PROPOSED CONSTRUCTION OF ALETTA 140MW WIND ENERGY FACILITY

TRAFFIC IMPACT STUDY FOR THE TRANSPORT OF WIND ENERGY EQUIPMENT TO A FACILITY IN THE NORTHERN CAPE PROVINCE

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TRANSPORTATION REPORT

SEPTEMBER 2016

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ISSUE & REVISION RECORD

QUALITY APPROVAL

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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.

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DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

Proposed Construction of the Aletta 140MW Wind Energy Facility, near Copperton, Northern Cape Province

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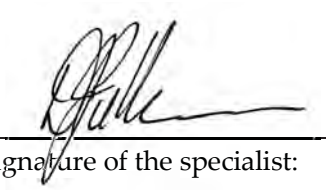
The specialist appointed in terms of the Regulations_

I, Dirk Iacobus Petrus van der Merwe, declare that –

General declaration:

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



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16 September 2016

Date:

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1 INTRODUCTION

1.1 General

BioTherm Energy (Pty) Ltd appointed BVi Consulting Engineers to undertake the Transportation Assessment for a proposed wind energy plant in the Northern Cape Province near the towns of Copperton and Prieska. A locality plan is included as *Annexure A.*

The assessment has been conducted for the site which is located approximately 36km southwest of the town of Prieska on Route R357. It is focused on the following aspects of transporting the Wind Energy equipment from a primary port of delivery to the installation site:

- Location of the Site (Nearest numbered road indicated)
- Trip generation during construction and operation of the plant
- Probable Haulage Routes (National and Provincial Roads will be utilised)
- Site Access Route (from a National roadway)
- Affected Communities

The following documents/sources were used in compiling this report and reference will be made if and where necessary:

- Google earth images for locality plans and route layouts.
- Road Access Guidelines
- TRH 11: Guidelines for granting of exemption permits for the conveyance of abnormal loads and for other events on public roads
- Highway Capacity Manual 2010: HCM 2010
- TRH17: Geometric Design of Rural Roads

1.2 Methodology for further study

This report includes the following:

- Possible route identification
- Construction Phase Assessment
- Capacity Assessment of transport routes
- Capacity Assessment of intersections

The construction phase assessment determines the transport impact in comparison to the status quo and includes the further assessment of:

- Intersection geometry
- Intersection function

2 SITE LOCATION

The site is located in the Northern Cape Province approximately 36km southwest of the town of Prieska within the Siyathemba Local Municipality and the Pixley ka Seme District Municipality. The equipment will be delivered to site from Saldanha Harbour over a distance of between 900km to 1200km or alternatively from Coega Harbour over a distance of 770km.

The site identified for this development is located off Route R357 with an existing access to the facility, Drielings Pan. The properties in question are:

- Portion 1 of Drielings Pan No.101
- Portion 2 of Drielings Pan No.101
- Portion 3 of Drielings Pan No.101
- Remainder of Drielings Pan No.101

Figure 2-1 shows the locality of the site in relation to the town of Prieska.

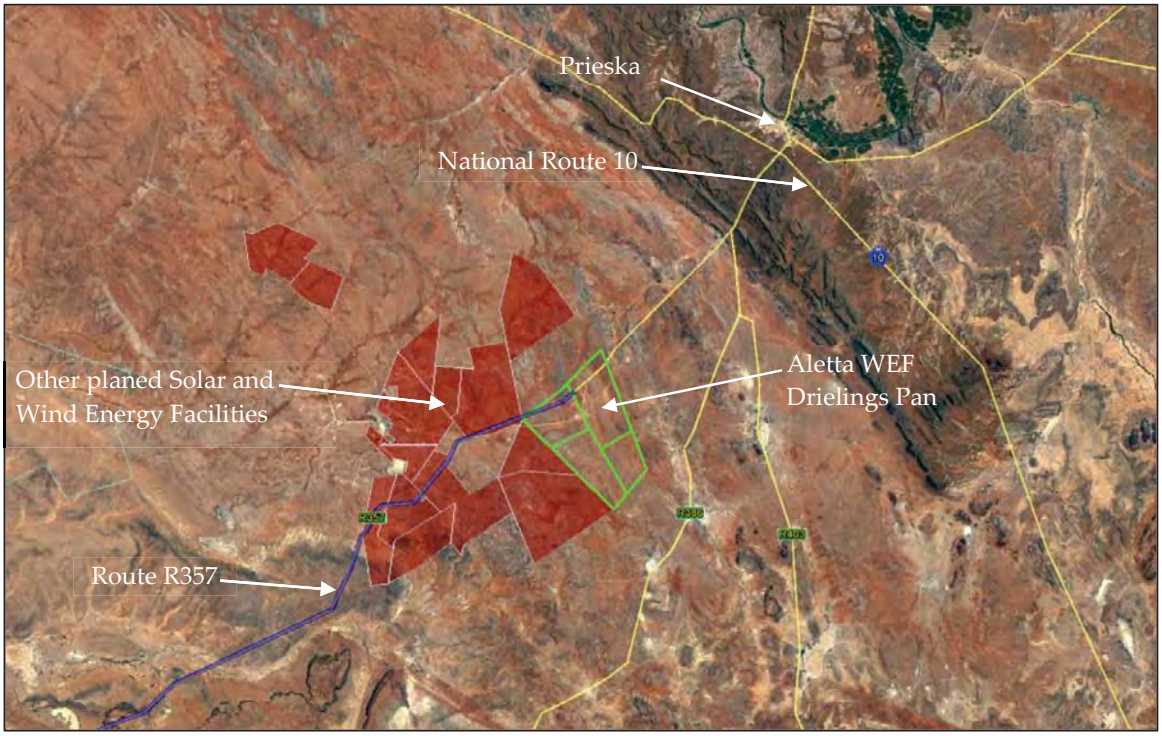


Figure 2-1: Prieska-Aletta Wind Energy Facility[1]

The construction stage of the plant is expected to take place over a period of 18 months during which local traffic will be affected. The expected traffic and trip generation figures are dealt with in a following chapter. The plant itself is expected to generate 140MW AC power and will feed into the national Eskom grid. The facility stretches over an area measuring 11 002 hectares.

[1] Image obtained from Google Earth Professional

3 RECOMMENDED HAULAGE ROUTE

As mentioned in the chapter above the turbine components will be transported to the Drielings Pan facility over a distance of between 900km to 1200km and 770km, from Saldanha harbour or Coega harbour, respectively. A number of routes were identified for the transport of the turbines and is indicated in ***Figure 3-1*** to ***Figure 3-4*** below.

3.1 Route Alternative 1 – Saldanha to Aletta WEF via Loeriesfontein (1222km)

The route overview is shown in ***Figure 3-1*** and is briefly described below:

- Travel from Saldanha Harbour towards Piketberg via the R45 and N7 highway towards and through the towns of:
  - Hopefield
  - Moorreesburg
  - Piketberg
- Turn left onto the R365 (Lang Street) and travel through the town of Piketberg.
- Exit toward Elands Bay on the R366 towards and through the towns of:
  - Redelinghuys
- Before Elands Bay turn north toward the R364, Graafwater towards and through the town of:
  - Leipoldtville
  - Graafwater
- Travel through Graafwater toward Clanwilliam and the N7 highway.
- Travel north along the N7 highway from Clanwilliam towards and through the towns of:
  - Klawer
  - Vanrhynsdorp
  - Nuwerus
  - Bitterfontein
- Turn Right onto the R358 and travel north-east for approximately 60km (gravel road).
- Turn Right onto the R355 toward Loeriesfontein (gravel road).
- At Loeriesfontein travel south on the R355 toward and through the towns of:
  - Calvinia
- At Calvinia turn north into Hoof Street for approximately 1.9km and then turn southeast onto the R27.
- Continue east on the R27/R63 towards and through the towns of:
  - Williston
  - Carnarvon
- At Carnarvon take the gravel road off the R63, west of End Street.
- Turn left into Mark Street and then right onto a gravel road, west of Boezak Street.
- Turn right into Tuin Street and travel through an open field north of Panos Street.
- Continue onto the R361 for approximately 0.55km and then turn right onto the R384.

- Travel on the R384 towards and through the towns of:
  - Vosburg
  - Britstown
- At Britstown turn east from the R384 into Dahlia Street for approximately 1km.
- Exit the town in a northerly direction on the N12 for approximately 2.5km
- Turn left onto the N10 towards the town of Prieska.
- At Prieska turn left onto the R357 and the Aletta WEF access.

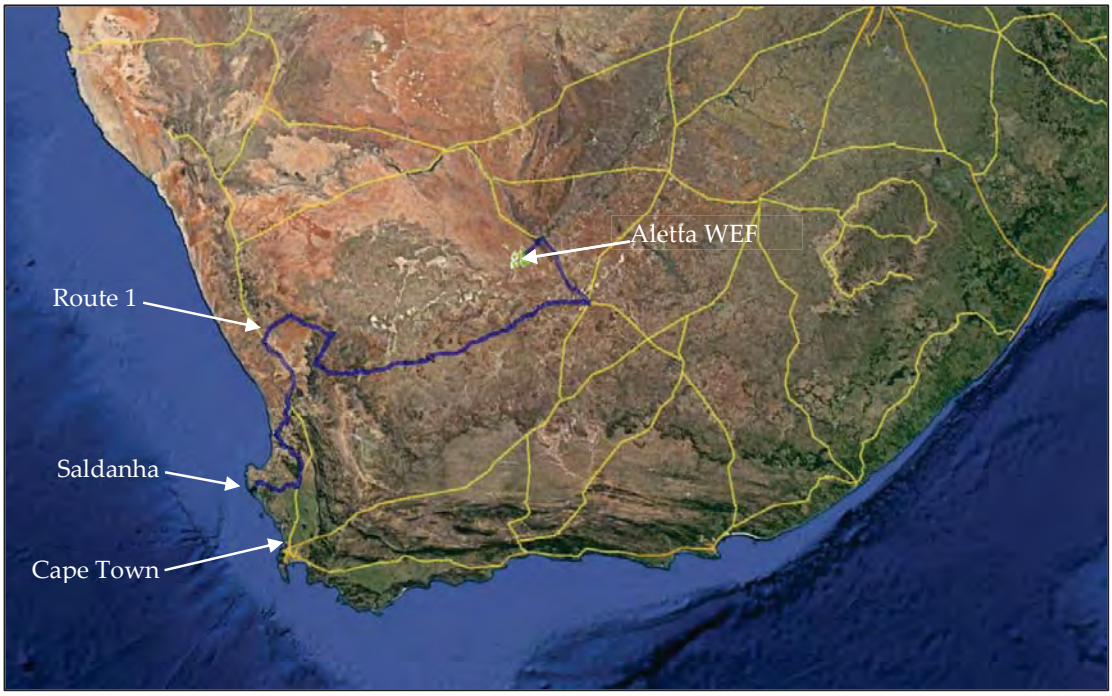


Figure 3-1: Transportation Route 1[2]

This route may be one of the preferred options as it avoids the Van Rhyns Pass and the Piekenierskloof Pass. Some route clearing may be needed with certain portions of the route already cleared for other wind energy projects. There is a railway bridge on the N7, located approximately 42km southeast of the town of Nuwerus. This may be a possible obstruction and in order to avoid this section, an application to use the facility road adjacent to the N7 must be investigated.

3.2 Route Alternative 2 – Saldanha to Aletta WEF via Vanrhynsdorp (1018km)

The route overview is shown in ***Figure 3-2*** and is briefly described below:

- Travel from Saldanha Harbour to Piketberg via the R45 and N7 highway towards and through the towns of:
  - Hopefield
  - Moorreesburg
  - Piketberg

[2] Image obtained from Google Earth Professional

- Travel through the town of Piketberg and exit toward Elands Bay on the R366 towards and through the towns of:
  - Redelinghuys
- Before Elands Bay turn north toward the R364, Graafwater towards and through the town of:
  - Leipoldtville
  - Graafwater
- Travel through Graafwater toward Clanwilliam and the N7 highway.
- Travel north along the N7 highway from Clanwilliam towards and through the towns of:
  - Klawer
  - Vanrhynsdorp
- At Vanrhynsdorp exit the town via the R27 towards and through the towns of:
  - Nieuwoudtville
  - Calvinia
- At Calvinia turn east on the R27/R63 towards and through the towns of:
  - Williston
  - Carnarvon
- At Carnarvon travel on the R384 towards and through the towns of:
  - Vosburg
  - Britstown
- At Britstown exit the town in a northerly direction on the N12 for approximately 2.5km
- Turn left onto the N10 towards the town of Prieska.
- At Prieska turn left onto the R357 and the Aletta WEF access.

Figure 3-2: Transportation Route 2[3]

[3] Image obtained from Google Earth Professional

The Vanrhyns Pass is not easily traversable by abnormal load vehicles and is therefore not a feasible nor recommended route.

3.3 Route Alternative 3 – Saldanha to Aletta WEF via National Route N1 (950km)

The route overview is shown in ***Figure 3-3*** and is briefly described below:

- Saldanha harbour via the R45 and R311 towards Moorreesburg.
- Travel southeast to the R44 via the Gouda Road and R46 towards and past the towns of:
  - Gouda
  - Tulbagh
  - Wolseley
- Outside Wolseley turn right onto the R43 to Worcester.
- At Worcester turn left onto the N1 highway towards and through the towns of:
  - Laingsburg
  - Beaufort West
  - Three Sisters
- At Three Sisters turn left onto the N12 north towards and through the towns of:
  - Victoria West
  - Britstown
- North of Britstown turn left onto the N10 northwest towards Prieska
- At the town of Prieska turn left onto the R357 toward Aletta WEF.

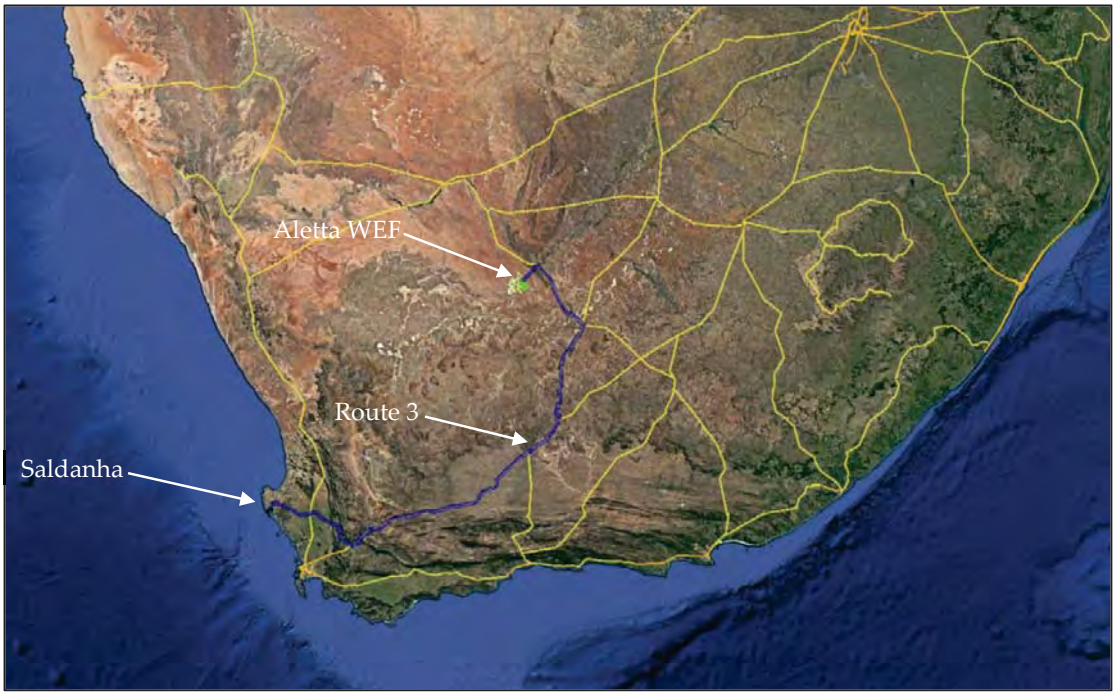


Figure 3-3: Transportation Route 3[4]

There are a number of non-traversable obstacles on this route such as interchange bridges and pedestrian bridges which will make this route not feasible.

[4] Image obtained from Google Earth Professional

3.4 Route Alternative 4 – Coega to Aletta WEF via National Route N10 (778km)

The route overview is shown in ***Figure 3-4*** and is briefly described below:

- Travel from Coega Harbour via Neptune Road.
- Merge onto the N2 towards Grahamstown.
- Continue onto the N10 highway towards and through the town of Cradock.
- Turn right onto the R61 northeast for approximately 60km.
- Turn left onto the R401 and continue towards and through the town of Hofmeyr.
- Travel southwest on the R401 for approximately 55km.
- Turn right onto the N10 and travel north towards and through the towns of:
  - Middleburg
  - Hanover
  - De Aar
- Travel past Britstown and turn right onto the N12 north towards the town of Prieska.
- Continue on the N12 for approximately 1.8km.
- North of Britstown turn left onto the N10 northwest towards Prieska
- At the town of Prieska turn left onto the R357 toward Aletta WEF.

Figure 3-4: Transportation Route 4[5]

This route may be the preferred option as it doesn't have any gravel roads and is much shorter than the other alternatives. Some route clearing may be needed with certain portions of the route already cleared for other wind energy projects.

[5] Image obtained from Google Earth Professional

3.5 Route Clearance

The vehicles used to transport the wind turbine equipment are abnormal load or oversize vehicles. Combinations or minor alternative sections may be needed. The transport route must however be cleared and all relevant permits obtained prior to the transport activities taking place. Other alternative may also be possible which could reveal itself during the route clearance process.

3.6 Permits & Consent Relating to Roads

The permits and consent required from authorities necessary for the transport of oversize loads are summarized in ***Table 3-1*** below. This summary is not necessarily exhaustive and further investigation will be needed by the route clearing consultant.

Table 3-1: Permits and consent requirements

Abnormal Load/Vehicle Permit in terms of National Road Traffic Act 93 of 1996, Section 81	Western Cape Provincial Department of Roads and Transport	The Contractor will obtain the necessary road transportation permits.
The South African National Roads Agency Limited and National Roads Act, Act 7 of 1998	SANRAL Western Region and/ or SANRAL Southern Region	The Contractor will obtain clearance from the South African National Roads Agency.
Abnormal Load/Vehicle Permit in terms of National Road Traffic Act 93 of 1996, Section 81	Northern Cape Provincial Department of Roads and Transport	The Contractor will obtain the necessary road transportation permits.
Abnormal Load/Vehicle Permit in terms of National Road Traffic Act 93 of 1996, Section 81	Eastern Cape Provincial Department of Roads and Transport	The Contractor will obtain the necessary road transportation permits.

3.7 Summary

3.7.1 Abnormal load route

Both Routes 1 and 4 can be used for the transportation of the wind turbine components. However, since Route 4 is much shorter, with no gravel roads, it should be the preferred route. Further investigation i.e. route clearing may prove that minor variations are necessary.

3.7.2 Normal load route

The delivery of materials such as cement, aggregate and sand will in all probability be from Upington along the National Route N10. Steel will be delivered from either Gauteng via the N12 or Cape Town via the N1 and N12.

It is assumed that labour will commute from Prieska as it is the nearest town to provide amenities.

4 TRIP GENERATION

4.1 Current AADT on Affected Route

It is assumed that the portion of average daily traffic that occur during the design hour (30th highest volume) is no more than 10% *(K=10)*. *TRH17: Geometric Design of Rural Roads*[6] provides service volumes for LOS B to be retained, which translates to 4900vpd as an estimated maximum average annual daily traffic (AADT[7]) for two lane rural highways. A number of dual carriageway sections are located on both Route 1 and Route 4, mainly near the ports of origin, being Saldanha or Coega. For equivalent levels of service to be retained on these dual carriageway sections an upper limit of 23300vpd is estimated.

The roadways affected by the component delivery are:

Table 4-1: Current ADT of Route 1

Station	ADT (vpd)	% Heavy
R27 near Saldanha	4365	8%
N7 south of Vanrhynsdorp	1300	30%
N7 north of Vanrhynsdorp	950	24%
R27 near Calvinia	700	21%
R63 near Williston	190	16%
R63 near Carnarvon	140	25%
R384 near Britstown	200	12%
N10 near Prieska	300	21%

It is clear from the volumes in ***Table 4-1*** that these roadways are operating well within the level of service parameters. The average heavy vehicle volume along Route Alternative 1 is 20%.

Table 4-2: Current ADT of Route 4

Station	ADT (vpd)	% Heavy
N2 north of Coega	11500	17%
N10 south of Cradock	1670	36%
R61 near Tarkastad	1220	15%
R401 near Middelburg	-	-
N10 south of Britstown	700	23%
N10 near Prieska	300	21%

It is also clear from ***Table 4-2*** that the current daily volumes are well within its limits and that the roadways are operating with an abundance of additional capacity. The average heavy vehicle volume along Route Alternative 4 is 22%.

[6] Technical Recommendations of Highways, TRH17: Geometric Design of Rural Roads, Department of Transport, 1988
[7] Annual Average Daily Traffic (AADT): it is the total volume of vehicle traffic of a highway or road for a year divided by 365 days.

4.2 Expected Trip Generation during Construction

To estimate the number of trips that will be generated during the construction period a few assumptions and related factors are stated:

- The wind energy facility will consist of sixty (60) turbine towers
- Each tower will require eight (8) oversize deliveries.
- The material for construction of the concrete foundations is assumed to be obtained commercially from Upington, 250km from site.
- Concrete batching will be done on site.
- The reinforced concrete base for each turbine is estimated at 560m³
- A maximum of two (2) turbines can be delivered per week.

The table below summarizes the estimated total trips generated over the construction period. These trips will then be assigned to their expected routes in order to analyse their impact.

Table 4-3: Trip Generation

		Components	Trips / Turbine	No of Turbines	Total Construction Trip (18 months)	
Site Establishment		All	-	-	20	20
Turbines	Abnormal Load	Blade	3	60	180	6042
		Tower	3	60	180	
		Nacelle	2	60	120	
	Normal Load	Aggregates	53.1	60	3186	
		Cement	20	60	1200	
		Sand	9.6	60	576	
		Steel	10	60	600	
Substation		Substation			2	5
		Diesel Tank			1	
		Hydraulic Oil Tank			1	
		Lubricating Oil Tank			1	
Erection of Turbine		Construction vehicles			5	798
		Crane transport			1	
		Labour transport			792	
					Total	**6845**

From the above information it is calculated that the development will generate **6845 trips** over an 18 month period. The trips generated by the construction activities are mainly due to the transport of components and materials. The assumed construction period is deemed to be quite short in terms of other contracts currently under way. This however will provide a conservative result in terms of the generated traffic per day.

Table 4-4: ADT Comparison of Route 1

Station	ADT (vpd)	% Heavy	Abnormal trips per day	Normal trips per day	New ADT (vpd)
R27 near Saldanha	4365	8%	3	-	4368
N7 south of Vanrhynsdorp	1300	30%	3	-	1303
N7 north of Vanrhynsdorp	950	24%	3	-	953
R27 near Calvinia	700	21%	3	-	703
R63 near Williston	190	16%	3	-	193
R63 near Carnarvon	140	25%	3	-	143
R384 near Britstown	200	12%	3	-	203
N10 near Prieska	300	21%	3	15	318

Table 4-5: ADT Comparison of Route 4

Station	ADT (vpd)	% Heavy	Abnormal trips per day	Normal trips per day	New ADT (vpd)
N2 north of Coega	11500	17%	3	-	12803
N10 south of Cradock	1670	36%	3	-	1673
R61 near Tarkastad	1220	15%	3	-	1223
R401 near Middelburg	-	-	3	-	-
N10 south of Britstown	700	23%	3	-	703
N10 near Prieska	300	21%	3	15	318

It was assumed that two (2) turbines will be delivered to site each week which roughly equates three (3) deliveries per day. Fifteen normal heavy and light vehicles will also travel to and from site daily but, over a much shorter distance. The latter was therefore only added to the traffic on the N10.

4.3 Expected Trip Generation during Operation

The operation and maintenance personnel will in all probability be stationed in the town of Prieska. It is envisaged that a very small number of trips would be generated to the site each day. These trips would however be of no significance to the road network.

4.4 Expected Trip Generation during Decommissioning

It can be assumed that the decommissioning trip generation would be equal to that of the construction and installation with full loads running in the reverse direction. The road network would need to be assessed at that stage.

5 ROUTE ASSESSMENT

5.1 Assessment of Impact on Long Distance Route

The *HCM 2010 Chapter 15: Two lane Highways* was consulted as the greatest portion of the route to be travelled by the delivery trucks are rural two lane highways of Class I, II or III. The trips generated by this development were evaluated in relation to the quantum of trips needed to change the Level of Service (LOS) on a portion of the rural highway and the ultimate capacity of two lane highways. The projected truck trips per day are deemed to be of no consequence to the LOS of the travelled route from Saldanha to Prieska or Coega to Prieska.

With regard to the speed at which these vehicles travel it is advised to allow queuing vehicles to pass at regular intervals as needed. The abnormal load vehicles should also under no circumstances travel in groups of two or more trucks. This will frustrate the general road user and cause irrational actions and possibly accidents. The bulk of the roadways being used are very low trafficked roads and should therefore not pose much of a problem.

5.2 Assessment of Impact on Local Traffic

The ultimate accepted capacity of a two lane highway is 3200 vehicles per hour. From historic traffic count data it was observed that the N10 roadway at Prieska has an abundance of spare capacity, as the current annual daily traffic (ADT) along this roadway is around 300vpd. This therefore indicates that the estimated additional traffic generated by the construction staff travelling to and from site, can be accommodated on the existing roadways. An impact rating table is provided in ***Table 5-4***.

Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period as well as on the National Road N10.

5.3 Assessment of Cumulative Impact

There are Fourteen (14) other Renewable Energy sites in the immediate surround to the Aletta WEF. The majority of these facilities are Photovoltaic Energy facilities with four (4) additional wind energy facilities.

The cumulative effect of the abnormal load vehicles on the daily traffic volume would elevate the delay experienced by the road user. This is assuming the exact same route will be used by all the individual developments. However, due to the REIPPP bidding process, it is highly unlikely that all these above mentioned facilities will be constructed at the same time.
The normal heavy and light vehicles will not affect the level of service of any of the sections of road proposed for use in terms of reaching its volume capacity. The speed of the abnormal load

trucks will however impact on the average travel speed (ATS[8]) and percentage time spent following (PTSF) of the roadways. This can however be mitigated by allowing other road users to pass at regular intervals and by avoiding clusters of abnormal load transport vehicles. The table below is provided as a rating of the cumulative impact expected from a transport perspective.

The additional cumulative trips generated in the event that all the facilities are in construction at the same time, is summarised in the tables below.

Table 5-1: Cumulative Impact Summary of Trips (Route 1)

Station	ADT (vpd)	Abnormal trips per day	Normal trips per day	New ADT (vpd)
R27 near Saldanha	4365	15	90	4470
N7 south of Vanrhynsdorp	1300	15	90	1405
N7 north of Vanrhynsdorp	950	15	-	965
R27 near Calvinia	700	15	90	805
R63 near Williston	190	15	90	295
R63 near Carnarvon	140	15	90	245
R384 near Britstown	200	15	90	305
N10 near Prieska	300	15	215	530

Table 5-2: Cumulative Impact Summary of Trips (Route 4)

Station	ADT (vpd)	Abnormal trips per day	Normal trips per day	New ADT (vpd)
N2 north of Coega	11500	15	90	11605
N10 south of Cradock	1670	15	-	1685
R61 near Tarkastad	1220	15	90	1325
R401 near Middelburg	-	15	90	-
N10 south of Britstown	700	15	90	805
N10 near Prieska	300	15	215	530

The Normal vehicle trips over the long distance routes indicated in the tables above are solar energy equipment transport vehicles delivering solar equipment to the ten (10) proposed solar facilities at Prieska.

A cumulative effect rating table is provided below.

[8] Average Travel Speed (ATS) and Percentage Time Spent Following (PTSF) are concepts from the Highway Capacity Manual 2010, TRB

Table 5-3: Cumulative Effect Rating Table

Cumulative Impact Assessment	
Environmental Parameter	A wind energy facility is to be constructed in the Northern Cape Province. This will have an impact on the haulage routes to site as well as the local traffic and the community.
Issue/ Impact/ Environmental Effect/ Nature	**Long distance route**: The trips generated by the delivery of wind turbine components to site are insignificant when compared to the ADT of the immediate road network as it does not affect and/or change the current Level of Service provided that the abnormal vehicle create passing opportunities on a regular basis. **Intersections**: The intersections will be temporary blocked, but will be of short duration and will not affect the LOS in any significant way. Traffic will be allowed to pass the abnormal load vehicle to minimize the queuing lengths. **Local traffic**: Roadways surrounding Prieska have an abundance of spare capacity and will be able to accommodate the estimated additional traffic generated by delivery vehicles, construction vehicles, on-site staff, etc. **Community**: The construction of this wind energy facility will have a positive impact on the surrounding communities as it will create more job opportunities.
Extent	The Aletta Wind Energy Facility will be constructed in the Prieska area and impact its immediate vicinity. The wind energy facility will only impact the chosen main haulage route, being either from Saldanha or Coega.
Probability	**Long distance route**: The suggested haulage routes are mainly single carriageways, and would therefore have a probable impact on the current traffic volumes during the construction period. **Intersections**: The blocking of intersections will have a definite impact, but will be compensated for as mentioned in the Impact section above. **Local traffic**: The chances of local traffic being adversely affected by the construction traffic are considered extremely low. **Community**: The construction of the wind energy facility will have a definite positive impact on the communities in the surrounding areas of the site.
Reversibility	All of the impacts mentioned above are completely reversible as the project is of short duration.
Irreplaceable Loss of Resources	All impacts mentioned above will not result in the loss of any resources.
Duration	The estimated construction to completion period is 18 months. Therefore the impact and its effects will last for the period of a relatively short construction period.
Cumulative Effect	The construction of the Aletta WEF will have low negative cumulative effects on the traffic and low positive cumulative effects on the community.
Intensity / Magnitude	As the construction of this wind energy facility is of short term duration the impacts on the area will only be temporary and the roadways will continue to function in a moderately modified way.
Significance Rating	The significance of the traffic and community impact is negative and positive low, respectively, as they are temporary and extend over a short period of time.

Table 5-4: Cumulative Effect Score

	Impact Rating of Long Distance Route	
	Pre-mitigation	Post mitigation
Extent	3	1
Probability	3	1
Reversibility	1	1
Irreplaceable Loss	1	1
Duration	1	1
Cumulative Effect	2	1
Intensity / Magnitude	2	1
Significance rating	**-22 (low negative)**	**-6 (low negative)**
Mitigation Measures	**Long distance route:** The majority of the haulage routes are single carriage ways which may result in light vehicles not able to pass the abnormal load vehicles. Mitigation measures to be put in place will be for the trucks to stop at regular intervals to allow queuing vehicles to pass.	
	Impact Rating of Intersections	
	Pre-mitigation	Post mitigation
Extent	2	1
Probability	3	1
Reversibility	1	1
Irreplaceable Loss	1	1
Duration	1	1
Cumulative Effect	2	1
Intensity / Magnitude	2	1
Significance rating	**-20 (low negative)**	**-6 (low negative)**
Mitigation Measures	**Intersections:** Traffic at intersections along the chosen haulage route will be affected, but only for a short duration. To accommodate for this, once the abnormal load vehicle has turned, traffic will be allowed to pass and subsequently reducing queuing lengths.	
	Impact Rating of Local Traffic	
	Pre-mitigation	Post mitigation
Extent	1	1
Probability	2	1
Reversibility	1	1
Irreplaceable Loss	1	1
Duration	1	1
Cumulative Effect	1	1
Intensity / Magnitude	1	1
Significance rating	**-7 (low negative)**	**-6 (low negative)**
Mitigation Measures	**Local traffic:** Since the abnormal load vehicles will avoid towns along the chosen haulage route, the effect on local traffic is negligible and no mitigation measures are needed.	
	Impact Rating of Community	
	Pre-mitigation	Post mitigation
Extent	2	n/a
Probability	4	
Reversibility	2	
Irreplaceable Loss	1	
Duration	1	
Cumulative Effect	4	
Intensity / Magnitude	2	
Significance rating	**+28 (low positive)**	**n/a**

6 ASSESSMENT OF INTERSECTIONS

Route alternative 4 was further assessed in terms of intersection geometry and capacity. A preliminary route clearance was performed as a desktop study and would therefore need to be performed in further detail for the transport phase of the project.

6.1 Preliminary Route Clearance

All of the intersections mentioned below was analysed using a turning movement simulation. Only one abnormal load vehicle was used to analyse the turning movements and is included as ***Annexure C***. It was reasoned that if the wind blade vehicle can turn at each intersection, every other vehicle will be able to, since it is the largest component to be transported to site. The analysis was done to determine whether there would be adequate clearance for all turning movements along the haulage route, when transporting the wind turbine components. The *Autoturn* analyses of the effected intersections are included in ***Annexure D***.

- **Intersection before Neptune Road:** Turn right towards Neptune Road

The geometric layout and aerial view of the intersection is shown in ***Figure 6-1*** below.

Figure 6-1: Geometric layout and aerial view of the intersection just before Neptune Road

The analysis revealed that there will be sufficient clearance for turning. However, it might be necessary to remove any shrubs in the surrounding area that will prevent this turning movement. Any signs in the vicinity may also need to be relocated. The detailed route clearance will reveal if this will be necessary.

- **Neptune Road:** Turn left into Neptune Road

The geometric layout and aerial view of the intersection is shown in ***Figure 6-2*** below.

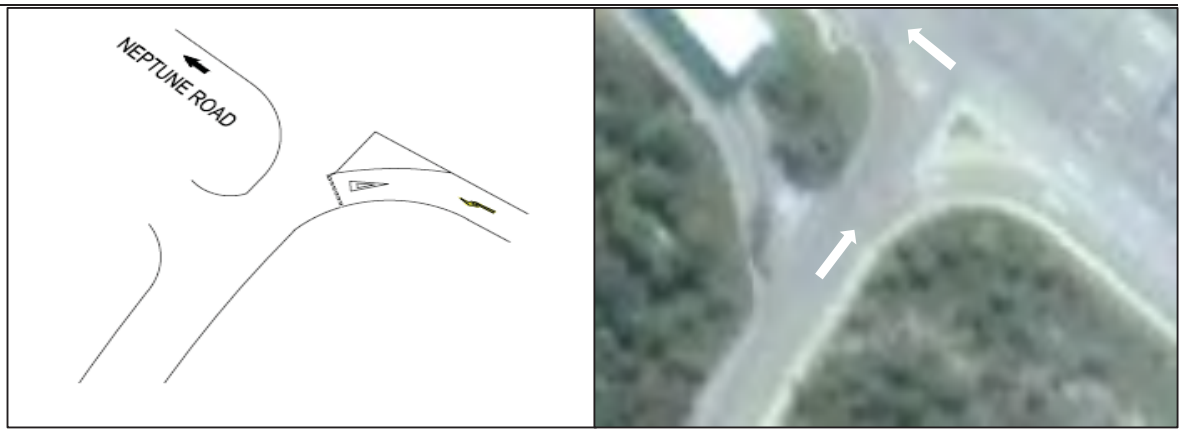


Figure 6-2: Geometric layout and aerial view of Neptune Road intersection

The intersection above will be able to accommodate the left turn movement into Neptune Road. It may be necessary to remove vegetation on the east side of the intersecting road, but will be determined with the detailed route clearance.

- **Neptune Road/ N2:** Turn left from Neptune Road onto the ramp and merge with N2

The geometric layout and aerial view of the intersection is shown in ***Figure 6-3*** below.

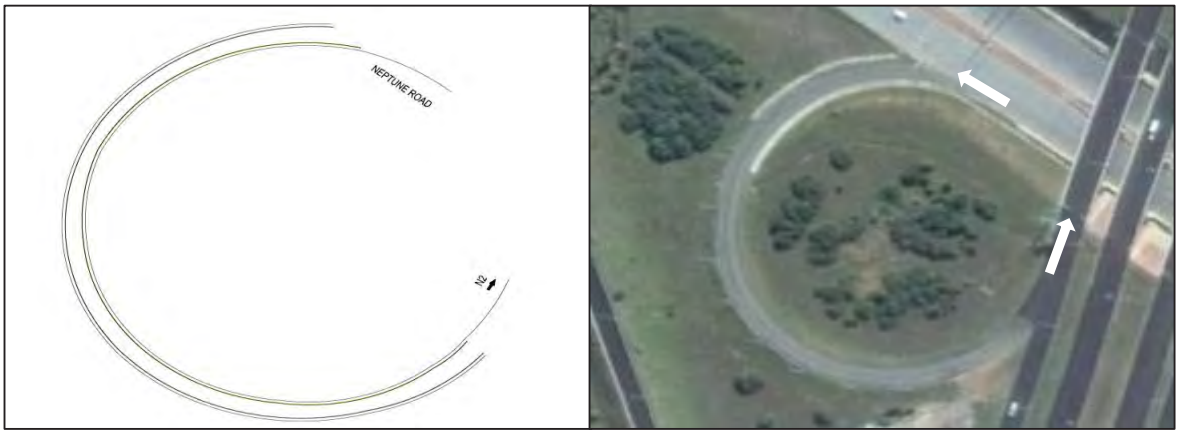


Figure 6-3: Geometric layout and aerial view of the Neptune Road/ N2 merge

From the analysis it is apparent that the N2 on-ramp will be able to accommodate the abnormal load vehicle. Any signs that may possibly prevent this turning movement will need to be relocated for the duration of the construction period. The detailed route clearance will verify the above mentioned.

- **N10/ R61:** Turn right from N10 onto R61

The geometric layout and aerial view of the intersection is shown in ***Figure 6-4*** below.

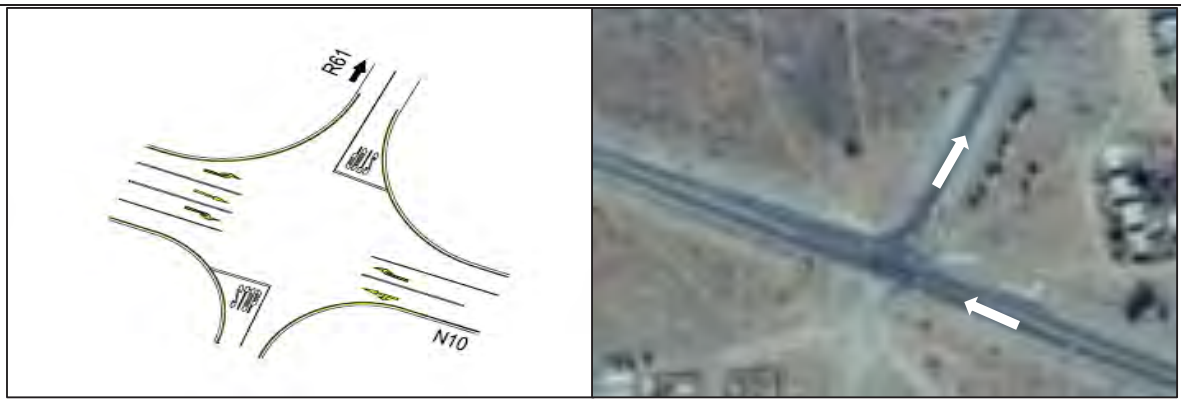


Figure 6-4: Geometric layout and aerial view of the N10/ R61 intersection

The abnormal load truck will have sufficient clearance to turn onto the R61. However, any signs on west and east side of the N10 may need to be removed that obstruct the turning movement. A detailed route clearance will reveal if such signs exist.

- **R61/ R401:** Turn left from R61 onto R401

The geometric layout and aerial view of the intersection is shown in ***Figure 6-5*** below.

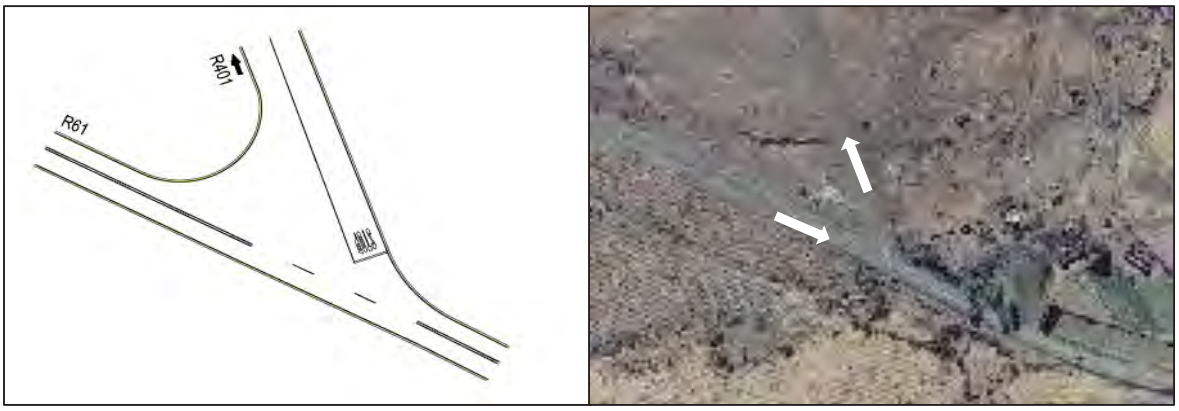


Figure 6-5: Geometric layout and aerial view of the R61/ R401 intersection

After analysing this intersection it was found that the R61 may be able to accommodate the turning movement, this will be confirmed through the detailed route clearance. There are signs on both the southwest and northwest side of the R61 that most probably need to be relocated. Additionally, the fence line on the north side may also require to be moved backward.

- **R401/ N10:** Turn right from R401 onto N10

The geometric layout and aerial view of the intersection is shown in ***Figure 6-6*** below.

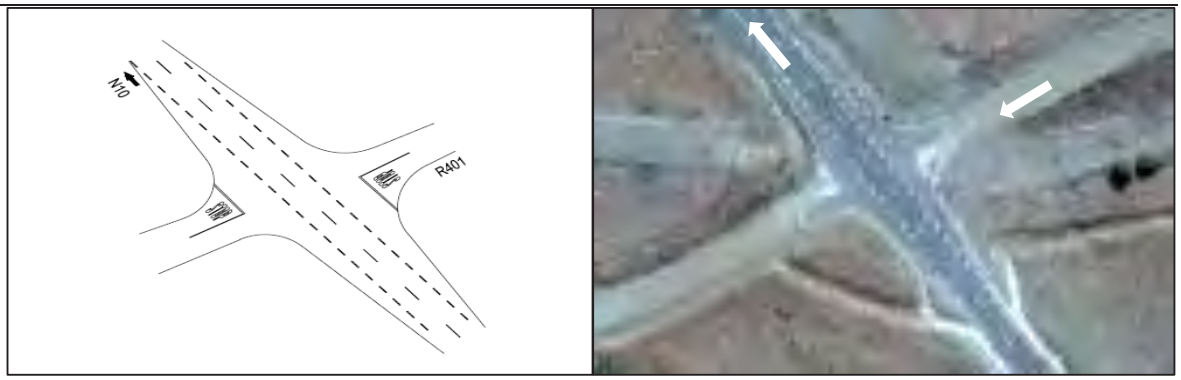


Figure 6-6: Geometric layout and aerial view of the R401/ N10 intersection

The analysis revealed that there is sufficient clearance for the abnormal load vehicle to turn right onto the N10. However, it might be necessary to temporarily relocate signs in the vicinity. This will be clarified during a detailed route clearance.

- **N10/ N12:** Turn right from N10 onto N12

The geometric layout and aerial view of the intersection is shown in ***Figure 6-7*** below.

Figure 6-7: Geometric Layout and aerial view of the N10/ N12 intersection

After the analysis was carried out, it was found that the N10 may be able to accommodate for the right turn movement onto the N12. However, wooden posts situated on both sides of the N10 may need to be temporarily removed and signs in the surrounding area relocated. This will only be determined once the detailed route clearance is finalised.

- **N12/ N10:** Turn left from N12 onto N10

The geometric layout and aerial view of the intersection is shown in ***Figure 6-8*** below.

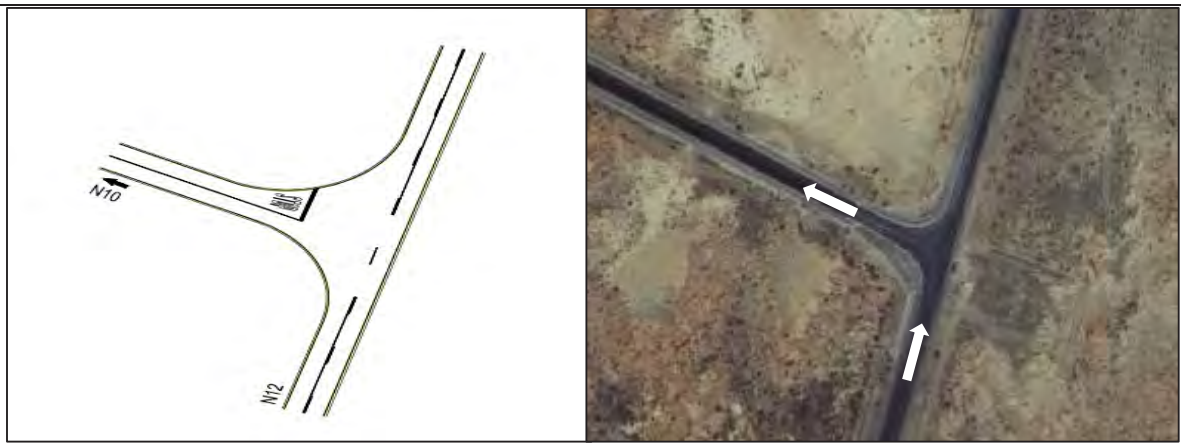


Figure 6-8: Geometric layout and aerial view of the N12/ N10 intersection

The above intersection will be able to accommodate the left turning movement. However, wooden posts may need to be temporarily removed on the west side, but will be clarified once the detailed route clearance is completed.

- **N10 (towards Prieska):** Turn right from N10 towards R357

The geometric layout and aerial view of the intersection is shown in ***Figure 6-9*** below.

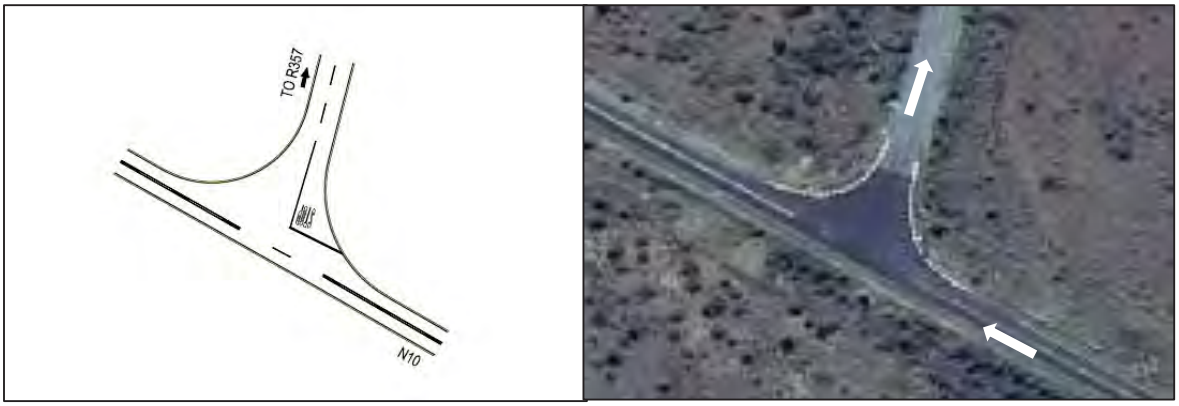


Figure 6-9: Geometric layout and aerial view of the N10 intersection

After analysis this intersection it was found that there will be sufficient clearance for the abnormal vehicle to turn. There is the possibility of a sign board obstructing the turning movement and this may need to be relocated. The existing fence lines may possibly need to be relocated as well. Everything will be clarified during the detailed route clearance.

- **R357 (towards Aletta WEF):** Turn left onto R357

The geometric layout and aerial view of the intersection is shown in ***Figure 6-10*** below.

Figure 6-10: Geometric layout and aerial view of the R357 intersection

This intersection may require upgrading for the left turn movement onto the R357, but will only be verified during the detailed route clearance. Other work that may need attention is the removal of shrubs that will obstruct the widening and also the relocation of the fence lines.

6.2 Level of Service (LOS) of Intersections

For all the intersections, mentioned in the section above, traffic will need to be blocked by traffic officials assisting the transport convey. The intersections will revert to normal operation once the turning movement of the abnormal load trucks is completed. This may affect the current level of service on the roadway, since these trucks travel at low speeds. To compensate for this, the queuing vehicles will be allowed to pass at regular intervals if needed and the oversize truck should not be allowed to travel in groups of two or more. The table below provides a summary of all vehicles passing by the intersections on the haulage Route Alternative 4.

Table 6-1: Main intersections affected on Route Alternative 4

Route	Intersection reference	Average traffic (vpd)	Abnormal load traffic (vpd)	Total delay at intersection (s)
N2 north of Coega	Figure 6-3	11500	3	45
N10 south of Cradock	Figure 6-4	1670	3	75
R61 near Tarkastad	Figure 6-5	1220	3	75
N10 south of Britstown	Figure 6-7	700	3	75
N10 near Prieska	Figure 6-8 Figure 6-9	300	3	75

These delays are estimates only and are considered to be acceptable. Assisting vehicles with amber lights and reflective markings must be in constant radio contact with each other and the truck driver to ensure the safety of the traveling public.

7 SITE ACCESS ROUTE

Access to the site will be via an existing gravel track off the R357, which is currently the farmer's access road, approximately 34km from the N10 intersection. This gravel road will need upgrading and extension and will need to be suitably maintained. Re-gravelling may be necessary as a maintenance measure, from time to time, throughout the operational life of the plant.

Sight distance at the access is more than adequate and the pavement structure seems to be sound and with little to no defects. However, should damage be caused by the transport vehicles along this roadway, it should be assessed and mitigating maintenance should be initiated.

An example of a site access layout is provided in ***Annexure B***. This layout is not recommended at this point but, simply provided for information.

8 EFFECTED COMMUNITIES

It is expected that the community of Prieska will participate in the construction phase of this development.

From a traffic point of view, the total daily construction traffic is deemed to be very low and will not significantly impact this community. The cumulative effect on the community was rated as a positive low impact in the impact rating table provided in ***Table 5-4***.

For route alternative 4 abnormal load vehicles will be using an alternative route and subsequently bypass towns. The community of Cradock will only be affected at the R61 turn off just before town, but as stated earlier in the report, the intersection will be blocked off for a very short duration.

9 SUMMARY AND CONCLUSION

The following conclusions are made:

- The impact of the construction traffic on the general traffic and the surrounding communities along the haulage route is considered to be low. The level of service on the roadways on which the components are transported may experience some additional delay which can be mitigated by:
  - Allowing the general traffic to pass the transport vehicle at regular intervals.
  - The abnormal vehicles should not travel in groups of two or more so as to limit the delays caused by the relatively slow vehicles.

- All the components will be transported by truck from Saldanha or Coega harbour to the site using the defined routes with possible minor deviations. These vehicles are classified as oversize vehicles and permits must be obtained in order to transport the turbine components.

- The access to the site is on road R357 which is a Provincial road and will necessitate the involvement of the Northern Cape provincial roads and transport department.

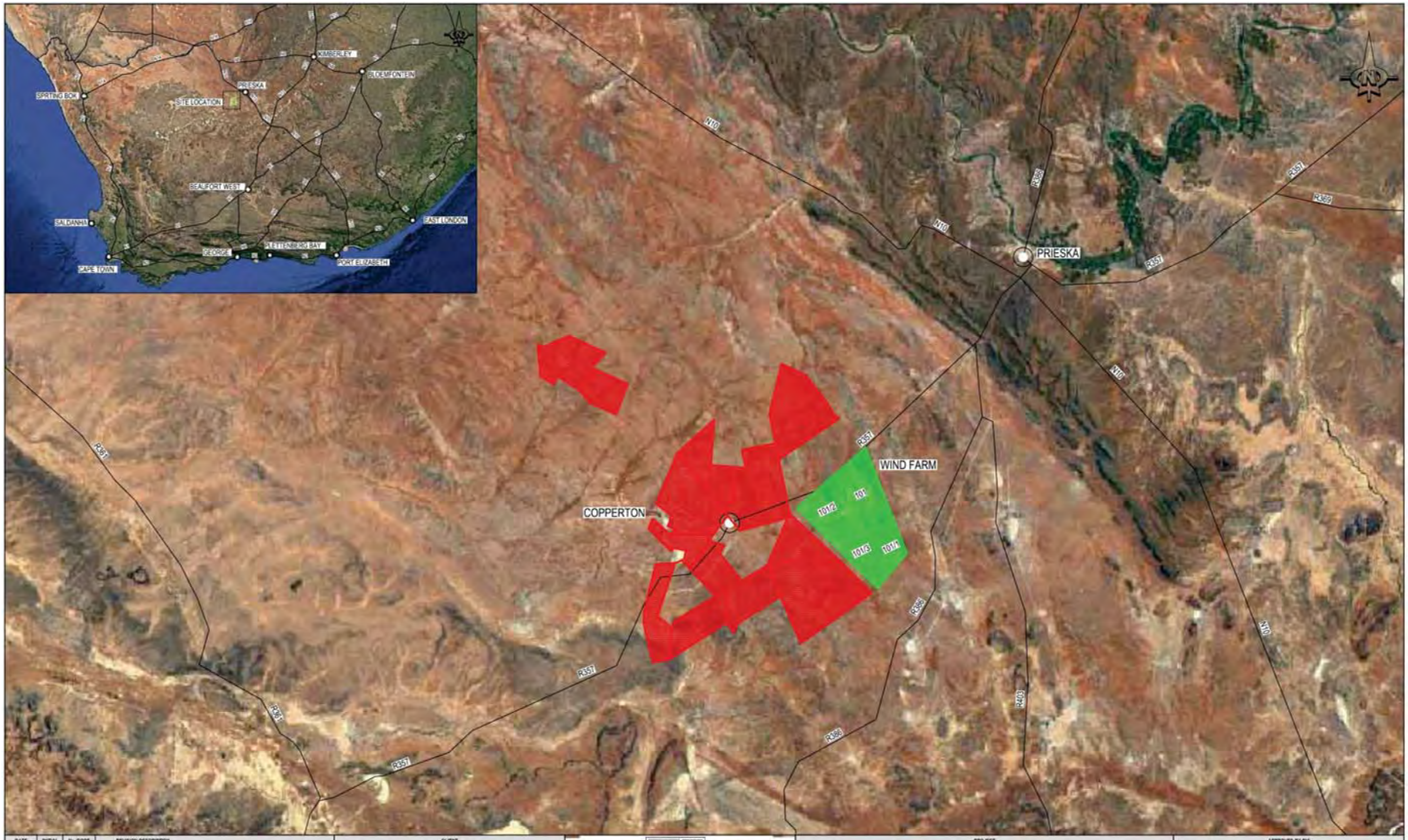
- SANRAL Western/ Southern Region will also need to be contacted in order to obtain consent for the abnormal load transport on their roadways.

- Adequate traffic accommodation signage must be erected and maintained on either side of the access on road R357 throughout the construction period.

- The cumulative impact and significance of the development of the wind energy facility is considered to be low negative and low positive impacts when traffic and surrounding community parameters, respectively, are examined.

ANNEXURE A

Locality Plan



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ENGINEERING PROCUREMENT MANAGEMENT

PROJECT: ALETTA WINDFARM

DRAWING TITLE: LOCALITY PLAN

APPROVED BY BVI

ENGINEER/TECHNOLOGIST | REG.NO. | DATE

SCALE	N.T.S	DRAWN	D.KELLY
DESIGNED	C.McGEORGE	CHECKED	D.vd.MERWE

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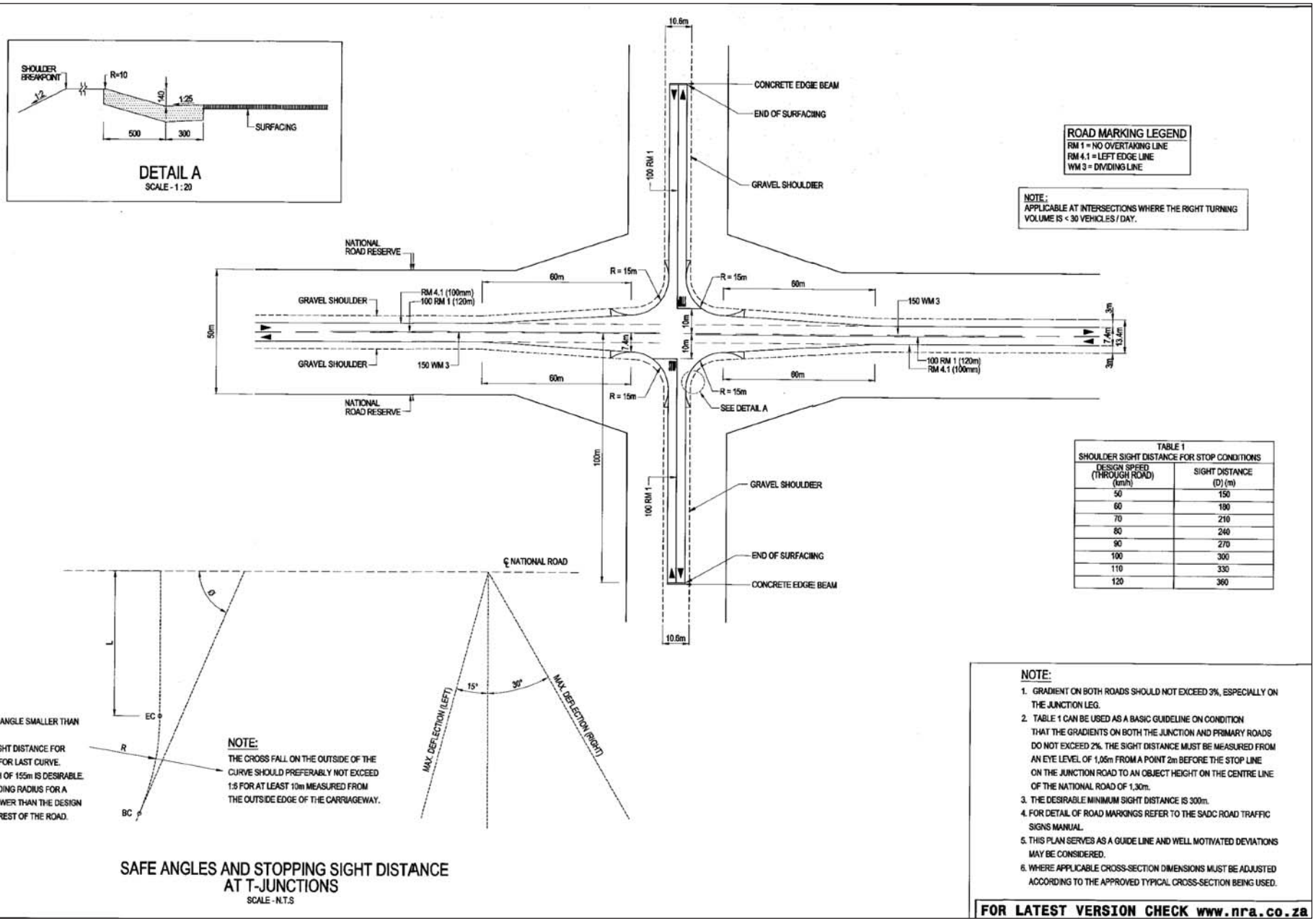
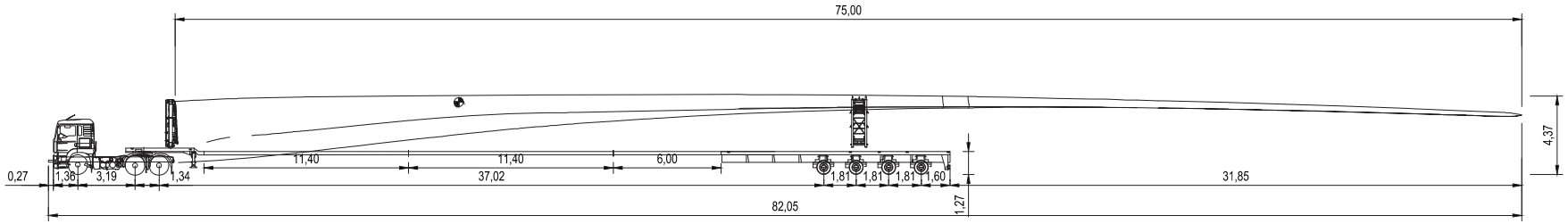
ANNEXURE B

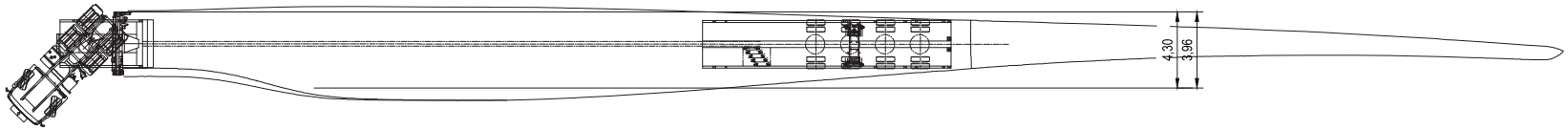
Typical access Geometry


SHOULDER BREAKPOINT
R=10
1:2
1:40
1:25
500
300
SURFACING
DETAIL A
SCALE - 1 : 20
10.6m
CONCRETE EDGIE BEAM
END OF SURFACIING
GRAVEL SHOULDIER
100 RM 1
ROAD MARKING LEGEND
RM 1 = NO OVERTAKING LINE
RM 4.1 = LEFT EDGE LINE
WM 3 = DIVIDING LINE
NOTE:
APPLICABLE AT INTERSECTIONS WHERE THE RIGHT TURNING VOLUME IS < 30 VEHICLES / DAY.
NATIONAL ROAD RESERVE
GRAVEL SHOULDER
RM 4.1 (100mm)
100 RM 1 (120m)
60m
R = 15m
150 WM 3
50m
7.4m
10m
3m
13.4m
SEE DETAIL A
100m
END OF SURFACIING
CONCRETE EDGE BEAM
TABLE 1
SHOULDER SIGHT DISTANCE FOR STOP CONDITIONS
DESIGN SPEED (THROUGH ROAD) (km/h)
SIGHT DISTANCE (D) (m)
50 150
60 180
70 210
80 240
90 270
100 300
110 330
120 360
℄ NATIONAL ROAD
Ø
L
EC
R
BC
MAX. DEFLECTION (LEFT)
15°
30°
MAX. DEFLECTION (RIGHT)
NOTE
1. Ø = DEFLECTION ANGLE SMALLER THAN SAFE ANGLE.
2. L = STOPPING SIGHT DISTANCE FOR DESIGN SPEED FOR LAST CURVE. MINIMUM LENGTH OF 155m IS DESIRABLE.
3. R = CORRESPONDING RADIUS FOR A SPEED 15km/h LOWER THAN THE DESIGN SPEED FOR THE REST OF THE ROAD.
NOTE:
THE CROSS FALL ON THE OUTSIDE OF THE CURVE SHOULD PREFERABLY NOT EXCEED 1:6 FOR AT LEAST 10m MEASURED FROM THE OUTSIDE EDGE OF THE CARRIAGEWAY.
SAFE ANGLES AND STOPPING SIGHT DISTANCE AT T-JUNCTIONS
SCALE - N.T.S
NOTE:
1. GRADIENT ON BOTH ROADS SHOULD NOT EXCEED 3%, ESPECIALLY ON THE JUNCTION LEG.
2. TABLE 1 CAN BE USED AS A BASIC GUIDELINE ON CONDITION THAT THE GRADIENTS ON BOTH THE JUNCTION AND PRIMARY ROADS DO NOT EXCEED 2%. THE SIGHT DISTANCE MUST BE MEASURED FROM AN EYE LEVEL OF 1,05m FROM A POINT 2m BEFORE THE STOP LINE ON THE JUNCTION ROAD TO AN OBJECT HEIGHT ON THE CENTRE LINE OF THE NATIONAL ROAD OF 1,30m.
3. THE DESIRABLE MINIMUM SIGHT DISTANCE IS 300m.
4. FOR DETAIL OF ROAD MARKINGS REFER TO THE SADC ROAD TRAFFIC SIGNS MANUAL.
5. THIS PLAN SERVES AS A GUIDE LINE AND WELL MOTIVATED DEVIATIONS MAY BE CONSIDERED.
6. WHERE APPLICABLE CROSS-SECTION DIMENSIONS MUST BE ADJUSTED ACCORDING TO THE APPROVED TYPICAL CROSS-SECTION BEING USED.
FOR LATEST VERSION CHECK www.nra.co.za

ANNEXURE C

Typical Abnormal Load Vehicle Dimensions





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CLIENT

BioTherm Energy

bvi ENGINEERING PROCUREMENT MANAGEMENT

Western Cape — Cape Town — (021) 527-7800 — cpt@bviwc.co.za

Registration no. 1998/020157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

ABNORMAL LOAD VEHICLE DIMENSIONS

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DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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ANNEXURE D

Autoturn Turning Movements: Route Alternative 4

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bvi ENGINEERING PROCUREMENT MANAGEMENT
Western Cape — Cape Town — (021) 527-7900 — cpt@bviwc.co.za
Registration no. 1998/020157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

INTERSECTION BEFORE NEPTUNE ROAD:
TURNING MOVEMENT

APPROVED BY BVi

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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Western Cape — Cape Town — (021) 527-7000 — cpt@bviwc.co.za
Registration no. 1998/000157/07

PROJECT: ALETTA WINDFARM

DRAWING TITLE: NEPTUNE ROAD INTERSECTION: TURNING MOVEMENT

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DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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Registration no. 1998/020127/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

NEPTUNE ROAD/ N2 MERGE: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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Western Cape — Cape Town — (021) 527-7930 — cpt@bviwc.co.za

Registration no. 1998/020157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

R61/ R401 INTERSECTION: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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Western Cape — Cape Town — (021) 527-7900 — cpt@bviwc.co.za

Registration no. 1998/000157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

R401/ N10 INTERSECTION: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST — REG. NO. — DATE

SCALE	1:2000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

PLAN NUMBER	REVISION NO.	DATE SAVED
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DATE	INITIAL	No./CODE	REVISION DESCRIPTION
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CLIENT

BioTherm Energy

bvi ENGINEERING PROCUREMENT MANAGEMENT
Western Cape — Cape Town — (021) 527-7300 — cpt@bviwc.co.za
Registration no. 1998/010157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

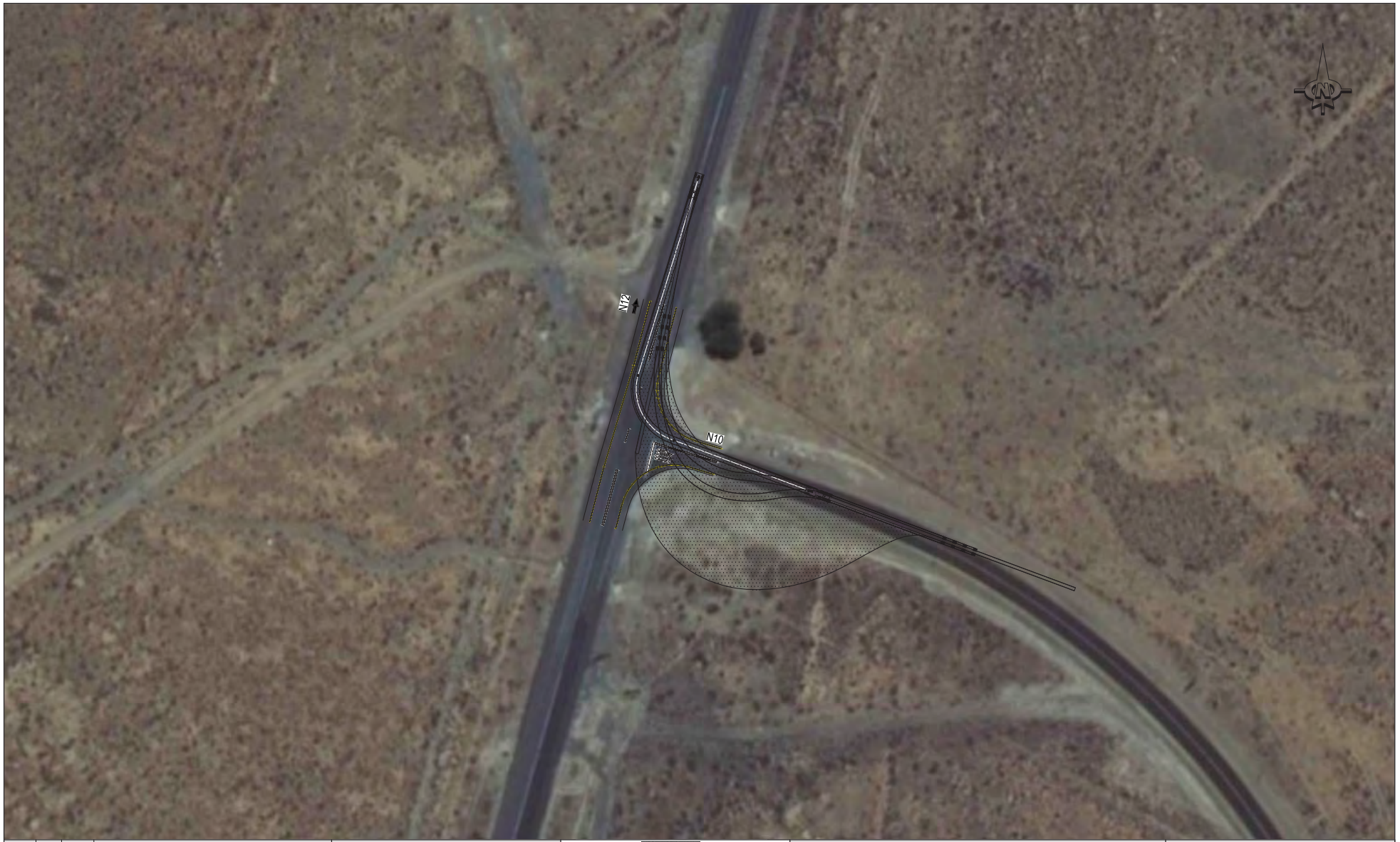
N10/ R61 INTERSECTION: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

PLAN NUMBER	REVISION NO.	DATE SAVED
32782.00-117-06	A	12 September 2016



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Western Cape — Cape Town — (021) 527-7800 — cpt@bviwc.co.za

Registration no. 1998/000157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

N10/ N12 INTERSECTION: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST — REG. NO. — DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

PLAN NUMBER	REVISION NO.	DATE SAVED
32782.00-117-07	A	12 September 2016

DATE	INITIAL	No./CODE	REVISION DESCRIPTION
12/09/2016	D. VD M	A/D	ISSUED FOR INFORMATION

CLIENT

BioTherm Energy

bvi ENGINEERING PROCUREMENT MANAGEMENT
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Registration no. 1998/020157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

N12/ N10 INTERSECTION: TURNING MOVEMENT

APPROVED BY BVI

ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
DESIGNED	L. VAN ZYL	CHECKED	D.VD MERWE

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CLIENT

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PROJECT

ALETTA WINDFARM

DRAWING TITLE

N10 INTERSECTION: TURNING MOVEMENT

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ENGINEER/TECHNOLOGIST | REG. NO. | DATE

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PLAN NUMBER	REVISION NO.	DATE SAVED
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CLIENT

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Registration no. 1998/010157/07

PROJECT

ALETTA WINDFARM

DRAWING TITLE

R357 INTERSECTION: TURNING MOVEMENT

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ENGINEER/TECHNOLOGIST | REG. NO. | DATE

SCALE	1:1000	DRAWN	L. VAN ZYL
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PLAN NUMBER	REVISION NO.	DATE SAVED
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