant regulatory requirements. The turbines may also be traded or sold as there is an active second-hand market for wind turbines, or they may be used as scrap metal. The decommissioning procedures will be undertaken in line with an Environmental Management Plan, and the site will be rehabilitated and returned to its pre-construction state.

The decommissioning phase of the development is expected to create skilled and unskilled employment opportunities. The traffic impacts on the public roads during the decommissioning phase of the site will be significantly less than the traffic impact determined during the construction phase, as much of the internal infrastructures (ie roads, buildings, etc.) will be retained by the landowners.

As part of the decommissioning process, a separate traffic impact assessment should be undertaken since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development. Thus, a specific decommissioning assessment has not been undertaken at this stage.

8 ASSESSMENT OF IMPACTS

As described in section 6.2, the proposed development is accessed from either the TR 01606 via Access Point A or the DR 02329 via Access Point B.

It is envisaged that most of the deliveries from the commercial centres in South Africa will be via Victoria West from either the NR 001 or NR 012. It is possible that smaller deliveries of sand and stone could be delivered via Carnarvon, depending on the source of the material.

8.1 CONSTRUCTION PHASE

The duration of the active construction phase is estimated to be in the order of 24 months. During the construction phase, traffic will be generated through two distinct sources:

- *The commuter traffic, getting personnel to and from the proposed development (Peak Traffic); and*
- *The freight traffic, the delivery of materials and equipment to the proposed development (Diurnal Traffic).*

It is envisaged that the transportation of the site personnel will result in Peak Traffic, while the delivery of equipment and materials to the site will be distributed throughout the day.

The traffic volumes generated, for both Peak Traffic and Diurnal Traffic, resulting from the proposed development has been addressed in Section 7. Thus, the expected increase in the traffic volumes on the road network during the peak construction phase of the proposed development is summarised in Table 12.

Table 12 - Construction Phase - Traffic Volumes

Roads	Day (divided into three-time frames)					
	06:30	Morning Peak Traffic (vph)	07:30	Diurnal Traffic (vph)	16:30	Afternoon Peak Traffic (vph)	17:30
TR 01606/1	16 vph		9 vph		16 vph	
TR 01606/2	16 vph		9 vph		16 vph	
TR 01606/3	16 vph		9 vph		16 vph	
TR 01606/4	16 vph		20 vph		16 vph	
TR 01607/1	22 vph		20 vph		22 vph	
TR 01607/2	9 vph		20 vph		9 vph	
TR 01607/3	9 vph		20 vph		9 vph	
TR 01607/4	9 vph		20 vph		9 vph	
TR 01607/5	9 vph		20 vph		9 vph	
TR 01607/6	9 vph		20 vph		9 vph	
A	31 vph		20 vph		31 vph	
B	31 vph		20 vph		31 vph	
DR 02329/1	31 vph		20 vph		31 vph	
TR 05801/1	6 vph		0 vph		6 vph	
N1	0 vph		20 vph		0 vph	
N12	0 vph		20 vph		0 vph	

Based on the information provided in the table above, no traffic volumes are increased by more than 50 trips per hour, for the proposed development. Thus negating the requirement for a TIA as specified in section 2.6 of the "South African Traffic Impact and Site Traffic Assessment Manual", which reads as follows; "A Traffic Impact Assessment shall be undertaken and submitted when an application is made for a change in land use and when the highest total additional hourly vehicular trip generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour".

Traffic volume generated during the peak construction phase of the proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 31.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 20. Which equates to approximately 160 trips per day.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 13.

Table 13 - Construction Phase - Traffic Assessment

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606/1	137 vpd	(32+72) = 104 vpd	241 vpd
TR 01606/2	117 vpd	(32+72) = 104 vpd	221 vpd
TR 01606/3	117 vpd	(32+72) = 104 vpd	221 vpd
TR 01606/4	117 vpd	(32+160) = 192 vpd	309 vpd
TR 01607/1	130 vpd	(44+160) = 204 vpd	334 vpd
TR 01607/2	120 vpd	(18+160) = 178 vpd	298 vpd
TR 01607/3	120 vpd	(18+160) = 178 vpd	298 vpd
TR 01607/4	120 vpd	(18+160) = 178 vpd	298 vpd
TR 01607/5	157 vpd	(18+160) = 178 vpd	335 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01607/6	341 vpd	(18+160) = 178 vpd	519 vpd
TR 01608/1	284 vpd	(0+160) = 160 vpd	444 vpd
TR 01608/2	177 vpd	(0+160) = 160 vpd	337 vpd
TR 01608/3	143 vpd	(0+160) = 160 vpd	303 vpd
TR 01609/1	183 vpd	(0+160) = 160 vpd	343 vpd
A	0 vpd	(62+160) = 222 vpd	222 vpd
B	0 vpd	(62+160) = 222 vpd	222 vpd
DR 02329/1	8 vpd	(62+160) = 222 vpd	230 vpd
TR 05801/1	79 vpd	(12+0) = 12 vpd	91 vpd
N1	3600 vpd	(0+160) = 160 vpd	3760 vpd
N12	1600 vpd	(0+160) = 160 vpd	1760 vpd

** The first value represents the Peak Traffic and the second value represents the Diurnal Traffic

The most significant expected Peak Traffic increase is on the DR 02329/1, which increases the Baseline ADT by 62 vpd. Based on a speed of 80 km/h, the traffic volume will result in a Following Density of 0.388 v/km, equating to a LOS A.

The most significant expected Diurnal Traffic of 160 vpd equates to a traffic volume of approximately 20 vph, in both directions, based on a speed of 80 km/h, the traffic volume will result in a Following Density of 0.525 v/km, equating to a LOS A.

The additional traffic volumes on the road network, does not compromise the level of service for these roads. Thus, even when the additional worst-case traffic volumes are applied, the road network is deemed acceptable.

Concrete Transportation

Due to the proposed location of the WEF, concrete truck will have to cross the DR 02329 which will result in the interactions with public road users when casting the WTG foundation. This will need to be verified during the final design phase of the project.

8.2 OPERATIONAL PHASE

The duration of the operational phase of the proposed development is estimated to be in the order of 20 years. During this phase, traffic will be generated through two distinct sources:

- *The commuter traffic, getting personnel to and from the proposed development (Peak Traffic); and*
- *The servicing, delivery of goods and the occasional visitor to the proposed development (Diurnal Traffic).*

It is envisaged that the transportation of the site personnel will result in Peak Traffic, while servicing, delivery of goods and visitors to the proposed development will be distributed throughout the day.

The traffic volumes generated, for both Peak Traffic and Diurnal Traffic, resulting from the proposed development operational phases, have been addressed in Section 7. Thus, the expected increase in the traffic volumes on the various roads during the operational phase of the proposed development are summarised in Table 14.

Table 14 - Operational Phase - Traffic Volumes

Roads	Day (divided into three-time frames)					
	06:30	Morning Peak Traffic (vph)	07:30	Diurnal Traffic (vph)	16:30	Afternoon Peak Traffic (vph)	17:30
TR 01606/1	2 vph		0.25 vph		2 vph	
TR 01606/2	2 vph		0.25 vph		2 vph	
TR 01606/3	2 vph		0.25 vph		2 vph	
TR 01606/4	2 vph		0.25 vph		2 vph	
TR 01607/1	3 vph		0.25 vph		3 vph	
TR 01607/2	2 vph		0.25 vph		2 vph	
TR 01607/3	2 vph		0.25 vph		2 vph	
TR 01607/4	2 vph		0.25 vph		2 vph	
TR 01607/5	2 vph		0.25 vph		2 vph	
TR 01607/6	2 vph		0.25 vph		2 vph	
A	5 vph		0.25 vph		5 vph	
B	5 vph		0.25 vph		5 vph	
DR 02329/1	5 vph		0.50 vph		5 vph	
TR 05801/1	1 vph		0.00 vph		1 vph	

Based on the information provided in the table above, no traffic volumes are increased by more than 50 trips an hour, for the proposed development. Thus negating the requirement for a TIA as specified in section 2.6 of the "South African Traffic Impact and Site Traffic Assessment Manual", which reads as follows; "A Traffic Impact Assessment shall be undertaken and submitted when an application is made for a change in land use and when the highest total additional hourly vehicular trip generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour".

Traffic volume generated during the operational phase of the proposed development are as follows:

- *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 5.*
- *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 0.50. Which equates to approximately 4 trips per day.*

The ADT generated during the operational phase of the proposed development on the public road network, expressed as an "Increased ADT", are shown in Table 15.

Table 15 - Operational Phase - Traffic Assessment

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606/1	137 vpd	(4+2) = 6 vpd	143 vpd
TR 01606/2	117 vpd	(4+2) = 6 vpd	123 vpd
TR 01606/3	117 vpd	(4+2) = 6 vpd	123 vpd
TR 01606/4	117 vpd	(4+2) = 6 vpd	123 vpd
TR 01607/1	130 vpd	(6+2) = 8 vpd	138 vpd
TR 01607/2	120 vpd	(4+2) = 6 vpd	126 vpd
TR 01607/3	120 vpd	(4+2) = 6 vpd	126 vpd
TR 01607/4	120 vpd	(4+2) = 6 vpd	126 vpd
TR 01607/5	157 vpd	(4+2) = 6 vpd	163 vpd
TR 01607/6	341 vpd	(4+2) = 6 vpd	347 vpd
A	0 vpd	(10+2) = 12 vpd	12 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
B	0 vpd	(10+2) = 12 vpd	12 vpd
DR 02329/1	8 vpd	(10+2) = 12 vpd	20 vpd
TR 05801/1	79 vpd	(2+0) = 2 vpd	81 vpd

** The first value represents the Peak Traffic and the second value represents the Diurnal Traffic

The most significant expected increase for both the Peak Traffic and Diurnal Traffic is on DR 02329/1. The Peak Traffic is expected to increase by 10 vpd, while the Diurnal Traffic is expected to increase by 2 vpd.

The additional traffic volumes on the road network, does not compromise the level of service for these roads. Thus, even when the additional worst-case traffic volumes are applied, the traffic density of the road network is deemed acceptable.

8.3 DECOMMISSIONING PHASE

As described in Section 7.4 above, a separate traffic impact assessment should be undertaken as part of the decommissioning process since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development. Thus, no traffic assessment for the decommissioning phase has been undertaken in this report.

9 ASSESSMENT OF CUMULATIVE IMPACTS

The assessment of the cumulative increased in traffic volumes on the road network within the study area during the proposed development's construction, operational and decommissioning phases are delineated below.

The extent of the known renewable energy projects earmarked within a 30 km radius of the proposed development has been defined in Section 6.4.

Besides for Loxton WEF 2 and Loxton WEF 3, there are several other renewable energy projects earmarked for development adjacent to the proposed development. These include the Hoogland WEF (Northern Cluster), Taaibos WEF Cluster, and Soutriver WEF Cluster.

The Hoogland WEF Northern Cluster comprises of two WEF, these are the Hoogland WEF 1 and Hoogland WEF 2, each WEF consisting of up to 60 WTG.

The Soutriver WEF Cluster comprises of three separate WEF, these are; Soutriver North WEF, Soutriver Central WEF and Soutriver South WEF, the number of WTG of each WEF are 31, 32 and 35 respectively. The Taaibos WEF Cluster comprises of two separate WEF, these are Taaibos North WEF and Taaibos South WEF, the number of WTG of each WEF are 40 and 36 respectively.

Each WEF on both Soutriver and Taaibos will include a Battery Energy Storage System (BESS), temporary and permanent laydown areas, an IPP Substation (SS), a Concrete Tower Manufacturing Facility (CTMF), access roads and a construction compound (CC) area. The temporary laydown areas, CTMF and CC areas will be converted to the BESS facility post-construction phase. Thus, significantly reducing the number of vehicles on the road network during the morning and afternoon peaks.

9.1 CONSTRUCTION PHASE

The cumulative traffic volumes on the public road network within the study area, for Peak and Diurnal traffic is delineated below.

Peak Traffic

The cumulative Peak Traffic volumes on the public road network within the study area is based on the simultaneous construction of the following:

- *All three Loxton WEF and associated Grid Connections; and*
- *Hoogland WEF (Northern Cluster) and associated Grid Connections,*

Resulting in a combined workforce complement of approximately 1 800 individuals.

It should be noted that personnel working at Hoogland WEF (Northern Cluster) is expected to commute to the development from Carnarvon and Victoria West, using the TR 01606 and TR 01607, respectively.

Since the proposed developments of Soutriver and Taaibos plan to provide on-site accommodation to the employees, these developments are not expected to contribute to Peak Traffic volumes.

Diurnal Traffic

The cumulative Diurnal Traffic volumes on the public road network within the study area is based on the simultaneous construction of the following:

- *All three Loxton WEF and associated Grid Connections;*
- *Hoogland WEF (Northern Cluster) and associated Grid Connections;*
- *Soutriver WEF Cluster; and*
- *Taaibos WEF Cluster.*

The proposed delivery route to Hoogland WEF (Northern Cluster) is expected to be via Loxton, on the TR 01607.

Due to the location of Soutriver WEF and Taaibos WEF, the most likely route for deliveries will be from either the DR 02320 and / or DR 02324, thus not using the same road network as the Hoogland WEF (Northern Cluster) and Loxton WEF.

Summary

Thus, the expected Peak and Diurnal cumulative traffic volumes on the public road network during the construction phase of the Hoogland WEF (Northern Cluster) and Loxton WEF, are provided in Table 16.

Table 16 - Cumulative Constructional Phase - Traffic Volume

Roads	Day (divided into three-time frames)					
	06:30	Morning Peak Traffic (vph)	07:30	Diurnal Traffic (vph)	16:30	Afternoon Peak Traffic (vph)	17:30
TR 01606/1	42 vph		17 vph		42 vph	
TR 01606/2	42 vph		17 vph		42 vph	
TR 01606/3	42 vph		17 vph		42 vph	
TR 01606/4	44 vph		34 vph		44 vph	
TR 01607/1	46 vph		60 vph		46 vph	
TR 01607/2	35 vph		61 vph		35 vph	
TR 01607/3	35 vph		61 vph		35 vph	
TR 01607/4	35 vph		61 vph		35 vph	
TR 01607/5	35 vph		61 vph		35 vph	

Roads	Day (divided into three-time frames)					
	06:30	Morning Peak Traffic (vph)	07:30	Diurnal Traffic (vph)	16:30	Afternoon Peak Traffic (vph)	17:30
TR 01607/6	35 vph		61 vph		35 vph	
TR 01608/1	5 vph		41 vph		5 vph	
TR 01608/2	5 vph		41 vph		5 vph	
TR 01608/3	4 vph		41 vph		4 vph	
A	51 vph		30 vph		51 vph	
B	31 vph		20 vph		31 vph	
C	20 vph		10 vph		20 vph	
DR 02324/1	20 vph		10 vph		20 vph	
DR 02329/1	35 vph		20 vph		35 vph	
TR 05801/1	46 vph		30 vph		46 vph	
TR 05801/2	44 vph		30 vph		44 vph	
N1	0 vph		62 vph		0 vph	
N12	0 vph		62 vph		0 vph	

Based on the information provided in the table above, there are several roads on which the traffic volume is increased by more than 50 trips an hour, thus necessitating the requirement for a TIA as specified in section 2.6 of the "South African Traffic Impact and Site Traffic Assessment Manual", which reads as follows; "A Traffic Impact Assessment shall be undertaken and submitted when an application is made for a change in land use and when the highest total additional hourly vehicular trips generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour".

The maximum cumulative traffic volumes generated on the various roads during the construction phase of the proposed Loxton Wind Energy Facilities are in the order of:

- *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 51.*
- *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 62. Which equates to approximately 496 trips per day.*

The assessment of the cumulative traffic impact generated during the peak construction phase expressed as an "Increased ADT" is provided in Table 17.

Table 17 - Cumulative Constructional Phase - Traffic Assessment

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606/1	137 vpd	(84+136) = 220 vpd	357 vpd
TR 01606/2	117 vpd	(84+136) = 220 vpd	337 vpd
TR 01606/3	117 vpd	(84+136) = 220 vpd	337 vpd
TR 01606/4	117 vpd	(88+272) = 360 vpd	477 vpd
TR 01607/1	130 vpd	(92+482) = 574 vpd	704 vpd
TR 01607/2	120 vpd	(70+484) = 554 vpd	674 vpd
TR 01607/3	120 vpd	(70+484) = 554 vpd	674 vpd
TR 01607/4	120 vpd	(70+484) = 554 vpd	674 vpd
TR 01607/5	157 vpd	(70+484) = 554 vpd	711 vpd
TR 01607/6	341 vpd	(70+484) = 554 vpd	895 vpd
TR 01608/1	284 vpd	(10+330) = 340 vpd	624 vpd
TR 01608/2	177 vpd	(10+330) = 340 vpd	517 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01608/3	143 vpd	(8+328) = 336 vpd	479 vpd
A		(102+240) = 342 vpd	342 vpd
B		(62+160) = 222 vpd	222 vpd
C		(40+80) = 120 vpd	120 vpd
DR 02324/1	3 vpd	(40+80) = 120 vpd	123 vpd
DR 02329/1	8 vpd	(70+162) = 232 vpd	240 vpd
TR 05801/1	79 vpd	(92+242) = 334 vpd	413 vpd
TR 05801/2	89 vpd	(88+242) = 330 vpd	419 vpd
N1	3600 vpd	(0+492) = 492 vpd	4092 vpd
N12	1600 vpd	(0+492) = 492 vpd	2092 vpd

** The first value represents the Peak Traffic and the second value represents the Diurnal Traffic

The maximum expected increase in Peak Traffic is on TR 01607/2, with an expected 46 vph. Based on a speed of 100 km/h, the traffic volume will result in a Following Density of 0.46 v/km, equating to a LOS A.

The maximum expected increase in Diurnal Traffic is on various sections of the TR 01607, with an expected 484 vpd, which equates to approximately 61 vph, in both directions. Based on a speed of 100 km/h, the traffic volume will result in a Following Density of 0.31 v/km, equating to a LOS A.

9.2 OPERATIONAL PHASE

The Peak and Diurnal cumulative traffic volumes on the road network related to the operational phase of the proposed Loxton WEF and Hoogland WEF (Northern Cluster) is provided in Table 18.

Table 18 - Cumulative Operational Phase - Traffic Volumes

Roads	Day (divided into three-time frames)					
	06:30	Morning Peak Traffic (vph)	07:30	Diurnal Traffic (vph)	16:30	Afternoon Peak Traffic (vph)	17:30
TR 01606/1	10 vph		0.75 vph		10 vph	
TR 01606/2	10 vph		0.75 vph		10 vph	
TR 01606/3	10 vph		0.75 vph		10 vph	
TR 01606/4	11 vph		0.75 vph		11 vph	
TR 01607/1	11 vph		1.00 vph		11 vph	
TR 01607/2	10 vph		1.00 vph		10 vph	
TR 01607/3	10 vph		1.00 vph		10 vph	
TR 01607/4	10 vph		1.00 vph		10 vph	
TR 01607/5	10 vph		1.00 vph		10 vph	
TR 01607/6	10 vph		1.00 vph		10 vph	
A	10 vph		0.50 vph		10 vph	
B	5 vph		0.25 vph		5 vph	
C	5 vph		0.25 vph		5 vph	
DR 02324/1	5 vph		0.25 vph		5 vph	
DR 02329/1	5 vph		0.25 vph		5 vph	
TR 05801/1	14 vph		0.50 vph		14 vph	
TR 05801/2	13 vph		0.50 vph		13 vph	

Based on the information provided in the table above, there are no traffic volumes that are increased by more than 50 trips an hour, thus negating the requirement for a TIA as specified in section 2.6 of the "South African Traffic Impact and Site Traffic Assessment Manual", "A Traffic Impact Assessment shall be undertaken and

submitted when an application is made for a change in land use and when the highest total additional hourly vehicular trip generation (including pass-by and diverted trips) as a result of the application exceeds 50 trips per hour".

The cumulative traffic volumes generated on the road network within the study area during the combined operational phase of the three Loxton Wind Energy Facilities are in the order of:

- *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 14;*
- *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 1.00. Which equates to approximately 8 trips per day.*

The assessment of the cumulative traffic impact generated during the operational phase expressed as an "Increased ADT" is provided in Table 19.

Table 19 - Cumulative Operational Phase - Traffic Assessment

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606/1	137 vpd	(20+6) = 26 vpd	163 vpd
TR 01606/2	117 vpd	(20+6) = 26 vpd	143 vpd
TR 01606/3	117 vpd	(20+6) = 26 vpd	143 vpd
TR 01606/4	117 vpd	(22+6) = 28 vpd	145 vpd
TR 01607/1	130 vpd	(22+8) = 30 vpd	160 vpd
TR 01607/2	120 vpd	(20+8) = 28 vpd	148 vpd
TR 01607/3	120 vpd	(20+8) = 28 vpd	148 vpd
TR 01607/4	120 vpd	(20+8) = 28 vpd	148 vpd
TR 01607/5	157 vpd	(20+8) = 28 vpd	185 vpd
TR 01607/6	341 vpd	(20+8) = 28 vpd	369 vpd
A		(20+4) = 24 vpd	24 vpd
B		(10+2) = 12 vpd	12 vpd
C		(10+2) = 12 vpd	12 vpd
DR 02324/1	3 vpd	(10+2) = 12 vpd	15 vpd
DR 02329/1	8 vpd	(10+2) = 12 vpd	20 vpd
TR 05801/1	79 vpd	(28+4) = 32 vpd	111 vpd
TR 05801/2	89 vpd	(26+4) = 30 vpd	119 vpd

** *The first value represents the Peak Traffic and the second value represents the Diurnal Traffic*

The maximum expected increase in Peak Traffic is on TR 01606/4 and TR 01607/1, with an expected 11 vph, in one direction. Based on a speed of 100 km/h, the traffic volume will result in a Following Density of 0.11 v/km, equating to a LOS A.

The maximum expected increase in Diurnal Traffic on various sections of the TR 01607, and is not expected to exceed 8 vpd. Based on a speed of 100 km/h, the traffic volume will result in a Following Density is less than 0.04 v/km, equating to a LOS A.

9.3 DECOMMISSIONING PHASE

As described in Section 7.4 above, a separate traffic impact assessment should be undertaken as part of the decommissioning process since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the proposed

development. Thus, no cumulative traffic assessment for the decommissioning phase has been undertaken in this report.

10 RISKS AND IMPACTS

Developments within an established environment can cause a significant impact on the road network, mainly when new development is introduced into the environment, which leads to an increase in traffic on the existing public roads. The traffic volume will vary depending on the phase of the development. More traffic is envisaged during the construction and decommissioning phases of the proposed development, while traffic volumes during the operational phase of the proposed development is deemed insignificant.

With the increase of traffic on the roads comes the potential increase in incidents. The incidents could vary from minor damage to the vehicle due to the road conditions to fatal collisions with other vehicles, pedestrians or even animals.

Traffic safety is directly related to the attitude of the drivers using the roads. The road condition will dictate the safe speed limit a responsible driver will travel. However, not all road users are responsible, resulting in frustrated drivers taking unnecessary chances, many of which involve excessive speeding.

Thus, to improve traffic safety on the roads, it is strongly suggested that all key personnel, including mini-bus and bus drivers, be provided with advanced driver training.

10.1 RISKS

The existing road network has numerous intrinsic risks, which could be exacerbated by the traffic generated due to the development. The most pertinent risks are briefly discussed below and need to be considered by the Project Developer during the various phases of the proposed development.

10.1.1 Traffic Volumes

The traffic volumes on the road network will be significantly more during the construction phase than expected during the operational phase of the proposed development.

During the construction phase of the proposed development, a significant increase in traffic is anticipated during the morning and afternoon peaks. The diurnal traffic related to the proposed development is less significant as it is spread over the entire day.

During the operational phase of the development, there will be a nominal increase in traffic on the local road network. The increase in traffic volumes will be limited to peak traffic with negligible diurnal traffic generated.

The increased traffic volumes will increase the potential of incidents on the roads within the study area, specifically at intersections and through urban areas.

A Traffic Management Plan will need to be compiled to identify and manage mitigation measures for the construction phase of the proposed development, refer to Section 11 for more detail.

10.1.2 Road Condition

The majority of the roads in the study area are paved, and the access roads are all gravel, and the structure varies from wide, well-maintained gravel roads to narrow, poorly maintained gravel paths.

During the construction phase of the proposed developments, there will be an increase in the traffic volumes on the local road network. The increased traffic volumes will place an additional burden on the roads within the study area.

Mitigation of this impact is regular maintenance of the roads by the local Northern Cape roads' authorities. However, it is unlikely that the local authorities will undertake the necessary road maintenance due to budget constraints. As is standard practice and customarily enforced as part of the planning approval for the development, the Project Developer undertakes to contribute towards or conducts regular maintenance of the roads network used by the Project Developer.

However, maintenance of the internal road network on the individual developments is the responsibility of the Project Developers contractor.

10.1.3 Reduced Visibility

Numerous natural phenomena could compromise the road user's visibility, thus increasing the road network's potential for accidents. These include inter alia:

- *Sun glare: When driving on the road into the sun, there is a high probability of being blinded by the sun, not being able to observe activities along the road and intersections, which could result in an incident;*
- *Inclement weather: Visibility is the primary concern when driving in inclement weather. Reduced visibility resulting from either the rain itself or from the spray of the vehicles travelling on the road. Skidding and aquaplaning resulting from water on the road surface is a probable risk;*
- *Dust: The generation of dust when travelling on unpaved roads is inevitable. The larger the vehicle, the more dust is generated. This dust hinders the drivers wishing to over-take with a clear view for over-taking, resulting in drivers taking unnecessary chances, which often result in unfavourable consequences.*

Mitigation measures to consider include

- *Dust suppression system,*
- *Compile a Transport Management Plan, sections of which to be part of induction training for all personnel travelling to the development during the construction phase.*

10.1.4 Pedestrians and Animals

The development is to be constructed in a rural area, including mountainous terrain. Large portions of the area are undeveloped and are home to various species of antelope.

Many roads pass through homesteads on routes to the proposed development, which is a concern. Drivers need to be aware of the importance of reducing speed when approaching and passing through these establishments.

Stray livestock, wild animals and pedestrians are all potential risks to road users. If drivers take evasive action at high speed, there is a strong probability that the vehicle

could roll, resulting in severe injuries or even fatalities. Failing to take evasive action will result in the inevitable fatality of the animal or pedestrian.

During all phases of the project, mitigation measures are limited to providing drivers with advanced driver training and training on how to handle a vehicle in the event of a tire blow-out or an antelope jumping in the road, as the incorrect evasive action could have dire consequences.

10.2 IMPACTS

The road network within the study area is limited, offering very little opportunity of selecting alternative routes. All routes evaluated for the proposed development are existing roads, and no new roads need to be constructed. However, remedial action on various intersections of the transportation routes might required, before executing the works can comence.

Traffic-related risks and impacts on the road network within the study area have been assessed using an assessment methodology provided by Arcus Consulting Services South Africa (Pty) Ltd for various phases of the proposed development, and are deliniated below.

10.2.1 Construction Phase

During the peak construction phase of the development, the following safety and road network integrity impacts have been assessed.

Increased Road Incidents

The impact of increased traffic volumes on public roads, which will cause congestion and increase the potential of incidents on the road network within the study area, is provided in Table 20.

Table 20 - Construction Phase - Increased Road Incidents

Impact Phase: Construction Phase					
Nature of the impact: Increased Road Incidents					
Description of Impact: The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	High	Irreversible	Highly Probable
	3	2	4	5	4
With Mitigation	Regional	Short term	High	Irreversible	Probable
	3	2	4	5	3
Significance Calculation	Without Mitigation			With Mitigation	
S=(E+D+R+M)*P	Moderate Negative Impact (56)			Moderate Negative Impact (42)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Post relevant road signage along affected routes; Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes; Transport Management Plan(TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. Refer to Section 11. The TMP needs to address, inter alia: - clearly defined route/s to the site for specific vehicles needed to transport equipment and materials - scheduled deliveries to avoid local congestion; Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.					
Residual impact	Fatality is irreversible				

Road Degradation

The impact of increased traffic volumes on the public roads, which will increase the potential for localised road network degradation within the study area, is presented in Table 21.

Table 21 - Construction Phase - Road Degradation

Impact Phase: Construction Phase					
Nature of the impact: Road Degradation					
Description of Impact: The increased traffic volumes on public roads will increase the potential for localised road network degradation within the study area.					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	Moderate	Recoverable	Highly Probable
	3	2	3	3	4
With Mitigation	Regional	Short term	Moderate	Recoverable	Probable
	3	2	3	3	3
Significance Calculation	Without Mitigation		With Mitigation		
S=(E+D+R+M)*P	Moderate Negative Impact (44)		Moderate Negative Impact (33)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Create a local WhatsApp Group for the local community and post notices of road conditions and proposed alternatives. Project Developer to contribute to the maintenance of the public roads in the area during the construction phase of the development/s. A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective views from road users. Upgrade unpaved roads to a suitable condition for proposed construction vehicles; Ensure that the roads are left in the same or better condition, post-construction.					
Residual impact	The condition of the roads are to be left in the same or better condition, post-construction				

Dust

The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences. The impact of increased traffic volumes on the unpaved public roads that will generate dust is presented in Table 22.

Table 22 - Construction Phase – Dust

Impact Phase: Construction Phase					
Nature of the impact: Dust					
Description of Impact: The increased traffic volumes on unpaved public roads will generate more dust. The higher the speed and the larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view of over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	3	2	3	1	4
	Regional	Short term	Moderate	Reversible	Probable
With Mitigation	3	2	3	1	3
	3	2	3	1	4
Significance Calculation	Without Mitigation		With Mitigation		
S=(E+D+R+M)*P	Moderate Negative Impact (36)		Low Negative Impact (27)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				

Mitigation measures to reduce residual risk or enhance opportunities: *Reduce travel speed for construction vehicles on the gravel road to reduce dust* *Dust suppression of the roads in the immediate vicinity of the site where feasible* *Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.*	
Residual impact	*There is no residual impact*

Intersection Safety

The impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, is presented in Table 23, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic.

Table 23 - Construction Phase - Intersection Safety

Impact Phase: Construction Phase					
Nature of the impact: Intersection Safety					
Description of Impact: The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.					
Impact Status: Negative					
	Extent (E)	*Duration (D)*	*Magnitude (M)*	*Reversibility (R)*	*Probability (P)*
Without Mitigation	*Regional*	*Short term*	*High*	*Irreversible*	*Highly Probable*
	3	*2*	*4*	*5*	*4*
With Mitigation	*Regional*	*Short term*	*High*	*Irreversible*	*Probable*
	3	*2*	*4*	*5*	*3*
Significance Calculation	*Without Mitigation*			*With Mitigation*	
*S=(E+D+R+M)*P*	*Moderate Negative Impact (56)*			*Moderate Negative Impact (42)*	
Was public comment received?	*No*				
Has public comment been included in mitigation measures?	*No comments have been received*				
Mitigation measures to reduce residual risk or enhance opportunities: *Compile TMP, refer to Section 11 of this Report.* *Reduce speed at intersections and use appropriate traffic warning signs* *Identify alternative routes where possible* *Request the assistance of local law enforcement* *Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.* *Provide drivers with advanced driver training.*					
Residual impact	*Fatality is irreversible*				

10.2.2 Operational Phase

During the operational phase of the development, the traffic volumes are considerably less than during the construction phase of the proposed development. Thus all impacts associated with increased traffic volumes have been omitted. Therefore, the only impact deemed essential during the operational phase of the proposed development is addressed below.

Intersection Safety

The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, is presented in Table 24, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Table 24 - Operational Phase - Intersection Safety

Impact Phase: Operational Phase					
Nature of the impact: Increased Road Incidents					
Description of Impact: The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	Very Low	Irreversible	Probable
	3	2	1	5	3
With Mitigation	Regional	Short term	Very Low	Irreversible	Probable
	3	2	1	5	3
Significance Calculation	Without Mitigation		With Mitigation		
S=(E+D+R+M)*P	Moderate Negative Impact (33)		Moderate Negative Impact (33)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Compile TMP, refer to Section 11 of this Report. Reduce speed at intersections and use appropriate traffic warning signs Identify alternative routes where possible Request the assistance of local law enforcement Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. Provide drivers with advanced driver training					
Residual impact	Fatality is irreversible				

10.2.3 Cumulative Construction Phase

During the peak construction phase of the three Loxton Wind Energy Facilities, the following safety and road network integrity impacts have been assessed.

Increased Road Incidents

The impact of increased traffic volumes on public roads, which will cause congestion and increase the potential of incidents on the road network within the study area, is provided in Table 25.

Table 25 - Construction Phase - Increased Road Incidents

Impact Phase: Construction Phase					
Nature of the impact: Increased Road Incidents					
Description of Impact: The increased traffic volumes on the public roads will increase the potential of incidents on the road network within the study area					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	High	Irreversible	Highly Probable
	3	2	4	5	4
With Mitigation	Regional	Short term	High	Irreversible	Probable
	3	2	4	5	3
Significance Calculation	Without Mitigation		With Mitigation		
S=(E+D+R+M)*P	Moderate Negative Impact (56)		Moderate Negative Impact (42)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Post relevant road signage along affected routes;					

Create local WhatsApp Group, notifying other road users of expected deliveries and associated routes; Transport Management Plan(TMP) is to be compiled once the contractor has been appointed and all the relevant details of the construction process are known. Refer to Section 11. The TMP needs to address, inter alia: - clearly defined route/s to the site for specific vehicles needed to transport equipment and materials - scheduled deliveries to avoid local congestion; Ensure all vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.	
Residual impact	Fatality is irreversible

Road Degradation

The impact of increased traffic volumes on the public roads, which will increase the potential for localised road network degradation within the study area, is presented in Table 26.

Table 26 - Construction Phase - Road Degradation

Impact Phase: Construction Phase					
Nature of the impact: Road Degradation					
Description of Impact: The increased traffic volumes on public roads will increase the potential for localised road network degradation within the study area.					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	Moderate	Recoverable	Highly Probable
	3	2	3	3	4
With Mitigation	Regional	Short term	Moderate	Recoverable	Probable
	3	2	3	3	3
Significance Calculation	Without Mitigation		With Mitigation		
S=(E+D+R+M)*P	Moderate Negative Impact (44)		Moderate Negative Impact (33)		
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Create a local WhatsApp Group for the local community and post notices of road conditions and proposed alternatives. Project Developer to contribute to the maintenance of the public roads in the area during the construction phase of the development/s. A photographic record of the road condition should be maintained throughout the various phases of the development/s. This provides an objective assessment and mitigates any subjective views from road users. Upgrade unpaved roads to a suitable condition for proposed construction vehicles; Ensure that the roads are left in the same or better condition, post-construction.					
Residual impact	The condition of the roads are to be left in the same or better condition, post-construction				

Dust

The larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view for over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences. The impact of increased traffic volumes on the unpaved public roads that will generate dust is presented in Table 27.

Table 27 - Construction Phase – Dust

Impact Phase: Construction Phase					
Nature of the impact: Dust					
Description of Impact: The increased traffic volumes on unpaved public roads will generate more dust. The higher the speed and the larger the vehicle, the more dust is likely to be generated. This dust hinders the drivers wishing to over-take without a clear view of over-taking, resulting in drivers taking unnecessary chances, which could result in unfavourable consequences					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	3	2	3	1	4
	Regional	Short term	Moderate	Reversible	Probable
With Mitigation	3	2	3	1	3

	3	2	3	1	4
Significance Calculation	Without Mitigation			With Mitigation	
S=(E+D+R+M)*P	Moderate Negative Impact (36)			Low Negative Impact (27)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Reduce travel speed for construction vehicles on the gravel road to reduce dust Dust suppression of the roads in the immediate vicinity of the site where feasible Regular preventative maintenance of roads within the immediate vicinity of the site should be conducted over weekends to minimise the impact on the average construction period.					
Residual impact	There is no residual impact				

Intersection Safety

The impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, is presented in Table 28, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic.

Table 28 - Construction Phase - Intersection Safety

Impact Phase: Construction Phase					
Nature of the impact: Intersection Safety					
Description of Impact: The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.					
Impact Status: Negative					
	Extent (E)	Duration (D)	Magnitude (M)	Reversibility (R)	Probability (P)
Without Mitigation	Regional	Short term	High	Irreversible	Highly Probable
	3	2	4	5	4
With Mitigation	Regional	Short term	High	Irreversible	Probable
	3	2	4	5	3
Significance Calculation	Without Mitigation			With Mitigation	
S=(E+D+R+M)*P	Moderate Negative Impact (56)			Moderate Negative Impact (42)	
Was public comment received?	No				
Has public comment been included in mitigation measures?	No comments have been received				
Mitigation measures to reduce residual risk or enhance opportunities: Compile TMP, refer to Section 11 of this Report. Reduce speed at intersections and use appropriate traffic warning signs Identify alternative routes where possible Request the assistance of local law enforcement Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator. Provide drivers with advanced driver training.					
Residual impact	Fatality is irreversible				

10.2.4 Cumulative Operational Phase

During the operational phase of the development, the traffic volumes are considerably less than during the construction phase of the proposed development. Thus all impacts associated with increased traffic volumes have been omitted. Therefore, the only impact deemed essential during the operational phase of the proposed development is addressed below.

Intersection Safety

The cumulative impact due to the increased traffic volumes at intersections, which will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, is presented in Table 29, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Table 29 - Operational Phase - Intersection Safety

Impact Phase: Operational Phase					
Nature of the impact: Increased Road Incidents					
Description of Impact: The increased traffic volumes at intersections will increase the potential risk of accidents at the intersections, resulting in serious injuries or even fatalities, especially at the intersection on the main roads, when slow moving vehicles from the site need to cross over fast travelling oncoming traffic.					
Impact Status: Negative					
	Extent (E)	*Duration (D)*	*Magnitude (M)*	*Reversibility (R)*	*Probability (P)*
Without Mitigation	*Regional*	*Short term*	*Very Low*	*Irreversible*	*Probable*
	3	*2*	*1*	*5*	*3*
With Mitigation	*Regional*	*Short term*	*Very Low*	*Irreversible*	*Probable*
	3	*2*	*1*	*5*	*3*
Significance Calculation	*Without Mitigation*			*With Mitigation*	
*S=(E+D+R+M)*P*	*Moderate Negative Impact (33)*			*Moderate Negative Impact (33)*	
Was public comment received?	*No*				
Has public comment been included in mitigation measures?	*No comments have been received*				
Mitigation measures to reduce residual risk or enhance opportunities: *Compile TMP, refer to Section 11 of this Report.* *Reduce speed at intersections and use appropriate traffic warning signs* *Identify alternative routes where possible* *Request the assistance of local law enforcement* *Ensure that all construction vehicles are roadworthy, visible, adequately marked, and operated by an appropriately licenced operator.* *Provide drivers with advanced driver training*					
Residual impact	*Fatality is irreversible*				

10.2.5 Decommissioning Phase

As part of the decommissioning process, a separate traffic impact assessment should be undertaken since many of the characteristics related to the traffic impact assessment, i.e. access routes, road geometry, traffic volumes, etc., would have changed over the operational life of the development. Thus, the impact assessment for the decommissioning phase has not been provided.

10.2.6 No-go Alternative

If the proposed development does not materialise, the increase in the traffic volume will not transpire, resulting in the following impacts:

Road Degradation

Less traffic on the roads means that the rate of degradation to the roads will be less. However, the maintenance of the roads will not be augmented by the proposed development. Improved maintenance of the roads will improve the quality of life for the road users and could increase the economic opportunities in the area. The status quo is therefore rated as of low negative significance.

Road Safety

Less traffic on the roads means less probability of an incident, reducing the likelihood of a fatality. Therefore the impact is neutral.

Statement

The improved road maintenance counteracts the negative impacts on the road network due to the development and economic prospects the development will bring to the local community and the impact the development has on a national scale.

11 TRAFFIC MANAGEMENT PLAN

As recommended in section 10, a Traffic Management Plan (TMP) for the project needs to be developed by the construction contractor appointed to execute the proposed development. The TMP must consider all the potential risks along the access routes and the roads on the site.

The main objectives of a TMP are to identify potential risks and mitigation measures to be implemented to negate the potential risks as far as reasonably possible. When compiling the TMP, preventing traffic congestion and minimising impacts to existing users on public roads needs to be a key consideration. Although the TMP needs to cover all phases of the development, the focus of the TMP will be the construction phase since this is when the traffic movements and risks are most significant.

The TMP shall therefore be developed by the contractor appointed to construct the proposed development. The implementation of the TMP needs to be vigorously managed.

A description of the most pertinent elements of the construction phase, together with the proposed transportation routes, are summarised below:

- *Abnormal loads, including WTG components and transformers for the development, emanating from one of the Terminal is expected to be on the TR 01607, via Victoria West;*
- *Site deliveries emanating from major commercial centres within South Africa is expected to be on the TR 01607, via Victoria West;*
- *Aggregate and cement for the concrete batching plant is envisaged to be transported to site from commercial sources from either Carnarvon or Victoria West;*
- *Personnel commuting routes originating from the local community will access the proposed development from either Carnarvon, Loxton or Victoria West, it is unlikely, but not imposable, that personnel will commute to the proposed development from other areas;*
- *The layout of the proposed development needs to address the interaction of site vehicles with vehicles on the public road network.*

Other key points include, inter alia:

- *Inclusion of section of the TMP in the induction training for all personnel travelling to the proposed development;*
- *Outlining of specific traffic management measures across all phases of the proposed development;*
- *Identification of specific routes for each type of vehicle needed to transport equipment and materials to the proposed development;*

- *Identification of mitigation measures to minimise impacts on existing road users;*
- *Reduction of the number of private and individual vehicles travelling to the proposed development;*
- *Provision of minibuses/buses for personnel commuting to the proposed development;*
- *Scheduling of deliveries by heavy vehicles to avoid the formation of convoys. Sufficient distance must be maintained between heavy vehicles to allow light vehicles to overtake safely;*
- *The establishment of truck waiting areas before arriving on site, to prevent congestion on the road and on site;*
- *Avoidance of routes which pass through homesteads and / or dangerous intersections;*
- *Alternative routes to and from the proposed development are to be identified and used as far as possible, thus spreading the traffic on the public road network; and*
- *Identification of the repair and maintenance strategy to be adopted during the various phases of the development.*

12 CONCLUSION AND RECOMMENDATIONS

The Project Developer proposes developing three commercial wind energy facilities and associated infrastructure, in the vicinity of Loxton within the Ubuntu Local Municipality of the Pixley Ka Seme District Municipality, within the Northern Cape Province of South Africa.

This report represents the TIA for the Loxton WEF 2.

12.1 CONCLUSION

Based on the information provided in this document, the following conclusions can be drawn:

Assessment Assumptions

- *The Loxton WEFs, consisting of Loxton WEF 1, Loxton WEF 2 and Loxton WEF 3, is to be constructed simultaneously;*
- *A project duration of 24 months is expected, which relates to an active construction phase of 18 months;*
- *During the peak construction phase, cumulative impact, worst-case scenario, includes simultaneous construction of the three Loxton WEF, Hoogland WEF (Northern Cluster) and associated Grid Connections, resulting in a combined workforce complement of approximately 1 800;*
- *Cumulative impact during the operational phase includes the simultaneous operation of the three Loxton WEF and Hoogland WEF (Northern Cluster). The traffic volume generated during the operational phase of the Grid Connections are extremely low and, as such, have been excluded;*
- *It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It can, however, be expected that the volumes will be lower than during the construction phase. As part of the decommissioning process, a separate traffic impact assessment should be undertaken, since many of the characteristics related to the traffic impact assessment, i.e. access routes,*

road geometry, traffic volumes etc., would have changed over the operational life of the development.

Road Conditions

- *Majority of the roads within the study area are paved roads, only the access routes from the main roads to the proposed developments are gravel. Some of the roads are in better condition than others. All roads adjacent to the proposed development are expected to deteriorate due to the increased traffic volumes. Thus, the Project Developer would have to assist local roads authorities with regular maintenance of these roads;*
- *The expected traffic increase on the road network during the peak construction phase will lead to more significant wear and tear on the roads but will not have an undue detrimental impact on the structure of the roads if the roads are properly maintained. The Project Developer shall contribute to maintaining the public road network affected by the development as identified by the local road authorities. It is proposed that the Project Developer contribute to the maintenance of the road network during the construction and the operational phases, commencing the year after successfully achieving Commercial Operation;*
- *The Project Developer shall ensure that the condition of the roads impacted by proposed development is left in a similar or better state, once the construction phase is complete;*
- *There is a strong possibility that several of the existing internal roads will have to be upgraded to facilitate the delivery of the WTG components; and*
- *Additional ongoing funding from the wind farms towards the maintenance of the roads will have a positive impact on the local road conditions and community.*

Transportation Route

- *The development is accessed from well-established transportation routes between large commercial centres within South Africa;*
- *The access point to the proposed development are from the TR 01606 via Access Point A, and from the DR 02329 via Access Point B, and has been provisionally identified, but will only be finalised in the design phase;*
- *Previously established transportation routes from the Ngqura Container Terminal, near Gqeberha, to existing wind farms, could be used for the transportation of equipment and material, including abnormal loads. This will depend on the length and weight of the components to be transported;*
- *It is proposed that the majority of the deliveries to the proposed development will be transported via Victoria West, on the TR 01606/7;*
- *The final route selection is subject to the limitations specified in the transport permits and the vehicles to be used by the appointed logistics company;*
- *Not all existing access routes to the proposed development from the main roads are conducive to heavy delivery vehicles. Thus, the preferred routes, and the section of the existing road network that will require upgrading (if necessary), will need to be identified during the design phase of the project;*
- *The TMP needs to prescribe which roads are to be used for deliveries;*
- *All site entrances from public roads, existing intersection and road alignments that require upgrading to accommodate the transportation requirements of*

equipment and material are to comply with geometric standards and approved by the relevant roads' authorities;

- *No anomalies associated with the proposed transportation routes were observed or identified that will compromise the development. However, this will have to be confirmed by the logistics contractor once the preferred WTG supplier has been selected;*

Traffic Volumes

- *The most significant impact on traffic volumes, result from the commuting of personnel, to and from the proposed developments, in the morning and the afternoon;*
- *At no point during the construction or operational phases of the proposed development, does the traffic volume on the various roads exceed 50 trips per hour, which is the threshold for a detailed Traffic Impact Assessment;*
- *The AADT for several of the roads within the study area could be obtained from the Northern Cape Roads Authorities;*
- *The traffic volume generated during the peak construction phase of the proposed development is in the order of:*
  - *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 31;*
  - *Diurnal Traffic: The maximum number of vehicles on various sections of the public road network within a given hour is estimated to be in the order of 20. Which equates to approximately 160 trips per day.*
- *The traffic volume generated during the operational phase of the proposed development is in the order of:*
  - *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 5;*
  - *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 0.50. Which equates to approximately 4 trips per day.*
- *The cumulative traffic volume generated during the peak construction phase of the Hoogland WEF (Northern Cluster), Loxton WEF and associated Grid Connections, are in the order of:*
  - *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 51;*
  - *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 62 vph. Which equates to approximately 496 trips per da.*
- *The cumulative traffic volume generated during the operational phase of all seven Wind Farms is in the order of:*
  - *Peak Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is not expected to exceed 14;*
  - *Diurnal Traffic: The maximum number of vehicles on any one section of the public road network within a given hour is estimated to be in the order of 1.00 vph. Which equates to approximately 8 trips per day;*
- *The additional traffic volume, based on cumulative worst-case scenario, does not compromise the level of service on the roads.*

Traffic Management Plan

- *A Traffic Management Plan (TMP) is required to outline specific traffic management measures across all phases of the development. The focus of the TMP will be the construction phase since this is when the traffic movements and risks are most significant. TMP must be compiled once the contractor has been appointed and all the relevant details of the construction process are known;*
- *The TMP should consider the scope of the development and take cognisance of the existing condition of the road network at the time the project commences;*

Safety

- *The Project Developer shall ensure that the contractor provides the necessary driver training to key personnel to minimise the potential of incidents on the public road network;*
- *Implement the relevant transport impact mitigations measures as detailed in Section 10.2 above.*
- *The Project Developer shall ensure that the contractor erects temporary signs on the public road network, warning motorists of construction vehicles on the approaches to the various Access Points to the proposed developments;*
- *This is an agricultural area, home to many species of small fauna, including livestock and wild animals. Stray animals on/crossing the road is a common occurrence that could result in a collision;*
- *Additional vehicles on the road will be subject to these hazards, with a potential for an increase in incidents;*
- *The passing through towns and homesteads along the route is a serious safety concern that needs to be included in the TMP;*
- *The interaction of concrete delivery trucks on the public road network is a safety concern and one that should be avoided as far as possible. Thus, the Project Developer should consider instructing the contractor to provided two batching plants, one for Loxton WEF 1 & 2 and one for Loxton WEF 3; and*
- *The area is prone to flash flooding, resulting in drifts being impassable. Road users need to be sensitised as to the intrinsic dangers of crossing these drifts when in flood.*

12.2 RECOMMENDATIONS

Based on the conclusions of this report, the following recommendations are made and should be included in the conditions of the environmental authorisation:

- *All remedial work or modifications to any of the public roads shall be done in consultation with and have the approval of the local road's authority (as is standard practice, this will be finalised during and be a requirement of the municipal planning approval process);*
- *The access to the proposed development from the main roads will need to be upgraded by the Project Developer to accommodate the expected transportation requirements. This upgrade would need to be implemented to facilitate the delivery of abnormal loads to the proposed development;*
- *The Project Developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development;*

Considering the above findings, it can be concluded that the proposed development will have generate an increase in the traffic volumes on the road network during the peak construction phase. However, this increase will be significantly less that the increase in the traffic volumes on the road network during the peak construction phase of the cumulative developments.

This report has assessed the cumulative impact of the additional traffic volumes on the surrounding road network generated by the proposed developments and has found the level of service on the road network to be acceptable. The current road network is not well maintained due to budgetary constraints within various spheres of government. The increase in traffic volumes will lead to greater wear and tear of the road network, especially during the construction phase. However, the relevant mitigation measures and continues maintenance undertaken by the Project Developer will ensuring the long-term operability of the road network.

It is the reasoned opinion of the author that the Loxton WEF 2, can be approved from a traffic and transportation perspective as there are no constraints or notable impacts that would jeopardise the implementation of the development, subject to the specific requirements included within this report.

13 APPENDICES

Appendix 1: Declaration

Appendix 2: NEMA Requirements for Specialist Reports

Appendix 3: Curriculum Vitae

APPENDIX 1 - DECLARATION

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/
Date Received:	

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

PROPOSED LOXTON WIND ENERGY FACILITIES (WEF), AND ASSOCIATED INFRASTRUCTURE LOCATED IN THE NORTHER CAPE PROVINCE.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:				
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	ATHOL SCHWARZ.			
Specialist Qualifications:	MASTERS DIPLOMA IN TECHNOLOGY.			
Professional affiliation/registration:	ECSA – 9270085.			
Physical address:	45 RAVEN STREET WEST BEACH CAPE TOWN.			
Postal address:	PO BOX 50105, WEST BEACH.			
Postal code:	7449	Cell:	082 777 1961	
Telephone:		Fax:		
E-mail:	SCHWARZATHOL@GMAIL.COM.			

2. DECLARATION BY THE SPECIALIST

I, ATHOL SCHWARZ, 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 the Specialist

ATHOL SCHWARZ.

Name of Company:

17 JANUARY 2023.

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ATHOL SCHWARZ, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

ATHOL SCHWARZ

Name ~~of Company~~

2023.1.18

Date

162650-6
SF BOTHA

Signature of the Commissioner of Oaths

SUID-AFRIKAANSE POLISIEDIENS
GEMEENSKAPSDIENSSENTRUM
18 JAN 2023
COMMUNITY SERVICE CENTRE
MELKBOSSTRAND
SOUTH AFRICAN POLICE SERVICE

Date

APPENDIX 2 - NEMA REQUIREMENTS FOR SPECIALIST REPORTS

Appendix 6	Specialist Report content as required by the NEMA 2014 EIA Regulations, as amended	Section
1 (1)(a)	(i) the specialist who prepared the report; and	Appendix 3
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 1
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 5.3
(cA)	an indication of the quality and age of the base data used for the specialist report;	Section 7.1.3
(cB)	a description of existing impacts on the site, cumulative impacts of the development and levels of acceptable change;	Section 8 & 9
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 5.5
(f)	details of an assessment of the specifically 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;	Section 6
(g)	an identification of any areas to be avoided, including buffers;	NA
(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;	NA
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5.6
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity, or activities;	Section 10
(k)	any mitigation measures for inclusion in the EMPr;	Section 12
(l)	any conditions for inclusion in the environmental authorisation;	Section 12
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	NA
(n)	a reasoned opinion-	Section 12
	(i) whether the proposed activity or portions thereof should be authorised; and	
	(iA) regarding the acceptability of the proposed activity or activities; and	
	(ii) if the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	NA
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	NA
(q)	any other information requested by the competent authority.	NA
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

APPENDIX 3 - CURRICULUM VITAE

ATHOL SCHWARZ Pr Tech Eng

Independent Author

Athol, is a Professionally Registered Civil Engineering Technologist with more than 35 years of experience, specialising in Civil and Structural Engineering services for renewable energy facilities and infrastructure. These services range from the concept phase all the way through to project close-out, including inter alia: design, contract and construction management phases.

Since 2010, Athol was employed by Hatch, as a Civil Engineering Author working on numerous infrastructure and renewable energy projects (including wind farms, fixed and rotating PV solar plants, CPV solar plants) for various Independent Power Producers (IPP) / Developers.

Athol has experience in traffic impact assessments, transportation route analysis, infrastructure development and design, construction and project management (NEC), with a keen eye for detail.

SPECIFIC RELEVANT EXPERIENCE

- *Red Cap Energy (Pty) Ltd - Impofu Wind Farms consisting of Impofu North Wind Farm, Impofu West Wind Farm and Impofu East Wind Farm*
- *juwi Renewable Energies (Pty) Ltd – Paulputs Traffic Impact Assessment*
- *CPV1 Solar - Touwsriver Solar, Western Cape, 36 MW Concentrated Photovoltaic Plant (1500 trackers), supervised civil infrastructure activities*
- *juwi Renewable Energies (Pty) Ltd - Moorreesberg Wind Energy Facility, Moorreesberg, Western Cape, consisting of 25 wind Turbine Generators - feasibility study for the routing of the access roads.*
- *juwi Renewable Energies (Pty) Ltd - Garob Wind Farm, Copperton, Northern Cape, consists of 46 Acciona 3.0 MW Wind Turbine Generators - conducted a hydrological study to determine the potential impact of the flood levels on the development,*
- *juwi Renewable Energies (Pty) Ltd - Wolf Wind Farm, Kleinpoort, Eastern Cape, consisting of 28 Wind Turbine Generators - identify the most viable access point onto the property and internal access road.*
- *Scatec Solar AS (Norway) - Dreunberg Filter Yard (Capacitor bank), 75 MW Single-axis PV plant – Burgersdorp, Eastern Cape – Quality control of civil activities.*
- *Scatec Solar AS (Norway) - Linde Filter Yard (Capacitor bank), 36.8 MW Single-axis PV plant – Hanover, Northern Cape – Quality control of civil activities.*
- *Scatec Solar AS (Norway) - Kalkbult Filter Yard (Capacitor bank),75 MW Single-axis PV plant – De Aar, Northern Cape – Quality control of civil activities.*
- *juwi Renewable Energies (Pty) Ltd - Keiskammahoek Wind Farm, King William's Town, Eastern Cape, consisting of 16 Wind Turbine Generators - feasibility study to minimise the impact on the commercial plantation due to the development of Keiskammahoek Wind Farm*
- *South Africa Mainstream Renewable Power De Aar PV (Pty) Ltd - 50 MW PV Plan – De Aar, Northern Cape – clients engineer*
- *South Africa Mainstream Renewable Power Droogfontein PV (Pty) Ltd – 50 MW PV Plan – Kimberly, Northern Cape – clients engineer*
- *juwi Solar ZA Construction 3 (Pty) Ltd - Aries, 9.7 MW PV Plant – Kenhardt, Northern Cape - civil author services and Traffic Impact Assessment*
- *juwi Solar ZA Construction 3 (Pty) Ltd - Konkoonsies, 9.7 MW PV Plan – Pofadder, Northern Cape - civil author services and Traffic Impact Assessment*
- *juwi Renewable Energies (Pty) Ltd - Namies Wind Energy Facility, near Aggeneys, Northern Cape, consists of between 46 and 58 wind turbine generators - transportation route assessment*

EDUCATION

Master's Diploma in Technology – Civil: Structures (1989)

National Higher Diploma (1987)

National Diploma (1986)

LANGUAGES

- *English*
- *Afrikaans*
- *French (limited)*

PROF AFFILIATIONS

- *ECSA - Professional Engineering Technologist,*
- *SAICE - South African Institution of Civil Engineering - Member*

COMPETENCES

- *Structural Design (concrete and steel),*
- *Project and Construction Management*

SOFTWARE

- *MS Office*
- *MS Projects*
- *Micro Station and Autocad*
- *Prokon*
- *Model Maker*

- *juwi Renewable Energies (Pty) Ltd - Outeniqua Wind Farm (North), Uniondale, Western Cape - transportation route assessment*
- *juwi Renewable Energies (Pty) Ltd - Wolf Wind Farm, Kleinpoort, Eastern Cape consisting of 25 Wind Turbine Generators - feasibility study for the access routes*
- *juwi Renewable Energies (Pty) Ltd - Outeniqua Wind Farm (South), Uniondale, Western Cape, 16 Wind Turbine Generators - feasibility study for the access routes*
- *UMOYA ENERGY (Pty) Ltd - Hopefield Wind Farm, approximately 6 km south-east of the town of Hopefield, Western Cape, consisting of 37, Vestas 1.8 MW WTG – ACS HV Yard and Substation.*
- *South Africa Mainstream Renewable Power Jeffreys Bay (Pty) Ltd - Jeffreys Bay Wind Farm, Humansdorp, Eastern Cape, consists of 60 Siemens 2.3 MW WTG - review the foundation design for the wind towers - review the designs for compliance to the national standards.*
- *juwi Solar ZA Construction 3 (Pty) Ltd - RustMo1, 6.8 MW PV Plant – Rustenburg, North-West - author services regarding access and internal gravel roads*
- *Barrick Africa (Pty) Ltd - Buzwagi Gold Mine in Tanzania – a feasibility study.*
- *juwi Renewable Energies (Pty) Ltd - Garob Wind Farm, Copperton, Northern Cape, consists of 46 Acciona 3.0 MW Wind Turbine Generators - transportation management plan.*
- *Slim Sun Swartland Solar Park - SlimSun Solar - 5 MW PV Plant – Malmesbury, Western Cape – ACS for HV Yard and Substation.*
- *Cennergi (Pty) Ltd - Kopleegte Switching Station at Amakhala Emoyen Phase 1, Bedford, Eastern Cape, consisting of 56 Nordex, 2,4 MW Wind Turbines Generators- ACS for HV Yard and Substation.*
- *EXXARO Resources Ltd And Watt Energy (Pty) Ltd - Wittekleibosch Switching Station at Tsitsikamma Community Wind Farm, Tsitsikamma, Eastern Cape, consists of 31 Vestas 3.0 MW WTG - ACS for HV Yard and Substation.*
- *Windlab Developments South Africa (Pty) Ltd - AMAKALA EMOYENI – Phase 2, Bedford, Eastern Cape, consisting of 66 WTG - feasibility study for access and internal road network*
- *Windlab Developments South Africa (Pty) Ltd – Phase 1, Bedford, Eastern Cape, consisting of 56 Nordex, 2,4 MW Wind Turbines Generators - feasibility study for access and internal road network*
- *IBEDRROLA - Klip Heuwel Switching Station at Caledon Wind Farm, Caledon, Western Cape, consisting of 9, Sinovel 3.0 MW Wind Turbines Generators – ACS for HV Yard and Substation.*
- *EXXARO Resources Ltd - Lephalale 60 MW PV Plant, 13 km north-west of the town of Lephalale, Limpopo - ACS for HV Yard and Substation.*
- *SASOL Technology - 3.6 MW PV Demonstration Plant – civil author services*
- *Solafrica Pty (Ltd) - Bokpoort CSP Project, a 50 MW Concentrating Solar Thermal Power Station (CSP – parabolic trough) located approximately 80 km east-south-east of Upington, Northern Cape - prepared enquiry documentation for the geotechnical investigation and topographic survey*