RED CAP ENERGY
MURA PV SOLAR FACILITIES
TRAFFIC IMPACT ASSESSMENT

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Report (Rev 0) – 30th November 2022

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Document Control

Revision	*Date*	*Description*	*Author*
Rev 0	*30th Nov 2022*	*Issued to Client for use*	*Athol Schwarz*

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1 EXECUTIVE SUMMARY

Red Cap Energy (Pty) Ltd, hereafter referred to as Red Cap, is proposing to develop four solar facilities and associated grid connections, on behalf of four separate Project Applicants, namely: Mura 1 (Pty) Ltd; Mura 2 (Pty) Ltd; Mura 3 (Pty) Ltd; and Mura 4 (Pty) Ltd, collectively known as the Mura Solar Energy Development, and hereafter referred to as the 'proposed developments'. The proposed developments are located between Loxton and Beaufort West, in both the Beaufort West Local Municipality within the Central Karoo District Municipality and Ubuntu Local Municipality within the Pixley ka Sema District Municipality. The proposed developments are in close proximity to the approved Nuweveld Wind Farm Development.

This is a combined Traffic Impact Assessment for the proposed developments, provided as part of the Environmental Impact Assessment process. Based on the latest available information, the proposed developments will have a maximum generating capacity of 400 MW.

This is a technical appraisal of the impact the traffic generated by the proposed developments will have on the existing road network, during the construction, operation, and decommissioning phases of the projects, which was assessed by Mr A. Schwarz, in terms of the relevant guidelines. A site visit of the area was conducted in September 2019.

There are several renewable energy projects earmarked for development in the adjacent area, which have been taken into consideration when assessing the cumulative impacts on the road network within the study area. The proposed road network used to commute personnel and transportation of equipment and material, to the proposed developments are well-established, and no new roads need to be constructed.

Traffic generation estimates used in this assessment is based on the experience of similar projects. The worst-case scenario for the cumulative impact has been adopted and includes the simultaneous construction of all four of the Mura Solar PV projects, the Hoogland Wind Cluster – North, the Hoogland Wind Cluster – South, the Gamma Grid Connection, and the operational phase of the three Nuweveld Wind Farms. The cumulative impact does exceed the 50 vehicles per hour threshold as stipulated in the South African Traffic Impact and Site Traffic Assessment Manual (2012) but does not exceed 150 vehicles per hour threshold as stipulated in the Manual for Traffic Impact Studies (RR93/635). 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 to be satisfactory, as the level of service is classified as a level B and higher.

The increase in traffic volumes will lead to more significant wear and tear, especially during the construction phase of the proposed developments, but will not have an undue detrimental impact on the structural integrity of the roads within the study area. 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 developer contributes towards the ongoing maintenance of the road network associated with the various phases of the proposed development.

In addition, several gravel sections through mountain passes are extremely treacherous and pose a potential risk to road users transporting staff to and from the proposed developments, which needs to be addressed by the developer.

Due to the constraints of these mountain passes, most of the traffic delivering equipment and material, to the proposed developments is anticipated to be via the town of Loxton.

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, 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.

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 these developments.

2 PROJECT SPECIFICATIONS

A synopsis of the project specification for the Mura Solar Energy Facilities is provided in Table 1.

Table 1 - Synopsis of Project Specifications

Project Components Description	***Specifications & Footprint areas***
Location	*The proposed development is located approximately 60 km north of Beaufort West, within the Central Karoo District Municipality of the Western Cape and Ubuntu Local Municipality within the Pixley ka Sema District Municipality*
Access	*Access to the proposed development is via the OP 08881 and existing private road from the DR 02317.*
Land Use	*The land use of the site and surrounding properties comprise low-density livestock farming (grazing).*
Extent	*The total area for each of the proposed developments are as follows* • *Mura 1 – 160 hectares,* • *Mura 2 – 430 hectares,* • *Mura 3 – 370 hectares, and* • *Mura 4 – 420 hectares.*
Affected Farm Portions	• *Aangrensend Abramskraal Farm 11,* • *Leeuwkloof Farm 43,* • *RE of Duiker Kranse Farm 45,* • *RE Portion 3 of Duiker Kranse Farm 45,* • *Portion 4 of Duiker Kranse Farm 45,* • *Sneeuwkraal Farm 46,* • *RE of Abrams Kraal Farm 206, and* • *Bultfontein Farm 13.*
Technology	*Solar Photovoltaic (fixed tables or tracking system still to be defined).*
Generation Capacity	*The power generating capacity for each of the proposed developments are as follows* • *Mura 1 – 150 MW,* • *Mura 2 – 400 MW,* • *Mura 3 – 320 MW, and*

Project Components Description	Specifications & Footprint areas
	• Mura 4 – 360 MW.
Substations	Two 132 kV substations are to be provided per proposed projects. Each Substation will extend over an area of 75 m x 150 m and shall consist of a Substation Building and High Voltage Gantries, within a fenced area.
Building Infrastructure:	The following structures are to be provided. • Offices, • Operational and maintenance (O&M)/control centre, • Warehouse/workshop, • Ablution facilities, and • Converter/inverter stations.
Battery energy storage system (BESS)	A battery energy storage system (BESS) shall be provided. Each BESS will have a substation. The BESS shall extend over an area of 4 hectares, which may be adjacent or slightly removed from each of the two substations depending on the local constraints. The BESS shall be connected to the substation by an underground high voltage cable.
Site roads	Internal access roads shall be provided. The extent of the internal road network will be in the order of 3 km. Permanent roads will be up to 4 m wide and over above this the roads may require side drains on one or both sides depending on the topography.
Security	Security access to be provided to the proposed development. Security fencing to be provided around the proposed development.

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
DFFA	Department of Forestry, Fishing, and the Environment
EIA	Environmental Impact Assessment
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
PV	Photovoltaic
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
SEF	Solar Energy Facility
TMP	Traffic Management Plan
vpd	Vehicle per day
vph	Vehicle per hour
v/km	Vehicle per kilometre
WEF	Wind Energy Facility

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.
Level of Service	The level of service in this document is based on the follower density and expressed as LOS A (acceptable) to LOS F (unacceptable).
Peak Traffic	Traffic at the time it is most busy.
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 TERMS OF REFERENCE

Red Cap on behalf of the Project Applicant, appointed Mr A. Schwarz to provide a Traffic Impact Assessment (TIA) for the proposed developments, which fall within the Central Karoo District Municipality of the Western Cape and Ubuntu Local Municipality within the Pixley ka Sema District Municipality. The properties on which the proposed projects are to be constructed and the extent of the proposed projects, are shown in Figure 1.

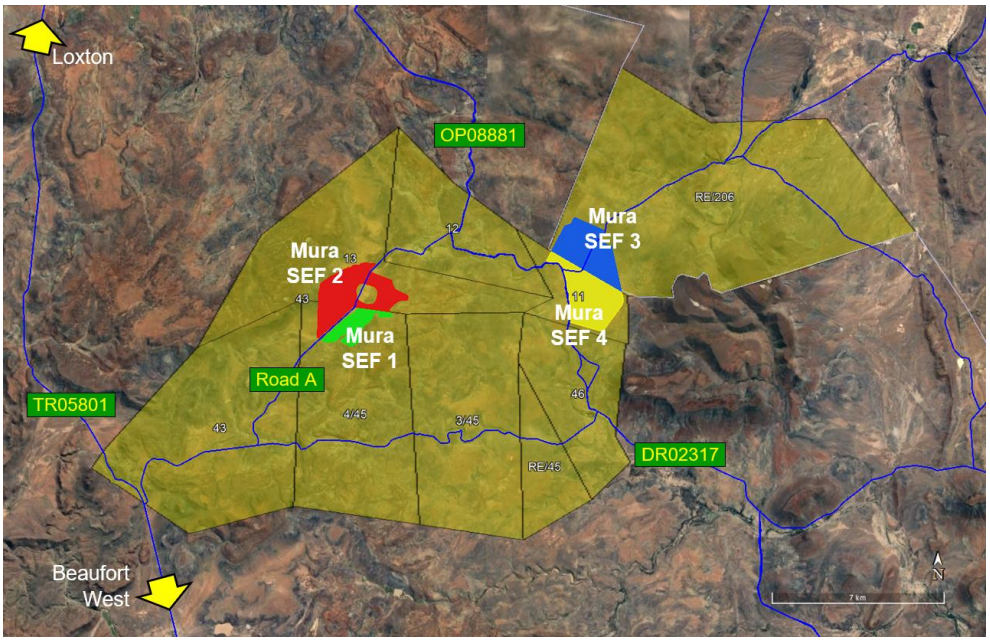


Figure 1 - Mura Solar Energy Facilities

This Traffic Impact Assessment 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 SCOPE AND OBJECTIVES

5.2.1 Scope

Red Cap is proposing to develop four Solar Energy Facilities (SEFs) and associated infrastructure.

The scope of this report includes, inter alia:

- *Identify the potential road network that could be affected by this 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 development.*
- *Determine mitigation and/or management measures which could be implemented to, as far as possible, reduce the effect of negative impacts.*
- *Incorporate and address all issues and concerns raised by Interested and Affected Parties (if and when applicable).*

5.2.2 Objectives

This report aims to determine the potential traffic impact the proposed developments will have on the existing road network within the study area.

5.3 LEGISLATION AND PERMIT REQUIREMENTS

In terms of the Environmental Impact Assessment Regulations, 2014, promulgated under the National Environmental Management Act (No 107 of 1998) and published in Government Notice No. R982 (and associated amendments), various aspects of the proposed project may have an impact on the environment and are considered to trigger certain listed activities. These activities are prohibited from being undertaken until an Environmental Authorisation has been obtained from the Competent Authority, namely the national Department of Forestry, Fisheries, and the Environment. It should be noted that full Scoping & EIA processes is required for the SEFs.

The DFFE Screening Tool and Report 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 TIA was not required. However, Red Cap thought it prudent to include a traffic impact assessment to ensure that all traffic related risks that may arise from the proposed developments are identified and mitigated.

5.3.1 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.*

5.3.2 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: Define 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.

5.3.3 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.

5.3.4 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, 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".*
- *"Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads".*

5.4 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 which will be used by vehicles associated with this development and other developments in the area.*
- *Establish the number of vehicle trips generated during the construction, operation and decommissioning of this 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 this development.*
- *Establish peak-hour vehicle trip rate generated during the construction, operation and decommissioning of this 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 these developments.*

- *Propose practical measures to mitigate the impacts of development-related traffic on the existing road network.*

5.5 ASSUMPTIONS

The compiling of this combined report for the proposed developments are based on the following assumptions:

Project

- *This is a combined report that includes all four of the proposed developments.*
- *Each of the proposed developments will be addressed individually in Section 8 below.*
- *The relevant Grid Connection will be included in the relevant proposed developments.*
- *Each of the proposed developments shall include two Substations, BESS, Office, Ablution, and Operational and Maintenance facilities.*
- *All proposed developments are to be constructed, simultaneously over a period of 24 months.*
- *The final layout of each proposed development is pending specialist's recommendations, where applicable.*

Cumulative Effects

- *As part of the Mura Solar Development, four Mura SEFs are proposed. In addition to the proposed developments, there are several other developments earmarked for construction in the area. Some developments will be implemented sooner than others, thus for the proposed development the following cumulative effects have been assumed to include:*
  - *The three Nuweveld WEFs; assumed to be in the operational phase.*
  - *The two Hoogland WEF Clusters (North and South); each cluster consisting of two WEFs and associated infrastructure, are assumed to be in the construction phase.*
  - *The Gamma Grid Connection is assumed to be its construction phase.*
- *The construction schedule of the projects listed above together with the proposed developments is unknown, at this point in time. Thus, a conservative (unrealistic) assessment has been adopted in the report, which assumes that all know developments will be either in the operational phase or constructional phase (as defined above), and the traffic of all the projects peak at the same time, resulting in a worst-case scenario.*

MANPOWER

- *The manpower complement, for each of the proposed developments (including grid connection) is provided below:*
  - *Mura 1 – 165 individuals.*
  - *Mura 2 – 435 individuals.*
  - *Mura 3 – 318 individuals.*
  - *Mura 4 – 354 individuals.*

  The total manpower complement for the four proposed developments, is in the order of 1 272 individuals.

- *The combined manpower complement, for the operation phase of the three Nuweveld WEF is expected to be in the order of 96 individuals.*
- *The combined manpower complement, for the four Hoogland wind farms and associated infrastructure during peak construction phase is assumed to be in the order of 1 200 individuals.*
- *The manpower complement for the proposed Gamma Grid Connections during peak construction phase is expected to be in the order of 60 individuals.*

Workforce Distribution

- *No accommodation is provided on-site.*
- *The workforce for the proposed developments is drawn from various towns within a travel distance of 200 km, and include Beaufort West, Carnarvon, Fraserburg, Hutchinson, Loxton, Murraysburg, Nelspoort 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 developments.*
- *The number of specialists deployed to the area for the proposed developments is assumed to be nominal and will not adversely affect the distribution as described above.*

Traffic

- *Delivery routes of equipment and materials to the proposed developments from various commercial centres within South Africa will follow well-established road networks.*
- *The commuting routes of personnel and delivery routes to the proposed development are subject to the limitations stipulated in the Traffic Management Plan for the project.*
- *For analysis purposes the shortest route from the surrounding towns 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. However, the Molteno Pass on the TR 05801 and the De Jager's Pass on the DR 02311, shall not be used by vehicles with a gross mass of more than ten tonnes for the commuting of personnel and the transportation of construction equipment and materials.*
- *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.*
- *All concrete is to be batched on-site (either within the solar PV areas or within the access road corridors), concrete mixing trucks will only be permitted on the public road network from the batching site (most likely the same sites used for Nuweveld East) to the solar sites.*

5.6 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 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 container terminals or commercial centres to the proposed developments need to be identified and verified by the logistics company that is to be appointed.*

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

5.7 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.*
- *All information relating to the roads within the Western Cape were obtained from the Western Cape Government Road Network Information System (https://rnis.westerncape.gov.za/rnis/rnis_web_reports.main.null).*
- *All data relating to traffic volumes on the roads within the Western Cape were obtained from the Western Cape Government Road Network Information System (https://rnis.westerncape.gov.za/rnis/rnis_web_reports.main.null).*

- *Traffic volumes on the roads within the Northern Cape and the national roads were obtained from Mikros Traffic Monitoring (Pty) Ltd, with approval from the required authorities.*
- *The number of working-age was obtained from the Department of Statistics South Africa (http://www.statssa.gov.za/?page_id=964).*
- *Information regarding mountain passes was obtained from Mountain Passes of South Africa (https://mountainpassessouthafrica.co.za/).*
- *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.*
- *TIA for the Nuweveld Wind Energy Projects.*
- *TIA for the Hoogland Wind Energy Project (Northern Cluster).*
- *TIA for the Hoogland Wind Energy Project (Southern Cluster).*
- *TIA for the Gamma Grid Connection; and*
- *The author took most of the photographs used in this report during the site visit.*

6 DESCRIPTION OF THE STUDY AREA

6.1 ROAD NETWORK

The existing road network adjacent to the proposed developments is well established. Consisting predominantly of the lower order gravel roads, which provides access to the local towns and the major commercial centres within South Africa.

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

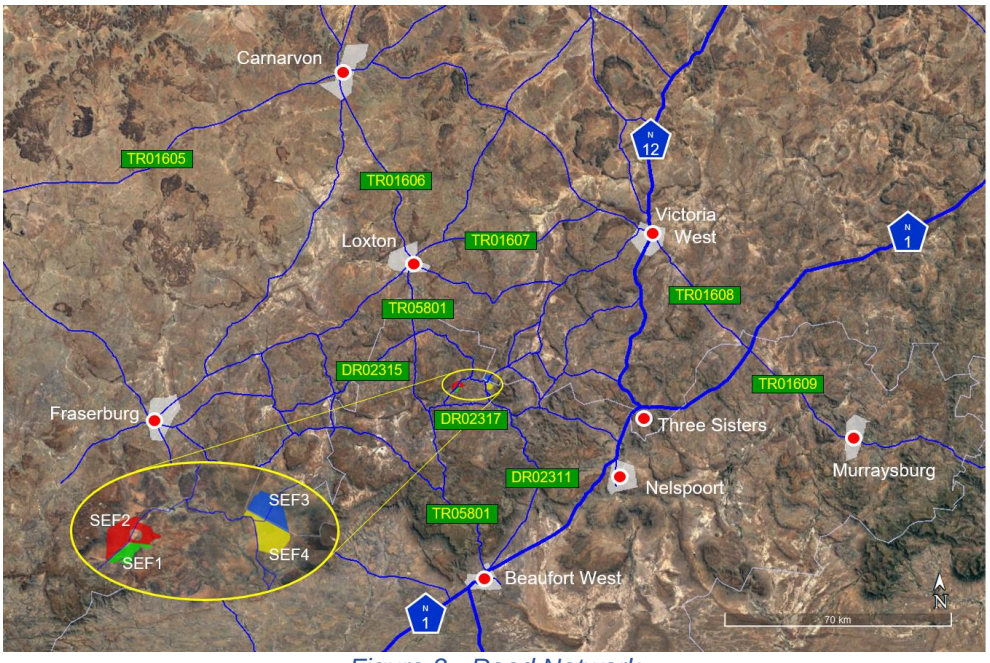


Figure 2 - Road Network

6.1.1 National Routes

National Routes are primary 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.

Only those national roads affected by the proposed developments are delineated below

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 001-8, section 8 between Beaufort West to Three Sisters, 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, Northwest and ends in Gauteng. The NR 001 and NR 012 merge approximately seven kilometres west of Beaufort West before splitting again at Three Sisters.

The NR 012-5, section 5 between Three Sisters to Victoria West, is a 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 - NR 012 (South of Victoria West)

6.1.2 Trunk Roads

Trunk roads are secondary arterial roads, 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.

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

TR 016 (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. The road between Carnarvon and Loxton represents section 6 of TR 016, thus the road number for this section of the road is TR 01606. While the road between Loxton and Victoria West represents section 7 of TR 016, thus the road number for this section of the road is TR 01607.

According to the Western Cape Road Information System, the Functional Class of section 9 of the TR 016 (R63), is a Class 2 road. 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

TR 05801 (R381)

The TR 05801 starts at the N1, north of Beaufort West (Western Cape) and ends at TR 01607 in Loxton (Northern Cape).

According to the Western Cape Road Information System, the Functional Classification of this road is a Class 2. The road is situated in a 20 m wide servitude,

sections of the road are paved, the surfacing and width details of this road are provided in Table 4.

Table 4 - TR05801 - Road Details

Start km	End km	Surface Type	Width	Shoulder Width	Shoulder Type
0	10.07	Surfaced	7.20	2.00	Unsurfaced
10.07	13.28	Surfaced	8.60	2.00	Unsurfaced
13.28	23.80	Gravel	7.00		
23.80	32.96	Surfaced	7.20	0.9	Unsurfaced
32.96	38.20	Surfaced	6.80	0.9	Unsurfaced
38.20	95.75	Gravel	8.50		
95.75	111.00	Gravel			

The paved sections of the TR 05801 consist of a single paved carriageway, with one lane in each direction and unpaved shoulders, as shown in Figure 6.

Figure 6 - TR05801 - Paved Section

Several sections of the road through the Molteno Pass are extremely treacherous, with no barriers and steep drop-offs, very tight corners, negative banking, and loose gravel. At 19.5 km from Beaufort West, there is a sharp bend in the road, a very tight bend with poor sighting distance, and is the site of numerous fatalities. A mirror has been installed to mitigate collision at this point. However, the mirror does not prevent single-vehicle incidents. The sharp bend is shown in Figure 7.

Figure 7 - TR05801 - Treacherous Bend on Molteno Pass

There are several drifts / narrow single lane low-level bridges provided along this route, an example of narrow single lane low-level bridges is shown in Figure 8.

Figure 8 - Narrow Single Lane Low-Level Bridge

6.1.3 Main Road

Main roads are tertiary arterial roads, 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 developments are delineated below.

MR 00588 (R356)

The MR 00588 starts at the junction with the MR 00566; east of Fraserburg, before ending at the TR 05801; south of Loxton.

The road consists of a gravel carriageway within a 30 m wide servitude, as shown in Figure 9. The condition of the road is good and allows for dual-directional traffic at speed.

Figure 9 - MR 00588

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 these roads 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 must 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 is 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.

Only those district roads affected by the proposed developments are delineated below.

DR 02311

The DR 02311 starts at NR 001-8 (east of Beaufort West) and ends at the junction with DR 02317.

According to the Western Cape Road Information System, the Functional Class of this road is a Class 4. The road is situated in a 20 m wide servitude, consisting of an 8.5 m wide gravel road, and is approximately 58.5 km long. Sections of the road, through the De Jager's Pass, are extremely treacherous, with no barriers and steep drop-offs, as shown in Figure 10

Figure 10 - DR 02311 (De Jager's Pass)

DR 02315

The DR 02315 starts at the junction with DR 02313 and intersects the DR 02314 before ending at the junction with TR05801 (R381). The section of the road between the DR 02315 and TR 05801 passes through a ravine, which requires a significant speed reduction. The road's width is significantly less than the required 7 m, making passing other vehicles very difficult, as shown in Figure 11. Travelling at high speed on this road is not advisable.

Figure 11 - DR02315

DR 02317

The DR02317 is 68 km long, starts at the junction with the TR 05801, and intersects with the DR 02311 (at 30.7 km) and the DR 02318 (at 40.5 km) before ending at the NR 001-08 (N1). The vertical alignment of the DR 02317, as shown in Figure 12, raises serious concerns, ranging from blind rises to loss of control when travelling at high speeds, the image below does not provide justice to the concerns.

Figure 12 - DR02317

At approximately 8 km from the TR 05801, the DR 02317 passes through an existing homestead, as shown in Figure 13.

Figure 13 - DR02317 - 8 km from TR05801

Another farming community straddles the DR 02317 at approximately 22 km from the TR 05801, as shown in Figure 14

Figure 14 - DR02317 - 22 km from TR05801

DR 02318

The DR 02318 is approximately 32.4 km long, starts at the junction with the NR 012-5, intersecting with the with the DR 02321 (to the right at 18.4.0 km), and DR 02320 (to the right at 22 km), and before ending at the junction with the DR 02317. The road is well utilised as shown in Figure 14.

Figure 15 - DR 02318

DR 02320

The DR 02320 is approximately 66 km long, starts at the junction with the TR 01607, and intersects with the DR 02324 (to the right at 32 km) before ending at the junction with the DR 02318. This road was not included in the site inspection; thus, the author cannot comment on the condition or the viability of using this route.

DR 02321

The DR 02321 is approximately 43.3 km long, starts at the junction with the NR 012, and ending at the junction with the DR 02318. This road was not included in the site inspection; thus, the author cannot comment on the condition or the viability of using this route.

6.1.5 Minor and Private Roads

Minor and private roads in the area, 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 the minor roads fall under the jurisdiction of the Provincial Roads Department, in which the roads are located, while the management and maintenance of the private roads is the responsible of the landowner. The minimum required level of service on these roads is a LOS C.

Most of these roads consist of a gravel carriageway, within a 20 m wide servitude.

OP08880

The OP08880 is 9.08 km long, starting at the TR 05801 before ending at the locked gate to the farm Slangfontein. The road is narrow and not well utilised, as shown in Figure 16.

Figure 16 - OP08880

OP 08881

The OP 08881 is 36.9 km long, starting at the DR 02317 before ending at the farm Slangfontein. This road will be used to access Mura 3 and Mura 4. This road was not included in the site inspection. Thus, the author cannot comment on the condition or the viability of using this route.

Road A

This is a private road that is to be used as the main access route to Nuweveld WEF East, Nuweveld Collector Substation, Mura 1 and Mura 2. This road was not included in the site inspection. Thus, the author cannot comment on the condition or the viability of using this route.

6.2 SITE ACCESS

Mura 1 and Mura 2

Access to both Mura 1 and Mura 2, is along Road A, from the DR 02317, at chainage 6.6 km. The entrance to Road A from the DR 02317 is shown in Figure 17.

Figure 17 - Access to Mura SEF 1 & 2

Mura 3 and Mura 4

Access to both Mura 3 and Mura 4, is along OP08881 from the DR 02317, at chainage 22.3 km.

6.3 TRANSPORTATION ROUTES

6.3.1 Commuter Routes

The towns in this part of the country are few and far between. There are several towns within a 200 km radius of the proposed development from which the workforce is to be drawn. These include Beaufort West, Carnarvon, Fraserburg, Hutchinson, Loxton, Murraysburg, Nelspoort and Victoria West. The anticipated commuting routes to the proposed development from the surrounding towns are highlighted in magenta, as shown in Figure 18.

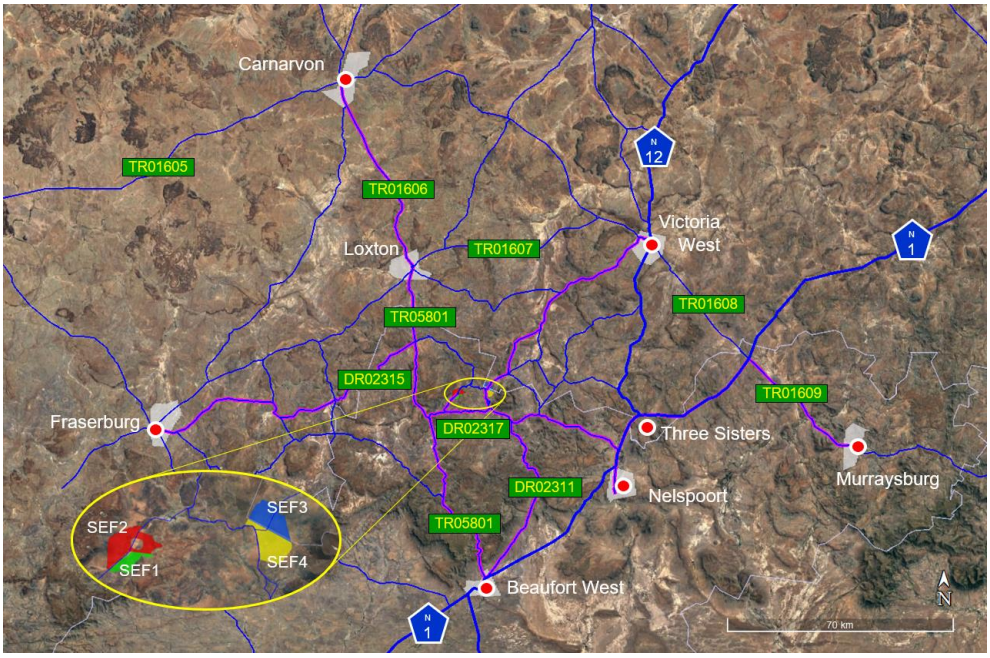


Figure 18 - Surrounding Towns

The proportionality of the workforce on the proposed developments from the surrounding towns, are based on the 'working-age' population in the town, modified by a 'weighting factor' which is calculated based on the distance travelled to the proposed development from the relevant town. The expected proportion of the workforce from the surrounding communities is depicted in Table 5.

Table 5 - Distribution of the Workforce

Town	Population	Travel Distance	Proportion (%)
Beaufort West	21376	78 km	67%
Carnarvon	4107	128 km	8%
Fraserburg	1854	139 km	3%
Loxton	604	65 km	2%
Murraysburg	2814	165 km	4%
Nelspoort	1212	83 km	4%
Victoria West	4978	106 km	11%

It should be noted that the town of Hutchinson, was excluded from the table as the proportionality was extremely low, less than 0.25%.

6.3.2 Freight Routes

Container Terminals

Transnet Port Terminals operates container terminals at Durban, Ngqura, Gqeberha and Cape Town. Thus, all the imported solar panels entering South Africa will be via one of these terminals. The container terminal and the most likely routes to the proposed developments will be via Victoria West and Loxton, as shown in Figure 19.

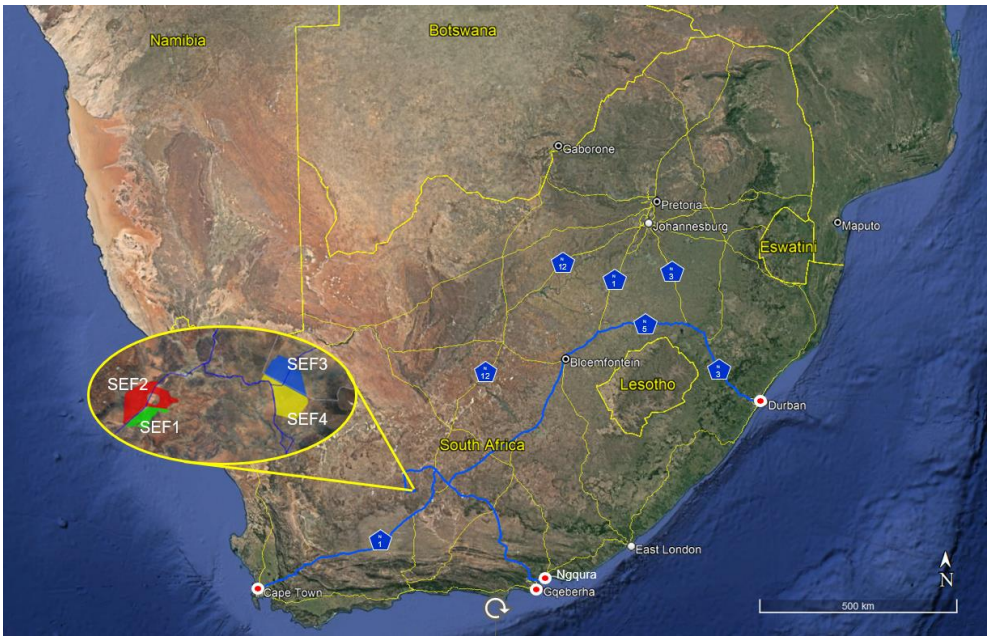


Figure 19 - Freight Routes from Container Terminals

The potential transportation routes from the various Container Terminals in South Africa to the proposed developments, are detailed in Table 6.

Table 6 - Distance - Port Terminals

Container Terminals	Distance
Cape Town	742 km
Durban	1265 km
Gqeberha	581 km
Ngqura	592 km

The closest container terminal to the proposed developments are the Ports at Gqeberha and Ngqura.

However, the preferred transportation route would ultimately be identified by the logistic company appointed to transport the 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 developments are either Cape Town or Johannesburg (or any supplier along these routes), as shown in Figure 20.

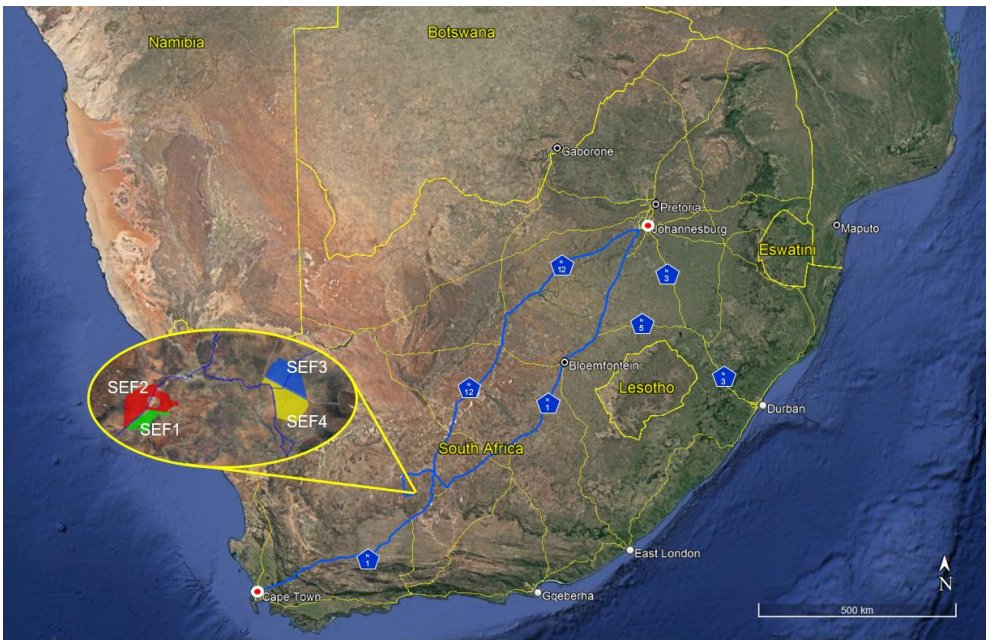


Figure 20 - Freight Routes from Commercial Centres

The distances from the proposed developments to selected commercial centres in South Africa are shown in Table 7.

Table 7 - Distance - Major Commercial Centres

Commercial Centres	Distance
Cape Town	742 km
Johannesburg (via N1)	1006 km
Johannesburg (via N12)	964 km

Although the closest major commercial centre to the proposed developments is located in the 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 Client, for the proposed developments, there are no other renewable developments with an approved Environmental Authorisation or applications under consideration within 30 km of the proposed developments.

However, there are several other renewable energy projects planned for development within the study area, the details of these are provided in Table 8.

Table 8 - Renewable Developments in the Area

No	EIA Reference No	Project Name	Technology/Status
1	14/12/16/3/3/2/2042-2044	Nuweveld WEF	Wind - Approved
2	14/12/16/3/3/32/2146-2147	Hoogland WEF – Northern Cluster	Wind
2a	14/12/16/3/3/1/2602	Hoogland GC – Northern Cluster	GC
3	14/12/16/3/3/1/2604-2605	Hoogland WEF – Southern Cluster	Wind
3a	14/12/16/3/3/1/2603	Hoogland GC – Southern Cluster	GC
4	To be confirmed	Gamma Grid Connection	GC
5	To be confirmed	Taaibos WEF Cluster	Wind
6	To be confirmed	Soutriver WEF Cluster	Wind
7	To be confirmed	Mura SEF 1	Sola PV
8	To be confirmed	Mura SEF 2	Sola PV

No	EIA Reference No	Project Name	Technology/Status
9	To be confirmed	Mura SEF 3	Sola PV
10	To be confirmed	Mura SEF 4	Sola PV
11	To be confirmed	Mura Grid Connection	GC

The locations of these renewable energy projects are show in Figure 20, using the reference number provided in Table 8.

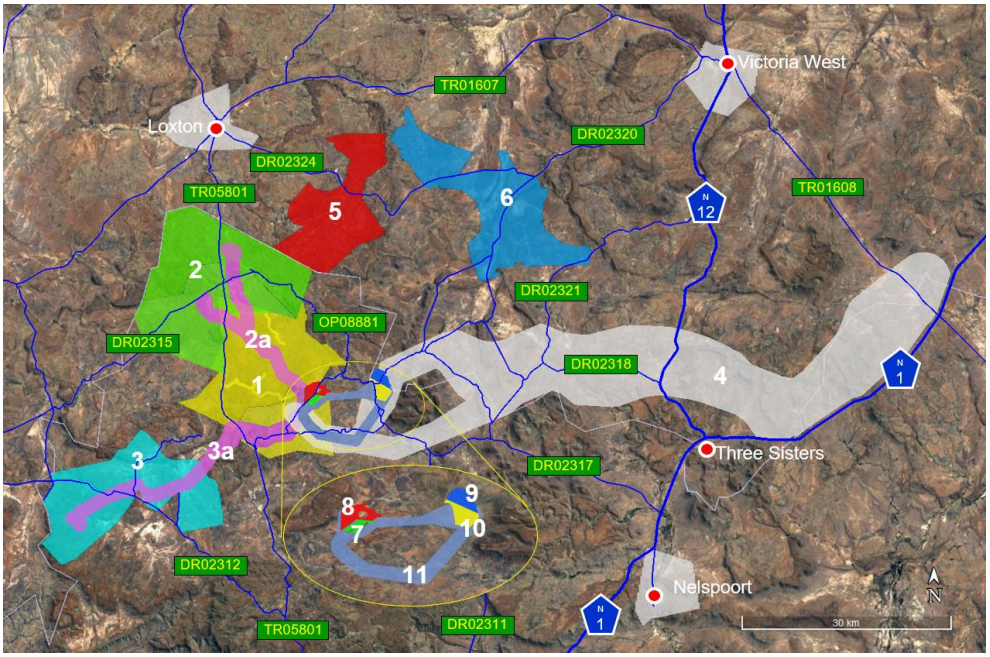


Figure 21 - Proposed Renewable Energy Projects and Associated Grid Connections

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 the proposed developments. Thus, the traffic trip generation for the construction, operation and decommissioning phrases used in this document is based on data provided by the client and obtained for similar projects. The estimated traffic generation detailed below represents a worst-case scenario.

7.1 STATUS QUO

The current traffic volumes on the public road network in the Western Cape are based on information extracted from the Western Cape Road Information System. The data is obtained from strip charts.

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

7.1.1 Strip Charts

Traffic volume data of selected roads within the study area are delineated below.

TR 01606

A Strip Chart for the TR 01606, between Carnarvon and Loxton is provided in Figure 22.

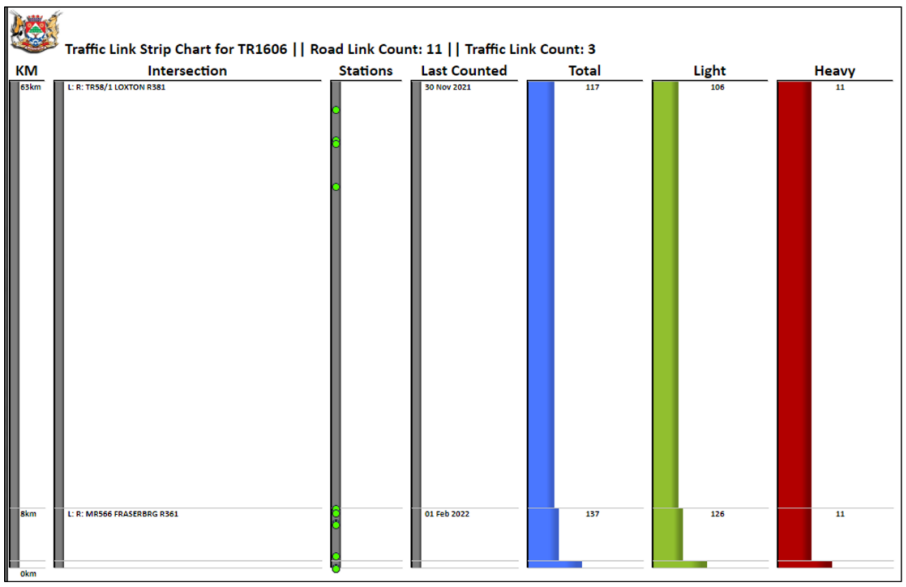


Figure 22 - TR 01606-Strip Chart

TR 01607

A Strip Chart for the TR 01607, between Loxton and Victoria West is provided in Figure 23.

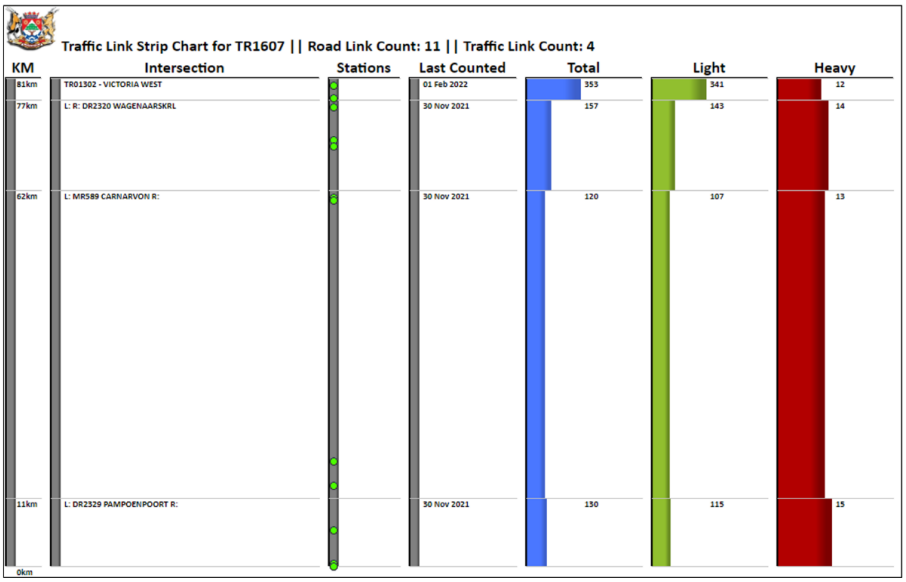


Figure 23 - TR 01607-Strip Chart

TR 05801

A strip chart of the TR 05801, from the junction with the NR 001-8 to the Western Cape Provincial boundary is provided in Figure 24.

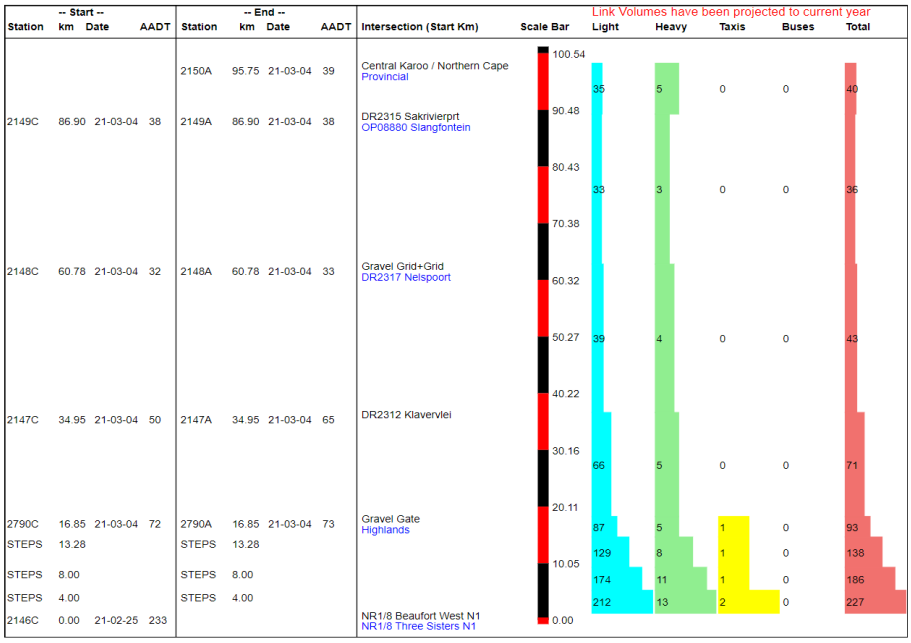


Figure 24 - TR 05801-Strip Chart (Western Cape)

A strip chart of the TR 05801, from the Western Cape/Norther Cape Provincial boundary to the TR 01607, at Loxton, is provided in Figure 25.

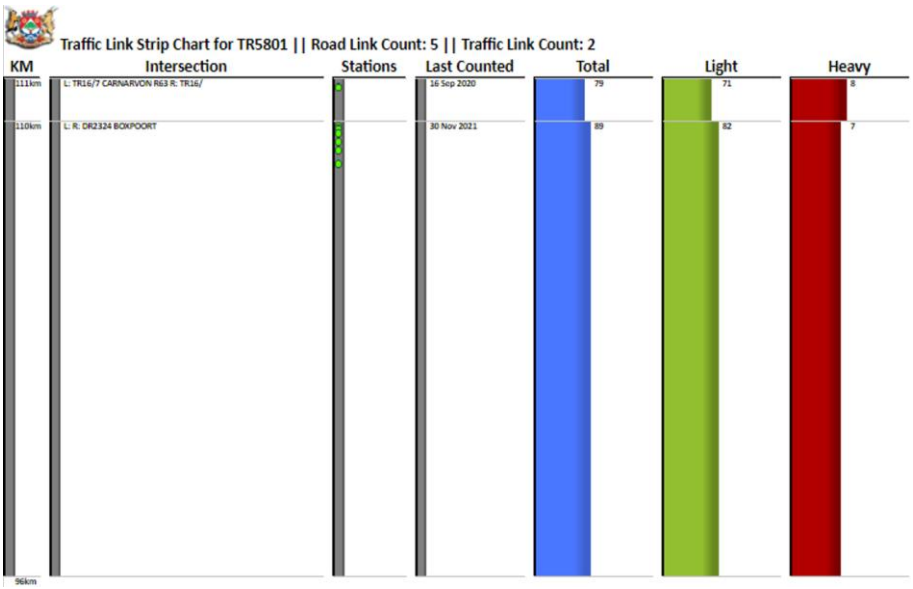


Figure 25 - TR 05801-Strip Chart (Northern Cape)

A discrepancy in the information provided by the two provinces has been noted.

The strip chart provided by the Northern Cape Roads Authority fails to include the MR 00588.

DR 02311

A strip chart of the DR 02311, from the junction with the NR 001-8 to the junction with DR 02317, is provided in Figure 26.

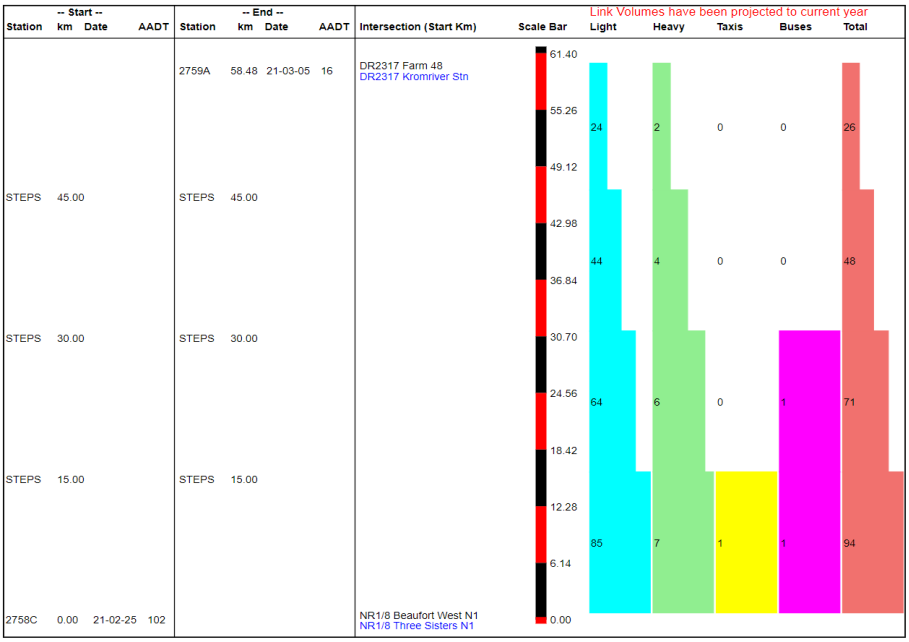


Figure 26 - DR 02311-Strip Chart

DR 02317

A strip chart of the DR 02317, from the junction with the NR 001-8 to the junction with TR 05801, is provided in Figure 27.

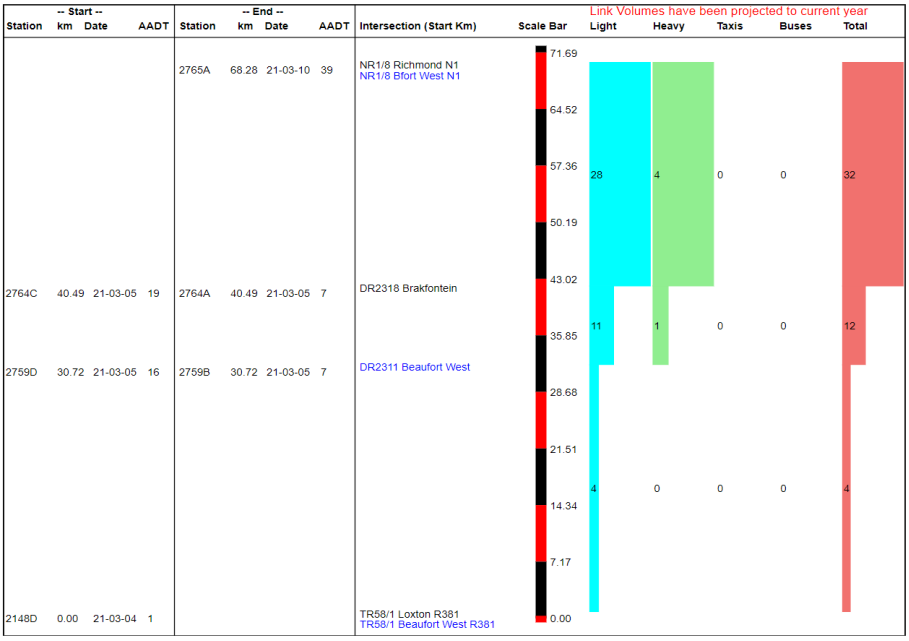


Figure 27 - DR 02317-Strip Chart

DR 02318

A strip chart of the DR 02318, from the NR 01205 to the Western / Northern Cape Provincial boundary, is provided in Figure 28

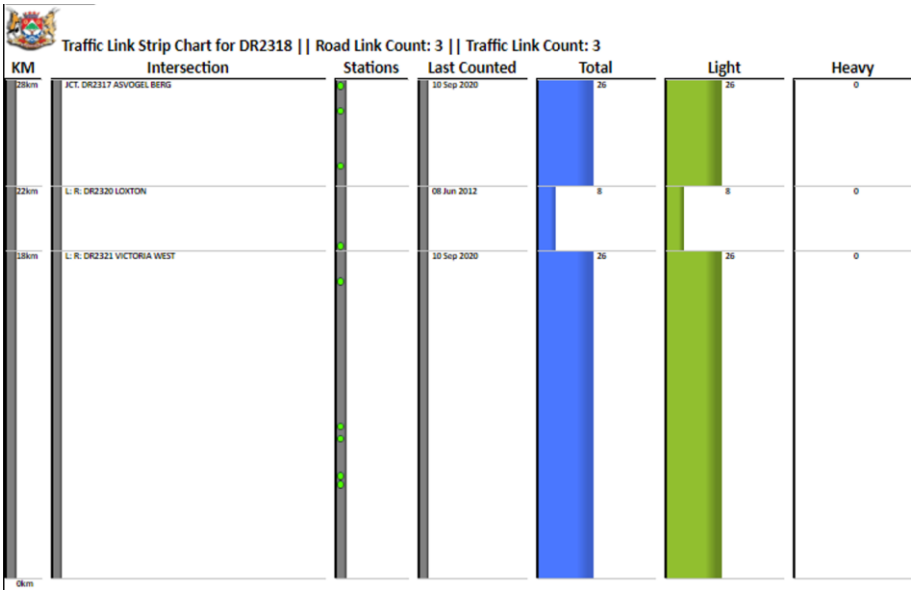


Figure 28 - DR 02318-Strip Chart (Northern Cape)

A strip chart of the DR 02318, from the Western / Northern Cape Provincial boundary to the junction with the DR 02317, is provided in Figure 29.

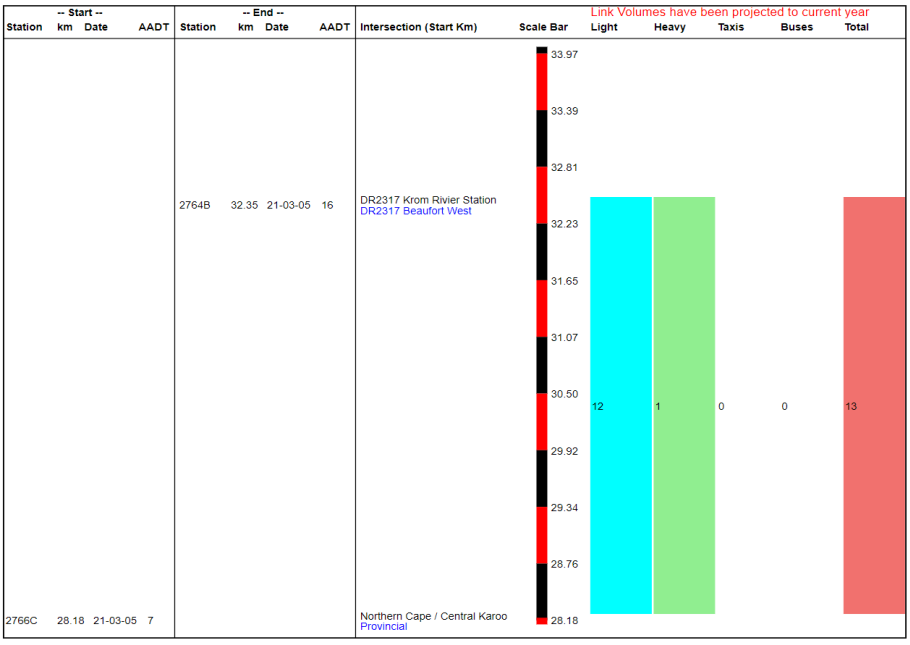


Figure 29 - DR 02318-Strip Chart (Western Cape)

A discrepancy in the information provided by the two provinces has been noted.

DR 02324

A Strip Chart for the DR 02324, between Loxton and the junction with the DR 02321 is provided in Figure 30.

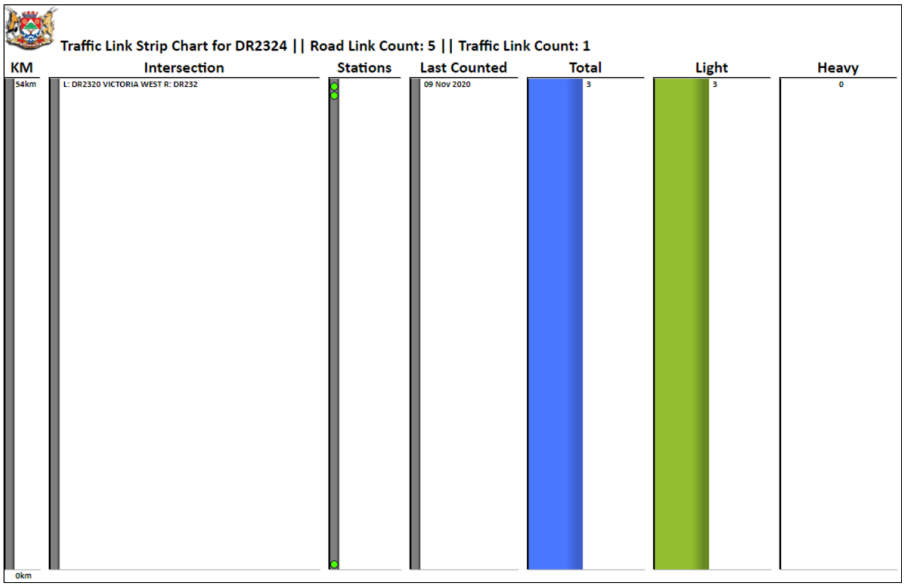


Figure 30 - DR 02324-Strip Chart

7.1.2 Baseline Traffic Volumes

The baseline traffic volumes for the road network within the study area adjacent to the proposed developments are based on the values obtained from the strip charts provided in section 7.1.1 above.

7.2 ROAD NETWORK MODEL

The road network within the study area of the proposed development has been comprehensively delineated in section 6.1 above.

A road network model, as shown in Figure 31, has been developed for analysis purposes and is the primary reference for the balance of this report.

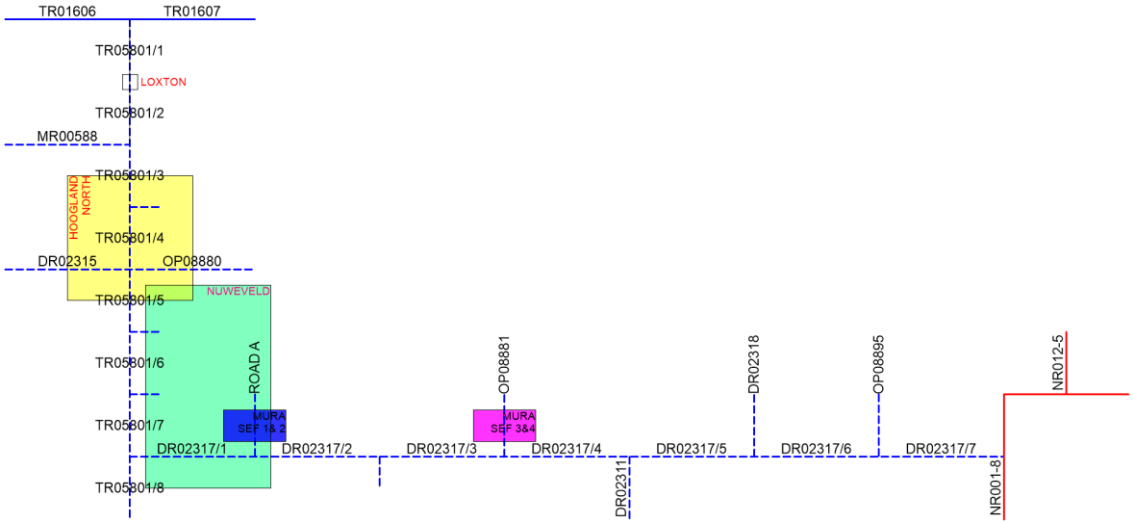


Figure 31 - Road Network Model

7.3 CONSTRUCTION PHASE

The construction phase of the proposed developments will generate the most significant increase in traffic volumes on the local road network. Construction traffic will include vehicles transporting equipment, material, and personnel. With the exception of the transformers and the BESS components, there are no abnormal or oversized components anticipated to be delivered to the proposed developments.

A construction period of 24 months is anticipated for each of 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 developments, and*
- *The delivery of equipment and material to the proposed developments.*

The simultaneous occurrence of these two activities is improbable and highly unlikely.

The commuting of personnel to and from the proposed developments 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 developments 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

Since this is a combined report for all four of the Mura Solar Energy Facilities. The workforce complement, and the peak traffic on the road network within the study area for each of the proposed developments is provided in Table 9.

Table 9 - Construction Phase - Peak Traffic

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Workforce	165	435	318	354
Number of Senior Staff	17	44	32	35
Number of Labours	149	392	286	319
Road	Number of Vehicles			
TR 01606	3 vph	3 vph	3 vph	3 vph
TR 01607/1	0 vph	0 vph	0 vph	0 vph
TR 01607/2	3 vph	5 vph	5 vph	5 vph
TR 05801/1	3 vph	3 vph	3 vph	3 vph
TR 05801/2	3 vph	4 vph	4 vph	5 vph
TR 05801/3	3 vph	4 vph	4 vph	5 vph
TR 05801/4	3 vph	4 vph	4 vph	5 vph
TR 05801/5	6 vph	7 vph	7 vph	8 vph
TR 05801/6	6 vph	7 vph	7 vph	8 vph
TR 05801/7	6 vph	7 vph	7 vph	8 vph
TR 05801/8	7 vph	15 vph	0 vph	0 vph
DR 02317/1	13 vph	22 vph	7 vph	8 vph
DR 02317/2	8 vph	10 vph	7 vph	8 vph
DR 02317/3	8 vph	10 vph	7 vph	8 vph
DR 02317/4	5 vph	5 vph	16 vph	18 vph
DR 02317/5	5 vph	5 vph	5 vph	5 vph
DR 02317/6	5 vph	5 vph	5 vph	5 vph
DR 02317/7	5 vph	5 vph	5 vph	5 vph
DR 02311	0 vph	0 vph	11 vph	13 vph
DR 02315	3 vph	3 vph	3 vph	3 vph
DR 02320	3 vph	5 vph	5 vph	5 vph
OP 08881	3 vph	5 vph	23 vph	26 vph
Road A	21 vph	32 vph	0 vph	0 vph

Peak traffic is generated by the commuting of personnel to and from each of the proposed developments, in the morning and afternoon. The maximum number of additional vehicles on the public road network within the study area for any one of the proposed developments is in the order of 22 vph (Mura SEF2 – DR 02317/1), this does increase to 32 vph on "Road A", which is a private access road.

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 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.*
  - *construction vehicles and equipment (i.e., earthmoving equipment, batching plant, etc.).*
  - *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.).*
- *solar panels and structural steel components, this constitutes that most significant transportation for these developments.*
- *self-contained inverters and electrical cables.*
- *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.).*

The traffic volumes generated for the proposed developments by 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, for all four of the proposed developments, is conservatively estimated to be in the order of eight return trips per day, which equates to approximately 2 vph.

Due to the size of the vehicles delivering the construction equipment and material, the most likely route for many of these deliveries to the proposed developments will be on the TR 05801 (R381) via Loxton, and DR 02317.

Earthworks

The construction of the sub-station platforms, battery storage area, and roads 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.

However, for this assessment provision has been made to source of suitable material from commercial quarries outside the study area. The gravel is assumed to be delivered to the proposed developments in 20 m^3 articulated rear tippers, over a period of 18 months. The increase in traffic volume for this activity, for each of the proposed developments is provided in Table 10.

Table 10 - Construction Phase – Diurnal Traffic (Earthworks)

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Volume of Material	7 425 m^3	14 850 m^3	7 425 m^3	7 425 m^3
Vehicles/hour	0.25 vph	0.50 vph	0.25 vph	0.25 vph

Due to the size of the vehicles delivering this material, the most likely route for these deliveries to the proposed developments will be on the TR05801 (R381) via Loxton, and DR 02317.

Raw Material – Concrete

All concrete will be mixed and placed on each of the proposed SEFs, over a period of 18 months. The majority will be for the securing the solar arrays, sub-stations, and battery storage facilities.

It is envisaged that on-site batching plants will be erected for the mixing of concrete for each of the proposed developments. The raw material for the concrete is to be delivered for the proposed developments from commercial sources. The increase in traffic volume for this activity, for each of the proposed developments is provided in Table 11.

Table 11 - Construction Phase – Diurnal Traffic (Concrete)

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Volume of Concrete	22 500 m³	48 000 m³	35 533 m³	38 600 m³
Cement (in m³)	5 198 m³	11 088 m³	8 208 m³	8 917 m³
Sand (in m³)	13 500 m³	28 800 m³	21 320 m³	23 160 m³
Stone (in m³)	15 750 m³	33 600 m³	24 873 m³	27 020 m³
Vehicles/hour	0.97 vph	2.06 vph	1.53 vph	1.66 vph

Due to the size of the vehicles delivering this material, the most likely route for these deliveries to the proposed developments will be on the TR05801 (R381) via Loxton, and DR 02317.

Solar Panels and Structural Steel

The traffic volumes relating to the delivery of solar panels and steel support structures for each of the proposed developments is dictated by the anticipated generating capacity. The number of trips generated for this activity is based on technical information provided by "Suntech". It is assumed that the panels and structural steel elements are delivered to each of the proposed developments over a period of 18 months. The increase in traffic volume for this activity, for each of the proposed developments is provided in Table 12.

Table 12 - Construction Phase – Diurnal Traffic (Solar Panels)

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Generating Capacity	150 MW	450 MW	320 MW	360 MW
Number of Panels	575 000	1 725 000	1 226 667	1 380 000
Vehicles/hour	1.95 vph	5.83 vph	4.15 vph	4.66 vph

Due to the size of the vehicles delivering this material, the most likely route for these deliveries to the proposed developments will be on the TR05801 (R381) via Loxton, and DR 02317.

Battery Energy Storage System

A Battery Energy Storage System (BESS) is to be constructed as part of each of the proposed developments. The facility takes excess power generated by the SEF, converts and stores the power in batteries. The BESS technology to be adopted on these projects will be Lithium Ion. 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. The increase in traffic volume for this activity, for each of the proposed developments is provided in Table 13.

Table 13 - Construction Phase – Diurnal Traffic (BESS)

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Area	4 ha	4 ha	4 ha	4 ha
Number of Containers	320	320	320	320
Vehicles/hour	2.40 vph	2.40 vph	2.40 vph	2.40 vph

Due to the size of the vehicles delivering this material, the most likely route for these deliveries to the proposed developments will be on the TR05801 (R381) via Loxton and DR 02317.

Substations

Substations are to be constructed as part of the proposed developments. Various types of vehicles will be used to deliver the construction equipment and materials to each of the proposed developments, which include steel gantries, transformers, switchgear, cables, circuit breakers, surge arresters, lightning conductor masts, scaffolding, formwork, reinforcing steel, brick, roof sheeting, fencing, structural steelwork, transformers, switchgear, cables, etc.

The increase in traffic volume for this activity, for each of the proposed developments is provided in Table 14.

Table 14 - Construction Phase – Diurnal Traffic (Substation)

	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
Total Weight	7 269 ton	7 269 ton	7 269 ton	7 269 ton
Vehicles/hour	0.58 vph	0.58 vph	0.58 vph	0.58 vph

Due to the size of the vehicles delivering this material, the most likely route for these deliveries to the proposed developments will be on the TR05801 (R381) via Loxton and DR 02317.

Summary

Based on the information provided above, a summary of the expected Diurnal Traffic on the various roads for the proposed developments is provided in Table 15.

Table 15 - Construction Phase – Diurnal Traffic

Road	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
TR 01606	1.23 vph	2.58 vph	1.79 vph	1.92 vph
TR 01607/1	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 01607/2	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/1	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/2	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/3	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/4	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/5	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/6	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/7	8.28 vph	14.52 vph	11.04 vph	11.69 vph
TR 05801/8	0.54 vph	0.85 vph	0.13 vph	0.13 vph
DR 02317/1	8.28 vph	14.52 vph	11.04 vph	11.69 vph
DR 02317/2	0.00 vph	0.00 vph	10.92 vph	11.56 vph
DR 02317/3	0.00 vph	0.00 vph	10.92 vph	11.56 vph
DR 02317/6	0.13 vph	0.13 vph	0.13 vph	0.13 vph
DR 02311	0.13 vph	0.13 vph	0.68 vph	0.71 vph
DR 02320	0.13 vph	0.13 vph	0.13 vph	0.13 vph
OP 08881	0.00 vph	0.00 vph	10.92 vph	11.56 vph
Road A	8.28 vph	14.52 vph	0.13 vph	0.13 vph

Road	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
N1	8.28 vph	14.52 vph	11.04 vph	11.69 vph
N12	8.28 vph	14.52 vph	11.04 vph	11.69 vph

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

7.4 OPERATIONAL PHASE

The operational life of the proposed developments 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 or maintenance activities.

The only on-site activities related to the proposed development will be the cleaning of the solar panels, monitoring, routine servicing, and unscheduled maintenance.

7.4.1 Peak Traffic

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

Thus, the envisaged traffic volumes on the various public roads for each of the proposed developments is depicted in Table 16.

Table 16 - Operational Phase – Peak Traffic

Road	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
TR 01606	1 vph	1 vph	1 vph	1 vph
TR 01607/1	0 vph	0 vph	0 vph	0 vph
TR 01607/2	2 vph	2 vph	2 vph	2 vph
TR 05801/1	1 vph	1 vph	1 vph	1 vph
TR 05801/2	1 vph	1 vph	1 vph	1 vph
TR 05801/3	1 vph	1 vph	1 vph	1 vph
TR 05801/4	1 vph	1 vph	1 vph	1 vph
TR 05801/5	2 vph	2 vph	2 vph	2 vph
TR 05801/6	2 vph	2 vph	2 vph	2 vph
TR 05801/7	2 vph	2 vph	2 vph	2 vph
TR 05801/8	2 vph	2 vph	0 vph	0 vph
DR 02317/1	4 vph	4 vph	2 vph	2 vph
DR 02317/2	4 vph	4 vph	2 vph	2 vph
DR 02317/3	4 vph	4 vph	2 vph	2 vph
DR 02317/4	2 vph	2 vph	4 vph	4 vph
DR 02317/5	2 vph	2 vph	2 vph	2 vph
DR 02317/6	2 vph	2 vph	2 vph	2 vph
DR 02317/7	2 vph	2 vph	2 vph	2 vph
DR 02311	0 vph	0 vph	2 vph	2 vph
DR 02315	1 vph	1 vph	1 vph	1 vph
DR 02320	2 vph	2 vph	2 vph	2 vph
OP 08881	2 vph	2 vph	6 vph	6 vph
Road A	8 vph	8 vph	0 vph	0 vph
TR 01606	1 vph	1 vph	1 vph	1 vph
TR 01607/1	0 vph	0 vph	0 vph	0 vph
TR 01607/2	2 vph	2 vph	2 vph	2 vph

Peak traffic is generated by the commuting of personnel to and from each of the proposed developments, in the morning and afternoon. The maximum number of additional vehicles on the public road network within the study area for any one of the proposed developments is in the order of 6 vph, this does increase to 8 vph on private roads.

7.4.2 Diurnal Traffic

Diurnal Traffic on the public roads resulting from each of the proposed developments is limited to servicing, deliveries of goods, and the occasional visitors.

The servicing, delivery of goods and visitors to each of the proposed developments is assumed to be in the order of two return vehicles per day. It is assumed that this traffic will travel to the proposed development from both Beaufort West and Loxton.

Based on the information provided above, the maximum number of vehicles that could travel on the same section of the road (not necessary in the same direction) in a single day would be in the order of two, for each of the proposed developments.

Thus, the envisaged traffic volumes on the various public roads during the operational phase of the proposed developments are depicted in Table 17.

Table 17 - Operational Phase - Diurnal Traffic

Road	MURA SEF 1	MURA SEF 2	MURA SEF 3	MURA SEF 4
TR 01606	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 01607/1	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 01607/2	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/1	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/2	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/3	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/4	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/5	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/6	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/7	0.25 vph	0.25 vph	0.25 vph	0.25 vph
TR 05801/8	0.25 vph	0.25 vph	0.00 vph	0.00 vph
DR 02317/1	0.25 vph	0.25 vph	0.25 vph	0.25 vph
DR 02317/2	0.00 vph	0.00 vph	0.25 vph	0.25 vph
DR 02317/3	0.00 vph	0.00 vph	0.25 vph	0.25 vph
DR 02311	0.00 vph	0.00 vph	0.25 vph	0.25 vph
OP 08881	0.00 vph	0.00 vph	0.25 vph	0.25 vph
Road A	0.25 vph	0.25 vph	0.00 vph	0.00 vph
N1	0.25 vph	0.25 vph	0.25 vph	0.25 vph
N12	0.25 vph	0.25 vph	0.25 vph	0.25 vph

Diurnal traffic is generated by the servicing, deliveries of goods, and the occasional visitors to each of the proposed developments. The maximum number of additional vehicles on the public road network within the study area for any one of the proposed developments is expected to be in the order of 0.25 vph, which should never exceed 2 vph.

7.5 DECOMMISSIONING PHASE

At the end of the operational phase, the proposed developments may be decommissioned, or its continued economic viability may be investigated. If the proposed developments are still deemed economically viable, the developments

could be re-engineered, and the operational life may be extended. If the developments are not financially viable, then the developments shall be decommissioned. The components will be disassembled, reused, recycled or disposed of in accordance with the relevant regulatory requirements. The decommissioning procedures will be undertaken in line with an Environmental Management Programme, and the site will be rehabilitated and returned to its pre-construction state.

The decommissioning phase of the development is expected to create employment opportunities for both skilled and unskilled labour. The traffic impacts on the public roads during the decommissioning phase of these developments will be significantly less than the traffic impact determined during the construction phase, as much of the internal infrastructures (i.e., roads, buildings, etc.) might 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

The access to each of the proposed developments has been described in section 6.2, The use of the Molteno Pass and De Jager's Pass are limited to light vehicles only. No vehicles with a gross vehicle mass of more than 10 tonnes should be permitted on this road due to the constraints through the pass.

Thus, for this report, it shall be assumed that 90% of all construction and equipment and material delivered to the proposed development shall be on the TR 05801 via Loxton, and the remaining 10% via the Molteno Pass or De Jager's Pass (whichever is applicable).

8.1 CONSTRUCTION PHASE

The duration of the construction phases for each of the proposed developments is assumed 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 developments (Peak Traffic), and*
- *The freight traffic, the delivery of materials and equipment to the proposed developments (Diurnal Traffic).*

It is envisaged that the transportation of personnel to and from each of the proposed developments will result in Peak Traffic, while the delivery of equipment and materials to each of the proposed developments will constitute the Diurnal Traffic, which will be distributed throughout the day.

The traffic volumes generated, for both Peak Traffic and Diurnal Traffic, resulting from each of the proposed developments has been addressed in Section 7. Thus, the expected increase in the traffic volumes on the public road network within the study area during the peak construction phase of each of the proposed developments is delineated below.

Mura 1

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 18 - Construction Phase - Traffic Volumes for SEF 1

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	3 vph		1.23 vph		3 vph	
TR 01607/1	0 vph		8.28 vph		0 vph	
TR 01607/2	3 vph		8.28 vph		3 vph	
TR 05801/1	3 vph		8.28 vph		3 vph	
TR 05801/2	3 vph		8.28 vph		3 vph	
TR 05801/3	3 vph		8.28 vph		3 vph	
TR 05801/4	3 vph		8.28 vph		3 vph	
TR 05801/5	6 vph		8.28 vph		6 vph	
TR 05801/6	6 vph		8.28 vph		6 vph	
TR 05801/7	6 vph		8.28 vph		6 vph	
TR 05801/8	7 vph		0.54 vph		7 vph	
DR 02317/1	13 vph		8.28 vph		13 vph	
DR 02317/2	8 vph		0.00 vph		8 vph	
DR 02317/3	8 vph		0.00 vph		8 vph	
DR 02317/4	5 vph		0.00 vph		5 vph	
DR 02317/5	5 vph		0.00 vph		5 vph	
DR 02317/6	5 vph		0.13 vph		5 vph	
DR 02317/7	5 vph		0.00 vph		5 vph	
DR 02311	0 vph		0.13 vph		0 vph	
DR 02315	3 vph		0.00 vph		3 vph	
DR 02320	3 vph		0.13 vph		3 vph	
OP 08881	3 vph		0.00 vph		3 vph	
Road A	21 vph		8.28 vph		21 vph	
N1	0 vph		8.28 vph		0 vph	
N12	0 vph		8.28 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 21 vph, on "Road A".*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 8.28 vph. Which equates to less than 67 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 19 - Construction Phase - Traffic Assessment for SEF 1

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(6+10) = 16 vpd	133 vpd
TR 01607/1	130 vpd	(0+66) = 66 vpd	197 vpd
TR 01607/2	353 vpd	(6+66) = 72 vpd	426 vpd
TR 05801/1	79 vpd	(6+66) = 72 vpd	152 vpd
TR 05801/2	89 vpd	(6+66) = 72 vpd	162 vpd
TR 05801/3	89 vpd	(6+66) = 72 vpd	162 vpd
TR 05801/4	40 vpd	(6+66) = 72 vpd	113 vpd
TR 05801/5	36 vpd	(12+66) = 78 vpd	115 vpd
TR 05801/6	36 vpd	(12+66) = 78 vpd	115 vpd
TR 05801/7	36 vpd	(12+66) = 78 vpd	115 vpd
TR 05801/8	43 vpd	(14+4) = 18 vpd	62 vpd
DR 02317/1	4 vpd	(26+66) = 92 vpd	97 vpd
DR 02317/2	4 vpd	(16+0) = 16 vpd	20 vpd
DR 02317/3	4 vpd	(16+0) = 16 vpd	20 vpd
DR 02317/4	4 vpd	(10+0) = 10 vpd	14 vpd
DR 02317/5	12 vpd	(10+0) = 10 vpd	22 vpd
DR 02317/6	32 vpd	(10+1) = 11 vpd	43 vpd
DR 02317/7	32 vpd	(10+0) = 10 vpd	42 vpd
DR 02311	26 vpd	(0+1) = 1 vpd	27 vpd
DR 02315	8 vpd	(6+0) = 6 vpd	14 vpd
DR 02320	13 vpd	(6+1) = 7 vpd	20 vpd
OP 08881	3 vpd	(6+0) = 6 vpd	9 vpd
Road A	4 vpd	(42+66) = 108 vpd	113 vpd
N1	2500 vpd	(0+66) = 66 vpd	2567 vpd
N12	862 vpd	(0+66) = 66 vpd	929 vpd

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

The most significant increase in Peak Traffic is expected on the "Road A", which increases the Baseline ADT by 42 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.525 v/km, equating to one vehicle every 2.85 minutes, resulting in an acceptable Level of Service (LOS A).

The most significant increase in Diurnal Traffic is in the order of 66 vpd, spread over eight hours and will be in both directions, which equates to a traffic volume (in one direction) of less than 4.5 vph, Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.113 v/km, equating to one vehicle every 13.3 minutes, resulting in an acceptable Level of Service (LOS A).

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 2

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 20 - Construction Phase - Traffic Volumes for SEF 2

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	3 vph		2.58 vph		3 vph	
TR 01607/1	0 vph		14.52 vph		0 vph	
TR 01607/2	5 vph		14.52 vph		5 vph	
TR 05801/1	3 vph		14.52 vph		3 vph	
TR 05801/2	4 vph		14.52 vph		4 vph	
TR 05801/3	4 vph		14.52 vph		4 vph	
TR 05801/4	4 vph		14.52 vph		4 vph	
TR 05801/5	7 vph		14.52 vph		7 vph	
TR 05801/6	7 vph		14.52 vph		7 vph	
TR 05801/7	7 vph		14.52 vph		7 vph	
TR 05801/8	15 vph		0.85 vph		15 vph	
DR 02317/1	22 vph		14.52 vph		22 vph	
DR 02317/2	10 vph		0.00 vph		10 vph	
DR 02317/3	10 vph		0.00 vph		10 vph	
DR 02317/4	5 vph		0.00 vph		5 vph	
DR 02317/5	5 vph		0.00 vph		5 vph	
DR 02317/6	5 vph		0.13 vph		5 vph	
DR 02317/7	5 vph		0.00 vph		5 vph	
DR 02311	0 vph		0.13 vph		0 vph	
DR 02315	3 vph		0.00 vph		3 vph	
DR 02320	5 vph		0.13 vph		5 vph	
OP 08881	5 vph		0.00 vph		5 vph	
Road A	32 vph		14.52 vph		32 vph	
N1	0 vph		14.52 vph		0 vph	
N12	0 vph		14.52 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 32 vph, on "Road A".*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 14.52 vph. Which equates to less than 117 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 21 - Construction Phase - Traffic Assessment for SEF 2

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(6+21) = 27 vpd	144 vpd
TR 01607/1	130 vpd	(0+117) = 117 vpd	247 vpd
TR 01607/2	353 vpd	(10+117) = 127 vpd	480 vpd
TR 05801/1	79 vpd	(6+117) = 123 vpd	202 vpd
TR 05801/2	89 vpd	(8+117) = 125 vpd	214 vpd
TR 05801/3	89 vpd	(8+117) = 125 vpd	214 vpd
TR 05801/4	40 vpd	(8+117) = 125 vpd	165 vpd
TR 05801/5	36 vpd	(14+117) = 131 vpd	167 vpd
TR 05801/6	36 vpd	(14+117) = 131 vpd	167 vpd
TR 05801/7	36 vpd	(14+117) = 131 vpd	167 vpd
TR 05801/8	43 vpd	(30+7) = 37 vpd	80 vpd
DR 02317/1	4 vpd	(44+117) = 161 vpd	165 vpd
DR 02317/2	4 vpd	(20+0) = 20 vpd	24 vpd
DR 02317/3	4 vpd	(20+0) = 20 vpd	24 vpd
DR 02317/4	4 vpd	(10+0) = 10 vpd	14 vpd
DR 02317/5	12 vpd	(10+0) = 10 vpd	22 vpd
DR 02317/6	32 vpd	(10+1) = 11 vpd	43 vpd
DR 02317/7	32 vpd	(10+0) = 10 vpd	42 vpd
DR 02311	26 vpd	(0+1) = 1 vpd	27 vpd
DR 02315	8 vpd	(6+0) = 6 vpd	14 vpd
DR 02320	13 vpd	(10+1) = 11 vpd	24 vpd
OP 08881	3 vpd	(10+0) = 10 vpd	13 vpd
Road A	4 vpd	(64+117) = 181 vpd	185 vpd
N1	2500 vpd	(0+117) = 117 vpd	2617 vpd
N12	862 vpd	(0+117) = 117 vpd	979 vpd

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

The most significant increase in Peak Traffic is expected on the "Road A", which increases the Baseline ADT by 64 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.80 v/km, equating to one vehicle every 1.875 minutes, resulting in an acceptable Level of Service (LOS A).

The most significant increase in Diurnal Traffic is in the order of 117 vpd, spread over eight hours and will be in both directions, which equates to a traffic volume (in one direction) of less than 7.5 vph, Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.188 v/km, equating to one vehicle every 8 minutes, resulting in an acceptable Level of Service (LOS A).

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 3

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 22 - Construction Phase - Traffic Volumes for SEF 3

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	3 vph		1.79 vph		3 vph		
TR 01607/1	0 vph		11.04 vph		0 vph		
TR 01607/2	5 vph		11.04 vph		5 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 05801/1	3 vph		11.04 vph		3 vph	
TR 05801/2	4 vph		11.04 vph		4 vph	
TR 05801/3	4 vph		11.04 vph		4 vph	
TR 05801/4	4 vph		11.04 vph		4 vph	
TR 05801/5	7 vph		11.04 vph		7 vph	
TR 05801/6	7 vph		11.04 vph		7 vph	
TR 05801/7	7 vph		11.04 vph		7 vph	
TR 05801/8	0 vph		0.13 vph		0 vph	
DR 02317/1	7 vph		11.04 vph		7 vph	
DR 02317/2	7 vph		10.92 vph		7 vph	
DR 02317/3	7 vph		10.92 vph		7 vph	
DR 02317/4	16 vph		0.00 vph		16 vph	
DR 02317/5	5 vph		0.00 vph		5 vph	
DR 02317/6	5 vph		0.13 vph		5 vph	
DR 02317/7	5 vph		0.00 vph		5 vph	
DR 02311	11 vph		0.68 vph		11 vph	
DR 02315	3 vph		0.00 vph		3 vph	
DR 02320	5 vph		0.13 vph		5 vph	
OP 08881	23 vph		10.92 vph		23 vph	
Road A	0 vph		0.13 vph		0 vph	
N1	0 vph		11.04 vph		0 vph	
N12	0 vph		11.04 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 23 vph, on OP 08881.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 11.04 vph. Which equates to less than 89 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 23 - Construction Phase - Traffic Assessment for SEF 3

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(6+15) = 21 vpd	138 vpd
TR 01607/1	130 vpd	(0+89) = 89 vpd	219 vpd
TR 01607/2	353 vpd	(10+89) = 99 vpd	452 vpd
TR 05801/1	79 vpd	(6+89) = 95 vpd	174 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 05801/2	89 vpd	(8+89) = 97 vpd	186 vpd
TR 05801/3	89 vpd	(8+89) = 97 vpd	186 vpd
TR 05801/4	40 vpd	(8+89) = 97 vpd	137 vpd
TR 05801/5	36 vpd	(14+89) = 103 vpd	139 vpd
TR 05801/6	36 vpd	(14+89) = 103 vpd	139 vpd
TR 05801/7	36 vpd	(14+89) = 103 vpd	139 vpd
TR 05801/8	43 vpd	(0+1) = 1 vpd	44 vpd
DR 02317/1	4 vpd	(14+89) = 103 vpd	107 vpd
DR 02317/2	4 vpd	(14+88) = 102 vpd	106 vpd
DR 02317/3	4 vpd	(14+88) = 102 vpd	106 vpd
DR 02317/4	4 vpd	(32+0) = 32 vpd	36 vpd
DR 02317/5	12 vpd	(10+0) = 10 vpd	22 vpd
DR 02317/6	32 vpd	(10+1) = 11 vpd	43 vpd
DR 02317/7	32 vpd	(10+0) = 10 vpd	42 vpd
DR 02311	26 vpd	(22+6) = 28 vpd	54 vpd
DR 02315	8 vpd	(6+0) = 6 vpd	14 vpd
DR 02320	13 vpd	(10+1) = 11 vpd	24 vpd
OP 08881	3 vpd	(46+88) = 134 vpd	137 vpd
Road A	4 vpd	(0+1) = 1 vpd	5 vpd
N1	2500 vpd	(0+89) = 89 vpd	2589 vpd
N12	862 vpd	(0+89) = 89 vpd	951 vpd

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

The most significant increase in Peak Traffic is expected on the OP 08881, which increases the Baseline ADT by 46 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.575 v/km, equating to one vehicle every 2.6 minutes, resulting in an acceptable Level of Service (LOS A).

The most significant increase in Diurnal Traffic is in the order of 89 vpd, spread over eight hours and will be in both directions, which equates to a traffic volume (in one direction) of less than 6 vph, Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.15 v/km, equating to one vehicle every 10 minutes, resulting in an acceptable Level of Service (LOS A).

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 4

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 24 - Construction Phase - Traffic Volumes for SEF 4

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	3 vph		1.92 vph		3 vph		
TR 01607/1	0 vph		11.69 vph		0 vph		
TR 01607/2	5 vph		11.69 vph		5 vph		
TR 05801/1	3 vph		11.69 vph		3 vph		
TR 05801/2	5 vph		11.69 vph		5 vph		
TR 05801/3	5 vph		11.69 vph		5 vph		
TR 05801/4	5 vph		11.69 vph		5 vph		
TR 05801/5	8 vph		11.69 vph		8 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 05801/6	8 vph		11.69 vph		8 vph	
TR 05801/7	8 vph		11.69 vph		8 vph	
TR 05801/8	0 vph		0.13 vph		0 vph	
DR 02317/1	8 vph		11.69 vph		8 vph	
DR 02317/2	8 vph		11.56 vph		8 vph	
DR 02317/3	8 vph		11.56 vph		8 vph	
DR 02317/4	18 vph		0.00 vph		18 vph	
DR 02317/5	5 vph		0.00 vph		5 vph	
DR 02317/6	5 vph		0.13 vph		5 vph	
DR 02317/7	5 vph		0.00 vph		5 vph	
DR 02311	13 vph		0.71 vph		13 vph	
DR 02315	3 vph		0.00 vph		3 vph	
DR 02320	5 vph		0.13 vph		5 vph	
OP 08881	26 vph		11.56 vph		26 vph	
Road A	0 vph		0.13 vph		0 vph	
N1	0 vph		11.69 vph		0 vph	
N12	0 vph		11.69 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 26 vph, on OP 08881.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 11.69 vph. Which equates to less than 94 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 25 - Construction Phase - Traffic Assessment for SEF 4

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(6+16) = 22 vpd	139 vpd
TR 01607/1	130 vpd	(0+94) = 94 vpd	224 vpd
TR 01607/2	353 vpd	(10+94) = 104 vpd	457 vpd
TR 05801/1	79 vpd	(6+94) = 100 vpd	179 vpd
TR 05801/2	89 vpd	(10+94) = 104 vpd	193 vpd
TR 05801/3	89 vpd	(10+94) = 104 vpd	193 vpd
TR 05801/4	40 vpd	(10+94) = 104 vpd	144 vpd
TR 05801/5	36 vpd	(16+94) = 110 vpd	146 vpd
TR 05801/6	36 vpd	(16+94) = 110 vpd	146 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 05801/7	36 vpd	(16+94) = 110 vpd	146 vpd
TR 05801/8	43 vpd	(0+1) = 1 vpd	44 vpd
DR 02317/1	4 vpd	(16+94) = 110 vpd	114 vpd
DR 02317/2	4 vpd	(16+93) = 109 vpd	113 vpd
DR 02317/3	4 vpd	(16+93) = 109 vpd	113 vpd
DR 02317/4	4 vpd	(36+0) = 36 vpd	40 vpd
DR 02317/5	12 vpd	(10+0) = 10 vpd	22 vpd
DR 02317/6	32 vpd	(10+1) = 11 vpd	43 vpd
DR 02317/7	32 vpd	(10+0) = 10 vpd	42 vpd
DR 02311	26 vpd	(26+6) = 32 vpd	58 vpd
DR 02315	8 vpd	(6+0) = 6 vpd	14 vpd
DR 02320	13 vpd	(10+1) = 11 vpd	24 vpd
OP 08881	3 vpd	(52+93) = 145 vpd	148 vpd
Road A	4 vpd	(0+1) = 1 vpd	5 vpd
N1	2500 vpd	(0+94) = 94 vpd	2594 vpd
N12	862 vpd	(0+94) = 94 vpd	956 vpd

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

The most significant increase in Peak Traffic is expected on the OP 08881, which increases the Baseline ADT by 52 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.65 v/km, equating to one vehicle every 2.3 minutes, resulting in an acceptable Level of Service (LOS A).

The most significant increase in Diurnal Traffic is in the order of 110 vpd, spread over eight hours and will be in both directions, which equates to a traffic volume (in one direction) of less than 7 vph, Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.175 v/km, equating to one vehicle every 8.5 minutes, resulting in an acceptable Level of Service (LOS A).

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

8.2 OPERATIONAL PHASE

The duration of the operational phase of each of the proposed developments 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 developments (Peak Traffic), and*
- *The servicing, delivery of goods and the occasional visitor to the proposed developments (Diurnal Traffic).*

It is envisaged that the transportation of personnel to and from each of the proposed developments will result in Peak Traffic, while the delivery of equipment and materials to each of the proposed developments will constitute the Diurnal Traffic, which will be distributed throughout the day.

The traffic volumes generated, for both Peak Traffic and Diurnal Traffic, resulting from each of the proposed developments has been addressed in Section 7. Thus, the expected increase in the traffic volumes on the public road network within the study area during the operational phase of each of the proposed developments is delineated below.

Mura 1

The Peak Traffic and Diurnal Traffic is summarised in Table 26.

Table 26 - Operational Phase - Traffic Volumes for SEF 1

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 vph		0.25 vph		1 vph	
TR 01607/1	0 vph		0.25 vph		0 vph	
TR 01607/2	2 vph		0.25 vph		2 vph	
TR 05801/1	1 vph		0.25 vph		1 vph	
TR 05801/2	1 vph		0.25 vph		1 vph	
TR 05801/3	1 vph		0.25 vph		1 vph	
TR 05801/4	1 vph		0.25 vph		1 vph	
TR 05801/5	2 vph		0.25 vph		2 vph	
TR 05801/6	2 vph		0.25 vph		2 vph	
TR 05801/7	2 vph		0.25 vph		2 vph	
TR 05801/8	2 vph		0.25 vph		2 vph	
DR 02317/1	4 vph		0.25 vph		4 vph	
DR 02317/2	4 vph		0.00 vph		4 vph	
DR 02317/3	4 vph		0.00 vph		4 vph	
DR 02317/4	2 vph		0.00 vph		2 vph	
DR 02317/5	2 vph		0.00 vph		2 vph	
DR 02317/6	2 vph		0.00 vph		2 vph	
DR 02317/7	2 vph		0.00 vph		2 vph	
DR 02315	1 vph		0.00 vph		1 vph	
DR 02320	2 vph		0.00 vph		2 vph	
OP 08881	2 vph		0.00 vph		2 vph	
Road A	8 vph		0.25 vph		8 vph	
N1	0 vph		0.25 vph		0 vph	
N12	0 vph		0.25 vph		0 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 two proposed developments are as follows:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 8 vph.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 0.25 vph. Which equates to approximately 2 vehicles, over an eight-hour period.*

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 27.

Table 27 - Operational Phase - Traffic Assessment for SEF 1

Road	ADT Baseline*	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(2+2) = 4 vpd	121 vpd
TR 01607/1	130 vpd	(0+2) = 2 vpd	132 vpd
TR 01607/2	353 vpd	(4+2) = 6 vpd	359 vpd
TR 05801/1	79 vpd	(2+2) = 4 vpd	83 vpd
TR 05801/2	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/3	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/4	40 vpd	(2+2) = 4 vpd	44 vpd
TR 05801/5	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/6	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/7	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/8	43 vpd	(4+2) = 6 vpd	49 vpd
DR 02317/1	4 vpd	(8+2) = 10 vpd	14 vpd
DR 02317/2	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/3	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/4	4 vpd	(4+0) = 4 vpd	8 vpd
DR 02317/5	12 vpd	(4+0) = 4 vpd	16 vpd
DR 02317/6	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02317/7	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02311	26 vpd	(0+0) = 0 vpd	26 vpd
DR 02315	8 vpd	(2+0) = 2 vpd	10 vpd
DR 02320	13 vpd	(4+0) = 4 vpd	17 vpd
OP 08881	3 vpd	(4+0) = 4 vpd	7 vpd
Road A	4 vpd	(16+2) = 18 vpd	22 vpd
N1	2500 vpd	(0+2) = 2 vpd	2502 vpd
N12	862 vpd	(0+2) = 2 vpd	864 vpd

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

The most significant increase in Peak Traffic is expected on the "Road A", which increases the Baseline ADT by 16 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.2 v/km, equating to one vehicle every 7.5 minutes, resulting in an acceptable Level of Service (LOS A).

The change in Diurnal Traffic volumes on the road network is negligible.

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 2

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 28 - Operational Phase - Traffic Volumes for SEF 2

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 vph		0.25 vph		1 vph		
TR 01607/1	0 vph		0.25 vph		0 vph		
TR 01607/2	2 vph		0.25 vph		2 vph		
TR 05801/1	1 vph		0.25 vph		1 vph		
TR 05801/2	1 vph		0.25 vph		1 vph		
TR 05801/3	1 vph		0.25 vph		1 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 05801/4	1 vph		0.25 vph		1 vph	
TR 05801/5	2 vph		0.25 vph		2 vph	
TR 05801/6	2 vph		0.25 vph		2 vph	
TR 05801/7	2 vph		0.25 vph		2 vph	
TR 05801/8	2 vph		0.25 vph		2 vph	
DR 02317/1	4 vph		0.25 vph		4 vph	
DR 02317/2	4 vph		0.00 vph		4 vph	
DR 02317/3	4 vph		0.00 vph		4 vph	
DR 02317/4	2 vph		0.00 vph		2 vph	
DR 02317/5	2 vph		0.00 vph		2 vph	
DR 02317/6	2 vph		0.00 vph		2 vph	
DR 02317/7	2 vph		0.00 vph		2 vph	
DR 02315	1 vph		0.00 vph		1 vph	
DR 02320	2 vph		0.00 vph		2 vph	
OP 08881	2 vph		0.00 vph		2 vph	
Road A	8 vph		0.25 vph		8 vph	
N1	0 vph		0.25 vph		0 vph	
N12	0 vph		0.25 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 8 vph, on Road A.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 0.25 vph. Which equates to 2 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 29 - Operational Phase - Traffic Assessment for SEF 2

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(2+2) = 4 vpd	121 vpd
TR 01607/1	130 vpd	(0+2) = 2 vpd	132 vpd
TR 01607/2	353 vpd	(4+2) = 6 vpd	359 vpd
TR 05801/1	79 vpd	(2+2) = 4 vpd	83 vpd
TR 05801/2	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/3	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/4	40 vpd	(2+2) = 4 vpd	44 vpd
TR 05801/5	36 vpd	(4+2) = 6 vpd	42 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 05801/6	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/7	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/8	43 vpd	(4+2) = 6 vpd	49 vpd
DR 02317/1	4 vpd	(8+2) = 10 vpd	14 vpd
DR 02317/2	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/3	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/4	4 vpd	(4+0) = 4 vpd	8 vpd
DR 02317/5	12 vpd	(4+0) = 4 vpd	16 vpd
DR 02317/6	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02317/7	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02315	8 vpd	(2+0) = 2 vpd	10 vpd
DR 02320	13 vpd	(4+0) = 4 vpd	17 vpd
OP 08881	3 vpd	(4+0) = 4 vpd	7 vpd
Road A	4 vpd	(16+2) = 18 vpd	22 vpd
N1	2500 vpd	(0+2) = 2 vpd	2502 vpd
N12	862 vpd	(0+2) = 2 vpd	864 vpd

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

The most significant increase in Peak Traffic is expected on the "Road A", which increases the Baseline ADT by 16 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.2 v/km, equating to one vehicle every 7.5 minutes, resulting in an acceptable Level of Service (LOS A).

The change in Diurnal Traffic volumes on the road network is negligible.

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 3

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 30 - Operational Phase - Traffic Volumes for SEF 3

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 vph			0.25 vph		1 vph	
TR 01607/1	0 vph			0.25 vph		0 vph	
TR 01607/2	2 vph			0.25 vph		2 vph	
TR 05801/1	1 vph			0.25 vph		1 vph	
TR 05801/2	1 vph			0.25 vph		1 vph	
TR 05801/3	1 vph			0.25 vph		1 vph	
TR 05801/4	1 vph			0.25 vph		1 vph	
TR 05801/5	2 vph			0.25 vph		2 vph	
TR 05801/6	2 vph			0.25 vph		2 vph	
TR 05801/7	2 vph			0.25 vph		2 vph	
TR 05801/8	0 vph			0.00 vph		0 vph	
DR 02317/1	2 vph			0.25 vph		2 vph	
DR 02317/2	2 vph			0.25 vph		2 vph	
DR 02317/3	2 vph			0.25 vph		2 vph	
DR 02317/4	4 vph			0.00 vph		4 vph	
DR 02317/5	2 vph			0.00 vph		2 vph	
DR 02317/6	2 vph			0.00 vph		2 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
DR 02317/7	2 vph		0.00 vph		2 vph	
DR 02311	2 vph		0.25 vph		2 vph	
DR 02315	1 vph		0.00 vph		1 vph	
DR 02320	2 vph		0.00 vph		2 vph	
OP 08881	6 vph		0.25 vph		6 vph	
Road A	0 vph		0.00 vph		0 vph	
N1	0 vph		0.25 vph		0 vph	
N12	0 vph		0.25 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 6 vph, on OP 08881.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 0.25 vph. Which equates to 2 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 31 - Operational Phase - Traffic Assessment for SEF 3

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(2+2) = 4 vpd	121 vpd
TR 01607/1	130 vpd	(0+2) = 2 vpd	132 vpd
TR 01607/2	353 vpd	(4+2) = 6 vpd	359 vpd
TR 05801/1	79 vpd	(2+2) = 4 vpd	83 vpd
TR 05801/2	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/3	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/4	40 vpd	(2+2) = 4 vpd	44 vpd
TR 05801/5	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/6	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/7	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/8	43 vpd	(0+0) = 0 vpd	43 vpd
DR 02317/1	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/2	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/3	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/4	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/5	12 vpd	(4+0) = 4 vpd	16 vpd
DR 02317/6	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02317/7	32 vpd	(4+0) = 4 vpd	36 vpd

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
DR 02311	26 vpd	(4+2) = 6 vpd	32 vpd
DR 02315	8 vpd	(2+0) = 2 vpd	10 vpd
DR 02320	13 vpd	(4+0) = 4 vpd	17 vpd
OP 08881	3 vpd	(12+2) = 14 vpd	17 vpd
Road A	4 vpd	(0+0) = 0 vpd	4 vpd
N1	2500 vpd	(0+2) = 2 vpd	2502 vpd
N12	862 vpd	(0+2) = 2 vpd	864 vpd

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

The most significant increase in Peak Traffic is expected on OP 08881, which increases the Baseline ADT by 12 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.1 v/km, equating to one vehicle every 10 minutes, resulting in an acceptable Level of Service (LOS A).

The change in Diurnal Traffic volumes on the road network is negligible.

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

Mura 4

The Peak Traffic and Diurnal Traffic is summarised in Table 18.

Table 32 - Operational Phase - Traffic Volumes for SEF 4

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 vph		0.25 vph		1 vph		
TR 01607/1	0 vph		0.25 vph		0 vph		
TR 01607/2	2 vph		0.25 vph		2 vph		
TR 05801/1	1 vph		0.25 vph		1 vph		
TR 05801/2	1 vph		0.25 vph		1 vph		
TR 05801/3	1 vph		0.25 vph		1 vph		
TR 05801/4	1 vph		0.25 vph		1 vph		
TR 05801/5	2 vph		0.25 vph		2 vph		
TR 05801/6	2 vph		0.25 vph		2 vph		
TR 05801/7	2 vph		0.25 vph		2 vph		
DR 02317/1	2 vph		0.25 vph		2 vph		
DR 02317/2	2 vph		0.25 vph		2 vph		
DR 02317/3	2 vph		0.25 vph		2 vph		
DR 02317/4	4 vph		0.00 vph		4 vph		
DR 02317/5	2 vph		0.00 vph		2 vph		
DR 02317/6	2 vph		0.00 vph		2 vph		
DR 02317/7	2 vph		0.00 vph		2 vph		
DR 02311	2 vph		0.25 vph		2 vph		
DR 02315	1 vph		0.00 vph		1 vph		
DR 02320	2 vph		0.00 vph		2 vph		
OP 08881	6 vph		0.25 vph		6 vph		
N1	0 vph		0.25 vph		0 vph		
N12	0 vph		0.25 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 for this proposed development is in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 6 vph, on OP 08881.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 0.25 vph. Which equates to 2 vehicles, over an eight-hour period.*

The ADT generated during the peak construction phase on the roads, expressed as an "Increased ADT", are shown in Table 19.

Table 33 - Operational Phase - Traffic Assessment for SEF 4

Road	ADT Baseline	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(2+2) = 4 vpd	121 vpd
TR 01607/1	130 vpd	(0+2) = 2 vpd	132 vpd
TR 01607/2	353 vpd	(4+2) = 6 vpd	359 vpd
TR 05801/1	79 vpd	(2+2) = 4 vpd	83 vpd
TR 05801/2	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/3	89 vpd	(2+2) = 4 vpd	93 vpd
TR 05801/4	40 vpd	(2+2) = 4 vpd	44 vpd
TR 05801/5	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/6	36 vpd	(4+2) = 6 vpd	42 vpd
TR 05801/7	36 vpd	(4+2) = 6 vpd	42 vpd
DR 02317/1	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/2	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/3	4 vpd	(4+2) = 6 vpd	10 vpd
DR 02317/4	4 vpd	(8+0) = 8 vpd	12 vpd
DR 02317/5	12 vpd	(4+0) = 4 vpd	16 vpd
DR 02317/6	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02317/7	32 vpd	(4+0) = 4 vpd	36 vpd
DR 02311	26 vpd	(4+2) = 6 vpd	32 vpd
DR 02315	8 vpd	(2+0) = 2 vpd	10 vpd
DR 02320	13 vpd	(4+0) = 4 vpd	17 vpd
OP 08881	3 vpd	(12+2) = 14 vpd	17 vpd
N1	2500 vpd	(0+2) = 2 vpd	2502 vpd
N12	862 vpd	(0+2) = 2 vpd	864 vpd

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

The most significant increase in Peak Traffic is expected on OP 08881, which increases the Baseline ADT by 12 vpd. Based on a speed of 40 km/h, the traffic volume will result in a Following Density of 0.1 v/km, equating to one vehicle every 10 minutes, resulting in an acceptable Level of Service (LOS A).

The change in Diurnal Traffic volumes on the road network is negligible.

The additional traffic volumes on the road network for this proposed development, does not compromise the level of service for these roads.

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 impact of the increased traffic volumes on the road network within the study area during the construction, operational and decommissioning phases of the proposed development is delineated below.

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

The cumulative impact assessment in this report is based on the following:

- *The simultaneous construction of the four Mura SEF and the Grid Connection.*
- *The simultaneous operation of the three Nuweveld WEF.*
- *The simultaneous construction of the two Hoogland Wind Energy Clusters, each cluster consisting of two wind farms and associated infrastructure, are assumed to be in the construction phase.*
- *The construction of the Gamma Grid Connection.*

It should be re-iterated that although this report assumes the simultaneous construction of the four Hoogland WEF, the four Mura SEF and the Gamma Grid Connection, together with the operation of the three Nuweveld WEF. Which is a worst-case scenario, the feasibility of all these projects being developed simultaneously is highly unlikely.

9.1 CONSTRUCTION PHASE

The cumulative traffic volumes generated of the road network within the study area during the construction phase of the proposed developments is based on the manpower complements of approximately 2 550 individuals, resulting in the Peak and Diurnal Traffic on the various roads within the study area as indicated in Table 34.

Table 34 - 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	28 vph		8 vph		28 vph	
TR 01607/1	0 vph		87 vph		0 vph	
TR 01607/2	34 vph		87 vph		34 vph	
TR 05801/1	44 vph		87 vph		44 vph	
TR 05801/2	81 vph		87 vph		81 vph	
TR 05801/3	74 vph		87 vph		74 vph	
TR 05801/4	75 vph		78 vph		75 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 05801/5	89 vph		68 vph		89 vph	
TR 05801/6	88 vph		68 vph		88 vph	
TR 05801/7	87 vph		68 vph		87 vph	
TR 05801/8	82 vph		23 vph		82 vph	
DR 02311	29 vph		1 vph		29 vph	
DR 02317/1	81 vph		48 vph		81 vph	
DR 02317/2	52 vph		23 vph		52 vph	
DR 02317/3	52 vph		23 vph		52 vph	
DR 02317/4	64 vph		1 vph		64 vph	
DR 02317/5	34 vph		0 vph		34 vph	
DR 02317/6	33 vph		0 vph		33 vph	
DR 02317/7	33 vph		0 vph		33 vph	
DR 02318	3 vph		0 vph		3 vph	
Road A	85 vph		23 vph		85 vph	
Road B	8 vph		0 vph		8 vph	
OP 08881	64 vph		23 vph		64 vph	
MR 00588	17 vph		0 vph		17 vph	
DR 02315	34 vph		10 vph		34 vph	
N1	0 vph		87 vph		0 vph	
N12	0 vph		87 vph		0 vph	

Based on the information provided in the table above, there are several roads within the study area where the expected traffic volumes increase by more than 50 trips an hour, thus necessitating the requirements for a TIA, as per 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".

However, there is no traffic volume on the road network within the study area where the expected traffic volumes increase by more than 150 trips an hour, the threshold stipulated in the "Manual for Traffic Impact Studies".

The maximum cumulative traffic volumes generated on the various roads within the study area 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 estimated to be in the order of 89 vph.*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 87 vph. Which equates to approximately 696 vehicles, over an eight-hour period.*

The assessment of the cumulative traffic impact generated during the peak construction phase expressed as an "Increased ADT" is provided in Table 35.

Table 35 - Cumulative Constructional Phase - Traffic Assessment

Road	ADT Baseline*	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(56+60) = 116 vpd	233 vpd

Road	ADT Baseline*	Additional Traffic Generated**	Increased ADT
TR 01607/1	130 vpd	(0+693) = 693 vpd	823 vpd
TR 01607/2	353 vpd	(68+693) = 761 vpd	1114 vpd
TR 05801/1	79 vpd	(88+695) = 783 vpd	862 vpd
TR 05801/2	89 vpd	(162+695) = 857 vpd	946 vpd
TR 05801/3	89 vpd	(148+699) = 847 vpd	936 vpd
TR 05801/4	40 vpd	(150+622) = 772 vpd	812 vpd
TR 05801/5	36 vpd	(178+544) = 722 vpd	758 vpd
TR 05801/6	36 vpd	(176+544) = 720 vpd	756 vpd
TR 05801/7	36 vpd	(174+544) = 718 vpd	754 vpd
TR 05801/8	43 vpd	(164+185) = 349 vpd	392 vpd
DR 02311	26 vpd	(58+11) = 69 vpd	95 vpd
DR 02317/1	4 vpd	(162+386) = 548 vpd	552 vpd
DR 02317/2	4 vpd	(104+186) = 290 vpd	294 vpd
DR 02317/3	4 vpd	(104+186) = 290 vpd	294 vpd
DR 02317/4	4 vpd	(128+4) = 132 vpd	136 vpd
DR 02317/5	12 vpd	(68+2) = 70 vpd	82 vpd
DR 02317/6	32 vpd	(66+0) = 66 vpd	98 vpd
DR 02317/7	32 vpd	(66+0) = 66 vpd	98 vpd
DR 02318	13 vpd	(6+2) = 8 vpd	21 vpd
Road A	4 vpd	(170+186) = 356 vpd	360 vpd
Road B	0 vpd	(16+2) = 18 vpd	18 vpd
OP 08881	3 vpd	(128+184) = 312 vpd	315 vpd
MR 00588	0 vpd	(34+3) = 37 vpd	37 vpd
DR 02315	8 vpd	(68+79) = 147 vpd	155 vpd
N1	2500 vpd	(0+693) = 693 vpd	3193 vpd
N12	862 vpd	(0+693) = 693 vpd	1555 vpd

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

The maximum increase in Peak Traffic is on TR05801/5, with an expected 89 vph, not all in the same direction. However, assuming that all the vehicles were traveling same direction at a speed of 60 km/h, the traffic volume will result in a Following Density of 1.48 v/km, equating to one vehicle every 40 seconds, resulting in a satisfactory Level of Service (LOS B)

The maximum increase in Diurnal Traffic is in the order of 87 vph, this volume is found on several roads within the study area, this is bio-directional traffic. Thus, assuming a 50:50 split, the density of the traffic would be in the order of 44 vph, plus the baseline, in a single direction. Based on a speed of 60 km/h, the traffic volume will result in a Following Density of 0.8 v/km, equating to one vehicle every 1.3 minutes, resulting in an acceptable Level of Service (LOS A).

9.2 OPERATIONAL PHASE

The cumulative traffic volumes generated on the road network within the study area during the construction phase of the proposed developments is based on the manpower complements of approximately 420 individuals, resulting in the Peak and Diurnal Traffic on the various roads within the study area as indicated in Table 36.

Table 36 - 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	12 vph		1 vph		12 vph	
TR 01607/1	0 vph		1 vph		0 vph	
TR 01607/2	16 vph		2 vph		16 vph	
TR 05801/1	20 vph		2 vph		20 vph	
TR 05801/2	29 vph		2 vph		29 vph	
TR 05801/3	26 vph		2 vph		26 vph	
TR 05801/4	24 vph		6 vph		24 vph	
TR 05801/5	27 vph		4 vph		27 vph	
TR 05801/6	26 vph		2 vph		26 vph	
TR 05801/7	25 vph		2 vph		25 vph	
TR 05801/8	20 vph		1 vph		20 vph	
DR 02311	4 vph		1 vph		4 vph	
DR 02317/1	21 vph		1 vph		21 vph	
DR 02317/2	16 vph		1 vph		16 vph	
DR 02317/3	16 vph		1 vph		16 vph	
DR 02317/4	16 vph		0 vph		16 vph	
DR 02317/5	12 vph		0 vph		12 vph	
DR 02317/6	12 vph		0 vph		12 vph	
DR 02317/7	12 vph		0 vph		12 vph	
DR 02318	0 vph		0 vph		0 vph	
Road A	21 vph		1 vph		21 vph	
Road B	0 vph		0 vph		0 vph	
OP 08881	16 vph		1 vph		16 vph	
MR 00588	5 vph		0 vph		5 vph	
DR 02315	11 vph		0 vph		11 vph	
N1	0 vph		1 vph		0 vph	
N12	0 vph		1 vph		0 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 renewable project in the study area are in the order of:

- *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 29 vph;*
- *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 6 vph. Which equates to approximately 48 vehicles, over an eight-hour period.*

The assessment of the cumulative traffic impact generated during the operational phase expressed as an "Increased ADT" is provided in Table 37.

Table 37 - Cumulative Operational Phase - Traffic Assessment

Road	ADT Baseline*	Additional Traffic Generated**	Increased ADT
TR 01606	117 vpd	(24+8) = 32 vpd	149 vpd
TR 01607/1	130 vpd	(0+6) = 6 vpd	136 vpd
TR 01607/2	353 vpd	(32+14) = 46 vpd	399 vpd
TR 05801/1	40 vpd	(40+14) = 54 vpd	94 vpd
TR 05801/2	40 vpd	(58+14) = 72 vpd	112 vpd
TR 05801/3	40 vpd	(52+14) = 66 vpd	106 vpd
TR 05801/4	40 vpd	(48+46) = 94 vpd	134 vpd
TR 05801/5	36 vpd	(54+30) = 84 vpd	120 vpd
TR 05801/6	36 vpd	(52+14) = 66 vpd	102 vpd
TR 05801/7	36 vpd	(50+14) = 64 vpd	100 vpd
TR 05801/8	43 vpd	(40+10) = 50 vpd	93 vpd
DR 02311	26 vpd	(8+4) = 12 vpd	38 vpd
DR 02317/1	4 vpd	(42+10) = 52 vpd	56 vpd
DR 02317/2	4 vpd	(32+4) = 36 vpd	40 vpd
DR 02317/3	4 vpd	(32+4) = 36 vpd	40 vpd
DR 02317/4	4 vpd	(32+0) = 32 vpd	36 vpd
DR 02317/5	12 vpd	(24+0) = 24 vpd	36 vpd
DR 02317/6	32 vpd	(24+0) = 24 vpd	56 vpd
DR 02317/7	32 vpd	(24+0) = 24 vpd	56 vpd
DR 02318	13 vpd	(0+0) = 0 vpd	13 vpd
Road A	4 vpd	(42+6) = 48 vpd	52 vpd
Road B	0 vpd	(0+0) = 0 vpd	0 vpd
OP 08881	3 vpd	(32+4) = 36 vpd	39 vpd
MR 00588	0 vpd	(10+3) = 13 vpd	13 vpd
DR 02315	8 vpd	(22+0) = 22 vpd	30 vpd
N1	0 vpd	(0+8) = 8 vpd	8 vpd
N12	0 vpd	(0+8) = 8 vpd	8 vpd

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

The maximum increase in Peak Traffic is on TR05801/2, with an expected 29 vph, not all in the same direction. However, assuming that all the vehicles were traveling same direction at a speed of 60 km/h, the traffic volume will result in a Following Density of 0.48 v/km, equating to one vehicle every two minutes, resulting in an acceptable Level of Service (LOS A)

The maximum increase in Diurnal Traffic is in the order of 6 vph, this volume is found on several roads within the study area, this is bio-directional traffic. Thus, assuming a 50:50 split, the density of the traffic would be in the order of 3 vph, which is negligible.

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

10 HAZARDS, IMPACTS AND MITIGATION

Although this is a combined report, where each Mura SEF is considered individually, the hazards, impacts and mitigations are addressed below, and are applicable to all. There is no development that has more significant harzards or impacts associated with the individual development.

Any new development within an established environment can cause a significant hazard on the road network, especially during the construction of the new development. As the construction of new developments will inadvertently increase the traffic volume 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 developments, while traffic volumes during the operational phase of the proposed developments are 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, which often have detrimental consequences.

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 HAZARDS AND RISKS

Hazards are any action that can cause harm, and Risks are the likelihood of harm being done.

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

10.1.1 Traffic Volumes

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

During the construction phase of the proposed developments, a significant increase in traffic is anticipated during the morning and afternoon peaks. The diurnal traffic related to this 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 passing through urban areas.

Mitigation measures to consider include:

- *During all phases of the project, mitigation measures are limited to providing drivers with advanced driver training on gravel roads.*
- *Ensure that the drivers are sensitised to the risks associated with travelling on gravel roads.*
- *Ensure that road users adhere to the road traffic law, especially at intersections.*
- *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

Many of the roads in the study area are gravel, and the structure varies from wide, well-maintained gravel roads to narrow, poorly maintained gravel paths. The passes through the Nuweveld Mountains are extremely treacherous, with very few barriers, steep drop-offs, very tight corners, negative banking, and loose gravel.

Many roads pass through drifts or low-level bridges that are impassable in heavy rains or flash floods.

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 measures to consider include:

- *Mitigation of this impact is regular maintenance of the roads by the local roads' authorities, both the Northern Cape and Western Cape. 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 developments, the developer undertakes to contribute towards or conducts regular maintenance of the roads network, within the study area, used by the developer, during all phases of the development. Which will be more prevalent during the construction phase, but will not negate the requirements during the operational phase.*
- *However, maintenance of the internal road network on the individual developments is the responsibility of the developer's 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, with unfavourable consequences.*

Mitigation measures to consider include:

- *Appling dust suppression system to the road network (where applicable), on regular basis.*
- *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.

The main access roads (DR02317) pass through homesteads on routes to the proposed developments, 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.

Mitigation measures to consider include:

- *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 development are existing roads, and no new roads need to be constructed. However, remedial action on various sections of the transportation routes will be required before executing the works.

Traffic-related risks and impacts on the road network within the study area have been assessed using an assessment methodology provided by WSP Group Africa (Pty) Ltd for various phases of this development.

The impact assessment below would apply to each of the Mura SEFs and therefore separate impact assessments have not been undertaken for each Mura SEF.

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 38.

Table 38 - 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;* *Traffic 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.* *The 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.* *The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road.*					
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 39.

Table 39 - 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.* *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.* *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 treacherous section of the gravel road, through the De Jager's Pass and Molteno Pass, is safety concern that need to be addressed by the developer in consultation with the local roads authority* *The route for construction vehicles from the TR 01606/7 to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton* *The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete.* *All vehicles delivering equipment and material to the proposed development using the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass not exceeding ten tonnes*	
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 40.

Table 40 - 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 41, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic.

Table 41 - 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 42, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Table 42 - 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, 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 43.

Table 43 - 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; Traffic 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 44.

Table 44 - 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. 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 45.

Table 45 - 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 46, especially at the intersection on the main roads, when vehicles from the site needing to cross over oncoming traffic.

Table 46 - 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 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 47, especially at the intersection on the main roads, when vehicles from the site need to cross over oncoming traffic.

Table 47 - 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 developments. 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 once the construction contractor has been appointed. 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:

- *Majority of the deliveries to the proposed development will be on the TR 05801 via Loxton and DR 02317.*
- *Night deliveries are strongly discouraged.*
- *Aggregate and cement for the concrete batching is envisaged to be transported to site from commercial sources via Loxton.*
- *The use of the Molteno Pass and De Jager's Pass shall be limited to vehicles with a gross mass of less than 10 tonnes.*
- *The proposed commuting routes used by personnel from the surrounding towns needs to be defined, and all relevant risks identified.*

Other key points include, inter alia:

- *Inclusion of section of the TMP in the induction training for all personnel travelling to the proposed developments.*
- *Outlining of specific traffic management measures across all phases of the proposed developments.*
- *Identification of specific routes for each type of vehicle needed to transport equipment and materials to the proposed developments.*
- *Identification of mitigation measures to minimise impacts on existing road users.*
- *Reduction of the number of private and individual vehicles travelling to the proposed developments.*
- *Provision of minibuses/buses for personnel commuting to the proposed developments.*
- *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.*
- *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.*
- *Identification of the repair and maintenance strategy to be adopted during the various phases of the development.*

12 CONCLUSION AND RECOMMENDATIONS

Red Cap, is proposing to develop four solar facilities and associated grid connections, on behalf of four separate Project Applicants. The proposed developments are located between Loxton and Beaufort West, in both the Beaufort West Local Municipality within the Central Karoo District Municipality and Ubuntu Local Municipality within the Pixley ka Sema District Municipality. The proposed developments are located in close proximity to the approved Nuweveld Wind Farm Development.

This report represents the combined Traffic Impact Assessment for the Mura Solar Energy Facilities.

12.1 CONCLUSION

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

Project

- *The proposed developments, collectively known as the Mura Solar Energy Facilities consists of:*
  - *Mura 1 and associated Grid Connection,*
  - *Mura 2 and associated Grid Connection,*
  - *Mura 3 and associated Grid Connection, and*
  - *Mura 4 and associated Grid Connection.*
- *The proposed developments are to be constructed simultaneously, over a period of 24 months.*

Assessment Assumptions

- *The simultaneous construction of the proposed developments, based on a manpower complement of approximately 1 272 individuals.*
- *The three Nuweveld WEF are assumed to have been constructed and are in the operational phase, based on a manpower complement of 96 individuals.*
- *The two Hoogland WEF Clusters, each cluster consisting of two WEF and associated infrastructure, are assumed to be in their construction phase, based on a manpower complement not exceeding 1 200 individuals.*
- *The Gamma Grid Connection is assumed to be its construction phase, based on a manpower complement not exceeding 60 individuals.*
- *The construction schedule of the renewable projects is unknown at this stage. A conservative assessment has been adopted which assumes that the traffic volumes of all the projects identified, peak at the same time, resulting in a worst-case scenario.*
- *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

- *Many of the roads within the study area are gravel roads. Some of the roads are in better condition than others. There is a higher level of maintenance on the roads in the Western Cape than there is in the Northern Cape. All roads adjacent to the proposed development are expected to deteriorate due to the increased traffic volumes. Thus, the developer would have to assist local roads authorities with regular maintenance of these roads.*
- *Some roads can be used by light vehicles but are not conducive to busses or delivery vehicles. The TMP needs to prescribe which roads are to be used.*
- *Traverses the Molteno Pass and De Jager's Pass, are extremely treacherous, with very few barriers, steep drop-offs, very tight corners, negative banking and loose*

gravel. The contractor needs to assess the viability of using this road for the commuting of personnel to and from site safely.

- *The majority of the deliveries to the proposed developments will be transported via the TR 05801 via Loxton and DR 02317;*
- *All vehicles delivering equipment and material to the proposed development using the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass not exceeding ten tonnes.*
- *The expected traffic increase on the road network during the peak construction phase will lead to more significant wear and tear of the roads but will not have an undue detrimental impact on the structure of the roads if the roads are properly maintained. The developer shall contribute to maintaining the public road network affected by the development as identified by the local roads' authorities. It is proposed that the developer contribute to the maintenance of the road network during the construction and the operational phases, commencing the year after successfully achieving Commercial Operation.*
- *Additional ongoing funding from the developer towards the maintenance of the roads will have a positive impact on the local road conditions and community.*
- *The public road network within the study are will need to be reassessed at the time of implementation to verify the functionality of the roads, which could have changed since the initial inspection.*

Transportation Route

- *The proposed developments are accessed from well-established transportation routes between large commercial centres within South Africa.*
- *Previously established transportation routes from the Commercial Centres and Container Terminal in South Africa are to be used.*
- *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.*
- *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.*
- *All equipment and material transported to the proposed developments on vehicles with a gross vehicle mass exceeding ten tonnes shall be on the TR05801 via Loxton.*
- *All vehicles transporting equipment and material to the proposed developments via the Molteno Pass and De Jager's Pass, shall be limited to a gross vehicle mass of not exceeding ten tonnes due to the constraints imposed by the road geometry;*
- *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 appointed.*

Traffic Volumes

- *The most significant impact on traffic volumes results 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 developments does the traffic volume on the various roads exceed 50 trips per hour, which is the threshold for a detailed Traffic Impact Assessment.*
- *The maximum traffic volume generated during the peak construction phase of the proposed developments is in the order of:*
    - *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 32 vph (SEF 2 – Road A)*
    - *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be less than 15 vph. Which equates to approximately 120 vehicles, over an eight-hour period (SEF 2).*
- *The maximum traffic volume generated during the operational phase of the proposed developments is in the order of:*
    - *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 8 vph (SEF 1 and SEF 2).*
    - *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 0.25 vph. Which equates to approximately 2 vehicles, over an eight-hour period.*
- *The cumulative traffic volume generated during the peak construction phase of the Mura SEF and Grid Connection, together with the operational phase of the three Nuweveld WEF and the construction of Hoogland WEF (North), Hoogland WEF (South) and the Gamma Grid Connection, 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 89 vph.*
    - *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 87 vph. Which equates to approximately 696 vehicles, over an eight-hour period.*
- *The cumulative traffic volume generated during the operational phase of four Mura SEF, the three Nuweveld WEF, the Hoogland WEF (North), and the Hoogland WEF (South), is in the order of:*
    - *Peak Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 29 vph;*
    - *Diurnal Traffic: The maximum number of vehicles on the road network within a given hour is estimated to be in the order of 6 vph. Which equates to approximately 48 vehicles, over an eight-hour period.*
- *The minimum required level of service for gravel roads is LOS C. For the worst-case scenario, the additional traffic volume of the proposed developments results in a LOS B. Thus, the additional traffic volume does not compromise the level of service of the roads.*

Safety

- *The winding roads through the De Jager's Pass and Molteno Pass, is a serious safety concern that needs to be addressed by the developer in consultation with the local roads' authority.*
- *The vertical alignment of the DR 02317, raises a number of serious concerns, ranging from blind rises to loss of control when travelling at high speeds.*

- *This is a rural 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.*
- *Excessive fine and loose material was observed along the various roads creating visibility concerns in dry weather and slippery conditions in wet weather.*
- *Additional vehicles on the road will be subject to these hazards, with a potential for an increase in incidents.*
- *The passing through homesteads that straddle the roads is a serious safety concern that needs to be included in the TMP.*
- *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 treacherous section of the gravel road, through the De Jager's Pass and Molteno Pass, is safety concern that need to be addressed by the developer in consultation with the local roads authority.*
- *The route for construction vehicles from the TR 01606/7 to the TR05801 should not unduly impact the local community of Loxton and should avoid the commercial centre of Loxton.*
- *The developer shall contribute to the maintenance of all roads affected by the development, during the construction and operational phases of the development.*
- *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 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.*
- *The 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.*
- *The developer shall ensure that the contractor erects temporary signs warning motorists of construction vehicles on the approaches to the access road.*
- *The developer shall ensure that the condition of the roads impacted by construction of the development is left in a similar or better state once the construction phase is complete.*
- *Implement the relevant transport impact mitigations measures as detailed in Section 10.2 above.*

Considering the above findings, it can be concluded that the proposed developments, will together with the other renewable developments contribute to the notable increase in traffic volumes on the road network during the peak construction phase. However, this report has assessed the impact of the additional traffic volumes on the roads within the study area and were found to be well within the acceptable level of service.

Noting that the 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, especially during construction, but will not have an undue detrimental impact on the road network within the study area if the mitigation measures are undertaken.

It is the reasoned opinion of the author that the proposed developments, 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

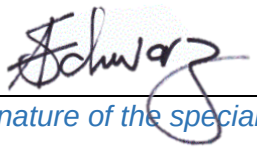
Appendix 2: NEMA Requirements for Specialist Reports

Appendix 3: Curriculum Vitae

APPENDIX 1 - DECLARATION

I, Athol Carl Schwarz, as the appointed specialist, hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I:

- *in terms of the general requirement to be independent:*
  - *other than fair remuneration for work performed/to be performed in terms of this application, have no business, financial, personal or other interest in the activity or application and that there are no circumstances that may compromise my objectivity; or*
  - *am not independent, but another specialist that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);*
- *in terms of the remainder of the general requirements for a specialist, am fully aware of and meet all of the requirements and that failure to comply with any the requirements may result in disqualification;*
- *have disclosed/will disclose, to the applicant, the Department and interested and affected parties, all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application;*
- *have ensured/will ensure that information containing all relevant facts in respect of the application was/will be distributed or was/will be made available to interested and affected parties and the public and that participation by interested and affected parties was/will be facilitated in such a manner that all interested and affected parties were/will be provided with a reasonable opportunity to participate and to provide comments;*
- *have ensured/will ensure that the comments of all interested and affected parties were/will be considered, recorded and submitted to the Department in respect of the application;*
- *have ensured/will ensure the inclusion of inputs and recommendations from the specialist reports in respect of the application, where relevant;*
- *have kept/will keep a register of all interested and affected parties that participate/d in the public participation process; and*
- *am aware that a false declaration is an offence in terms of regulation 48 of the 2014 NEMA EIA Regulations.*



Signature of the specialist:

Athol Schwarz
Name:

30th November 2022
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 5.2
(cA)	an indication of the quality and age of the base data used for the specialist report;	Section 7.1.2
(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;	Section 1
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;	Section 5.4 Section 7.2
(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 6.1
(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 5.5
(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 12.2
(l)	any conditions for inclusion in the environmental authorisation;	Section 12.2
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	NA
(n)	a reasoned opinion-	Section 12.2
	(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*