MAINSTREAM RENEWABLE POWER SOUTH AFRICA (PTY) LTD

PROPOSED CONSTRUCTION OF THREE WIND FACILITIES AND ONE SOLAR ENERGY FACILITY NEAR AGGENEYS IN THE NORTHERN CAPE, SOUTH AFRICA

(30985.00-REP-002 REV 1)

PRELIMINARY TRAFFIC MANAGEMENT STUDY

NOVEMBER 2014

PREPARED FOR:

MAINSTREAM RENEWABLE POWER SOUTH AFRICA
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ISSUE & REVISION RECORD

QUALITY APPROVAL

	Capacity	Name	Signature	Date
By Author	Project Manager	Andrew Geel		13/11/2014
Approved by Design Centre Leader	Project Director	André Greyling		13/11/2014

This report has been prepared in accordance with BVi Consulting Engineers Quality Management System. BVi Consulting Engineers is ISO 9001: 2008 registered and certified by NQA Africa.

REVISION RECORD

Revision Number	Objective	Change	Date
0	Issue to Client for comments and work approval	None	14/11/2014
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CLIENT APPROVAL RECORD

	Capacity	Name	Signature	Date
Mainstream Renewable Power				

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1 INTRODUCTION

1.1 TERMS OF REFERENCE

Mainstream Renewable Power South Africa (Pty) Ltd has identified the need for Civil and Electrical Engineering inputs during the feasibility stages of a proposed renewable energy project. BVi Consulting Engineers (Pty) Ltd was appointed to prepare a *Preliminary* E*ngineering Services Report* that will aim to address this need. Submission of a *Preliminary Traffic Management Report* forms part of the scope, and is the subject of this report.

1.2 APPOINTMENT

Mainstream appointed BVi Consulting Engineers to do a desktop study of the available routes, legislation on and regulations including potential access routes to the proposed wind and solar farm facility.

1.3 OBJECTIVES AND STRATEGIES

1.3.1 Strategy Followed

The proposed development was assessed to determine the specific *traffic* needs during the different phases of implementation, specifically construction and installation, operation and decommissioning.

A desktop study was performed using the information made available by Mainstream and relevant authorities, utilising engineering judgement and by studying the relevant guidelines that are available.

1.3.2 Purpose of the project

The purpose of the project is to investigate possible locations for the generation of wind and solar energy.

1.3.3 Purpose of the report

The purpose of the report is to conduct a preliminary traffic management plan for the wind and solar farm site and related transportation routes. The following two main transportation activities will be investigated:

- Transportation by means of abnormal vehicles for the delivery of the wind turbine components to the site.

- Transportation of materials, equipment and people to and from the site from the surrounding areas.

The preliminary traffic management study will aim to provide the following objectives:

- Identify envisaged activities related to traffic movement for the construction, operation and commissioning of the wind and solar energy facility.
- Provide a Main Route for the transportation of the wind turbine components from the entry point to the proposed site.
- Provide a preliminary transportation route for the transportation of materials, equipment and people to site.
- Estimate the daily traffic generated for the envisaged transportation activities.
- Outline traffic management issues for the proposed development.

1.4 AVAILABLE INFORMATION

The following sources of reference were studied:

- Technical Recommendations for Highways (TRH 11): *Draft Guidelines for Granting Exemption Permits for the Conveyance of Abnormal Loads and for Other Events on Public Roads*. March 2000.
- *Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads"* 1st Edition, July 2009
- *Preliminary Transport Risk Assessment Report,* as completed by ALE Heavylift (South Africa) for Mainstream Renewable Power South Africa (Pty) Ltd. November 2012.

2 DESCRIPTION OF THE PROJECT

Mainstream Renewable Power is proposing the development of three wind farms and a solar energy facility near Aggeneys in the Northern Cape Province.

The proposed facilities are located on portions of the following farms:

- Portions 1 and Remaining Extent of Farm 209 (Poortje); and
- Portion 1 and 2 of Farm 212 (Namies Suid)

The extent of the site identified for this development includes an area of approximately 17 500 hectares with a perimeter of 55km, and is subject to refinement based on detailed design investigations.

The proposed location falls within the Department of Water Affairs defined quaternary catchment D81G and the site is bounded by National Route 14 to the north and Regional Road 358 to the south. Access to the site will be off National Route 14 via a proposed new formal intersection, located at an existing at-grade intersection leading to an unsurfaced road.

2.1 SITE LOCATION

The extent of the investigation is based on the provisional distribution of wind turbines and solar panels as indicated on the 20140930-EM-Khai, 20140930-EM-Korana and 20140930-EM-Poortjies kmz files provided by Mainstream. This area is based on boundaries determined by Mainstream and based on project requirements.

The area of investigation is located approximately 30km south of Pofadder in the Northern Cape Province, as indicated on the attached Annexure 1: Locality Plan.

2.2 IDENTIFICATION OF ENVISAGED ACTIVITIES RELATED TO TRAFFIC MOVEMENT

The traffic generated by the wind energy facilities can be divided into three phases as outlined below:

2.2.1 Construction Phase

This phase includes the transport of people, materials and equipment to site. This phase also includes civil works for internal roads construction, excavations of footings and trenching for electrical cables. It is envisaged that this phase will generate the largest traffic.

2.2.2 Operation and Maintenance Phase

This phase involves the operation and maintenance of the wind and solar energy facility estimated over a period of 25 years. The replacement of the wind turbine components would require a crane and abnormal vehicles that will require access to the site via the public road network. This phase is expected to generate less traffic than the construction and decommissioning phase.

2.2.3 Decommissioning Phase

At the end of the operational lifetime the decommissioning phase will again require access for large cranes and transport vehicles. These vehicles will be necessary to dismantle and remove the energy infrastructure and it would involve similar traffic flow arrangements as during the construction phase.

2.3 PORT OF ENTRY FOR THE WIND TURBINE AND SOLAR COMPONENTS

2.3.1 General

It is assumed that the wind turbine towers will be sourced locally and the rest of the turbine components will be imported from international suppliers. Due to the size and weight it is accepted that delivery and transport will be done by ship. Two suitable harbours were identified as possible points of entry for importing the wind turbine components, namely Cape Town and Saldanha Bay Harbour.

The Saldanha Bay Harbour is situated approximately 650km from the site and approximately 140km closer to the site than the Cape Town Harbour. Both these harbour prove feasible as entry points. It is proposed that Saldanha Harbour be used as the preferred point for importing the wind turbines, due to its proximity to site.

2.3.2 Contact Information for the Port of Saldanha

The following information may be used for future reference.

Port Manager: Sipho Nzuza
Tel: (27) 022 703 4420
E-mail: William.Roux@transnet.net
Website: http://www.transnetnationalportsauthority.net/

2.3.3 Brief Technical Description of Saldanha Bay Harbour

The harbour is situated within the natural Saldanha Bay and the bay is protected by a 3.1km long artificial breakwater. The port has developed into a modern harbour when it became necessary to facilitate the export of iron ore from the Northern Cape. The construction of the deep water jetty in Saldanha Bay made it possible to accommodate large ore carriers and other ships.

The port has a 990m long jetty containing two iron ore berths linked to the shore along a 3.1km long causeway. There is an 874m multipurpose quay for the handling of break-bulk cargo and a 365m tank berth at the end of the ore jetty with a permitted draught of 21.25m alongside. The multipurpose quays (berths 201-203) are a total of 874m long with a draught permitted between 12m and 13.4m. The Port operates for 24 hours a day and there are no bunkering facilities along Saldanha Bay. Wind turbine moulds manufactured in China were previously imported and off-loaded at this Port with success. The moulds were used to manufacture 50 meter long rotor blades that were used in earlier wind farm developments.

2.4 MAIN ROUTE FOR THE TRANSPORTATION OF LARGE/ ABNORMAL LOADS

A preliminary investigation showed that it will be possible to transport the imported wind turbine and solar array components by road to Namies. The proposed route will include the following sections of road:

- R399 (Saldanha Town to Piketberg) - Approximately 98km.
- N7 (Piketberg to Vredendal) - Approximately 151 km.
- R363 (Vredendal to N7) - Approximately 100km.
- N7 to Springbok - Approximately 200km.
- N14 (Springbok to Namies Site) – Approximately 142km.

Figure 3-1 below shows the proposed main transport route from Saldanha Harbour to the Namies Suid/ Poortjies site.

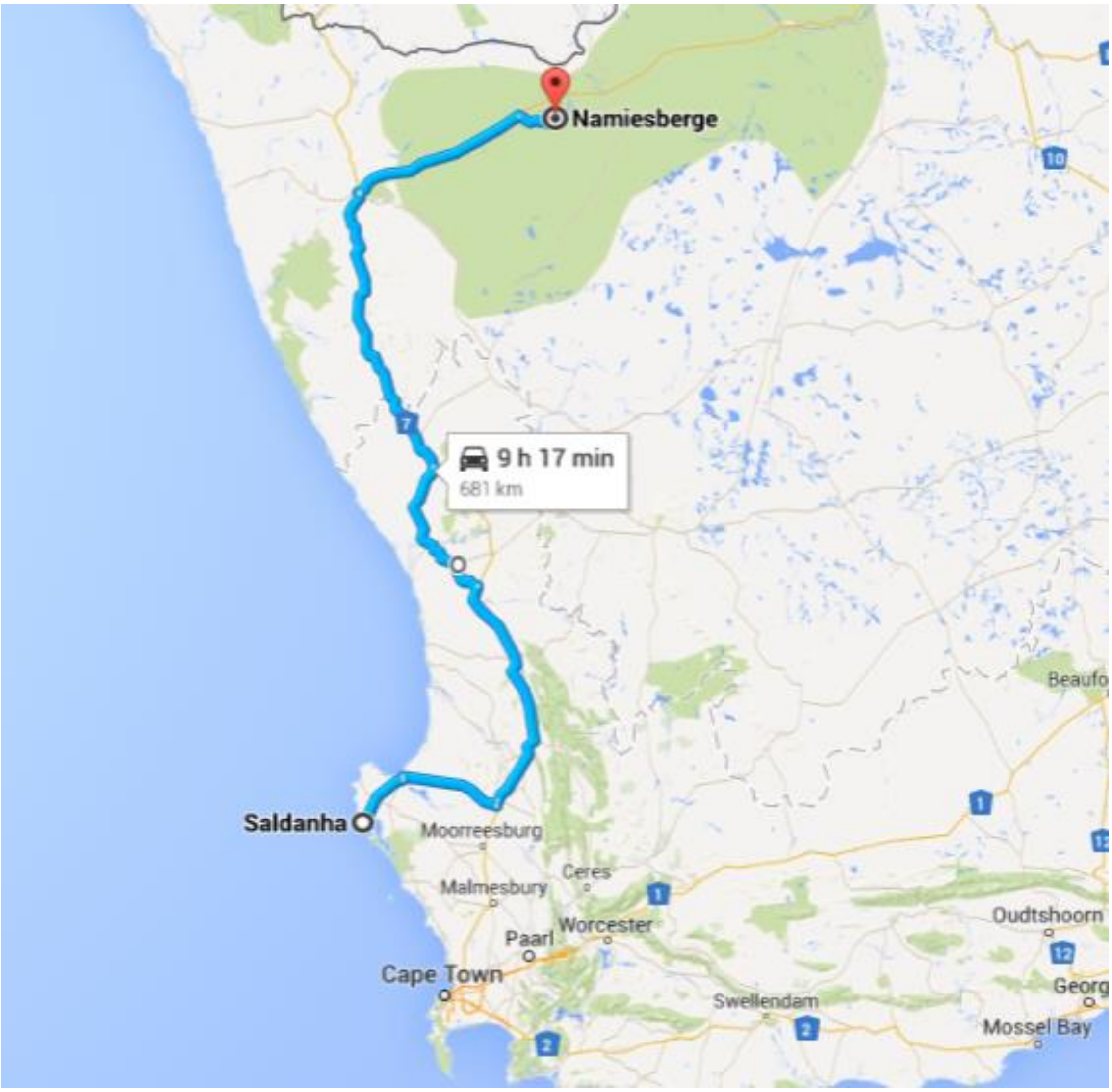


Figure 2-1: Main Transport Route from Saldanha Harbour to Namies Suid/ Poortjies site

2.4.1 Description of the Main Route

The route from Saldanha to Springbok outlined above consists of a single lane road with paved shoulders for the entire 591km. The road condition is generally good and will be able to withstand the increase in traffic loading caused by the transportation of the wind turbine and solar array components. Large sections of the N7 are currently being upgraded by SANRAL.

A detour off the N7 will be required at Vredenburg due to height limitation on a section of the N7 where the Sishen Saldanha railway line crosses via an overhead bridge. A preliminary Transport Risk Assessment Report was completed by ALE Heavylift (South Africa) for a similar project entitled "*Proposed Construction of a Wind and Solar Energy Facility on Kangnas Farm near Springbok in the Northern Cape South Africa - Preliminary Engineering Services Report.*" This report should be referred to for any Abnormal Transport requirements, and is included in *Annexure 2.*

2.4.2 Access to Namies Suid/ Poortjies Site

Access to the site is currently obtained via an unsurfaced road, utilising an at-grade intersection. The intersection is below the standard required for the transportation of equipment, materials and people. Mainstream will therefore require a new intersection off the N14 to deliver access to site. The preferred access point is approximately 111km from Springbok.

Approval for the proposed access will require an application and approval process through SANRAL that should be addressed timeously. *Figure 2-2* and *Figure 2-3* below shows the proposed position of the intersection for the access road to site. The intersection will have to be constructed per SANRAL geometric design standards and will be owned and operated by SANRAL. A typical layout of such an intersection is included in *Figure 2-4* below:

No sight distance or safety problems are envisaged at the existing intersection. It is therefore assumed after a preliminary investigation that SANRAL will not have reason to reject the request to upgrade the intersection to the required standard.

Further upgrades to the unsurfaced road that accesses the northern boundary of the site will be required in order to meet the standards required for the conveyance of abnormal loads. The upgrades will take the form of vertical and horizontal re-alignments in order to ensure that abnormal loads can be transported safely. Vertical re-alignment will be undertaken by means of additional fill where required. Horizontal re-alignment may be required to increase the radius of certain curves.

The access road to the site will also require periodic maintenance during the construction period, as the unsurfaced gravel roads are prone to forming corrugations under heavy traffic. For this reason, and due to the fact that the access route to site from the N14 was not designed for such traffic, it is recommended that permission be sought from the relevant road authority before construction commences. These recommendations will be pursued during the design phase of the project.

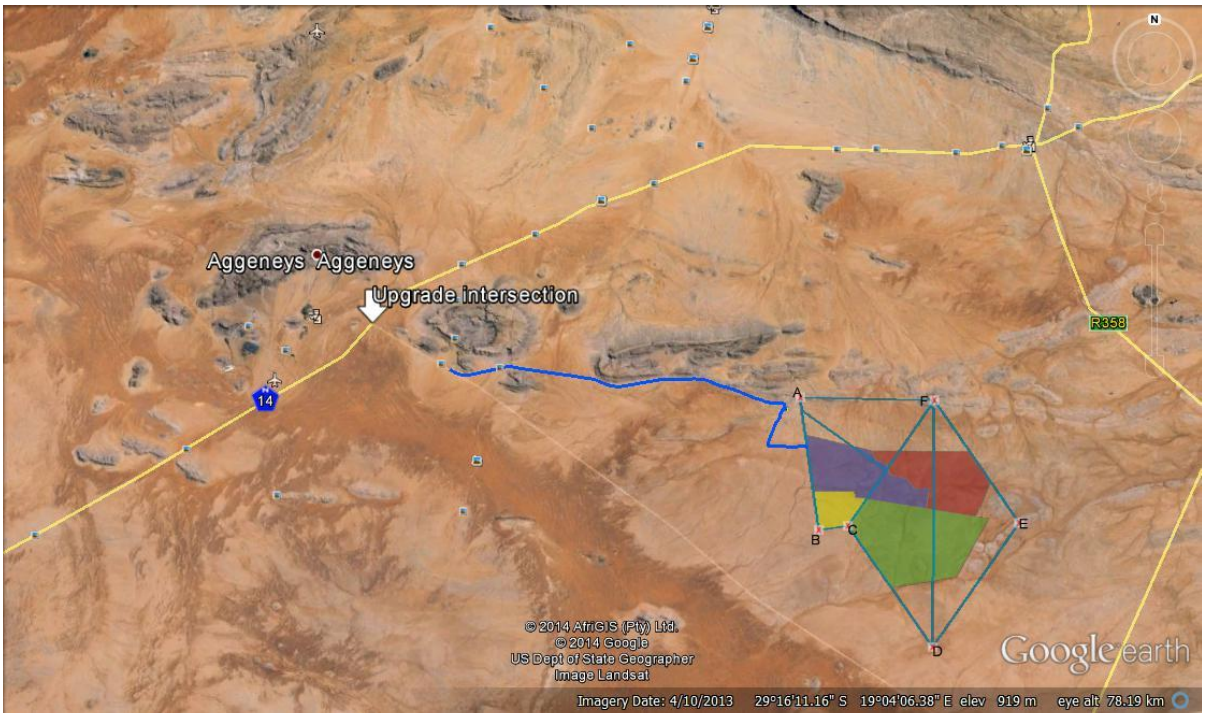


Figure 2-2- Proposed New Accesses to Namies Suid/ Poortjies – plan view

Figure 2-3: Proposed access point to Namies Suid/ Poortjies site adjacent to N14 – street view

The design and layout of the intersection at the access point to the site will be per SANRAL standards. The proposed typical access layout is shown in *Figure 2-4* below.

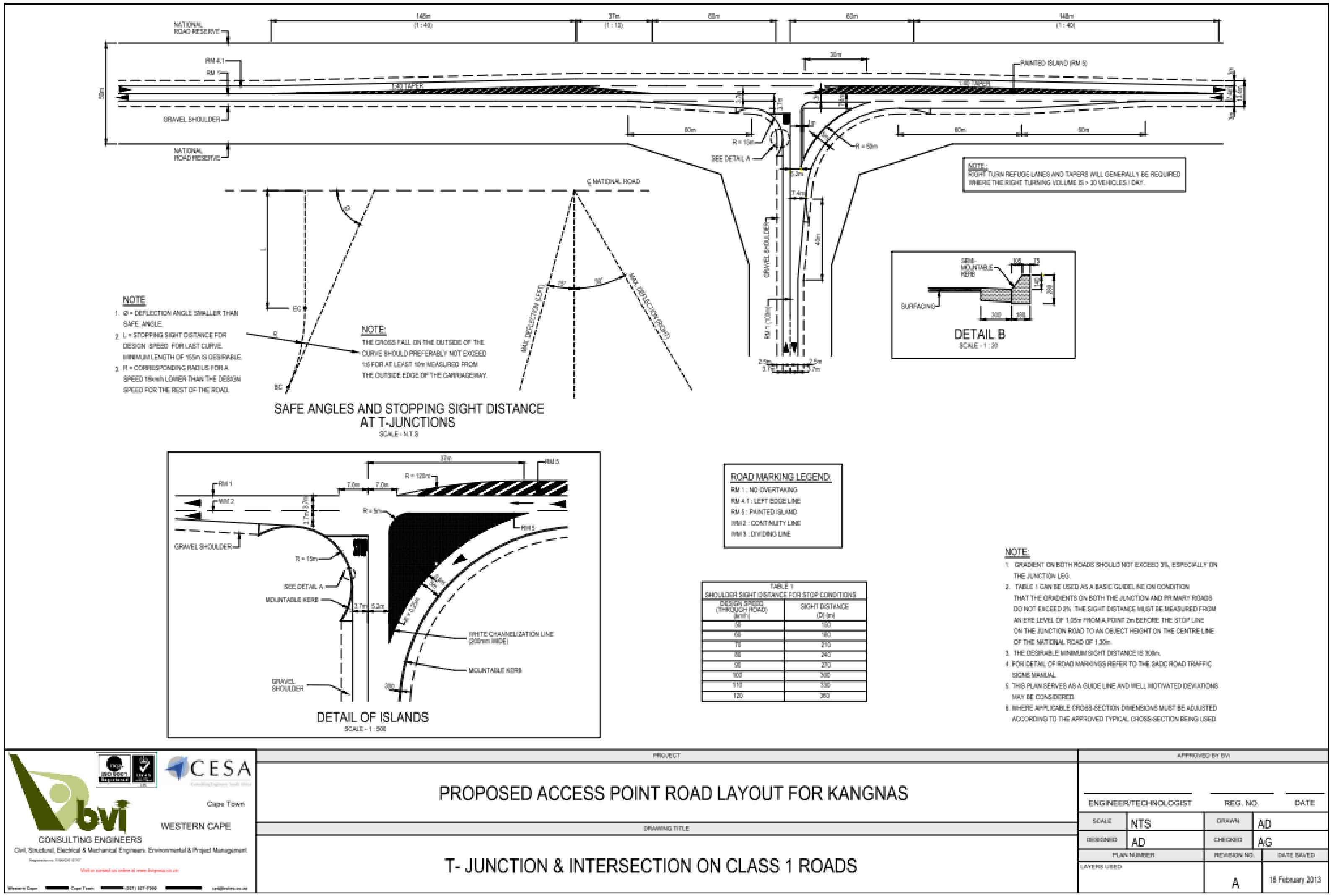


Figure 2-4: Proposed Access Road Layout for wind and solar facility

2.5 MAIN ROUTE FOR THE TRANSPORTATION OF MATERIALS, PLANT AND PEOPLE

Figure 2-5 below shows the location of the site in relation to the closest large town, Springbok, which is situated approximately 142km from site. It is envisaged that most materials, plant, services and people will be procured in and require transportations from Springbok. Additional resources will also be sourced from Pofadder, although it is assumed that due to the relative size of the towns, Springbok will be the primary source of materials, labour and resources.

Figure 2-5: Main route for the transportation of resources to Namies Suid/ Poortjies Site

2.6 EXISTING TRAFFIC

The proposed construction and development of this site will generate traffic that will need to be accommodated on the current road infrastructure

The increase in traffic caused by the transportation of the wind turbine components from Saldanha Bay to Springbok is assumed to be negligible as it will take place under the regulation and requirements of the Abnormal Permit authorities. During the permit process actions will be taken to ensure minimal disruptions to the existing road users. The largest increase in traffic will be along the N14 between Springbok and the site and it will have to accommodate the majority of the traffic generated by the two main transportation activities.

To understand the impact the historic traffic data for the N14 between Springbok and Pofadder was obtained. Pofadder is situated approximately 162km north east from Springbok and 30km north of the Namies Suid/ Poortjies site. The historic traffic data is shown in the table below:

Table 2.1- Historic Trip Generation between Springbok and Pofadder

Historic Traffic Trip Generation of N14 between Springbok and Pofadder for Year 2011		
Section	**Springbok and Pofadder**	
	No.	**%**
Average Daily Traffic (ADT)	608	
Average Daily Truck Traffic (ADTT)	44	7.2

Table 2.1 shows that the Average Daily Traffic (ADT) between Springbok and Pofadder is generally in the order of 600 vehicles of which the Average Daily Truck Traffic (ADTT) consist of 44 vehicles. Based on the Cross Section width of 12.0m, it can be assumed that this road was constructed as PGWC Class 1 Cross Section capable of carrying in excess of 2000 vehicles a day. The road is therefore not currently close to its original design capacity. This information will form the basis to assess the traffic impact resulting from the two main transportation activities.

2.7 TRAFFIC GENERATION DURING THE CONSTRUCTION PHASE

During the construction phase the following activities will generate additional traffic:

- The transportation and delivery of the wind turbine and solar components.
- The transport of water and materials.
- The transport of equipment and people.

The estimated trip generation rates are discussed in the section below.

2.7.1 Traffic Generation for the Delivery of the Wind Turbine Components

Table 2.2 below shows the estimated daily traffic that can occur during the delivery of the wind turbine components to site. The calculations are based on the delivery of six complete turbines per week.

Table 2.2- Traffic Generation Rates for the Delivery of Wind Turbine Components

GENERATED TRAFFIC FOR THE DELIVERY OF THE WIND TURBINE COMPONENTS				
Activity	**Assumptions**	**Trips/ Week***	**No. Used**	**Trips /Day**
Turbine Components	3xTower sections per turbine =1 Tower/truck (AV)	18	3	3
	1xNacelle (hub) per turbine = 1 Nacelle/truck (AV)	6	1	1
	3xBlades per turbine= 1 Blade per truck (AV)	18	3	3
Estimated Abnormal Truck per day				**7**

From *Table 2.2* it can be seen that 7 Abnormal Vehicles (AV) will be required for the delivery of one complete wind turbine.

Based on the assumption that six completed turbines will be delivered to site per week, the ADT will increase from 608 to 615 and the ADTT will increase from 44 to 51 vehicles. It can therefore be assumed that the transportation of the wind turbines will increase the ADT and ADTT by 1.1% and 15% respectively. Due to the fact that abnormal permit regulations will apply and due to the low increase in traffic it is assumed that the effect on the existing traffic will be negligible.

2.7.2 Traffic Generation for the Delivery of the Solar Array Components

Table 2.3 below shows the estimated daily traffic that may be assumed to occur during the delivery components for the collar panel array. The calculations are based on the delivery of a total of 2400 panels per week.

Table 2.3- Traffic Generation Rates for the Delivery of Solar Panel Components

GENERATED TRAFFIC FOR THE DELIVERY OF THE SOLAR PANEL COMPONENTS				
Activity	**Assumptions**	**Trips/ Week***	**No. Used**	**Trips /Day**
Solar (PV) Components	40 solar (PV) panels per truck (1x2m panels)	60	5	12
	50 columns (2 per panel) per truck	20	5	4
Estimated Super-link Truck per day				**16**

Based on Table 2.3 it can be seen that 16 super-link trucks per day will be used to deliver the solar PV panels and associated fittings to site. The Average Daily Traffic (ADT) will therefore increase from 608 to 624 (2.6% increase) and the Average Daily Truck Traffic will increase from 44 to 60 trucks (36% increase). The increase due to solar PV panel transport on ADT and ADTT is therefore negligible in terms of the design traffic of 2000 vehicles per day.

2.7.3 Traffic Generation for the Transportation of Materials, Equipment and People

To make it possible to calculate the amount of traffic generated during this phase a certain number of assumptions were made as the project is still in the planning phases.

It is estimated that a total of 1200 jobs can be created during the construction of the wind and solar farm. Not all the jobs will be created at once since the project will be constructed in four phases and it is also assumed that all employees will reside in Springbok. Based on this it can be assumed that approximately 49 vehicle trips will be generated during the peak hours of 07:00 – 08:30 and 16:00 – 17:30. The details used to calculate the total labour during the construction of the project is shown in *Table 2.4* below.

Table 2.4- Estimated Labour Opportunities

CONSTRUCTION LABOUR REQUIREMENTS				
Construction Phase	**Technical Staff**	**Skilled Labour**	**Unskilled Labour**	**TOTALS**
Road Construction	3	15	25	43
Foundation Construction	9	45	100	154

Electrical System Construction	5	15	20	40
Substation Construction	5	10	15	35
Wind Turbine Assembly and Installation	10	25	30	65
Solar Array Assembly and Installation	8	30	25	63
TOTALS	**40**	**140**	**125**	**407**
Vehicle Trips/Day	35	10	4	49

Table 2.5 below combines this data as well as further assumptions to predict the expected daily traffic that will be generated by the transportation of materials, equipment and people. It must be noted that a worst case scenario was used as it was assumed that all the materials required for construction will be obtained from suppliers off-site. The estimated generated traffic can therefore be seen as a maximum and will likely be much less than anticipated.

Table 2.5- Traffic Generation Rates for During Construction

GENERATED TRAFFIC FOR THE TRANSPORTATION OF PEOPLE, MATERIALS AND EQUIPMENT			
Activity		**Assumptions**	**Trips/day**
People	Technical and Non-technical Staff	See *Table 2.4* above	49
Material	Crushed Rock	About 292 m³ of crushed rock will be required for the construction of one foundation. The volume of concrete required per foundation was estimated to be 460 m³ It is assumed that two turbine bases will be constructed per week and this will generate the following number of daily truck trips.	30
	Sand	About 206 m³ of sand will be required for the construction of one foundation. It is assumed that two turbine based will be constructed per week and this will generate the following number of daily truck trips.	8
	Natural Gravel	It is assumed that 1.2km of natural gravel roads will be constructed every week in 150mm layers @ 0.2km/day using tipper trucks @ 10m³/truck to import material. This action will generate the following amount of truck traffic per day.	30
	Water	Based on preliminary water use calculation elsewhere it is assumed that the following number of 32 000 litre water trucks will be required per day.	8
Electrical	Substations, cables, overhead cables and transmission poles	200 transmission poles (30 poles/week) using an interlink truck	1
		Trucks for carting electrical equipment using an interlink truck.	1
Total Light Motor Vehicles			**45**
Total Heavy Motor Vehicles			**82**
TOTAL DAILY TRAFFIC			**127**

From *Table 2.4* it can be seen that the total daily traffic generated by the transport of people, materials and equipment is estimated at approximately 127 vehicles per day per project.

In summary, the total daily traffic generated during the construction phase is as follows:

Total light motor vehicles:	**45**
Heavy motor vehicles:	
Wind:	7
Solar:	16
Construction:	86
Total Heavy Vehicles:	**109**
TOTAL:	**154**

The expected increase therefore between Springbok and the site is from 608 to 762 vehicles per day for an estimated period of 18 months per project. The traffic increase is approximately 25% but does not increase the expected ADTT to close to the 2000 vehicles a day design capacity. The management of the traffic at the proposed new access should however receive special attention during the implementation phase of the project.

2.7.4 Traffic Generation for the Operation and Maintenance Phase

It is assumed that a maximum of 20 permanent employees will be employed per phase to oversee the operation and maintenance of the wind farm. It is therefore assumed that a total of 80 persons will be employed once all the phases are operational. Assuming 2 workers per vehicle, the increase in traffic after construction is estimated at 40 vehicles per day for a period of 25 years. This is an insignificant impact on the current road traffic and will require no special attention.

2.7.5 Traffic Generation for the Decommissioning Phase

Depending on the maintenance period, access for large cranes and transport vehicles would be necessary to dismantle and remove the turbines. The traffic generated would be the same as discussed in the delivering of the wind turbine components in *Section 2.7.1* on *Page 10*. The operation of the proposed development is assumed to be 25 years after which it will be decommissioned.

2.8 TRAFFIC MANAGEMENT ISSUES

2.8.1 Objectives

The purpose of this section is to ensure the following three goals are achieved:

- To ensure that all traffic generated by the site will not impact the safety of the general public.
- To reduce potential conflicts that may result from commuters and the construction traffic.

- To identify any issues that may impact on the successful transportation of the required resources.
- To note important requirements for future consideration.

2.8.2 Risks

The risks involved with the proposed project include the following:

- Damage to existing infrastructure by construction vehicles
- Accidents caused by construction vehicles

In order to eliminate the potential of injury to persons and/or property a traffic plan is required to ensure that all activities are performed in a safe manner.

2.8.3 Legal Requirements

All vehicles used during the transportation of materials and construction activities for the proposed wind farm is required to be roadworthy per the National Road Traffic Act (NRTA).
For any vehicles that operate under an exemption permit (Abnormal Loads), a roadworthy certificate may not be required. However the exemption permit will require that the vehicle is fit for operation on public roadways.

The documents referenced for acquiring the exemption permit are the *"Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads"* 1st Edition, July 2009, and *"TRH 11: Dimensional and Mass Limitations and Other Requirements for Abnormal Load Vehicles"* 8th Edition, March 2010.

Both the NRTA and the National Road Traffic Regulations, 2000 (NRTR) prescribe limitations on vehicle dimensions, limitations on axle and vehicle masses that a vehicle using a public road must comply with.

2.8.4 Abnormal Loads

Each wind turbine will require at least 7 abnormal loads to transport the separate components.

2.9 PRELIMINARY TRANSPORTATION MANAGEMENT PLAN

2.9.1 Envisaged Transport Requirements

The majority of the traffic being generated by the proposed development will take place during the delivering of the wind turbine components and subsequently the construction of the access roads and wind turbines foundations. The requirements for transporting abnormal vehicles/loads are specified in TRH 11.

Once the wind farm is fully functional, the day-to-day operations will generate very little additional traffic. The majority of this traffic will be travelling along the N14 to and from Springbok.

2.9.2 Traffic Communication and Management

A full-time designated transport coordination manager should be appointed to oversee and manage the traffic safety officers. Additionally, the designated transport coordination manager should inform and keep up-to-date the interested and affected parties of all the activities taking place that may have a direct impact on them.

A traffic safety officer shall be nominated to make all the necessary arrangements to maintain the required traffic measures for the duration of the project as outlined in the "*Standard Specifications for Road and Bridge Works for State Road Authorities*,"1998 edition. The safety officer shall liaise daily with the transportation coordination manager to keep them updated with the state of all the traffic arrangements.

For each convoy of abnormal vehicles/loads a designated safety officer shall be appointed. During the delivery of the wind turbine components, the person in charge shall be in communication with the transport coordination manager.

The transport co-ordination manager should document the progress of the vehicles to mitigate any issues that may arise during the transportation phase.

If an escort vehicle is required by the exemption permit and if the abnormal vehicle needs to travel through an urban area, the local authority's Chief Traffic Officer shall be informed at least 2 hours before the arrival of the vehicles. All construction vehicles entering the site shall also be available via radio or telephone communication to the transport coordination manager.

2.9.3 Law Enforcement

All vehicles travelling to and from the site shall adhere to all laws imposed by the law enforcement agencies, and shall comply with any requests made by the law enforcement officials. During the transportation of abnormal loads/vehicles, the exemption permit may require that the vehicle(s) be escorted by a traffic officer. The traffic officer escort will be provided by the relevant road authority.

2.9.4 Adherence to Posted Speed Limits

All vehicles shall comply with the posted speed limits on public roads as well as a proposed 20km/h speed limit within the development. For additional speed limits that are imposed on the construction traffic using public roads, refer to the South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 for the restrictions.

For the transportation of abnormal loads/vehicles, the speed restrictions placed on the vehicles must be in compliance with the *TRH 11: Dimensional and Mass Limitations and other Requirements for Abnormal Load Vehicles*.

The maximum allowable speed that an abnormal vehicle is permitted to travel on public roads is the more stringent of factors dependent on either the load on the tyres, the load on bridges or the dimensions of the vehicle.

The speed restrictions for a mobile crane (cranes mounted on truck type chassis and all terrain cranes) are limited to 60km/h. Centre mounted cranes are not allowed to operate on public roads.

2.9.5 Abnormal Vehicles and Transport Loads

All construction traffic shall comply with the legal load requirements as outlined in the National Road Traffic Act and National Road Traffic Regulations.

All abnormal vehicles and loads to be transported are required to have a valid permit before any trip is begun. When the vehicle exceeds the mass limitations the vehicle or combination of vehicles will need to be registered with the Abnormal Vehicle Registration (AVR) and provided an AVR Number.

An abnormal load permit is acquired by completing a permit application issued by the relevant permitting office. Additionally, supporting documentation such as route clearances, stability calculations, etc. must be supplied as part of the application.

2.9.6 Safety and Visibility of Vehicles

As per the exemption permit for abnormal vehicles/loads, an escort is required to accompany the abnormal vehicle to warn the normal travelling public and to promote safe flow of traffic if the normal flow of traffic is disrupted by the abnormal vehicle. The permit will state whether an own escort or traffic officer escort is required.

In order to transport abnormal loads safely, it is required that adequate warning devices be used. These consist of flags, boards, and lights. Refer to TRH 11 for the requirements of these warning devices.

2.9.7 Travelling During Sensitive Periods

2.9.7.1 *Construction Traffic*

Construction traffic entering the site along public roads should be limited to times when peak hour traffic can be avoided where possible. The peak traffic occurs during 7h00 to 8h30, and 16h00 to 17h30. Construction traffic will also not be permitted to travel at night or during embargo periods such as public holidays or long weekends by the permit issuing authority.

2.9.7.2 *Abnormal Vehicles*

For abnormal vehicles/loads, travel can be restricted to the following times of the day and/or year:

2.9.7.3 *Embargo Days*

An embargo may be placed on travelling of abnormal vehicles/loads during certain periods such as public holidays, school holidays or long weekends. Additionally a municipality along the route may place a restriction on travel times to avoid the peak travel times in the mornings and evenings.

2.9.7.4 *Weekend Travel*

Depending on the dual classification of the abnormal load and route, as defined by TRH 11, the requirement for loads to travel on Saturdays and up to 14:00 on Sundays are as follows:

- On Category A routes: Classes D1 and D2 loads
- On Category B routes: Class D1 loads

This is only applicable if the overall height of the load does not exceed 4.6m and no mass exemptions exist.

2.9.7.5 *Night Travel*

In general travelling at night (after sunset and before sunrise) is not allowed for abnormal loads. However night travel may be permitted at the discretion of the issuing authority under specific conditions which will be stated on the exemption permit.

2.9.8 Phasing of Deliveries

A safe holding area should be available for the storage of the turbine components at the port of arrival (i.e. Saldanha Port). The exemption permit will state the number of abnormal vehicles/loads that can be travelling at once. This is to avoid any congestion along the public roads.

2.9.9 Sign Posting

The South African Road Traffic Signs Manual (SARTSM), Volume 2, June 1999 is to be used for all traffic during the construction activities of the proposed project. Signage will be required along the N14 before the proposed access point of the construction area to warn the public of the activities.

During periods of high construction traffic entering and exiting the site, it is recommended that flagmen help direct the traffic. This will enable the safe movement of construction and public traffic at the entrance and reduce the number of potential conflicts.

2.9.10 Road Infrastructure Upgrading

The access route to the proposed site requires upgrading to a standard that can be utilised by construction traffic and abnormal loads. Geometric alterations to the road and intersections will be required in the form of increasing of curve radii, the widening of roads where required and alterations to vertical alignment to accommodate design abnormal load trailer. Additional road layer-works may have to be imported if the existing gravel wearing course is found to be unsuitable for the design traffic.

2.9.11 Pavement Deterioration

Any damage caused by the construction vehicles to the existing road infrastructure shall be repaired, prior to the completion of the project. To determine and recover the damage caused by abnormal vehicles, a mass fee in R/km is calculated and then multiplied by the distance to be travelled to determine an amount payable. There are several methods used to calculate this in a way that converts the various arrangements of wheels and axles into a measure that allows a comparison of the arrangements. These are the Equivalent Standard Axle concept, the Equivalent Single Wheel Mass method, and a method based on the South African mechanistic-empirical pavement design methodology.

The exemption permit will require that this fee be calculated and paid before the permit is issued, therefore no further provisions need to be made.

2.9.12 Traffic Impact on the Environment

All vehicles utilised during the delivery of materials and construction activities on the site shall be deemed roadworthy.

This includes being in compliance with the environmental guidelines in reference to the allowable emissions that may be emitted from the vehicles. In the event that an oil or petrol leak occurs, the spillage should be cleaned up and disposed of per the environmental guidelines. Construction vehicles delivering raw materials to the site shall be covered to prevent any debris from falling on the road.

2.9.13 Conclusion and Recommendation

It is recommended that a detailed traffic management plan be completed once the project details are finalised and before construction can commence.

3 REFERENCES

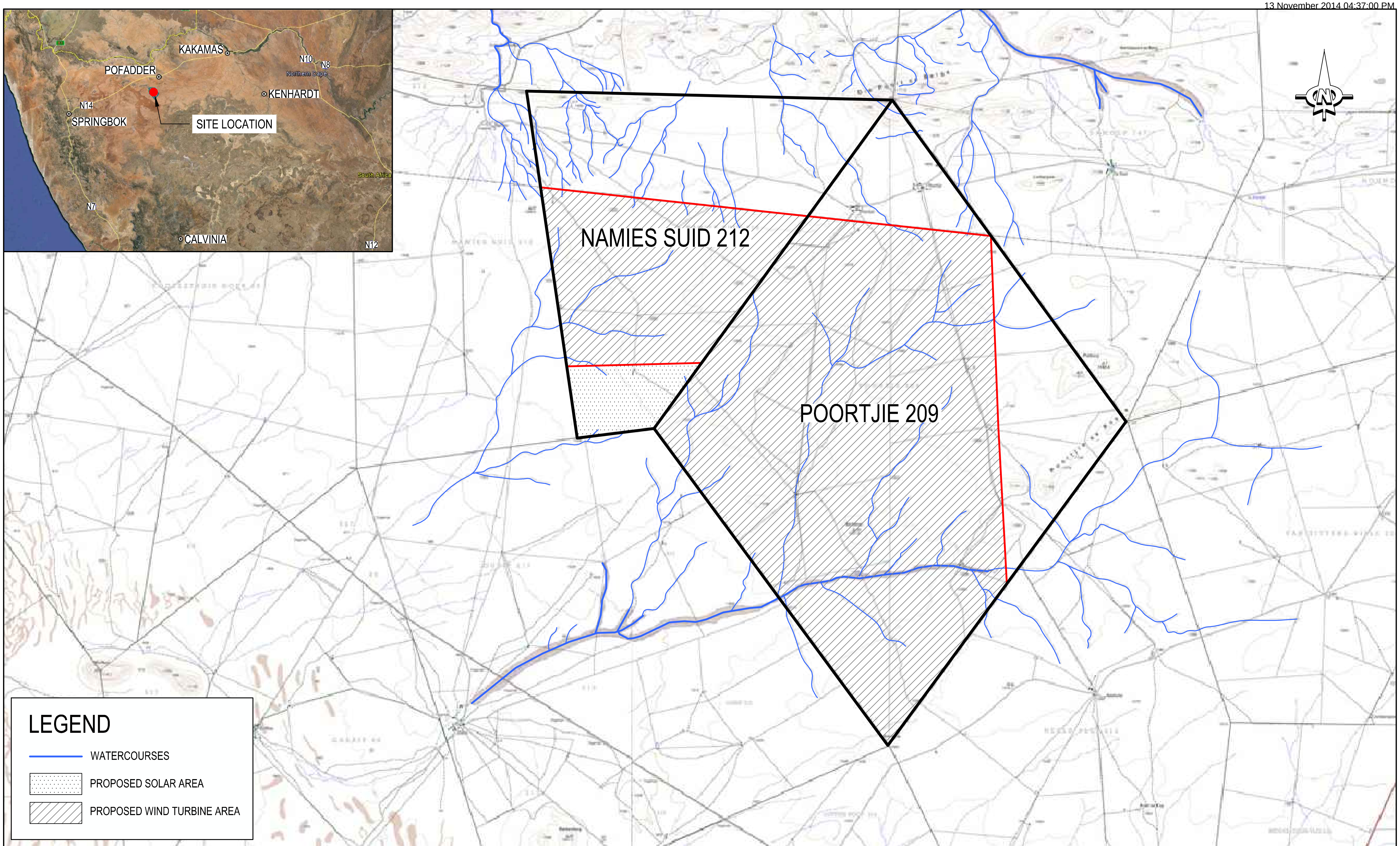
Technical Recommendations for Highways (TRH 11): *Draft Guidelines for Granting Exemption Permits for the Conveyance of Abnormal Loads and for Other Events on Public Roads.* March 2000.

Administrative Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads" 1st Edition, July 2009

Preliminary Transport Risk Assessment Report, as completed by ALE Heavylift (South Africa) for Mainstream Renewable Power South Africa (Pty) Ltd. November 2012.

ANNEXURE 1 – Locality Plan

13 November 2014 04:37:00 PM



DATE	INITIAL	No./CODE	REVISION DESCRIPTION
13/11/2014	B.V.W	1/D	FOR REPORT

CLIENT: MAINSTREAM RENEWABLE POWER

bvi ENGINEERING PROCUREMENT MANAGEMENT

CESA

PROJECT: POFADDER WIND AND SOLAR ENERGY FACILITY

DRAWING TITLE: LOCALITY PLAN

APPROVED BY BVi

ENGINEER/TECHNOLOGIST	REG. NO.	DATE	
SCALE	N.T.S	DRAWN	BVW
DESIGNED	AFG	CHECKED	AFG
PLAN NUMBER	REVISION NO.	DATE SAVED	
C2438c-001-01	A	13 November 2014	

C2438 LOCALITY PLAN FOR REPORT.DWG

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ANNEXURE 2 – Preliminary Transport Risk Assessment Report

WORLDWIDE HEAVY TRANSPORTATION AND LIFTING

ALE
SMARTER, SAFER, STRONGER

Port of Ngqura N10 North Loop
Port of Saldanha N1 North East Loop
Port of Saldanha N7 North Loop

PRELIMINARY TRANSPORT RISK ASSESSMENT REPORT

Client:	Mainstream Renewable Power South Africa		
Contact Person:	Hein Reyneke	Email:	Hendrik.Reyneke@mainstreamrp.com
Prepared by:	Johann van Zyl	Email:	j.vanzyl@ale-heavylift.com
Date:	2012.11.08	Pages:	
Our ref:	RSU-12- 175-01	Revisions:	01

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CONTENTS

1. INTRODUCTION

1.1. SUMMARY

The aim of this preliminary transport risk assessment report is to fulfil the scope of work and to summarize the deliverables per route surveyed as defined in section 1.2. and 1.3. below.

The report is structured into the three main routes as defined in section 1.4. below. The secondary routes to the respective sites as defined in section 1.5. below are structured under the applicable main routes.

1.2. SCOPE OF WORK

1. A preliminary transport risk assessment report for the main routes and secondary routes to the respective sites.
2. Identify suitable port of entry
3. Identify best route to respective sites
4. Define any known risks and issues on the routes identified

1.3. DELIVERABLES PER ROUTE SURVEYED

1. Route introduction
2. Photographic record of recorded data
3. Route risk register
4. Route conclusion
5. Google Earth KMZ routes for main and secondary routes

1.4. MAIN ROUTES:

1. Route 1: Port of Ngqura N10 North Loop
2. Route 2: Port of Saldanha N1 North East Loop
3. Route 3: Port of Saldanha N7 North Loop

Refer to Appendix 'A': Google Earth KMZ Routes for Main and Secondary Routes

1.5. SITES:

1.	Springfontein	S30 21.158 E25 40.910
2.	Victoria West 1	S31 39.667 E23 28.150
3.	Victoria West 2	S31 36.765 E23 17.920
4.	Nooitgedacht	S32 49.912 E18 05.710
5.	Perdekraal	S33 04.380 E20 04.344
6.	Sutherland	S32 43.800 E20 44.143
7.	Beaufort West 1	S32 45.885 E22 30.689
8.	Beaufort West 2	S32 56.381 E22 32.668
9.	Kangnas	S29 30.461 E18 17.408
10.	Pofadder	S29 17.954 E19 12.437

Refer to Appendix 'B': Google Earth KMZ Waypoints for Sites

2. PORT OF ENTRY

2.1. BACKGROUND INFORMATION ON PORT OF NGQURA:

Acting Port Manager & Harbor Master: Captain Neil Chetty
Tel: +27 41 507 1900
Email: neil.chetty@transnet.net

Website: www.transnetnationalportsauthority.net

The Port of Ngqura // Coega which began commercial ship operations (Containers) in October 2009, lies some 20km North East of Port Elizabeth and is South Africa's 8th and latest commercial port development, situated at the mouth of the Coega River in Nelson Mandela Bay. Transnet National Port Authority of SA is responsible for developing the deep-water port; white Transnet Port Terminal (TPT) has been appointed to handle all terminal operations.

An Industrial Development Zone, knows as the Coega IDZ, has been developed over the 12,000-hectare site in the area including the river and port, with a 4,500 ha core development immediately identified. The IDZ will serve as a primary location for new industrial development for export driven industries.

The Port is of deep-water construction capable of serving post-Panamax dry and liquid bulkers and the new generation of cellular container ships.

The design vessels for the port are:

Dry Bulk Carriers
Dead Weight Tonnage: 80,000DWT
Length OA: 250m
Beam: 36.5m
Loaded Draught: 14.0m

Cellular Container Vessels
TEU: 4,500
Deadweight Tonnage: 70,000 DWT
Length OA: 300m
Beam: 40m
Loaded Draught: 14m

The horizontal geometry of the port is such that 150,000DWT bulkers and 6,500TEU cellular container ships can maneuver within the port, although initial dredging is being limited to accommodate the design vessels only.

Levels of storage within the port:

The port will allow temporary storage of WTG components in the port. The area available is + - 20.000m²
ALE also has access to additional storage area close to the finger jetty.

Port Handling:

The WTG components will arrive on a geared vessel, i.e. a vessel with its own cranes to offload.

The components will be received Free Alongside Ship (FAS) onto suitable transport combinations for transport to the laydown area.

The components will be offloaded // loaded onto transporters with either // or // and mobile cranes, forklifts, crane trucks, reach stackers.

The Additional WTG pieces can be stooled off (staged) in the Laydown Area.

2.2. BACKGROUND INFORMATION ON PORT OF SALDANHA:

NOTE: HeavyLift Vessels (HL V) // Project Vessels do not call this port, unless chartered.

Port of Saldanha
Private Bag X 1
7395 SALDANHA

Tel: + 27 22 701 4302 / 4
Fax: + 27 22 714 4236

Tel: + 27 22 703 4420 (Port Manager)
Email: eugene.kearns@transnet.net

Tel: + 27 22 703 4100 (Harbor Master)
Email: peter.stow@transnet.net

Tel: + 27 22 701 4344 / 5 (Marine Security Department)
Website: www.transnetnationalportsauthority.net

Saldanha MPT (Multi Purpose Terminal)
Tel: + 27 22 703 4934

The Port of Saldanha Bay, South Africa's largest natural anchorage and port with the deepest water is 60 nautical miles northwest of Cape Town.

Situated at Longitude 17º 58' E and Latitude 33º 02' S, Saldanha Bay is partly protected by a 3.1km long artificial breakwater.

The port has developed into a modern harbor only recently, when it became necessary to facilitate the export of iron ore from the Northern Cape. This required the construction of a railway more than 800km to the mines at Sishen in the Northern Cape and the construction of a deep-water jetty in Saldanha Bay to accommodate the Capsize ore carriers.

The total area occupied by the port (land and water areas) is 18,300 ha with an outer boundary of 91km.

Port Limitations:
The port of Saldanha Bay accepts vessels of up to 20.5m draught although the harbor master conditionally accepts vessels with a draught of 21.5m. The port entrance channel is dredged to a depth of -23m Chart Datum and -23.7m CD at the commencing of the entrance channel. The entrance channel has a minimum width of 400m. The turning basin seaward of the jetty has a diameter of 580m and a depth of -23.2m CD.

The draught at the multipurpose quays is 12m for berth 201 and 13.5m for berths 202 and 203. Pilotage is compulsory and tugs are required for ship working.

Marine Craft:
Saldanha Bay is served by a fleet of three tugs assisted by a fourth sent from Cape Town when required (vessels exceeding a draught of 19m require four tugs). The Saldanha based tugs are named Jutten, Marcus and Meeuw and are 1976-built Voith Schneider tractor tugs each with a bollard pull of 43 tons.

Pilotage service is compulsory and is provided by a diesel-powered pilot boat named Ivubu. The port has two launches named Sysie and Dikkop.

Port Volumes:
During the financial year 2008/09 ended 31 March 2009 the Port of Saldanha Bay handled a total of 452 ships with a total gross tonnage of 25,423,117-gt.

In 2008/09 cargo handled by the port totaled 50,282,909 tons, including oil. Of this total 49,632,380t was bulk cargo (33,958,761t exports; 13,966,243t imports; and 1,707,376t transshipped), and 650,529t break-bulk (603,115t exports and 47,414t imports). The port handled no containers during 2008.

Port Facilities:
Saldanha Bay is a common user port. The port has a 990m long jetty containing two iron ore berths linked to the shore along a 3.1km long causeway/breakwater. There is also an 874m long multipurpose quay for the handling of break-bulk cargo and a 365m tanker berth at the end of the ore jetty with a permitted draught of 21.25m alongside.

The iron ore jetty is 630m long with a permitted draught of 21.25m alongside. The multipurpose quays (berths 201-203) are a total of 874 long with a max draught permitted between 12m and 13.4m. Cargo handled at the multipurpose terminal includes various mineral exports, steel coils and pig iron. Imports include anthracite, coking coal and steel pellets.

Port control operates 24 hours a day. There are no bunkering facilities at Saldanha Bay. A full diving service is available for ship inspection and other services but ship repair is limited mainly to the fishing industry. Large ship repairs can however be carried out by services provided from Cape Town.

The port has a full chandling and stevedore service available. Saldanha Bay has yachting marina facilities and a NSRI base for sea rescue.

Port Handling:

The WTG components will arrive on a geared vessel, i.e. a vessel with its own cranes to offload.

The components will be received free Alongside Ship (FAS) onto suitable transport combinations for transport to the laydown area.

The components will be offloaded // loaded onto transporters with either // or // and mobile cranes, forklifts, crane trucks, reach stackers.

The HeavyLift pieces can be stooled off (staged) in the Laydown Area.

3. ROUTE 1: PORT OF NGQURA N10 NORTH LOOP

3.1. ROUTE INTRODUCTION:

Route 1 is the preferred route for most of the wind energy sites in the Eastern Cape during phase 1. The route is not an established abnormal route, but has the potential to be developed into an established abnormal route. The Olifantskop Pass which has to be negotiated poses a risk. Traffic control points would have to be introduced at the start and end of the 3.4km long pass which would take approximately 15min for a convoy of abnormal combinations to cross. The route also passes through the centre of many towns which is a risk to be taken into consideration.

The route starts in Port Elizabeth at the exit from Port of Ngqura and roughly follows the N2, N10 and R390 and ends at the R701 and R715 junction near Bethulie. The total distance of route 1 is 466km.

3.1.1. Map of Route 1: Port of Ngqura N10 North Loop (Gamin BaseCamp format):

Refer to Appendix 'C': Garmin BaseCamp Map of Routes

3.1.2. Route Description

	Start of Route 1	
	Port Elizabeth	
1.	Drive northwest on Neptune Road	4.3km
2.	Turn right onto R102	12.4km
3.	Turn left onto N2 towards Grahamstown	20.5km
	Cannonville, Colchester	
4.	Take exit 797 to the left onto N2 towards Grahamstown/R72/Port Alfred	1.6km
5.	Take exit 798 to the left onto R72 towards Port Alfred	286m
6.	Take ramp to the left towards N10/Cradock	26m
7.	Turn left onto R72	613m
8.	Turn right onto N10	194km
	Paterson, Olifantskop Pass, Cookhouse, Cradock	
9.	Turn left onto Voortrekker Street (N10)	454m
10.	Turn right onto J.A. Calata Street (N10)	1.7km
11.	Turn right onto Ziervogel Way	345m
12.	Turn left onto Hofmeyer Way (R390)	61.4km
	Hofmeyer	
13.	Turn right onto R401	327m
14.	Turn left onto R390	34.3km
15.	Turn right onto R56	10.2km
	Steynsburg	
16.	Turn left onto R56	1.2km
17.	Turn left onto R390	65.5km
	Venterstad	
18.	Turn right onto R58	37.8km
19.	Turn left onto R390	15.4km
20.	Turn left onto R701	4.1km
	Bethulie	
	Arrive at end of Route 1	

3.2. PHOTOGRAPHIC RECORD OF ROUTE

Overhead bridge on the N2 at Cannonville, just past the Sondags River

Olifantskop Pass

Olifantskop Pass

Turn left onto Voortrekker Street (N10)

Turn left onto Hofmeyer Way (R390)

Steynsburg, Turn right onto R56

Steynsburg, Turn left onto R56

Steynsburg, Turn left onto R390

3.3. <u>ROUTE RISKS REGISTER:</u>

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Overhead bridge on the N2 at Cannonville, just past the Sondags River	Obstruction	Clearance = 5.8m Typical trailer height = 1.05m Max laden height: 1.05 + 4.3 = 5.35m OK	Constructing a bypass *or* Use of specialized nacelle and tower adaptors which would reduce the laden height of the abnormal combinations
2	Olifantskop Pass	High risk	Road width; Blind corners; Traffic	Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
3	Tracking	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	It can be expected that some of the turns on route 1 would require works and/or removal of street furniture in order to accommodate the abnormal combinations transporting tower and blade sections. Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Medium	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
5	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 1 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

3.4. ROUTE CONCLUSION

Route 1 is the best route from port of Ngqura to reach the Springfontein, Noupoort and Victoria West wind energy sites. Being the preferred route for most of the wind energy sites in the Eastern Cape during phase 1, the route will be developed to become an established abnormal route.

3.5. SECONDARY ROUTE: SPRINGFONTEIN

3.5.1. Route Description

Start of Secondary Route: Springfontein
Bethulie
1. Drive north on R715
2. Cross N1 and continue to drive north on S1475
3. Turn left onto S139

Arrive at Springfontein wind energy site

3.5.2. Route Conclusion

The R715 and S1475 does not pose any risk. The 9.2km gravel section on the S139 would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

3.1. SECONDARY ROUTE: VICTORIA WEST

3.1.1. Route Description

	Start of Secondary Route: Victoria West	
	Bethulie	
1.	Drive southwest on R715	47.4km
2.	Turn right towards N1 ramp	402m
3.	Turn left onto N1	119km
	Colesberg, Hanover	
4.	Turn right onto N10 ramp	380m
5.	Turn right onto N10	300m
6.	Turn left onto road	300m
7.	Turn left onto road	700m
8.	Turn right onto N1	116km
	Richmond	
	Arrive at Victoria West wind energy site	

3.1.2. Route Conclusion

An overhead bridge on the N1 in Hanover with a clearance of 5.15m obstructs the route. An existing bypass could be developed to accommodate the WTG components with a height in excess of 4m (assuming a safe clearance of 0.1m), i.e. the tower-middle section and tower-lower section.

Picture 1: Hanover bypass

4. ROUTE 2: PORT OF SALDANHA N1 NORTH EAST LOOP

4.1. ROUTE INTRODUCTION:

Route 2 is an established superload route from the OP599 (“Die Verbindings Pad”), Port of Saldanha to the N1, Worcester. High voltage overhead cables originating from a substation next to the R45 that may have to be permanently raised depending on the required clearance above the laden WTG components. The route also passes through the centre of Worcester and De Doorns to bypass overhead bridges on the N1. Two passes, the Nuwekloof Pass and the Hex Pass, has to be negotiated. Traffic control points might have to be introduced at the start and end of these two passes.

The route starts at the exit from the Port of Saldanha and roughly follows the OP599 (“Die Verbindings Pad”), R27, R45, N7, R311, R46, R44, R303, R43 and N1 and ends at the N1 and N9 junction near Colesburg from where the route 1 sites could also be accessed. The total distance of route 2 is 932km.

4.1.1. Map of Route 2: Port of Saldanha N1 North East Loop (Gamin BaseCamp format):

Refer to Appendix ‘C’: Garmin BaseCamp Map of Routes

4.1.2. Route Description

	Start of Route 2	
	Saldanha	
1.	Drive east on the OP599 ('Die Verbindings Pad')	2.66km
2.	Turn right onto gravel ramp	300m
3.	Turn right onto the MR559 (Camp Road)	3.5km
4.	Turn left onto the OP538	3.6km
5.	Turn right onto the OP599 ('Die Verbindings Pad')	4.2km
6.	Turn left onto the R27	4.8km
7.	Turn right onto R45	82.4km
	Langebaanweg, Hopefield	
8.	Turn left onto N7	27.5km
	Mooreesburg	
9.	Turn right onto R311	32.2km
	Ongegund, Riebeek Wes, Riebeek Kasteel	
10.	Turn left onto R46	9.9km
11.	Turn left onto R44	38km
	Gouda	
12.	Turn right onto Voortrekker Street (R46)	7km
	Wolseley	
13.	Turn right onto R303	7km
14.	Turn left onto R43	24.5km
15.	Turn left onto N1	5.4km
	Worcester	
16.	Turn right onto Hoog Street	2km
17.	Turn left onto Robertson Road (R60)	8.8km
18.	Turn left onto road	5km
19.	Turn left onto road	4.4km
20.	Turn left onto N1 towards De Doorns	21.1km
	De Doorns	
21.	Turn left onto Voortrekker Road	4.8km
22.	Turn left onto N1 towards Beaufort West	315km
	Touwsrivier, Laingsburg, Beaufort West	
23.	Enter roundabout traffic circle	131m
24.	Take the third left onto Donkin Street (N1)	312km
	Richmond, Hanover, Colesberg	
	Arrive at end of Route 2	

4.2. PHOTOGRAPHIC RECORD OF ROUTE

Overview gravel ramp onto MR559 (Camp Road)

NOTES:

km Reading: 0.0km

Turn left from the OP599 ('Die Verbindings Pad') road onto gravel ramp

	NOTES: km Reading: 0.3km
Turn right from the gravel bypass onto the MR559 (Camp Road)	
	NOTES: km Reading: 3.8km
Turn left from the MR559 (Camp Road) onto the OP538	

<table>
<tr><td></td><td>NOTES:

km Reading: 7.2km</td></tr>
<tr><td colspan="2">Turn right from the OP538 Vredenburg Road onto the OP599 (“Die Verbindings Pad”) Town</td></tr>
<tr><td></td><td>NOTES:

km Reading: 8km</td></tr>
<tr><td colspan="2">Turn left from the OP599 (‘Die Verbindings Pad’) onto the R27</td></tr>
</table>

	NOTES: km Reading:14.8km
Turn right from the R27 onto the R45	
	NOTES: Headroom = 6.4m km Reading: 23.9km
Substation on left hand side of the R45	

NOTES:

km Reading: 109km

Turn left from the R45 onto the N7

NOTES:

km Reading: 167.8km

Turn left from the R311 onto the R46

NOTES:

km Reading: 177.6km

Turn left from the R46 onto the R45

NOTES:

km Reading: 206.9km

Turn right from the R46 onto the R46

<table>
<tr><td></td><td>NOTES:

km Reading: 207.2km</td></tr>
<tr><td colspan="2">Turn right from the R45 onto the R303</td></tr>
<tr><td></td><td>NOTES:

km Reading: 225km</td></tr>
<tr><td colspan="2">Turn right from the R303 onto the R43</td></tr>
</table>

NOTES:

km Reading: 231.9km

Turn left from the R43 onto the R46

NOTES:

km Reading: 248.1km

Turn left from the R46 onto the N1

<table>
<tr><td></td><td>NOTES:

Headroom = 5.81m.

km Reading:252.2km</td></tr>
<tr><td colspan="2">Use off ramp 108 on the N1 to avoid the overhead bridge over the N1, Worcester</td></tr>
<tr><td></td><td>NOTES:

Headroom = 5.3m

Use bypass route

km Reading: 252.2km</td></tr>
<tr><td colspan="2">Overhead bridge no. 5009 over the N1, Worcester</td></tr>
</table>

	NOTES: Headroom = 5.4m Use bypass route km Reading: 275km
Overhead bridge over the N1, De Doorns	
	NOTES: Headroom = 6.1m. Use bypass route km Reading: 276.2km
Overhead pedestrian bridge over the N1, De Doorns	

	NOTES: 7.4% Inclines Tracking drawings to be constructed km Reading: 285.7km
Hex River Pass	
	
Road conditions on top of the Hex River Pass	

	
Bridge 4918 over the Leeu River on the N1 (Typical)	
	
N1, Beaufort West	

Enter roundabout and take the 3rd exit in the direction of Johannesburg on the N1.

4.3. ROUTE RISKS REGISTER:

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Nuwekloof Pass	High risk	Road width; Blind corners; Traffic	Tracking drawings to be constructed . Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
2	Bypass route through the centre of Worcester	High	Congestion; Road width; Turning radius; Street furniture	Tracking drawings to be constructed and local municipalities and public to be approached to participate in finding a common solution
	Navigating through the city centre will is classified as high risk. Tracking drawings will have to be constructed to thoroughly assess the risk. Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
3	Tracking around traffic circle in Beaufort West	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Medium	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Due to the volume of abnormal combinations that will transport WTG components through the towns, it can be expected that the local municipalities and public will object to the disruption. It is suggested that the local municipalities and public be approached to participate in finding a common solution.			
5	High voltage overhead cables	Medium	Headroom	Further investigation with responsible regional department of Eskom to ascertain the required clearance above laden height of WTG components

6	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 2 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

4.4. ROUTE CONCLUSION

Route 2 is the best route from port of Saldanha to reach the Nooitgedacht, Perdekraal, Sutherland and Beaufort West wind energy sites. Route 2 is an established superload route from the OP599 ("Die Verbindings Pad"), Port of Saldanha to the N1, Worcester. The N1 onwards frequently carries smaller abnormal loads. However, the route has never accommodated loads equal to the blade lengths and for this reason tracking is highlighted as one of the high risks. As opposed to the N2, N10 and R390 on route 1, most of route 2 is on the N1 which is straight, open and flat for the most part. Well suited for abnormal combinations with only focussed areas that hold risks.

4.5. SECONDARY ROUTE: NOOITGEDACHT

4.5.1. Route Description

Start of Secondary Route: Nooitgedacht
Vredenburg

1.	Drive north on the R27	6.9km
2.	Turn left onto road	5.7km
3.	Turn right onto R399	2.6km

Arrive at Nooitgedacht wind energy site

4.5.2. Route Conclusion

The secondary road to Nooitgedacht diverts from route 2 at the intersection with the R27 and the R45. Nooitgedacht wind energy site is only a stone throw away and holds low risk.

4.6. SECONDARY ROUTE: PERDEKRAAL

4.6.1. Route Description

Start of Secondary Route: Perdekraal
De Doorns

1.	Drive northwest on the R46	31.7km
2.	Turn right onto R355	5.9km
3.	Turn right onto road	7.2km
4.	Turn right onto road	29.2km

Arrive at Perdekraal wind energy site

4.6.2. Route Conclusion

The R46 does not pose any risk. The 36.4km gravel section on the would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

4.7. SECONDARY ROUTE: SUTHERLAND

4.7.1. Route Description

	Start of Secondary Route: Sutherland	
	Matjiesfontein	
5.	Drive north on R354	33.6km
6.	Turn right onto Komsberg/Kareedoringkraal road	34.6km
	Arrive at Sutherland wind energy site	

4.7.2. Route Conclusion

The R354 is a narrow winding road with many blind turns. It might not be commercially viable to deploy traffic control points on all the various sections of the road. Escort vehicles could be specifically trained for this section of road in order to anticipate problem areas and safely escort the combinations through. The 36.6km Komsberg/Kareedoringkraal gravel section would require regular maintenance and might restrict delivery of WTG components to site during heavy rains. It is said to often flood during heavy rains and is classified as high risk for the transportation of WTG components.

4.8. SECONDARY ROUTE: BEAUFORT WEST

4.8.1. Route Description

	Start of Secondary Route: Beaufort West	
	Beaufort West	
1.	Drive south on the N12	64.3km
	Arrive at Beaufort West wind energy site	

4.8.2. Route Conclusion

The 64.3km tarred section on the N12 holds only low risk.

5. ROUTE 3: PORT OF SALDANHA N7 NORTH LOOP

5.1. ROUTE INTRODUCTION:

Route 3 is an established abnormal route. However, the route has never accommodated abnormal combinations with the length of the tower and blade sections or the volume of components. The bypass route from Klawer via Vredendal and Lutzville to Nuwerus has some sharp turns and gravel sections that have to be investigated further to establish the impact that high volumes of abnormal combinations will have.

The route splinters off from route 2 and starts at the junction between the N7 and the R311 just before passing through Moorreesburg. It follows the N7 and N14 with a bypass route from Klawer to Nuwerus on the R362 and R363. The total distance of route 3 is 586m.

5.1.1. Map of Route 3: Port of Saldanha N7 North Loop (Gamin BaseCamp format):

Refer to Appendix 'C': Garmin BaseCamp Map of Routes

5.1.2. Route Description

	Start of Route 3	
	Moorreesburg	
1.	Drive north on the N7	183km
	De Hoek, Piketberg, Nieuwoud, Clanwilliam, Klawer	
2.	Turn left onto Church Street (R363)	821m
3.	Turn right onto Niewoudt Street (R362)	17.2km
4.	Turn right onto R27	21m
5.	Turn right onto R27	3.4km
	Vredendal	
6.	Turn right onto R362	16.6km
7.	Bear right onto R363	6.6km
	Lutzville	
8.	Turn left onto Stasie Road (R362)	535m
9.	Bear left onto R363	27.8km
	Koekenaap	
10.	Turn right onto R363	27.5km
	Nuwerus	
11.	Turn left onto N7	192km
	Bitterfontein, Garies, Karkams, Kamieskroon, Springbok	
12.	Take exit 549 to the left onto R355 towards N14/Pofadder	565m
13.	Turn right onto R355 towards N14/Pofadder	324m
14.	Turn left onto R355	383m
15.	Turn right onto N14	110km
	Carolusberg, Aggeneys	
	Arrive at end of Route 3	

5.2. PHOTOGRAPHIC RECORD OF ROUTE

Headroom = 5.3m

Use bypass route from Klawer to Nuwerus via Vredendal, Lutzville and Koekenaap

Overhead Railway Bridge on N7, Vanrhynsdorp

Klawer, turn left onto R363 to bypass route

<table>
<tr><td></td><td></td></tr>
<tr><td colspan="2">Klawer, turn right onto R362</td></tr>
<tr><td>
</td><td>Tracking drawings to be constructed</td></tr>
<tr><td colspan="2">Vredendal, turn right onto R362</td></tr>
</table>

5.3. ROUTE RISKS REGISTER:

The following risks have been identified.

No.	Risk	Category	Restriction	Solution / Mitigation
1	Bypass route from Klawer to Nuwerus via Vredendal, Lutzville and Koekenaap	High	Congestion; Road width; Turning radius; Street furniture	Tracking drawings to be constructed and local municipalities and public to be approached to participate in finding a common solution
	Navigating through the bypass route is classified as high risk. Tracking drawings will have to be constructed to thoroughly assess the risk. Due to the volume of abnormal combinations on the sections of gravel road and within town centres during the transport WTG components, it can be expected that road conditions will deteriorate and the local municipalities and public will object to the disruption. It is suggested that the condition of the gravel sections be investigated further and that local municipalities and public be approached to participate in finding a common solution.			
2	Piekenierskloof Pass	High	Road width; Blind corners; Traffic	Traffic accommodation plan to be compiled
	Due to the volume of abnormal combinations that will transport WTG components through the pass, the chance of an accident taking place is classified as high risk. A traffic accommodation plan has to be compiled to thoroughly assess the risk.			
3	Tracking	Medium	Road width; Turning radius; Street furniture	Tracking drawings to be constructed
	It can be expected that some of the turns on route 3, especially on the bypass route, would require works and/or removal of street furniture in order to accommodate the abnormal combinations transporting tower and blade sections. Tracking drawings will have to be constructed to thoroughly assess the risk.			
4	Disruption to local municipalities and public when passing through towns	Low	Rate of delivery to wind energy sites	local municipalities and public to be approached to participate in finding a common solution
	Most towns located on route 3, with the exception of the bypass route, are not on the N7/N14 but located off the main roadways. For this reason disruption to local municipalities and public is classified as low risk.			
5	Overpass bridges	Low	Gross combination mass; Ground bearing pressure	Route clearance by consulting bridge engineers to be compiled
	All the overpass bridges on route 2 have either been constructed according to the 1931 MOT (Military of Transport) system, or the 1981 NC30 system which was implemented from 1984 onwards. The chance that any of the overpass bridges on route 1 will not be able to carry the gross combination mass or ground bearing pressure of the abnormal combinations is classified as low risk.			

5.4. ROUTE CONCLUSION

Route 3 is the best route from port of Saldanha to reach the Kangnas and Pofadder wind energy sites.

5.5. SECONDARY ROUTE: KANGNAS

Kangnas is located on route 3, approximately 45km past Springbok on the N14.

5.6. SECONDARY ROUTE: POFADDER

5.6.1. Route Description

	Start of Secondary Route: Pofadder	
1.	Drive southeast on road	8km
2.	Turn left on road	24.3m
	Arrive at Pofadder wind energy site	

5.6.2. Route Conclusion

The 32.3km gravel section climbs gradually towards the Pofadder wind energy site. It would require regular maintenance and might restrict delivery of WTG components to site during heavy rains.

6. PROJECT DRAWINGS AND REFERENCE DOCUMENTS

56 SETS 106/2500kW WTG 80m TOWER					
DESCRIPTION OF GOODS	**LENGTH**	**WIDTH**	**HEIGHT**	**kgs/unit**	**CBM/unit**
Blade	52,000	3,400	2,850	10,127	503.880
Hub	4,400	4,930	3,700	26,300	80.260
Spinner (stackable of 3 tiers)	1,860	1,860	930	706	3.217
Nacelle	8,450	4,310	3,870	32,320	140.943
Nacelle-Cap (stackable of 3 tiers)	2,960	2,650	2,760	877	21.649
Generator	4,940	4,940	2,410	58,209	58.813
Tower-upper section	27,490	3,276	3,767	37,977	339.246
Tower-middle section	27,860	3,767	4,300	53,537	451.279
Tower-lower section	22,320	4,300	4,300	69,639	412.697
Foundation ring	4,300	4,300	1,800	10,878	33.282
Containers	12,090	2,350	2,690	12,000	76.427

7. APPENDICES

7.1. APPENDIX 'A' – GOOGLE EARTH KMZ ROUTES FOR MAIN AND SECONDARY ROUTES
- 7.1.1. ROUTE 1: PORT OF NGQURA N10 NORTH LOOP
- 7.1.2. ROUTE 2: PORT OF SALDANHA N1 NORTH EAST LOOP
- 7.1.3. ROUTE 3: PORT OF SALDANHA N7 NORTH LOOP

7.2. APPENDIX 'B' – GOOGLE EARTH KMZ WAYPOINTS FOR SITES
- 7.2.1. SPRINGFONTEIN S30 21.158 E25 40.910
- 7.2.2. NOUPOORT S31 12.293 E25 03.030
- 7.2.3. VICTORIA WEST 1 S31 39.667 E23 28.150
- 7.2.4. VICTORIA WEST 2 S31 36.765 E23 17.920
- 7.2.5. NOOITGEDACHT S32 49.912 E18 05.710
- 7.2.6. PERDEKRAAL S33 04.380 E20 04.344
- 7.2.7. SUTHERLAND S32 43.800 E20 44.143
- 7.2.8. BEAUFORT WEST 1 S32 45.885 E22 30.689
- 7.2.9. BEAUFORT WEST 2 S32 56.381 E22 32.668
- 7.2.10. LOERIESFONTEIN S30 28.369 E19 33.351
- 7.2.11. KANGNAS S29 30.461 E18 17.408
- 7.2.12. POFADDER S29 17.954 E19 12.437

7.3. APPENDIX 'C' – GARMIN BASECAMP MAP OF ROUTES
- 7.3.1. ROUTE 1: PORT OF NGQURA N10 NORTH LOOP
  - 7.3.1.1. SPRINGFONTEIN
  - 7.3.1.2. VICTORIA WEST
- 7.3.2. ROUTE 2: PORT OF SALDANHA N1 NORTH EAST LOOP
  - 7.3.2.1. NOOITGEDACHT
  - 7.3.2.2. PERDEKRAAL
  - 7.3.2.3. SUTHERLAND
  - 7.3.2.4. BEAUFORT WEST
- 7.3.3. ROUTE 3: PORT OF SALDANHA N7 NORTH LOOP
  - 7.3.3.1. KANGNAS
  - 7.3.3.2. POFADDER