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AEP KATHU SOLAR (Pty) Ltd.
TRANSPORT STUDY AND TRAFFIC
MANAGEMENT PLAN

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EXECUTIVE SUMMARY

The transport needs for the proposed AEP Kathu Solar PV Facility, with a generating capacity of 75 MW on Portion 0 of the Farm Legoko 460 near Kathu was investigated to confirm access route and site access for the development of a solar facility.

The general requirements are:

- Legal limits for normal heavy vehicle freight
- Abnormal Permits required for transport of transformers
- Maximum vertical clearance on most routes is 5,2m for Abnormal Load but should preferably be limited to 4,8m.

The general freight for the solar farms comprise of building materials, solar panels and frames and an 80MVA transformer(s). The imported freight will be transported from South African ports to the respective sites. Building materials will be transported from sources in surrounding towns while certain elements will be transported from various manufacturing centres in South Africa.

The preferred import origin of the imported elements to the proposed AEP Kathu Solar PV Facility will be from the Saldanha Port. The distance of 1006 km comprises of surfaced roads the full way. However, should Saldanha Port not be available for handling the freight, then the Port Elizabeth / Coega Port could be used as an alternative port. The transport distance in this case is 1072 km.

No toll fees are required on the route from the preferred port. Abnormal Permits will be required for transport of the transformer in any event. The traffic during construction and during operation will have negligible impact on existing and future traffic.

The route is predominantly on National or Provincial Roads with suitable standards for transport of container freight. It is also suitable for abnormal loads with permits. There is a possibility of limited risk of delays for normal routine maintenance works (repairs and reseals) depending of the time of transport and scheduling of roads contracts. The Olifantshoek Bridge on the N14 is currently undergoing repairs scheduled to finalise around October 2016. It is duly noted that overloading restrictions are not in place to date. However, pressure grouting is scheduled to start during January 2016- during which restraints on abnormal loads may arise and occur to the completion of the contract. Thus, in the case of restrictions on abnormal loads, an alternative route is accessible via Postmasburg.

The transport of elements from manufacturing centres within South Africa is predominantly on National and Provincial roads, which presents no limitations for normal freight.

The proposed preferred access road from the N14/6 to the site is at km 46,26E at an existing farm access. The access is at an acceptable safe point with sufficient sight distance which would be acceptable to SANRAL.

In general no obvious problems are expected with freight transport along the proposed routes to the site necessary for the construction and maintenance of the site.

1 INTRODUCTION

~~Atlantic Renewable Energy Partners, on behalf of~~ AEP Kathu Solar (Pty) Ltd, has engaged Aurecon to prepare a Transport Management Plan for the implementation of the AEP Kathu Solar PV Facility near Kathu on Portion 0 of Farm 460 Legoko along the N14. The site location is indicated on the key plan below:

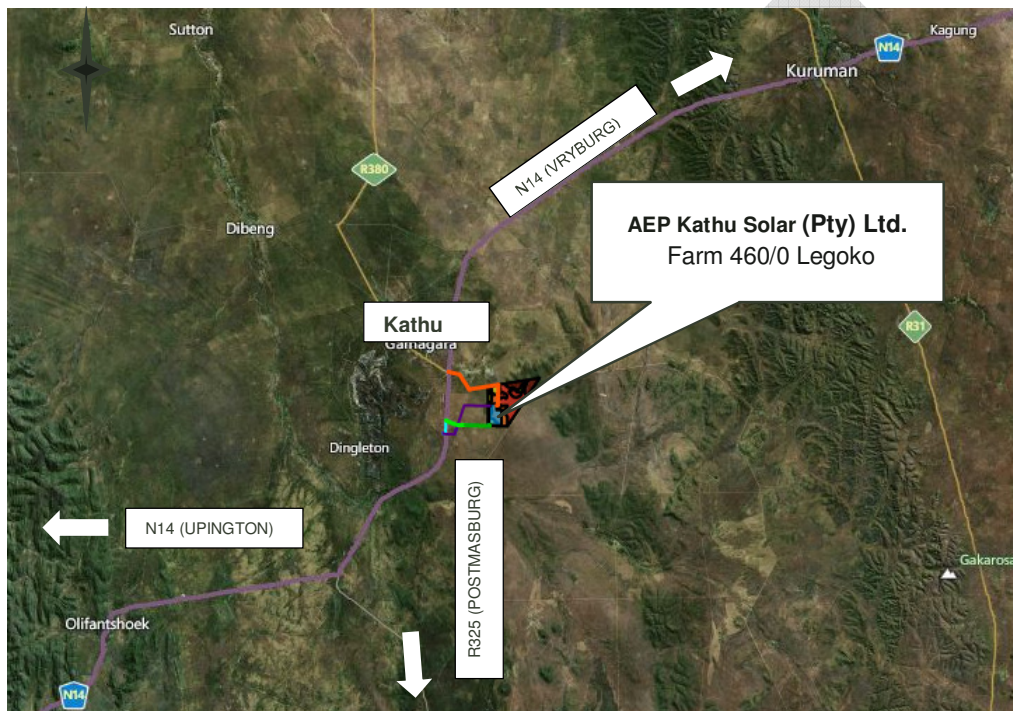


Figure 1: Key Plan

The proposed stage for the PV solar site will be developed to a 75 MW capacity.

The scope of the study is to evaluate the transport requirements to support the development of the AEP Kathu Solar PV Facility.

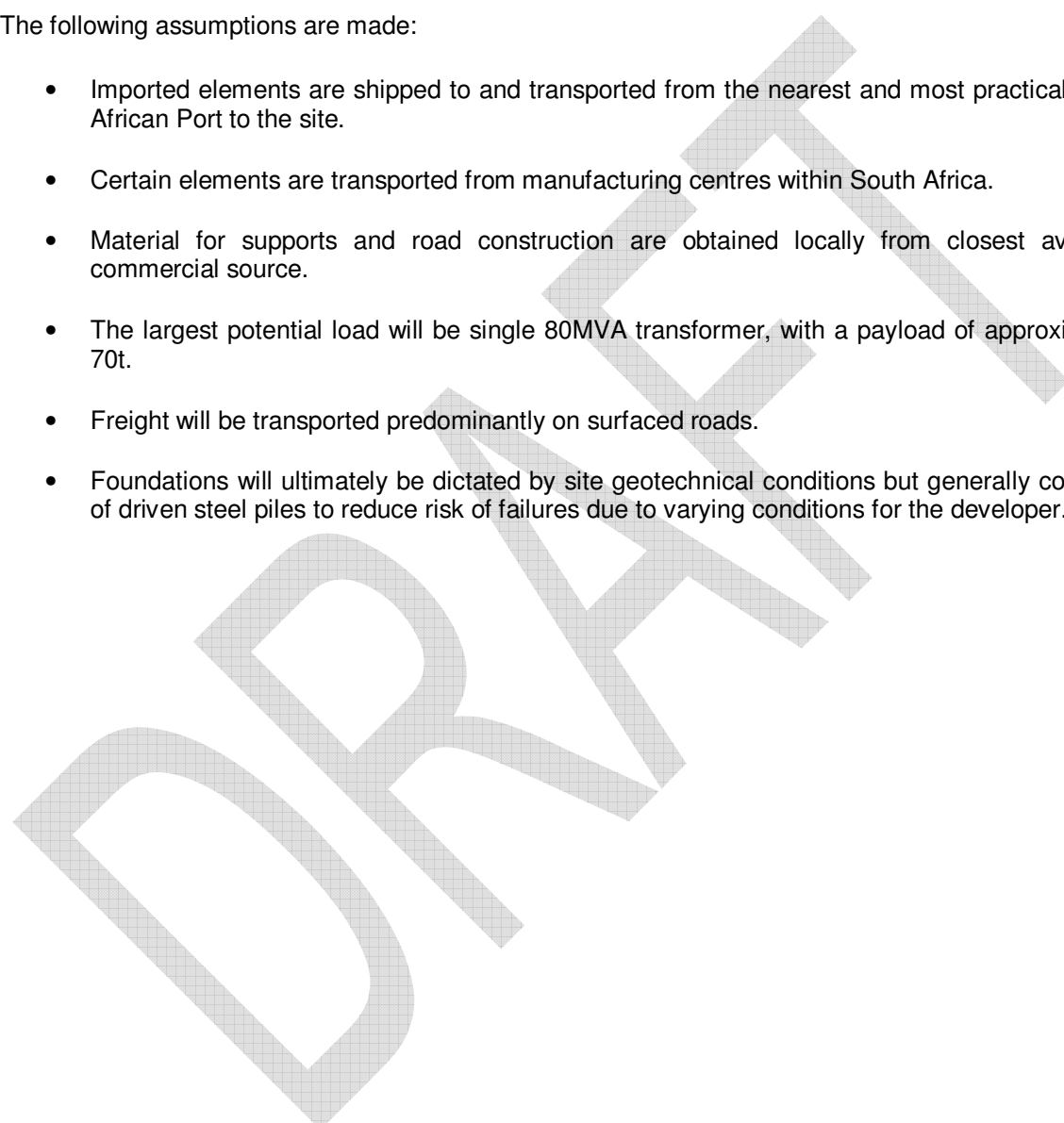
The scope of the Transport Management Plan includes inter alia:

- Determine the access freight routes between points of delivery and departure for the components.
- Confirm the associated clearances required for the necessary equipment to be transported from the point of delivery to the various sites.
- Confirm freight and transport requirements during construction and maintenance,
- Propose origins and destinations of equipment,
- Determine (Abnormal) Permit requirements if any,
- Propose traffic accommodation measures during construction of the access on the National Road.



2 DEFINITIONS / ASSUMPTIONS

The following assumptions are made:

- Imported elements are shipped to and transported from the nearest and most practical South African Port to the site.
 - Certain elements are transported from manufacturing centres within South Africa.
 - Material for supports and road construction are obtained locally from closest available commercial source.
 - The largest potential load will be single 80MVA transformer, with a payload of approximately 70t.
 - Freight will be transported predominantly on surfaced roads.
 - Foundations will ultimately be dictated by site geotechnical conditions but generally comprise of driven steel piles to reduce risk of failures due to varying conditions for the developer.
- 

3 EVALUATION OF SITE TRANSPORT

3.1 General Freight Requirements

3.1.1 Legislation

The general limitations on road freight transport are currently:

- Axle load limitation of 7,7t on front axle, 9,0t on single rear axles.
- Axle unit limitations are 18t for dual axle unit and 24t for 3 axle unit.
- Bridge formula requirements to limit concentration of loads and to regulate load distribution on the vehicle.
- Gross vehicle mass of 56t. This means a typical payload of about 30t.
- Maximum vehicle length of 22m for interlinks, 18,5m for horse and trailer and 13,5m for a single unit.
- Width limit of 2,6m.
- Height limit 4,3m.

Abnormal permits are required for vehicles exceeding these limits.

3.1.2 Solar Facility Freight

Materials and equipment transported to the site comprise of:

- Building materials (concrete aggregates, cement and gravel).
- Construction equipment such as piling rigs and cranes.
- Solar panels (panels and frames).
- Transformers and cables.
- Inverters possibly containerised.

The following is anticipated:

- a) Building materials comprising of concrete materials for strip footings or steel piles will be transported using conventional trucks which should adhere to legal loading limits.
- b) Solar Panels and frames will probably be transported in containers using conventional heavy vehicles within the legal limits from nearest South African port. The number of loads will be a function of the capacity of the solar farm and the extent of the frames.
- c) Transformers will most probably be transported by abnormal vehicles from the nearest South African port.

3.1.3 Traffic Statement

It is estimated from experience on other similar projects that the number of heavy vehicles per 1MW installation would be between 15 and 20 heavy vehicle trips depending on the site condition and founding requirements. The total trips for the 75 MW plant would be between 1100 and 1500 heavy vehicle trips. These trips would be made over an estimated period of 9 months.

In the worst case the number of heavy vehicle trips per day would be in the order of 5 to 10 trips. The impact of this on the general traffic would therefore be negligible as the additional peak hour traffic would be at most 2 trips.

Personnel during construction is estimate to be between 200 and 400 and will most likely reside in Kathu or Kuruman as the closest community or alternatively a compound on site or close by. It is recommended that the majority of construction personnel is transported to and from site by means of busses.

This personnel transport will contribute the majority of the estimate daily trips of between 15 to 20 trips. The impact of this on the general traffic would therefore also be considered negligible as the additional peak hour traffic would be at most 10 trips.

After construction, the generated site traffic would be limited to maintenance support, with only a few light vehicles per day.

Current Annual Average Daily Traffic (AADT) traffic volumes on N14 are estimated from the most recent SANRAL yearbook to be more than 4100 just north of the site between Kuruman and Kathu and a maximum hourly flow of about 525 veh/h.

It can therefore be stated that the construction traffic of less than 20 vehicles during the peak hour (<4% impact) and the post construction traffic of less than 5 vehicles per day (<1% impact) would have almost no significant impact on the existing traffic as well as negligibly pavement structure consumption.

3.2 AEP Kathu Solar PV Energy Facility - Access Route

3.2.1 Site Description

The site description is as follows:

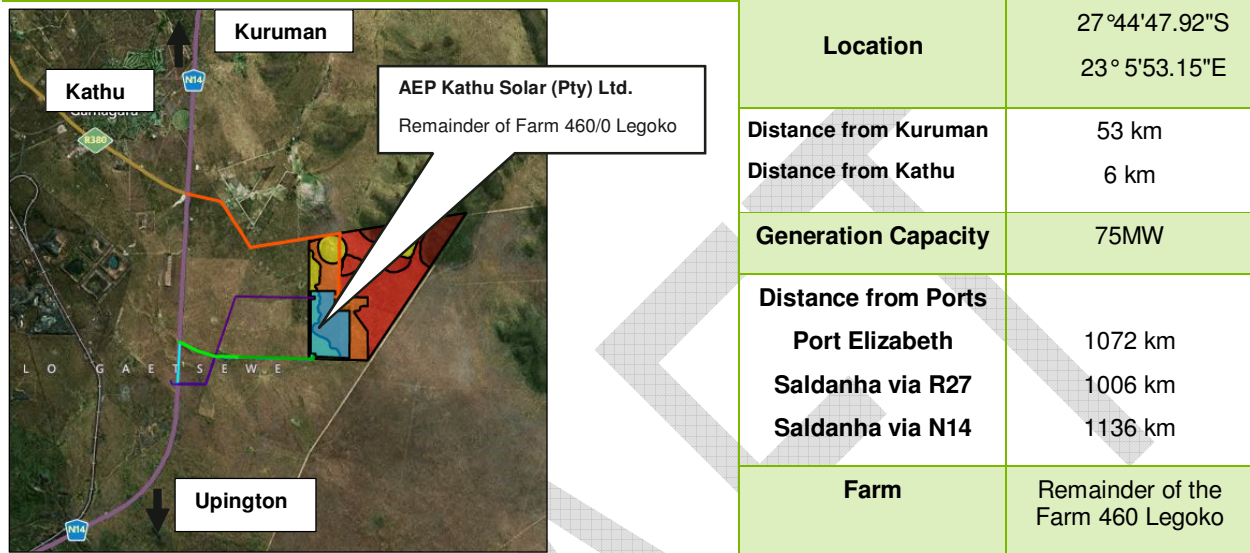


Figure 2: Site Description for AEP Kathu Solar PV Facility

3.2.2 Preferred Route from Port

The route for transportation of imported equipment is either from Port Elizabeth/Coega or Saldanha which have a similar travelling distance. However Saldanha is the preferred Port with the slightly shorter route and the more suitable harbour as indicated in the figure below.

It should be noted that the Ports Authority also has preferences on freight import, which should be considered.

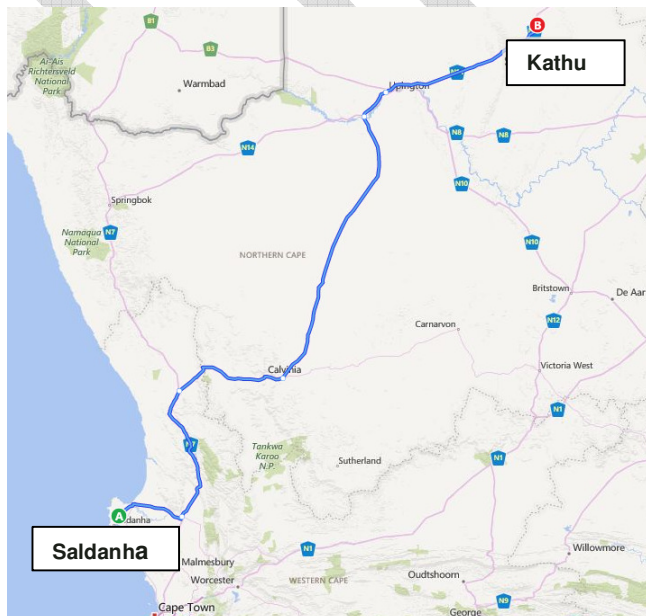


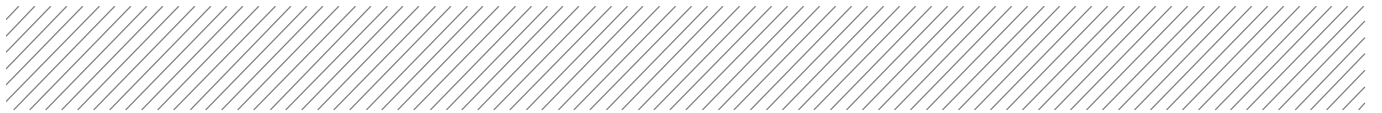




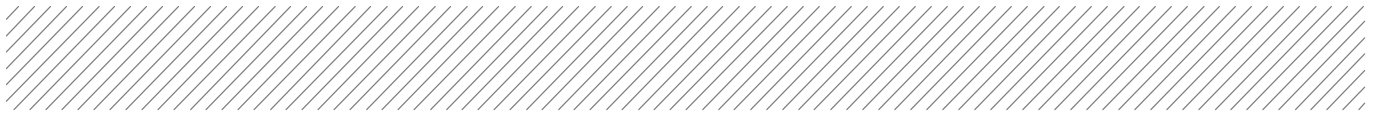
Figure 3: Preferred Route from Port



Table 1: Route Elements - Details

| Element | Route Name | From | To | Distance [km] | Type |
|---------|--|----------|-----------|---------------|---|
| 1 | R27 | Saldanha | Velddrif | 23 | Surfaced Provincial Road |
| |  | | | | R27 is a surfaced 2 lane road with surfaced shoulders |
| 2 | R399 | Velddrif | Piketberg | 62 | Surfaced Provincial Road |
| |  | | | | R399 is a surfaced 2 lane road with gravel shoulders |



| Element | Route Name | From | To | Distance [km] | Type |
|---------|--|--------------|--------------|---------------|---|
| 3 | N7 | Piketberg | Vanrhynsdorp | 174 | Surfaced National Road |
| |  | | | | N7 is a single carriageway two lane road with gravel shoulders (Surfaced in places) |
| 4 | R27 | Vanrhynsdorp | Calvinia | 121 | Surfaced National Road |
| |  | | | | R27 is a single carriageway two lane road with surfaced shoulders (Recently upgraded) |



| Element | Route Name | From | To | Distance [km] | Type |
|----------------------------|--|----------|---------|---------------|---|
| 5 | R27 | Calvinia | Keimoes | 366 | Surfaced National Road |
| |  | | | | R27 is a single carriageway two lane road with gravel shoulders |
| 6 | N14 | Keimoes | Site | 252 | Surfaced National Road |
| |  | | | | N14 is a single carriageway two lane road with gravel shoulders |
| 7 | Site access road | N14 | site | 8 | Surfaced Road and Gravel Access Road 6m wide |
| TOTAL DISTANCE [km] | | | | 1006 | |

Note: 1 The recommended route is indicated in the table

3.2.3 Route for Construction materials

Material sources for road building and concrete works is available in Kathu and all material will most likely be transported from these and possibly other surrounding towns on the National and Provincial roads.

3.2.4 Alternative Route from Port

Should the preferred port not be available for any reason – especially in view of the large volume of wind turbine equipment currently imported - , then the Port Elizabeth/Coega Port could be used as alternative. The route from Port Elizabeth (a distance of 1072km) is shown in the following figure.

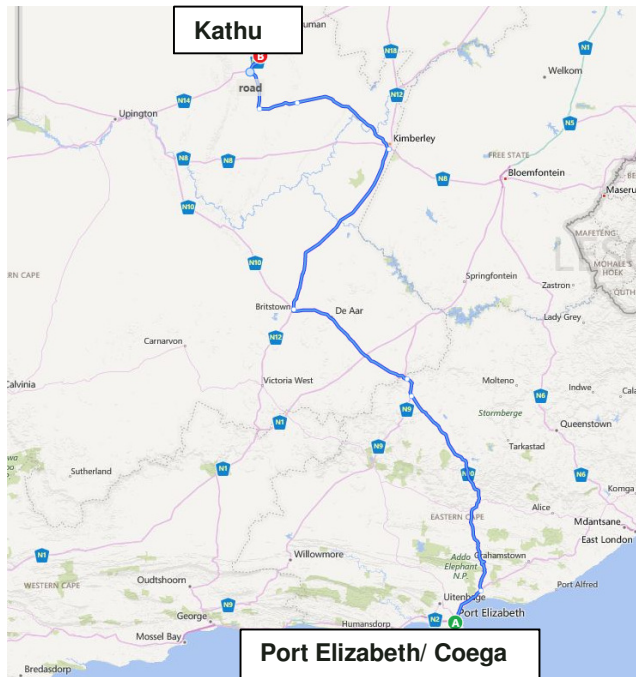


Figure 4: Alternative Port Route

3.2.5 Routes from other Larger Manufacturing Centres

The other main manufacturing centres include

- Gauteng - greater Johannesburg area (Modderfontein, Edenvale, Nigel, Germiston, Brakpan, Elandsfontein) for inverters and support structures.
- Cape Town – greater metropolitan area for some of the components.

The routes to the site from these centres are predominantly on Provincial and National roads. The following figure shows the most probable routes.

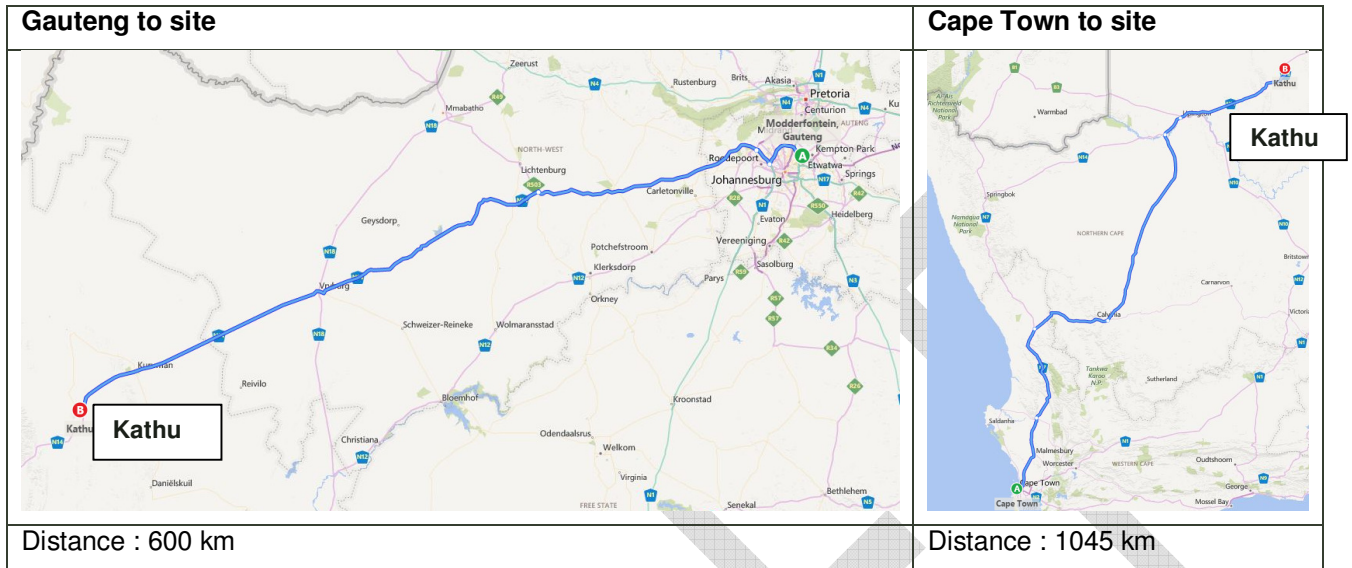


Figure 5: Routes from Other Manufacturing Centres

There are no limitations on normal freight within the legal limits on these routes.

3.2.6 Authority and Permit Requirements

The following is noted:

- No toll fees are required on the routes from the port. On the routes from the other manufacturing centres, certain portions of the national routes are tolled which will require toll fees.
- Abnormal permit will be required for the transport of the transformer by the logistics contractor. The estimated permit value will be a function of the actual vehicle configuration as well as the convoy requirements, but is estimated at R9000 – R15000 per trip. This application process would take approximately a month to complete and should be applied for once the project has reached financial close.

3.2.7 Route Limitations of the Preferred Route from the Port

The routes elements are evaluated as follows:

Table 2: Route Elements - Evaluated

| Element | Road | Remark | Comment |
|----------------|------|---|---------|
| General | | No limitations on normal heavy vehicles | |
| | | Permits required from the Provincial Authorities for abnormal loads for transformer | |
| | | Vertical clearance of bridges in general 5,2m. However, should the transformer exceed 5,2m then the route will have to be confirmed or altered as required but the permit conditions will direct the load on an approved route. | |

| Element | Road | Remark | Comment |
|---------|-----------------|--|--|
| 1 | R27 | None | |
| 2 | R399 | Possible delays due to periodic maintenance required by PGWC | Currently a rehabilitation project until March 2017. |
| 3 | N7 | Possible delays due to periodic maintenance required by SANRAL. Currently 3 Stop-Go controls with 10 to 20 minute delays | Currently a rehabilitation project until February 2016 |
| 4 | R27 | Low possibility of periodic maintenance required by SANRAL | Recently rehabilitated |
| 5 | R27 | Low possibility of periodic maintenance required by SANRAL | Recently resealed |
| 6 | N14 | Low possibility of periodic maintenance required by SANRAL | Olifantshoek bridge closed for Abnormal loads. Repair contract under way |
| 7 | New Access Road | None | Part of the internal roads |

3.2.8 Site Access Road

3.2.8.1 Access to Road Network

The access to the site is proposed off the National Road N14.

The access position could be at one of two positions, which should be approved by SANRAL as sufficient sight distances (stopping and shoulder) are present, as follows:

- Access Road Alternative 1:** Off the N14 and R380 intersection to the proposed AEP Kathu Solar PV Energy Facility (shown by the orange route). The access follows an existing surfaced road for 1,2km , then 1,65km along the boundary of the Farm Bestwood 459 on an existing track to the farm boundary of Legoko 460 , then 2,8km along the Northern farm boundary of Legoko 460 on an existing farm road and then 2,0km on an existing track to the proposed PV site– a total length of 7,65km.- A servitude would need to be secured with the farm owner of Bestwood for the section along the farm boundary. This option is however close to the farm homestead and probably not preferred by the owner.
- Access Road Alternative 2:** Off the N14 on an existing gravel farm road for 1.97km (green line) and a further 2.42km of new road (blue line) would need to be constructed– a length of 4,39km. The access road falls on Portion 1 of the Farm 460 Legoko so a servitude would need to be secured with the farm owner, however this is the preferred access road option because it is located further away from the farm homestead in the north western corner of Portion 0 of the Farm Legoko 460.

The options are indicated in the following figure:

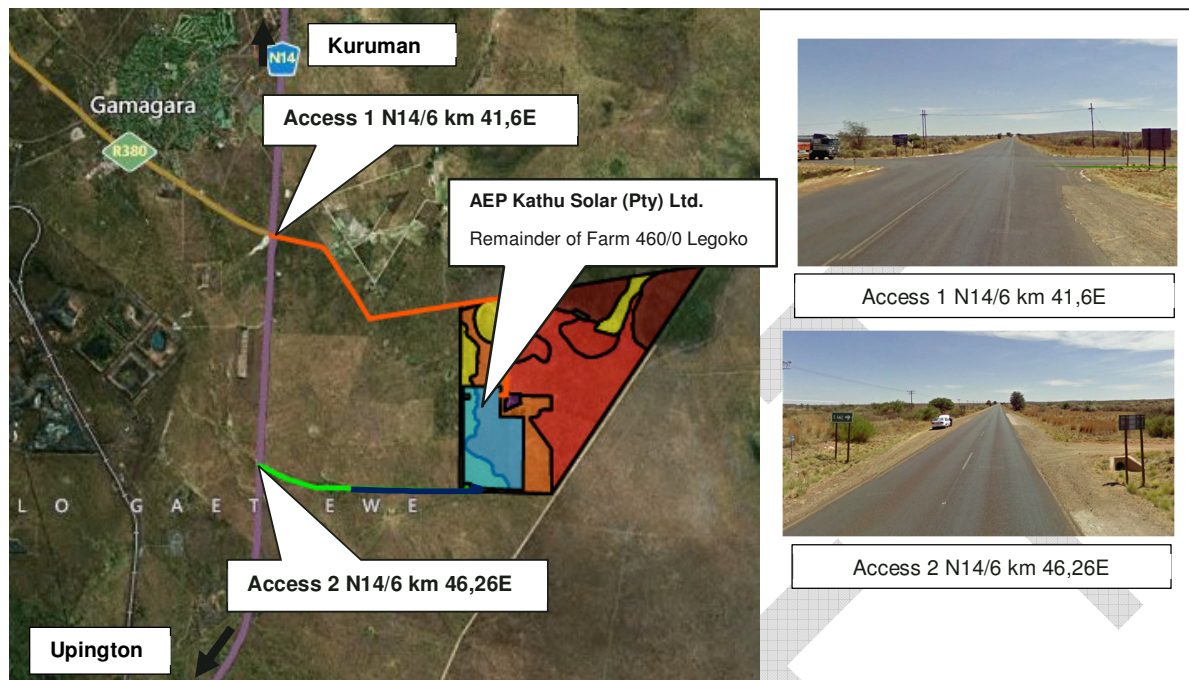


Figure 6: Access Position to portion 0 of farm 460 Legoko.

3.2.8.2 Preferred Access Route

Both of the access options illustrated above are considered to be viable from environment and technical viewpoints, however access road 2 is preferred because it is located further away from the farm homestead in the north western corner of Portion 0 of the Farm Legoko 460 thus an application for using this access must be submitted to SANRAL. These alternatives must be investigated further detail at a later stage.

The access road should be upgraded to at least a 5m width (preferable 6m with sufficient shoulders) with a gravel wearing course layer.

3.2.8.3 Structures and Services

Existing structures and services such as drainage structures and pipelines will be evaluated at crossings and suitably strengthened if required.

The site drains to the West. Suitable drainage elements will be provided on the access road to ensure minimal disturbance of the existing drainage patterns.

3.2.9 Accommodation of Traffic during Construction

During construction of the access, traffic will have to be accommodated as per SADC Road Traffic Signs Manual requirements. The following typical minimum signage requirements will have to be implemented to ensure safety if the road needs closure during construction on the public road.

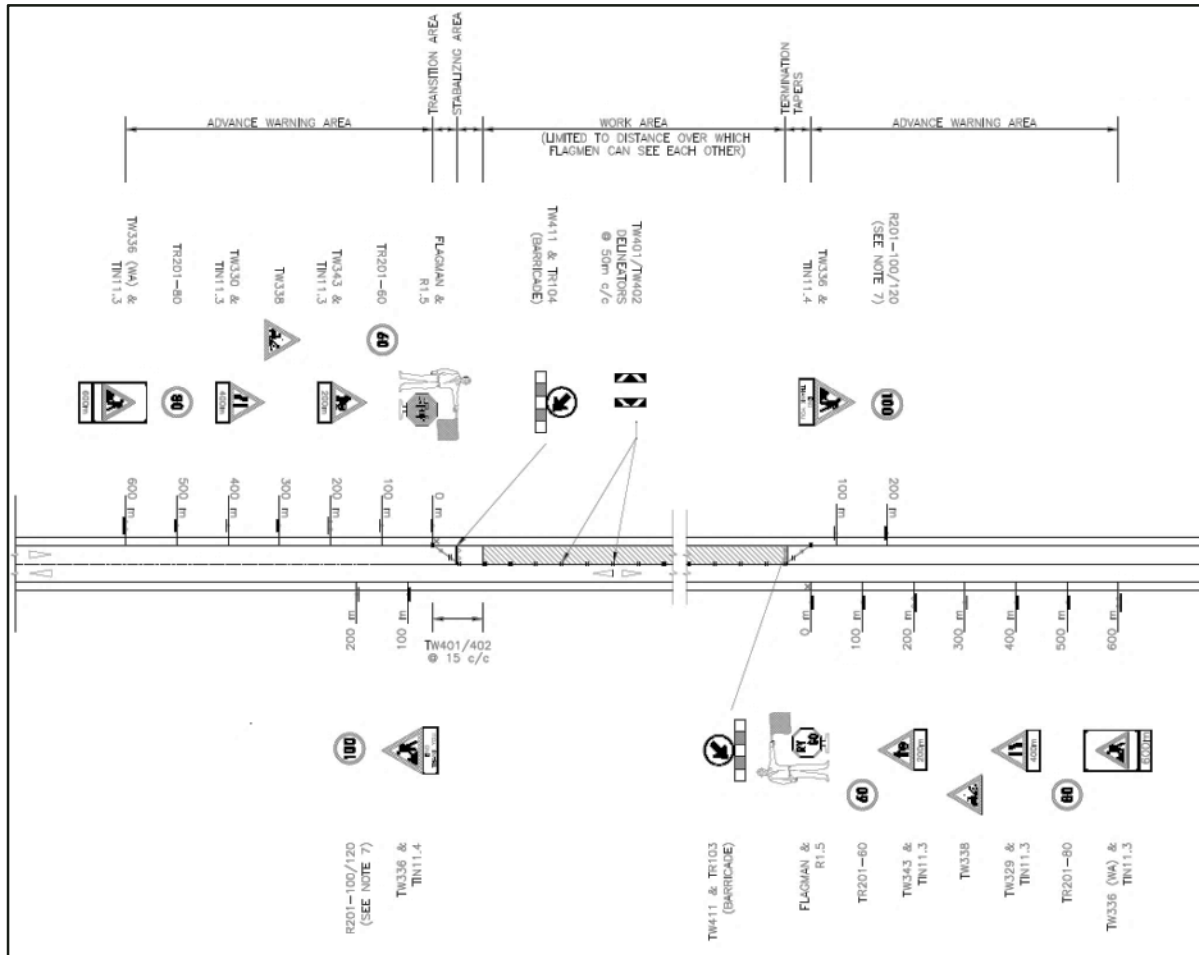


Figure 7: Accommodation of Traffic - Typical Layout

4 CONCLUSION

The transport needs for the proposed AEP Kathu Solar PV Facility, with a generating capacity of 75 MW on Portion 0 of the Farm Legoko 460 near Kathu, was investigated to confirm access route and site access for the development of a solar facility.

The general requirements are:

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