APPENDIX O

Traffic Assessment

Bokpoort II Solar Farm: Photovoltaic Facility 1 Site Traffic Assessment

FOR
ACWA POWER (LTD) PTY

TRAFFIC REPORT

11 May 2016

PREPARED BY
ROYAL HASKONINGDHV (PTY) LTD

QUALITY ASSESSMENT

PROJECT NAME: Bokpoort II Solar Farm: Photovoltaic Facility 1 Site Traffic Assessment:		
PROJECT NO: T01.pta.000761	**DATE:** 11 May 2016	**REPORT STATUS:** Final
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SYNOPSIS:

This traffic impact assessment report determines the impact of the development and operations of Bokpoort Phase II Solar Farm near Groblershoop on the adjacent road network. This report is for the development of the 75 MW Photovoltaic Facility (PV1).
The report addresses the Status Quo, construction process, site logistics, traffic impact, intersection and traffic management guidelines.

QUALITY VERIFICATION

This report has been prepared under the controls established by a quality management system that meets the requirements of ISO 9001: 2000.

Verification	Capacity	Name	Signature	Date
By Author	RHDHV	Ms. L. van Wyk		11 May 2016
Checked by	Project Principal	Mr. I. Reutener		11 May 2016
Authorized by	RHDHV Project Leader	Mr. I. Reutener		11 May 2016
Submitted to	ACWA Power	Me. L. Rathanya		11 May 2016

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1 INTRODUCTION

1.1 Purpose of report

The purpose of the traffic assessment report is to determine the impact of the construction and operations of the Photovoltaic (PV) Facility Phase 1 at the proposed Bokpoort II Solar Farm on the roads, traffic, pedestrians, parking, and safety.

The report will address:

- Description of the Status Quo, including the existing traffic data and analysis at the surrounding road network and accesses to the site;
- Description of the construction process and methodology, including transport of materials and staff to site and site logistics during the construction and operational phases;
- Describe and quantify the traffic impact during construction period using intersection capacity analysis software;
- Address the access / egress at the site.

This traffic scoping study will form part of the Environmental Impact Assessment specialist studies for the development of the Bokpoort II solar farm.

1.2 Overview of project

The proposed Bokpoort II project will consist of three facilities, including two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150 MW Concentrated Solar Power (CSP) Tower facility. The combined power generation capacity of the entire Bokpoort II solar development will be 300 MW.

1.3 Location of project

The proposed development is on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390, located within the !Kheis Local Municipality in the ZF Mgcawu District Municipality, Northern Cape Province. The site is located 20 km to the northwest of Groblershoop and to the east of the Orange River. Bokpoort II is adjacent (to the north east) of the Bokpoort I Solar Farm on which the construction phase was completed in March 2016. The site is also adjacent to the proposed Soldraai Solar Plant for which the initial investigation studies (EIA) is currently under way.

Access to the site is via a private Transnet Road running parallel to the Sishen Saldanha railway line. Permission has been arranged with Transnet to obtain access to the site during the application for construction of Bokpoort I.

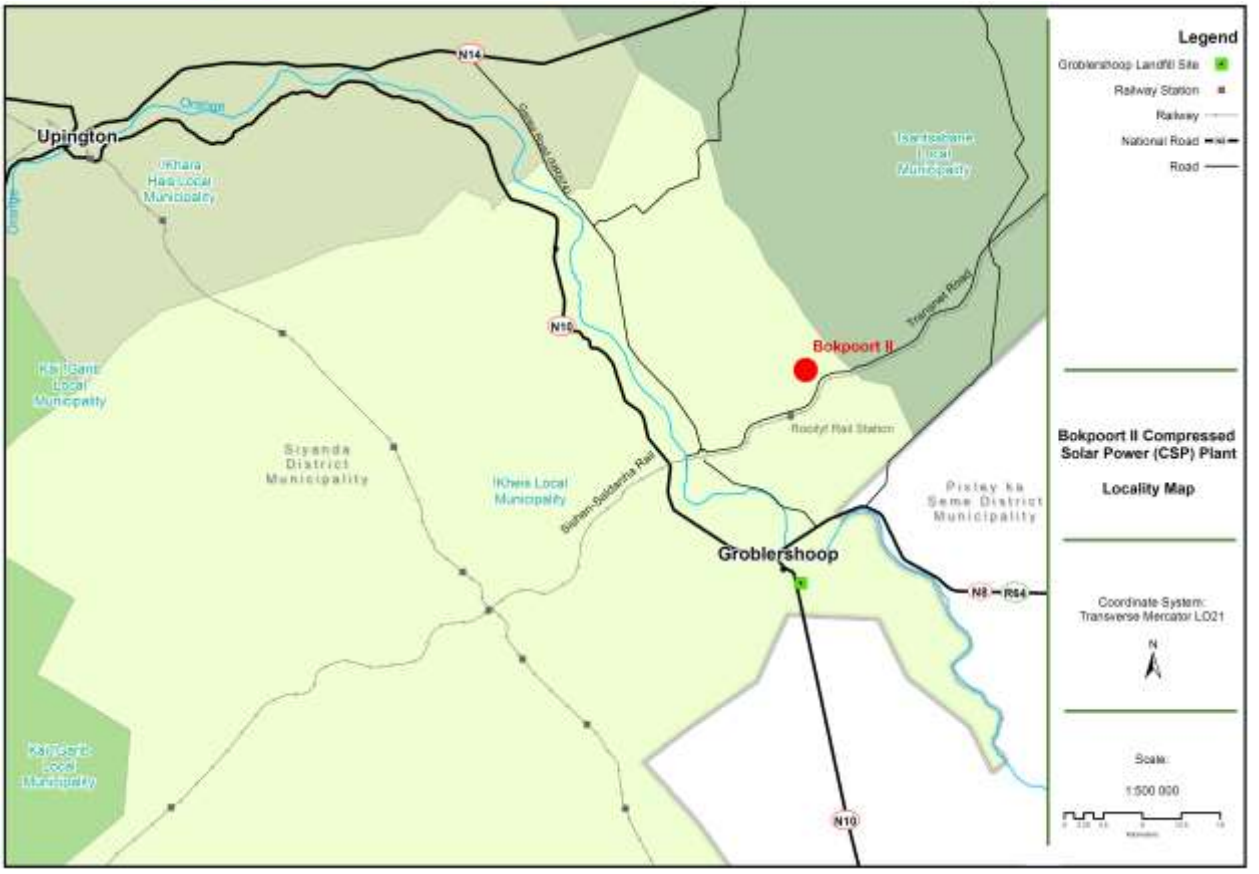

Figure 1: Locality Map

1.4 Consultant

Royal HaskoningDHV (RHDHV) was appointed by ACWA Power Africa Holdings (Pty) for the traffic specialist studies for the Environmental Management Plan (EMP).

1.5 Project impacting on this study

The following projects in the study area should be noted:

- The proposed Sanddraai solar power (CSP) and photovoltaic (PV) plant on the farm Sand Draai 391, adjacent to Bokpoort;
- Bokpoort I solar plant for which construction was completed in March 2016; and
- Request by farmers (grape farmers adjacent to the river) to upgrade of the Gariep District Road due to dust generated by construction traffic.

The construction period of each of these projects are shown in Figure 2. PV1 is Phase 1 of the construction for Bokpoort II, followed by the construction of PV2 and the CSP tower.

The combined traffic impact, should all of the above projects occur simultaneously is included in **Annexure B**.

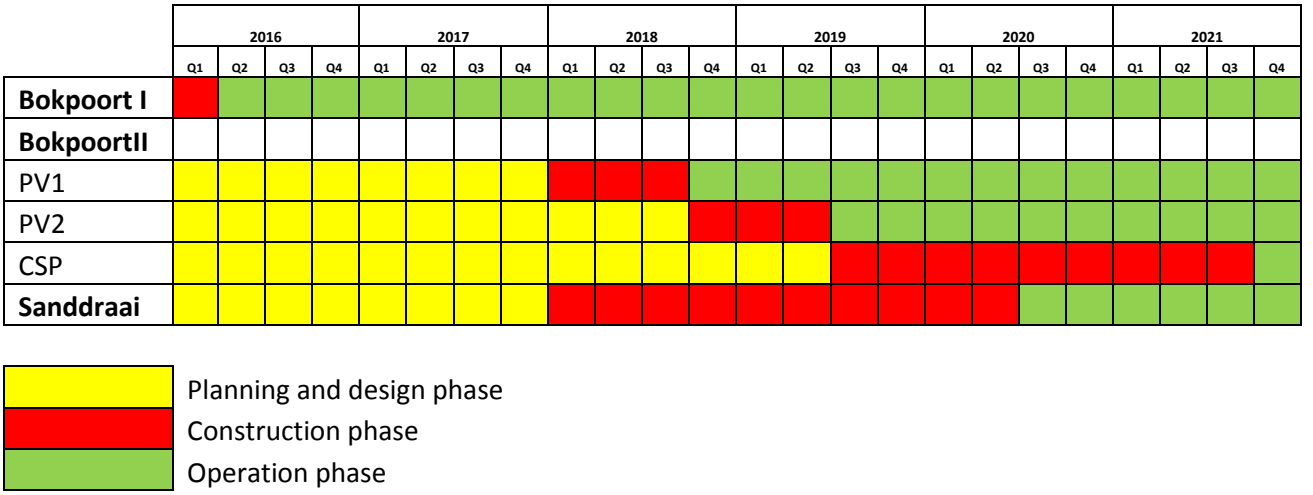

Figure 2: Construction program for the various projects

(Note: Assuming PV1 is built first and PV2 and CSP built consecutively)

2 STATUS QUO

2.1 Land Use

Existing landuse: The proposed development is on the north-eastern portion of the Remaining Extent (RE) of the Farm Bokpoort 390. It is currently zoned as agricultural and the farm is used for farming sheep and cattle. The main farming activity in the area is vineyards with sultana farms on both sides of the Orange River close to (up to 500 to 1000m) the river bank and further away from the river is livestock farming and eco-tourism.

Future landuse: The proposed future zoning for the site is Special Purposes.

2.2 Access to site

Access to the farm is via a private Transnet gravel road, running adjacent to the Sishen-Saldanha railway line. The proposed access to the solar farm will be via the Transnet Road as shown in Figure 1.

2.3 Road network

The N14, N10 and N8 are the primary roads in the region and are the main link between the economic centres of Gauteng and Namibia. Access to the site is via the Gariep Road the the Transnet Private Road. Details of the road network are given in Table 1.

2.4 Intersections

The intersections are all unsignalised and operating at a good Level of Service (LOS of A) with sufficient spare capacity. Details of the intersections are given in Table 2.

Table 1: Overview of road network

Road	Ownership	Geometry	Discussion	Layout
N14	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed 120km/hr Longitudinal profile: Flat	Major east west link between Gauteng and Namibia via Upington. Use as haul route for equipment and materials from Gauteng to site. Condition: Good	
N10	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed 120km/hr Longitudinal profile: Flat	Major east west link between east coast (Port Elizabeth) to Namibia via Groblershoop and tying in with the N14 at Upington. It intersects the N1 and the N12. Use as haul route for equipment and materials from Cape Town and PE harbours. The road essentially follows the Orange River alignment. Condition: Fair to good	
N8 (R64)	South African National Roads Agency (SANRAL)	Paved Single carriageway 2 lanes (one per direction) 3.7m wide paved lanes with 2m wide gravel shoulders Speed 120km/hr Longitudinal profile: Flat	Major link between Bloemfontein and Kimberley and Groblershoop linking with the N10 at Groblershoop. Condition: Fair to good	

Road	Ownership	Geometry	Discussion	Layout
Gariep Road (MR874)	Northern Cape Department of Transport	Gravel road 2 lanes (one per direction) 10 wide Speed 60km/hr Longitudinal profile: Flat	The road runs parallel and to the east of the Orange River serving as access to the farms along the Orange River. The road links the N14 with the N8. Major dust issues has been noted by farmers due to construction vehicles. The road is aligned through the southern sections of the farm Bokpoort. Condition: Fair	
Transnet Road (Loop 16 Access Road)	Transnet	Gravel road 2 lanes (one per direction) 10 wide Speed 60km/hr Longitudinal profile: Flat	Private Transnet Road to serve the Sishen-Saldanha Railway line. Road is main access to Bokpoort Farm Condition: Fair	

Table 2: Overview of intersections

Inter-section	LOS	Discussion	Layout
N14/Gariep Road	Exist: A During construction: A During Operations: A	Sight distance: Good Dedicated right turning lanes: None Safety: Poor N14 is a high speed (120km/hr) road. There is no dedicated turning lanes for vehicles having to turn from the N14 into the Gariep Road. This use of the Gariep Road, even though shorter when travelling from Gauteng, is not recommended as a haul route due to safety on the N14 and dust issues along the Gariep Road.	
N8/Gariep Road	Exist: A During construction: B During Operations: A	Sight distance: Good Dedicated right turning lanes: None Safety: Poor N10 is a high speed (120km/hr) road. There is no dedicated turning lanes for vehicles having to turn from the N10 into the Gariep Road.	
Gariep Road/Transnet Road	Exist: A During construction: A During Operations: A	Sight distance: Fair, after bridge over rail Dedicated right turning lanes: None Safety: Poor Very little traffic currently on road. The approach to the intersection is poor, with poor visibility and geometry.	

2.5 Non-motorised transport

No pedestrians or cyclists were noted on any of these roads during the site visit. No cyclists or pedestrians are allowed on the national roads (N14, N10, N8). Workers and staff working on the farms along the Gariep Road, mostly live on the farms. Similar with the Transnet Private Road. There are no towns or settlements along these two roads, apart from the farms along the Gariep Road.

No dedicated non-motorised transport facilities are provided or required.

2.6 Accident hotspots

The Gariep gravel road has seen a number of fatal accidents due to speeding, overtaking and poor visibility caused by dust from the road due to vehicles.

Figure 3: Recent road accidents

2.7 Railway Lines

The Sishen-Saldanha railway line runs adjacent to the farm Bokpoort. There is a cross-over siding, Rooilyf) for the iron-ore trains in the central sector of Bokpoort (Loop 16). There are on average three (3) trains per day on this line. (Source: Transnet Freight Rail). The rail line and siding could potentially be used for transport of materials to site, but it is highly doubtful if a special train will be scheduled to this site due to lack of rolling stock from Transnet's side. Rail was not used during the construction of Bokpoort I, and therefore it is assumed that it is highly unlikely that the Sishen-Saldanha railway line will be used during the construction of Bokpoort II.

2.8 Proposed refuse sites

The proposed refuse sites and haul distance include:

- Holfontein (hazardous waste) (814 km via N8); and
- Local municipality (general waste) at Grobershoop (35km).

The haul routes to the refuse sites are shown in Figure 4.

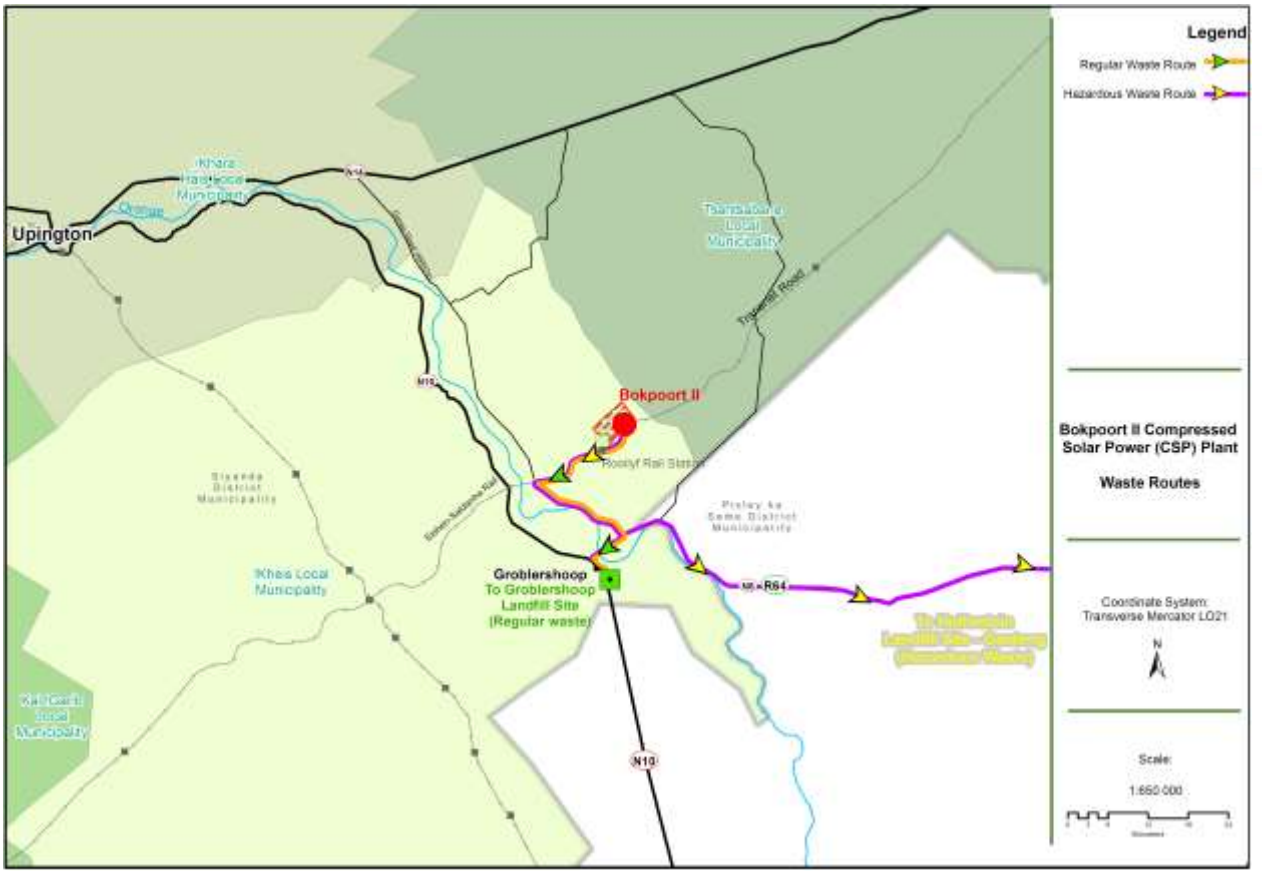

Figure 4: Waste Haul Routes

2.9 Haul routes

The shortest haul route from Gauteng is via the N8 as shown in Table 3

Table 3: Haul distance from Gauteng

Road Distances from Gauteng	Length (km)
Johannesburg CBD to Bokpoort via N8 and R59	794
Johannesburg CBD to Bokpoort via N8 and N12	795
Johannesburg CBD to Bokpoort via N14 via Upington and then N10	908
Johannesburg CBD to Bokpoort N14 (Gariep Road) – not allowed	*811*

The Gariep Road from the N14 is not recommended as a haul route due to the road safety and dust issues. This route is however 126km shorter than the alternative via the N10 when travelling from Upington. This should be noted in the construction tender.

Table 4: Haul route lengths

Road Distances for Haul and Waste Routes	Length (km)
N14/Gariep Rd Crossing via Upington and N10 to Bokpoort	191
N14/Gariep Rd Crossing via Gariep Road to Bokpoort	65
Difference	126

As shown in Table 4, the haul route via Upington is 126km longer than travelling via the Gariep Road/N14 intersection and could have a cost implication for the contractor.

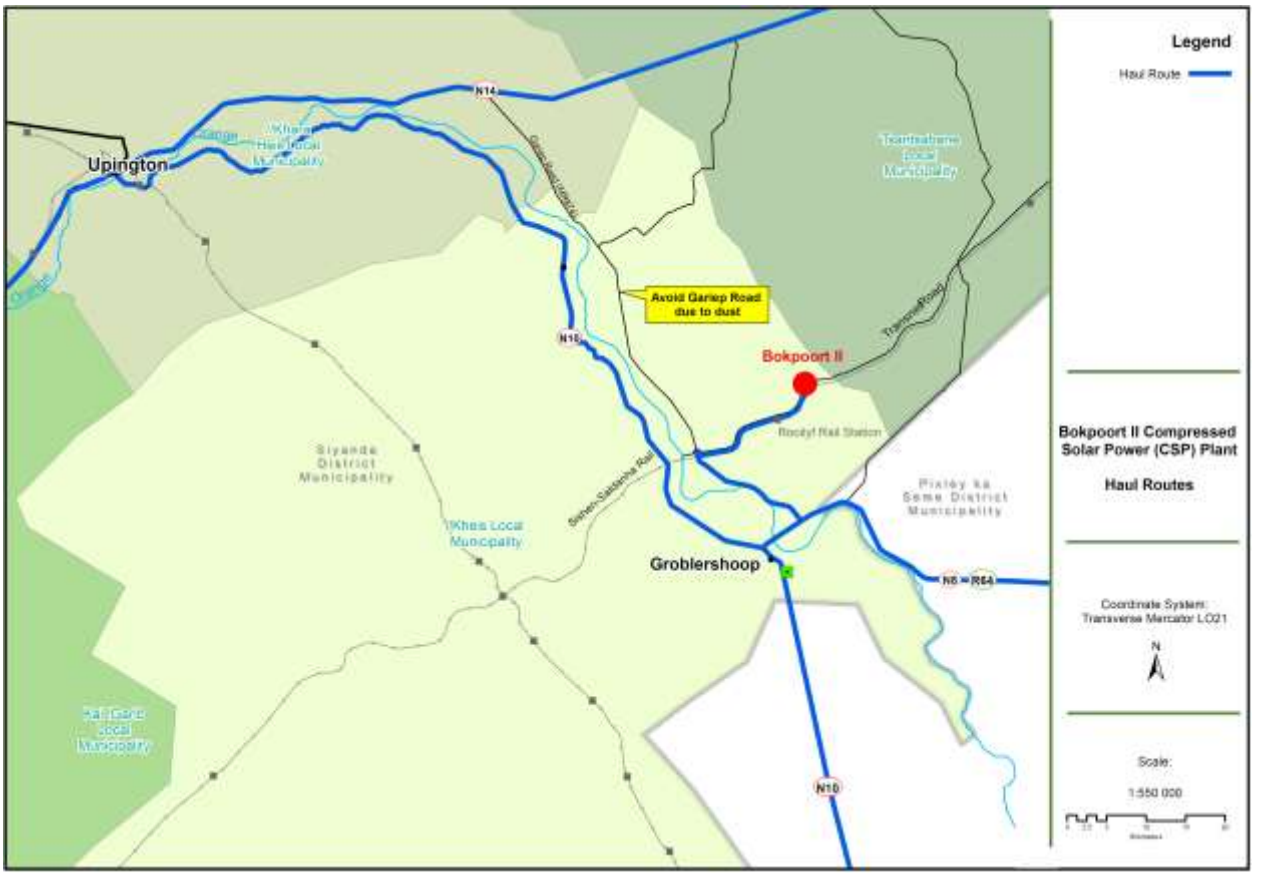

Figure 5: Haul Routes

2.10 Traffic counts

The major intersections were counted on 9-10 March 2016. The traffic volumes are summarised in Figure 6.

Table 5: Traffic volumes (peak hour)

Intersection	Morning peak hour volumes	Afternoon peak hour volumes	Daily volumes
N14/Gariep	168	157	16800
Gariep/Transnet	36	46	265
N8/Gariep	257	274	1340

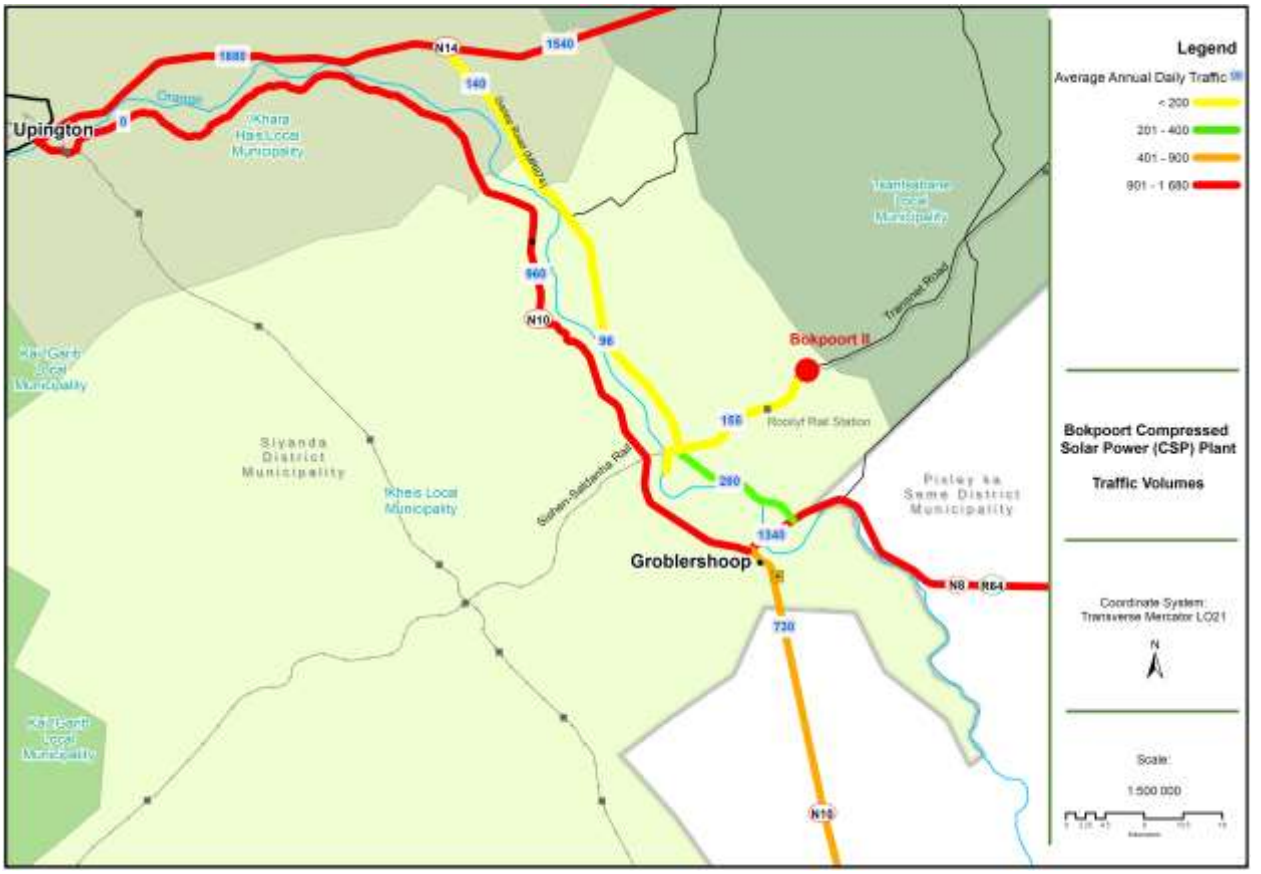

Figure 6: Existing Daily Traffic Volumes (March 2016)

2.11 Road Hierarchy

The road hierarchy is shown in Table 6. Traffic calming and parking is typically not allowed along the Mobility Corridors (Class 1, 2, 3), but is allowed along the Access Routes (Class 4, 5).

Table 6: Road Hierarchy

Road	Class	Speed
N14, N10, N8	Class 1, National Road	120 km/hr
Gariep Road	Class 3, Minor arterial	80 km/hr
Transnet Railway Road	Class 5, Local access road	60 km/hr

2.12 Public Transport Infrastructure

There are no dedicated public transport loading/pick-up bays along the Gariep Road and the Transnet Private Road. There are no scheduled public transport routes along these two roads. Minibus-taxis transported construction staff to Bokpoort I from the adjacent residential areas. The developer will have to provide transport to site for the construction staff.

2.13 Dust

The nature of the Gariep Road (calcrete) and speeds at which vehicles are travelling on the road, generates a lot of dust. The dust impacts on the farming production rates, especially where the Gariep Road is close to vineyards (within 1km). Various complaints were received during the construction of Bokpoort I from farmers wrt dust caused by construction vehicles.

	
Dust generated by heavy vehicle turning from Gariep Road onto Transnet Road (looking from railway bridge in westward direction)	Dust from car that passed on the Gariep Road

Figure 7: Dust along Gariep Road

3 CONSTRUCTION OF BOKPOORT II

3.1 Overview of the facility

The proposed Bokpoort II project will consist of three facilities, including two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150 MW Concentrated Solar Power (CSP) Tower facility. The combined power generation capacity of the entire Bokpoort II solar development will be 300 MW.

Overview of Phase 1 (PV1) and Phase 2 (PV2):

- Plant footprint: 240;
- Number of panels: 280 000;
- Panel dimensions: 1956 x 992 mm;
- 32 panels in each array;
- Panel direction: Portrait in single axis tracking configuration;
- Number of inverters: 38 units x 2MWac;
- Main transformer/ on site substation capacity and size: On site substation 33/132 kV , 1 x 75 MW (onan) Step-Up Transformer;
- Office/workshop size (area): 15 Ha; and
- New overhead line (length, servitude and tower height): 132kV OHL , 5 km, Tower height of 35m, Overhead line servitude of 30m (15 m each side).

3.2 Phasing of construction and construction period

The construction will occur in three phases over a 46 month construction period. For purposes of this analysis, it is assumed that PV1 will be constructed first.

- Phase 1: PV1: 9 months construction period;
- Phase 2: PV2: 9 months construction period; and
- Phase 3: CSP Tower: 28 month construction period;

It is anticipated that construction of Phase 1 (PV1) will commence on 15 January 2018 and be completed in 9 months by 15 December 2020. It is anticipated that Phase 1 of the site will be operational by October 2018.

Phase 2 (PV2) will commence immediately after completion of Phase 1.

Construction will be carried out during the daytime only (07h00 to 18h00) from Monday to Saturday.

Note: *For purposes of the PV1 facility transport analysis, it is assumed that the PV1 facility will be constructed first with PV2 and CSP following consecutively. Similarly, for purposes of PV2 and CSP, it is assumed that that facility will be constructed first. Annexure B includes an analysis where all three facilities and Sanddraai Solar Plant are constructed simultaneously to determine the combined impact.*

3.3 Construction staff

The anticipated construction staff on site during the construction peak period includes:

Phase 1: PV1 (this report):

- Local residents: 40 employees;
- Core construction staff provided by the contractor: 10 staff; and
- Total 50 people.

3.4 Accommodation and transport for staff

Accommodation (construction camp) was provided on site for 200 staff during the construction of Bokpoort I. It is however, not anticipated that accommodation will be provided on site for staff during the construction of Bokpoort II Phase 1 (PV1). Local residents and core staff staying in the area (mostly Groblershoop, Upington and on farms) will be transported to site by staff shuttle or public minibus-taxis. Other staff will travel by private vehicle to the site.

3.5 Construction activities

The following construction activities will occur during the construction of Bokpoort II:

- A high voltage yard within the power station precinct;
- Water and waste water treatment facilities;
- Water storage tanks for cleaning;
- Demineralization plant;
- Access roads (temporary and permanent, and external and internal roads);
- Construction of access road from the Transnet Road;
- Establishing of loading/offloading and storage areas, parking and truck movement areas within the site;
- A crane will be established to assist with the vertical transport of material;
- Material (steel, concrete, gravel, mirrors, salt etc.) will be delivered to the site, mostly via the road;
- Maintenance, medical, administrative, services, control buildings;
- Water supply pipeline for construction and operation phase;
- Raw water pipeline and reservoirs;
- Transmission line to Eskom substation;
- Power supply for the construction phase;
- Communications mast/ telecommunications facilities;
- General and hazardous waste storage and handling facilities (temporary and permanent);
- Batching plant (Including concrete and asphalt);
- Construction staff and office accommodation;
- Meteorological station;
- Salt melting unit;
- Petrol station;
- Canteen;

- Fire fighting water storage tanks;
- Water pump station;
- Covered and uncovered parking;
- Rain water buffer basin;
- Rain water storage;
- Compressed air unit;
- Truck washing station for cleaning of vehicles;
- Backup diesel generator for safe shut down.

3.5.1 Road upgrades and new roads

New access road

A new access road will have to be constructed to connect the Transnet Road with the site as shown in Figure 8. This will be done during Phase 1 (construction of the PV1).

A new access south of the existing Bokpoort I CSP plant or alternatively via the existing Bokpoort I access road can be constructed. The two roads are approximately 600m apart. The proposed access road should be at least 7m wide, paved road to reduce dust on the mirrors. The geometry of the road to meet the requirements of large abnormal loads.

Figure 8: New access road to Bokpoort II

3.6 Construction vehicles

The construction vehicles will consist of crane, articulated flatbed to deliver the crane and the shuttering (abnormal loads), concrete trucks, concrete pump, tipper trucks to remove the rubble from the site and to deliver raw material (sand, gravel, salt etc.) for the concrete batch plant, delivery vehicles, and staff vehicles.

3.7 Construction traffic generated

The construction traffic generated consists of:

- The materials to be delivered, includes mostly the solar panels/mirror and raw construction materials for the concrete bases, structures and other ad-hoc deliveries;
- Staff entering and exiting the site.

Table 7: Construction Generated Traffic

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
	In	**Out**	**In**	**Out**	**In**	**Out**
Staff	16	4	6	16	31	31
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	4	4	4	4	37	37
Total vehicles	**21**	**9**	**11**	**21**	**78**	**78**

It is expected that during the peak hour the following traffic will be generated:

- AM peak hour 30 trips; and
- PM peak hour 32 trips.

Sufficient space should be provided on the site to hold all staff vehicles and shuttles, visitors, construction vehicles and delivery vehicles.

The waste material from the site will be loaded directly into the tipper trucks to be moved to the waste sites.

Details of the generated traffic is included in Annexure A: Traffic Data.

3.8 Stakeholder coordination

3.8.1 Eskom and Telkom

Coordination with Eskom and Telkom to be done before construction of Bokpoort II to ensure their infrastructure does not cause a safety risk during the transport of loads exceeding 5.8m (Eskom) and 5.5m (Telkom) in height respectively. The haul routes ((see Figure 4) are along

National Roads which meets the requirements for the transport of heavy and abnormal roads. The Gariep Road, Transnet Road was also used to transport heavy and abnormal loads during the construction of Bokpoort I, and will not posed a constraint.

Should any haul routes (see Figure 4) for the transport of heavy and abnormal loads change, Eskom and Telkom to escort the vehicle to lift overhead lines when necessary.

3.8.2 Road authorities

All heavy load and wide load movements need to be coordinated with SANRAL and the Northern Cape Provincial Authorities and scheduled and the routes of such movements to be publicised in advance.

The developer to confirm if the road-over-rail bridge of the Gariep District Road over the Sishen-Salhanha railway line (Bridge # 5185) has sufficient capacity when transporting abnormal loads for the projects. It has sufficient capacity for standard loads and was used to transport materials and equipment to the existing Eskom substation adjacent to Bokpoort II and for Bokpoort I.

Whilst the aim will be at all times to avoid any damage to the road, the Principle Contractor shall be responsible for any damage to roads, signs etc. caused by the works. Any such damage shall be rectified as soon as practically possible, and in a manner approved by the relevant road authority.

3.8.3 Transnet

Access to Bokpoort II via a private Transnet gravel road, running adjacent to the Sishen-Saldanha railway line. The proposed access to the solar farm will be via the Transnet Road as shown in Figure 1. The developer to meet with Transnet (Head of the Sishen-Saldanha Operations, 083 275 5900) to confirm the continued usage of the Transnet Road for the construction of Bokpoort II. This road was upgraded (widened to 8m and gravelled) during the construction of Bokpoort I and meet the requirements for Bokpoort II. Items to address will include: continued usage of the road, dust suppression, maintenance plan (blading and regravelling during and after construction), access control, etc.

4 OPERATIONAL PHASE

4.1 Staff

The anticipated staff employed during the operational phase include:

- Phase 1: PV1: 10 employees;
- Phase 2: PV2: 10 employees;
- Phase 3: CSP Tower: 21 employees; and
- Fully operational: 41 employees.

It is anticipated that:

- No staff will stay on site during the operational phase;

- 24 hour operations, including 3 shifts of the following number of people per shift:
  - Phase 1: PV1: 4 employees;
  - Phase 2: PV2: 4 employees;
  - Phase 3: CSP Tower: 7 employees; and
  - Fully operational: 15 employees.

4.2 Traffic

Traffic generated by Bokpoort II during the operational phase peak hour is less than 10 vehicles an hour, which includes staff transport, visitors and deliveries.

Transport and traffic will therefore have a very small to negligible impact during the operational phase.

5 DECOMMISIONING PHASE

The design life for the site is 25 years. At completion of the 25 year period, the site might continue to operate, or all the constructed facilities will be demolished and removed to the licenced waste sites, including:

- Holfontein (hazardous waste) (814 km via N8); and
- Local municipality (general waste) at Grobershoop (35km).

The decommissioning phase is not addressed in this report and needs to be addressed before the decommissioning occurs and an appropriate mitigation plan put in place at that time. It is anticipated that traffic generated during the decommissioning phase will be about 60% of the traffic generated during the construction phase over a 6 month period.

6 RISK/IMPACT ASSESSMENT

6.1 Impact Assessment Methodology

The significance of the identified impacts was determined using the approach outlined by the Department of Environmental Affairs and Tourism Guideline document on EIA Regulations, (April 1998). This approach incorporates two aspects for assessing the potential significance of impacts, namely occurrence and severity, which are further sub-divided as follows:

Occurrence:

- Probability of occurrence; and
- Duration of occurrence.

Severity:

- Scale / extent of impact; and
- Magnitude (severity) of impact.

To assess each of these factors for each impact, the following ranking scales are used:

Table 8: Risk Assessment Ranking Scales

Factor	Ranking Scale
Probability of occurrence	5 - Definite/don't know
	4 - Highly probable
	3 - Medium probability
	2 - Low probability
	1 - Improbable
	0 - None
Duration of occurrence	5 - Permanent
	4 - Long-term
	3 - Medium-term (8-15 years)
	2 - Short-term (0-7 years) (impact ceases after the operational life of the activity)
	1 – Immediate
Scale / extent of impact	5 - International
	4 - National
	3 - Regional
	2 - Local
	1 - Site only
	0 - None
Magnitude (severity) of impact	10 - Very high/don't know
	8 - High
	6 - Moderate
	4 - Low
	2 - Minor

Once these factors are ranked for each impact, the significance of the two aspects, occurrence and severity, is assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The impact significance will then be rated as follows:

Significance Points	Rating	Discussion
SP >75	Indicates high environmental significance	An impact which could influence the decision about whether or not to proceed with the project regardless of any possible mitigation.
SP 30 – 75	Indicates moderate environmental significance	An impact or benefit which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.
SP <30	Indicates low environmental significance	Impacts with little real effect and which should not have an influence on or require modification of the project design.
+	Positive impact	An impact that constitutes an improvement over pre-project conditions

6.2 Overview of impact significance

The envisioned impact of the Bokpoort II PV1 plant during the construction phase and operational phase on the surrounding road network includes:

- Deterioration of road network condition;
- Increase in dust;
- Increase in traffic volumes impacting on Level of Service of the infrastructure; and
- Deterioration of road safety conditions.

Table 9: Overview of significance points before implementation of the mitigation measures

Factor	Deterioration of road network condition		Increase in dust, impacting on farms production		Increase in traffic volumes		Deterioration of road safety conditions	
	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph
Probability of occurrence	5	2	5	2	5	2	4	1
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	6	2	6	2	6	2	6	2
Significance points	**50**	**16**	**50**	**16**	**50**	**16**	**40**	**8**

Deterioration of road network condition:

The increase in traffic, and especially in heavy loads cause an increase in deterioration of the road network. The heavy vehicles are unlikely to have a significant impact on the National Road

(N10, N14 and N8) as these roads have been built to high standard to carry heavy loads over a long design period. The surrounding gravel road network (Gariep and transport Roads) have not been designed to carry many repetitions of heavy loads as they cater specifically for local farmers. There is a high possibility that the gravel roads will sustain damage during the construction period. The operational phase will not generate heavy vehicle volumes and the impact will be insignificant.

Increase in dust:

Increase in dust is only applicable to the gravel roads. Dust is generated due to heavy vehicles and high speeds, therefore the impact is more significant during the construction phase than during the operational phase.

Increase in traffic volumes impacting on Level of Service of the infrastructure:

The increase of traffic during the peak hour of between 44 and 46 vehicles will not have a significant impact on the Level of Service of the roads or intersections. It will have very little impact during the operational phase with about 4 trips per hour.

The intersections were analysis over the construction period and for the operational period, including N14/Gariep, Gariep/Transnet, Gariep/N8, N8/N10 intersections. These will all operate at an acceptable LOS for the duration of the construction period and the small amount of traffic generated during the operational phase, does not warrant the upgrade of any of the intersections as it does not impact the LOS of the intersections.

Deterioration of road safety conditions:

Road safety deterioration is due to dust and speeding, causing drivers to lose control on the gravel roads. Due to the upgrade of the Gariep Road for the construction of Bokpoort I, it enable drivers to reach high speeds exceeding the recommended 80km/hr. High speed accidents and fatalities has occurred, including some of the construction staff. The speeds should be controlled by local traffic police.

6.3 Mitigation and Monitoring Measures

From Table 9 above, it can be concluded that all four of the identified environmental impacts is of moderate environmental significance (SP30-75). These are therefore impacts which is sufficiently important to require management and which could have an influence on the decision unless it is mitigated.

The key mitigation and monitoring measures to implement includes:

- The Transnet Road be regravelled (150mm thick over width) before construction of the CSP. Thereafter it should be graded on a monthly basis. The road section adjacent to Bokpoort I to be watered down on a regular basis (at least weekly, depending on the wind direction and rain conditions) to reduce the dust and impact on the mirrors. Alternatively it

could be coordinated with Bokpoort I wrt washing of mirrors. Transnet is also concerned regarding dust on their railway lines. The prevention of dust, maintenance of the gravel road and regravelling of the road to be coordinated with Transnet;

- The section of the Gariep Road between the N8/Gariep Road intersection and the Gariep/Transnet intersection to be paved before construction commence with Bokpoort II. The paving of this road to be coordinated with developers of other solar plants in the area, farmers, Northern Cape Province Roads Department. This will increase the road safety and minimize the dust impact on the farms along this section of the road;
- Speed limit to be managed by Traffic Police on the Gariep Road;
- Construction traffic to follow the route via Upington and avoid using the northern section of the Gariep Road between the N14 and the Transnet Road;
- Onsite accommodation will be provided and transport arranged for the labourers on site, to reduce the traffic volumes using the gravel roads (Gariep Road and Transnet Road).

Table 10: Overview of significance points after implementation of the mitigation measures

Factor	**Deterioration of road network condition**		**Increase in dust, impacting on farms production**		**Increase in traffic volumes**		**Deterioration of road safety conditions**	
	Con. Ph	**Ops.Ph**	**Con. Ph**	**Ops.Ph**	**Con. Ph**	**Ops.Ph**	**Con. Ph**	**Ops.Ph**
Probability of occurrence	3	2	3	2	5	2	3	1
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	4	2	2	2	2	2	4	2
Significance points	**24**	**16**	**18**	**16**	**30**	**16**	**24**	**8**

Table 11: Gariep Road

Section No	Gariep Road
Aspect (of Activity Service or Product)	Gariep gravel road
Potential impact	Improve road quality, reduce speeding, improve road safety
Objectives	Reduce dust, reduce accidents, provide safer road network
Performance Criteria	Limit speeding – no one to exceed the 80km/hr speed limit Four-monthly regravelling Watering of road surface during the dry season to reduce dust
Mitigation measure(s)	Gariep Road between N14 and Transnet Road • Construction vehicles on this section to be restricted; Gariep Road between N8 and Transnet Road • The section of the Gariep Road between the N8/Gariep Road intersection and the Gariep/Transnet intersection to be paved. This will increase the road safety and minimize the dust impact on the farms along this section of the road; Speeding along Gariep Road whole route: • Developer to recommend that contractor's vehicles at site be equipped with tracking systems and that the contractors be obligated to display their vehicle travel logs indicating maximum speed and exceedances of a set threshold (eg 80km/hre along the Gariep Road). This will provide direct control on contractor utilisation of roads and a maximum speed. Penalties to be applied to contractor and his sub-contractors. This to be defined in the contract documentation.
Responsible person / party	Developer
Time-frame	Section paved before start of construction Other factors, ongoing implementation
For Monitoring Purposes only – Successfully Implemented / Corrective action required (To be completed by SHE Manager)	

Table 12: Transnet Road

Section No	Transnet Road
Aspect	Transnet gravel road
Potential impact	Improve road quality, reduce speeding, improve road safety
Objectives	Reduce dust, reduce accidents, provide safer road network
Performance Criteria	Limit speeding – no one to exceed the 60km/hr speed limit Regravel before start of project (150mm thick over width) Monthly blading of road Watering of road surface during the dry season and monitoring of wind direction to reduce dust on Bokpoort I mirrors and Transnet Railway line. Maintenance and rehabilitation to be coordinated with Transnet
Mitigation measure(s)	• The gravel road be graded on a monthly basis and regravelled at the end of the construction period; • Road to be watered during the dry season to reduce dust (typically on a weekly basis, but depending on traffic volumes and wind direction); • Speed limit to be managed by contractor
Responsible person / party	Client

Time-frame	Ongoing implementation
For Monitoring Purposes only – Successfully Implemented / Corrective action required (To be completed by SHE Manager)	

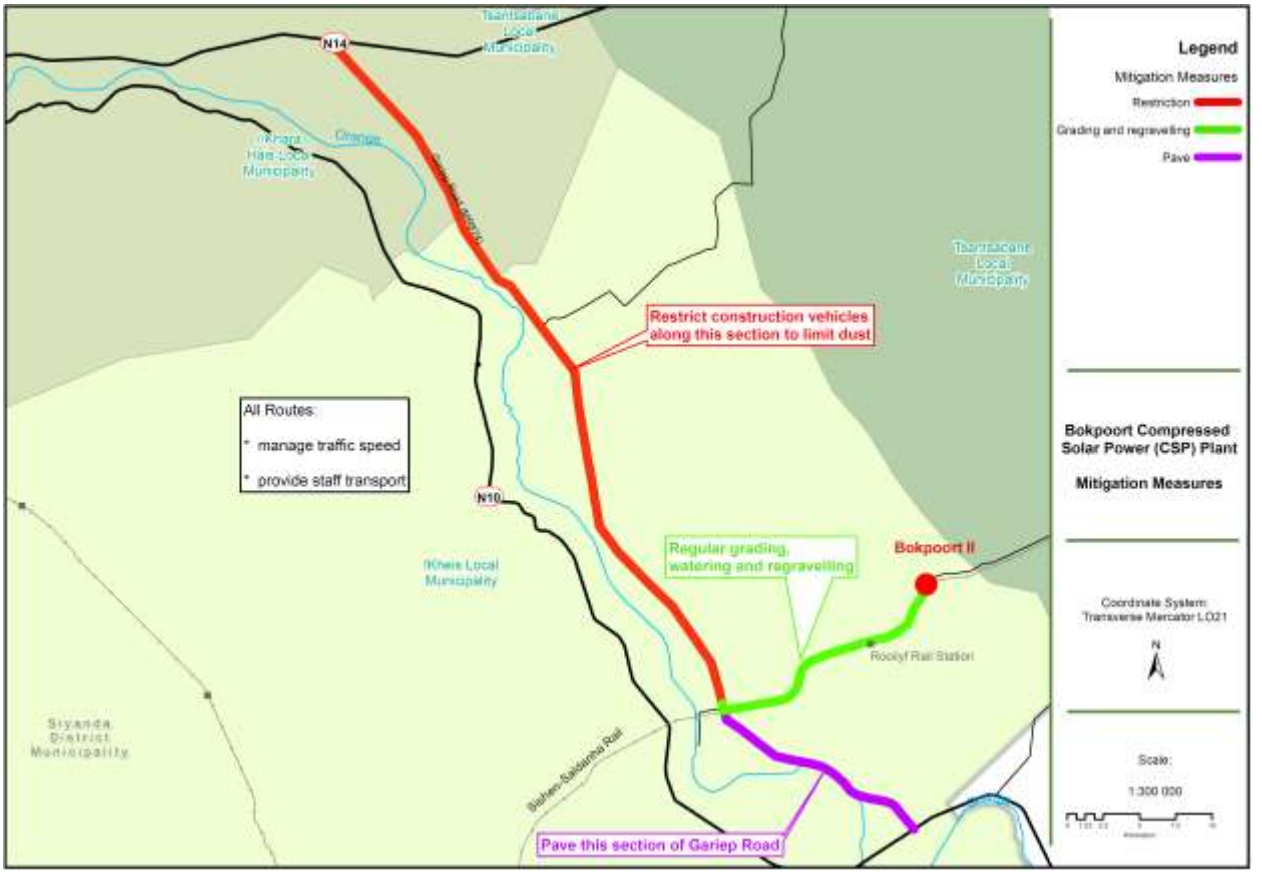

Figure 9: Key mitigation measures

Other housekeeping mitigation measures includes the following

General

- It is important to plan the construction to optimise work efficiency and safety and to minimise traffic and road user congestion, delay and inconvenience.

Construction traffic management

- Provision of clear and early warning of construction vehicles at intersection Gariep/Transnet Roads;

- Access, entry and exit of all construction and material delivery vehicles should be strictly controlled;
- Holding of all construction vehicles to be done on site and sufficient parking to be provided for all staff, visitors, shuttles, public transport, construction and delivery vehicles;
- Vehicles and equipment shall be serviced regularly to avoid the contamination of area from oil and hydraulic fluid leaks etc.;
- Servicing must be done off-site or adhere to environmental requirements.

Access:

- Access of all construction and material delivery vehicles should be strictly controlled and vehicles (type eg private, heavy, number plates, owner etc.) recorded;
- Security gates to entrance of site;
- All access routes (Gariep Road and Transnet Private Road) to be maintained and rehabilitated prior to the Contractor leaving the site;
- Strategic positioning of entry and exit points to ensure as little impact/ effect as possible on the traffic flow; and
- The main routes to the site must be clearly defined and signposted.

Site Housekeeping

- Material deliveries to form part of the contractors overall delivery programme for the site;
- Generally, all contractors associated with the development will be expected to follow a "good housekeeping" policy at all times. This will extend to the responsible use of the road network by contractor vehicles and their staff. The Principle Contractor will ensure this is enforced;
- Vehicle registration forms to be completed before arrival to ensure that site staff are accounted for and vehicles have been checked and been given a site pass;
- Throughout the period of construction, the Province, District and Local Municipalities to be made aware of the name and contact details of the Contractor's Site Foreman that they can communicate with should any matters arise in connection with any aspects of the construction that are affecting the road;
- Trucks carrying debris or excavated and fill materials to be covered with a tarpaulin as necessary.

On-site speed restrictions

- On-site speed restrictions to be imposed for 15 km/h once through the security gate and 40km/hr on the access road to the site (turn-off from the Transnet Road).

7 REFERENCES

Committee of Transport Official (COTO), TMH16, Vol 1, South African Traffic Impact and Site Traffic Assessment Manual, August 2012

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Department of Transport, Parking Standards – Second Edition, Report No. PR 3/85, Pretoria, 1985.

Bokpoort I EIA, Royal Haskoning DHV

South African Road Traffic Signs Manual (SARTSM), 1999

ANNEXURE A: TRAFFIC DATA

Traffic generated by PV1

Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
	In	Out	In	Out	In	Out
Staff	16	4	6	16	31	31
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	4	4	4	4	37	37
Total vehicles	**21**	**9**	**11**	**21**	**78**	**78**

Traffic generated (staff vehicles)

	Pax	Peak day	Pax/ trip	Trips peak hour	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
					In	Out	In	Out	In	Out
Management	5	5	1	5	5	1	2	5	15	15
Other staff by private car	5	5	1.2	5	5	1	2	5	10	10
On site staff (site accommodation)	0	0	n.a. (walk)							
Local labour by staff bus	20	20	35	2	2	1	1	2	2	2
Local labour by minibus taxi	20	20	8	4	4	1	1	4	4	4
Total staff vehicles					**16**	**4**	**6**	**16**	**31**	**31**

Assumptions

Total staff peak period	*50*
Total staff peak day	*50*
Peak day staffing	*100%*
Peak hour trips	*90%*
Management trips per day	*3*
Staff trips per day	*2.2*
AM peak hour trips to site (in)	*85%*
AM peak hour trips from site (out)	*15%*
PM peak hour trips to site (in)	*20%*
PM peak hour trips from site (out)	*80%*

Construction vehicles

	Vehicles per day
Bulk material	12
Containers, equipment	9

Salt	3
Mirrors	8
Other diverse (10% additional)	4
Total	**37**

Assumptions re Concrete Required on Site

Concrete	***m3***
Solar tower	*0*
Tower base	*0*
Heliostat base pads (32 mirrors per heliostat)	*8750*
Other structures	*10000*
Total	***18750***

Assumptions

1x1x1base

280,000 mirrors of 2 x 1m
32 mirrors per heliostat
(64m2)

	Unit weight (kg/m3)	***Ratio***	***m3/m3***	***m3***	***Tonnes***	***Trucks (total)***	***Per day***
Concrete	*2400*			*18750*	*45000*		
Cement	*1440*	*1*	*0.07*	*1313*	*1890*	*86*	*1*
Sand	*1840*	*2.5*	*0.58*	*10875*	*20010*	*910*	*4*
Stone	*2900*	*3*	*0.7*	*13125*	*38063*	*1730*	*7*
Total deliveries per day for concrete							***12***

Assumptions for delivery vehicles

Payload of delivery vehicle (truck)	*22*	*tonnes*
Payload of delivery vehicle (flatbed)	*35*	*tonnes*
Even distribution over construction period (28 months)	*234*	*days*

Assumptions for other materials

Other deliveries	***Assume***	***m3***	***Unit weight (kg/m3)***	***Weight per item (kg)***	***Tonnes***	***Trucks (total)***	***Avg Trucks per day***
Containers for temporary offices, site accommodation, ablution, kitchen	*20*					*20*	*1*
Steel reinforcement (concrete)	*5%*	*938*	*7850*		*7363*	*335*	*2*
Specialist Steel Units (Mirror mounting brackets, trusses, membranes, etc)	*8750*			*1050*	*9188*	*418*	*2*
Foundation ring	*8750*			*394*	*3444*	*157*	*1*
Control equipment for heliostat	*8750*			*128*	*1120*	*51*	*1*
Special equipment (plant, pumps, storage units)							*2*
Salt		*6400*	*2170*		*13888*	*631*	*3*
Mirrors	*280000*	*1630*	*2470*	*2470*	*4026*	*1750*	*8*
Total							***20***

Traffic generated should all project occur simultaneously, including Bokpoort II (PV1, PV2, CSP) and Sanddraai SP

Construction of Bokpoort II and Sanddraai simultaneously Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
	In	Out	In	Out	In	Out
Bokpoort II	55	18	22	55	189	189
Sanddraai	44	1	1	44	115	115
Total vehicles	**99**	**19**	**23**	**99**	**304**	**304**

Bokpoort II: Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
	In	Out	In	Out	In	Out
Bokpoort II: Staff	47	10	14	47	110	110
Ad-hoc delivery and service support vehicles (small)	1	1	1	1	10	10
Construction and delivery vehicles (large)	7	7	7	7	69	69
Total vehicles	**55**	**18**	**22**	**55**	**189**	**189**

Traffic generated (staff vehicles)

	Pax	Peak day	Pax/ trip	Trips peak hour	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
					In	Out	In	Out	In	Out
Management	25	25	1.2	21	19	4	5	19	63	63
Other staff by private car	20	20	1.4	15	14	3	4	14	32	32
On site staff (site accommodation)	200	200	n.a. (walk)							
Local labour by staff bus	140	140	40	5	5	1	2	5	5	5
Local labour by minibus taxi	100	100	12	10	9	2	3	9	10	10
Total staff vehicles					**47**	**10**	**14**	**47**	**110**	**110**

Assumptions

Total staff peak period	*485*
Total staff peak day	*485*
Peak day staffing	*100%*
Peak hour trips	*90%*

Management trips per day	*3*
Staff trips per day	*2.2*
AM peak hour trips to site (in)	*85%*
AM peak hour trips from site (out)	*15%*
PM peak hour trips to site (in)	*20%*
PM peak hour trips from site (out)	*80%*

Construction vehicles

	Vehicles per day
Bulk material	12
Containers, equipment	25
Salt	6
Mirrors	18
Other diverse (10% additional)	7
Total	**69**

Assumptions re Concrete Required on Site

Concrete	***CSP (m3)***	***PV1 (m3)***	***PV2 (m3)***	***Total***
Solar tower	*7 072*	*0*	*0*	*7 072*
Tower base	*2 700*	*0*	*0*	*2 700*
Heliostat base pads (32 mirrors per heliostat)	*2 188*	*8 750*	*8 750*	*19 688*
Other structures	*10 000*	*10 000*	*10 000*	*30 000*
Total	***21 960***	***18 750***	***18 750***	***59 460***

	Unit weight (kg/m3)	***Ratio***	***m3/m3***	***m3***	***Tonnes***	***Trucks (total)***	***Per day***
Concrete	*2 400*			*59 460*	*142 703*		
Cement	*1 440*	*1*	*0.07*	*4 162*	*5 994*	*272*	*1*
Sand	*1 840*	*2.5*	*0.58*	*34 487*	*63 455*	*2 884*	*4*
Stone	*2 900*	*3*	*0.70*	*41 622*	*120 703*	*5 486*	*8*
Total deliveries per day for concrete							*12*

Assumptions for delivery vehicles

Payload of delivery vehicle (truck)	*22*	*tonnes*
Payload of delivery vehicle (flatbed)	*35*	*tonnes*
Even distribution over construction period (28 months)	*728*	*days*

Assumptions for other materials

Other deliveries	***CSP 1***	***PV1***	***PV2***	***Avg Trucks per day***
Containers for temporary offices, site accommodation, ablution, kitchen	*1*	*1*	*1*	*3*
Steel reinforcement (concrete)	*1*	*2*	*2*	*5*
Specialist Steel Units (Mirror mounting brackets, trusses, membranes, etc)	*1*	*2*	*2*	*5*
Foundation ring	*1*	*1*	*1*	*3*
Control equipment for heliostat	*1*	*1*	*1*	*3*
Special equipment (plant, pumps, storage units)	*2*	*2*	*2*	*6*
Salt	*0*	*3*	*3*	*6*
Mirrors	*2*	*8*	*8*	*18*
Total				***49***

ANNEXURE B: COMBINED TRANSPORT IMPACT OF MULTIPLE PROJECTS OCCURRING SIMULTANEOUSLY

Overview

This section investigates the impact should Bokpoort II be constructed in one phase, simultaneously with the adjacent Sanddraai Solar Plant.

The proposed Bokpoort II project will consist of three facilities, including two 75 Mega Watt (MW) photovoltaic (PV) facilities and one 150 MW Concentrated Solar Power (CSP) Tower facility. The proposed Sanddraai Solar Power Plan which will also generate 300 MW.

Construction period

The construction of Bokpoort II will occur in one phases over a 28 month construction period:

- CSP Tower: 28 month construction period;
- PV1: 9 months construction period; and
- PV2: 9 months construction period.

Sanddraai will be constructed in 34 months. It is assumed that construction of both Sanddraai and Bokpoort II will commence 15 January 2018.

Construction will be carried out during the daytime only (07h00 to 18h00) from Monday to Saturday.

The combined traffic impact, should all of the above projects occur simultaneously is included in **Annexure B**.

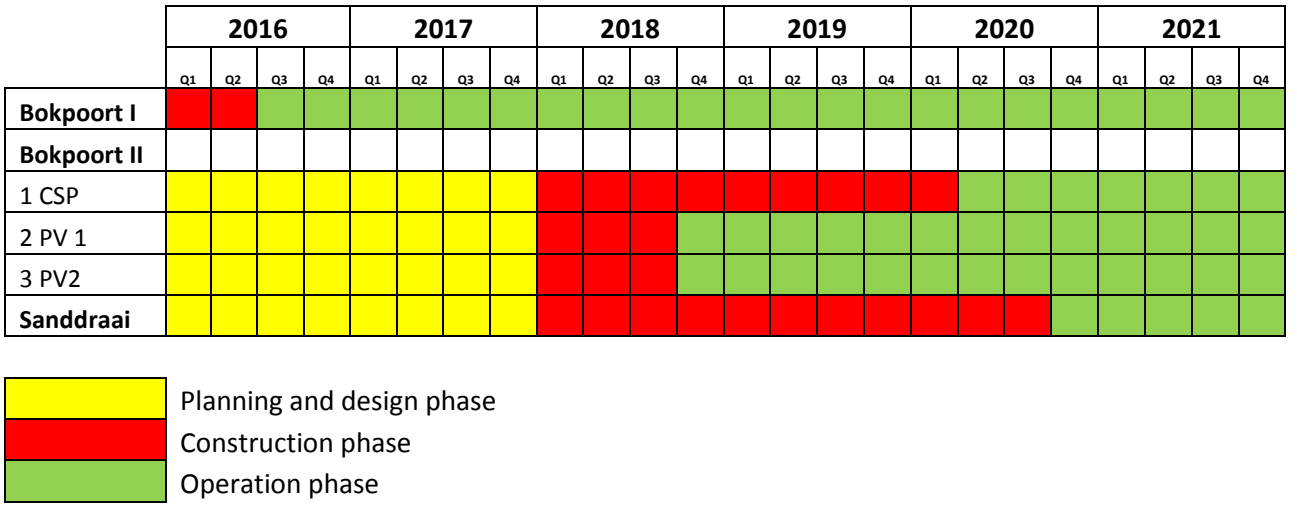

Figure B1: Construction program for the various projects

Access

The proposed access to the two solar power sites is shown in Figure B2 below.

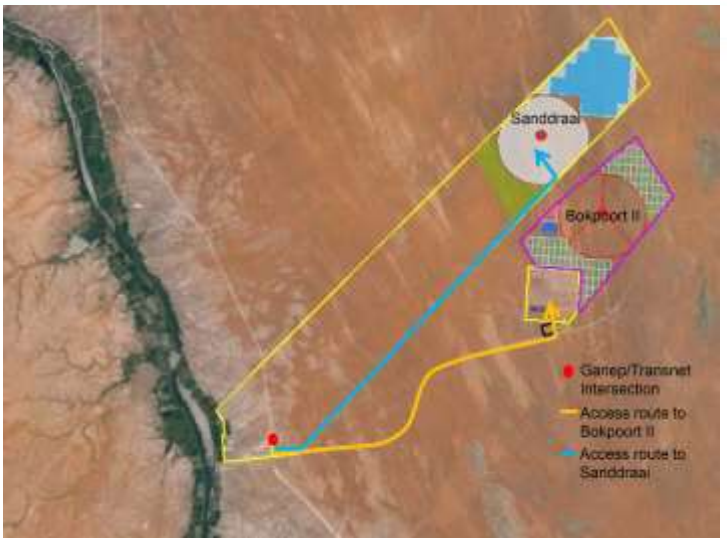

Figure B2: Access to Bokpoort II and Sanddraai

Construction traffic generated

The construction traffic generated are included in Annexure A and summarised below.

Table B1: Total Typical Daily Traffic Generated (Staff and Construction vehicles)

	Morning (AM) Peak hour		Afternoon (PM) Peak hour		Daily	
	In	**Out**	**In**	**Out**	**In**	**Out**
Bokpoort II	55	18	22	55	189	189
Sanddraai	44	1	1	44	115	115
Total vehicles	**99**	**19**	**23**	**99**	**304**	**304**

The combined sites generate 118 vehicles in the morning peak hour and 122 vehicles in the afternoon peak hour.

A SIDRA 6.1 intersection analysis was done of the Gariep Road/Transnet Road intersection to confirm the Level or Service should both plants be constructed simultaneously. The intersection will operate at an acceptable LOS for the duration of the construction period (2018 to 2021) for both the morning and afternoon peak hour.

Risk/Impact Assessment

The envisioned impact of the Bokpoort II CSP, PV1, PV2 and Sanddraai Solarplant during the construction phase and operational phase on the surrounding road network includes the same factors as for the CSP, including:

- Deterioration of road network condition;
- Increase in dust;
- Increase in traffic volumes impacting on Level of Service of the infrastructure; and
- Deterioration of road safety conditions.

The significance points will remain the same as the probability of occurrence is similar, the duration of the event is in the same order, the extent of the impact remains local and the magnitude is of similar extent.

Table B2: Overview of significance points before implementation of the mitigation measures

Factor	Deterioration of road network condition		Increase in dust, impacting on farms production		Increase in traffic volumes		Deterioration of road safety conditions	
	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph
Probability of occurrence	5	2	5	2	5	2	4	1
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	6	2	6	2	6	2	6	2
Significance points	**50**	**16**	**50**	**16**	**50**	**16**	**40**	**8**

The key mitigation and monitoring measures to implement remains:

- The Transnet Road be regravelled (150mm thick over width) before construction of the CSP. Thereafter it should be graded on a monthly basis. The road section adjacent to Bokpoort I to be watered down on a regular basis (at least weekly, depending on the wind direction and rain conditions) to reduce the dust and impact on the mirrors. Alternatively it could be coordinated with Bokpoort I wrt washing of mirrors. Transnet is also concerned regarding dust on their railway lines. The prevention of dust, maintenance of the gravel road and regravelling of the road to be coordinated with Transnet;
- The section of the Gariep Road between the N8/Gariep Road intersection and the Gariep/Transnet intersection to be paved before construction commence with Bokpoort II. The paving of this road to be coordinated with developers of other solar plants in the area, farmers, Northern Cape Province Roads Department. This will increase the road safety and minimize the dust impact on the farms along this section of the road;
- Speed limit to be managed by Traffic Police on the Gariep Road;
- Construction traffic to follow the route via Upington and avoid using the northern section of the Gariep Road between the N14 and the Transnet Road;

- Onsite accommodation will be provided and transport arranged for the labourers on site, to reduce the traffic volumes using the gravel roads (Gariep Road and Transnet Road).

Table B3: Overview of significance points after implementation of the mitigation measures

Factor	Deterioration of road network condition		Increase in dust, impacting on farms production		Increase in traffic volumes		Deterioration of road safety conditions	
	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph	Con. Ph	Ops.Ph
Probability of occurrence	3	2	3	2	5	2	3	1
Duration of occurrence	2	4	2	4	2	4	2	4
Scale / extent of impact	2	2	2	2	2	2	2	2
Magnitude (severity) of impact	4	2	2	2	2	2	4	2
Significance points	**24**	**16**	**18**	**16**	**30**	**16**	**24**	**8**

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	14/12/16/3/3/2/881
NEAS Reference Number:	DEAT/EIA
Date Received:	

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, 2010; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 718, 2009

PROJECT TITLE

Proposed 75 MW Photovoltaic Development (PV1) on the Remaining Extent of the Farm Bokpoort 390 near Groblershoop in the !Kheis Local Municipalitly, Northern Cape.

Specialist:	Traffic Engineer		
Contact person:	Leonie van Wyk		
Postal address:	PO Box 25302, Monument Park, Pretoria		
Postal code:	0105	Cell:	0835543399
Telephone:	0123675800	Fax:	0123478378
E-mail:	Leonie.vanwyk@rhdhv.com		
Professional affiliation(s) (if any)	ECSA		

Project Consultant:	**Golder Associated Africa (Pty) Ltd**		
Contact person:	**Marié Schlechter**		
Postal address:	**P.O. Box 6001, Halfway House**		
Postal code:	**1685**	Cell:	**082 320 8150**
Telephone:	**011 254 4800**	Fax:	**086 582 1561**
E-mail:	**mschlechter@golder.co.za**		

4.2 The specialist appointed in terms of the Regulations_

I,Leonie van Wyk 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 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Royal HaskoningDHV

Name of company (if applicable):

12 May 2016

Date: