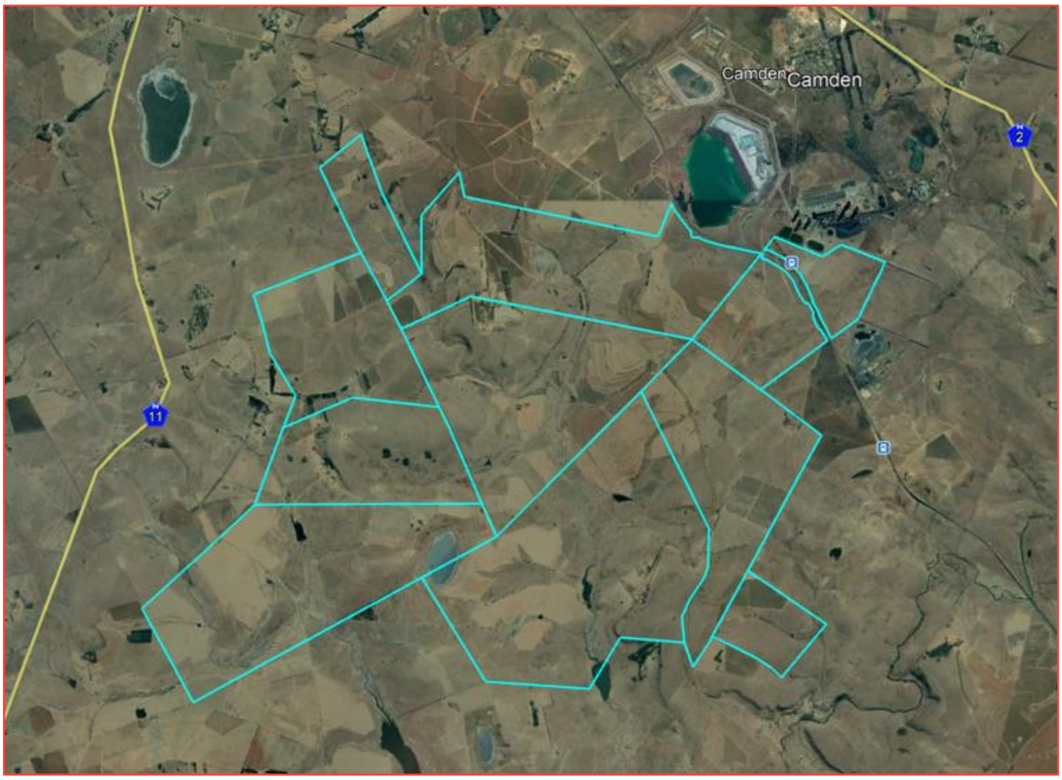
ENERTRAG SOUTH AFRICA

CAMDEN I WIND & SOLAR ENERGY, GREEN HYDROGEN & AMMONIA MANUFACTURING FACILITY, MPUMALANGA

TRANSPORT IMPACT ASSESSMENT

28 JUNE 2022

DRAFT



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PROJECT NO.: 41103247-CAMDEN I TIA
DATE: JUNE 2022

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Our ref.: 41103247-CAMDEN I TIA

28 June 2022

DRAFT

Ashlea Strong
WSP Environment

Dear Madam:

Subject: Camden I WEF/Solar/Green hydrogen & ammonia Facility: Transport Impact Assessment

Please find attached herewith the revised TIA for your review.

Yours sincerely,

Christo Bredenhann
Associate: Transport Planning

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Signature				
Checked by	Wayne Petersen Pr Eng	Wayne Petersen Pr Eng		
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SIGNATURES

PREPARED BY

Christo Bredenhann, Associate

REVIEWED BY

Wayne Petersen, Director

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PRODUCTION TEAM

CLIENT

WSP Environment & Energy on behalf of ENERTRAG SOUTH AFRICA	Ashlea Strong

WSP

Project Director	Wayne Petersen *Pr. Eng*
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SUBCONSULTANTS

N/a

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1 INTRODUCTION

1.1 BACKGROUND

WSP Group Africa (Pty) Ltd (WSP) has been appointed by Enertrag South Africa, via Camden I Wind (RF) Pty Ltd, Camden I Solar (RF) Pty Ltd and Camden Green Energy (RF) Pty Ltd SPVs respectively, to undertake a Transport Impact Assessment (TIA) of the proposed Camden I Wind Energy, Solar PV Energy and Green Hydrogen and Ammonia Facilities, to be located near Camden in Mpumalanga Province.

The Camden I facility, along with the Camden II Wind Energy Facility (WEF) will form part of the Camden Renewable Energy Complex.

This report assesses the expected transport related impacts of the facility during the construction, operation and potential subsequent decommissioning phases. The purpose of this report is to consider the transport impact that the facility will have on the surrounding road network and environment, and to propose mitigating measures to address these impacts, where required.

1.1 SCOPE

The Scope of the TIA is broadly based on the requirements of the South Africa Committee of Transport Officials, South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Vol. 1, Version 1, August 2012. Note that a full TIA including traffic surveys and capacity analysis of affected intersections is excluded.

The scope covers the following:

- Previous traffic related studies, submissions and approvals (if relevant).
- Description of the extent of the development, including location and land-use/s.
- Description of the phased development of the facility (if applicable).
- Record of site visits.
- Description of the local and potentially affected road network, including planning and comment on the road condition, where information is available.
- Assessment of the required site access, parking and internal circulation.
- Assessment of expected trip generation (construction & operational phases).
- Assessment of public transport and non-motorised transport needs
- Recommendations and conclusions with regards to the required traffic and transport related mitigation required.
- Assessment of the transport related environmental impacts and proposed mitigation required.
- Description of latent development in the vicinity of the facility that may also have an impact on the local road network.
- Assessment of the cumulative transportation impact of the latent developments in the study area.

Note that a Traffic Impact Assessment of the associated electrical grid infrastructure has been excluded from this study, as it does not require assessment. The reason for this is that the expected trip generation to construct this infrastructure will be negligible, and the traffic related impact will therefore be negligible.

1.2 PREVIOUS SUBMISSIONS

No prior TIA's has been undertaken for this facility.

1.3 TYPE AND EXTENT OF THE DEVELOPMENT

CAMDEN I WIND ENERGY FACILITY

A summary of the details of the Wind Energy Facility (WEF) and associated infrastructure is included in Table 1-1.

Table 1-1: Technical details of the Camden I WEF & associated Infrastructure

Facility Name	Camden I Wind Energy Facility
Applicant	Camden I Wind Energy Facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Extent	6000 ha
Buildable area	Approximately 200 ha, subject to finalization based on technical and environmental requirements
Capacity	Up to 200MW
Number of turbines	Up to 37
Turbine hub height:	Up to 200m
Rotor Diameter:	Up to 200m
Foundation	• Concrete foundations of approximately of 25m diameter x 4.5m deep required per turbine. • Dimensions may vary as required by the geotechnical conditions. • +/- 2500m³ concrete per foundation. • Concrete foundation will be constructed to support a mounting ring. • Excavation approximately 1000m², in sandy soils due to access requirements and safe slop stability requirements.
Operations & maintenance building footprint:	Located near the substation. Septic/conservancy tanks (operational phase) with portable toilets for construction phase. Typical areas include: - Operations building – 20m x 10m = 200m² - Workshop – 15m x 10m = 150m² - Stores - 15m x 10m = 150m²
Construction camp laydown	Typical area 100m x 50m = 5000m². Sewage: Septic/conservancy tanks and portable toilets
Temporary laydown or staging area:	Typical area 220m x 100m = 22 000m². Laydown area could increase to 30 000m² for concrete towers, should they be required.
Cement batching plant (temporary):	Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo.
Internal Roads:	Width of internal road – Between 5m and 6m.

	Where required for turning circle/bypass areas, access or internal roads may be up to 20m wide to allow for larger component transport. Length of internal roads – Approximately 60km.
Cables:	The medium voltage collector system will comprise of cables up to and include 33kV that run underground, except where a technical assessment suggest that overhead lines are required, in the facility connecting the turbines to the onsite substation.
IPP site substation and battery energy storage system (BESS):	Total footprint will be up to 6.5ha in extent (5ha for the BESS and 1.5ha for the IPP portion of the substation). The substation will consist of a high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, and other substation components as required. The associated BESS storage capacity will be up to 200MW/800MWh with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology however the specific technology will only be determined following EPC procurement. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.

CAMDEN SOLAR PV FACILITY

A summary of the details of the solar PV facility and associated infrastructure is included in Table 1-2.

Table 1-2: Technical details of the Camden I Solar PV Energy Facility & associated Infrastructure

Facility Name	Camden I Solar Energy Facility
Applicant	Camden I Solar Energy Facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Extent	~705 ha
Buildable area	Approximately 280 ha
Capacity	Up to 100MW
Power system technology	Solar PV
Operations & maintenance building footprint:	Located near the substation. Septic/conservancy tanks (operational phase) with portable toilets for construction phase. Typical areas include: - Operations building – 20m x 10m = 200m² - Workshop – 15m x 10m = 150m² - Stores - 15m x 10m = 150m²
Construction camp laydown	Typical area 100m x 50m = 5000m².

	Typical laydown area 100m x 200m = 20,000m². Sewage: Septic/conservancy tanks and portable toilets
Cement batching plant (temporary):	Gravel and sand will be stored in separate heaps whilst the cement will be contained in a silo. The footprint will be around 0.5ha Maximum height of the silo will be 20m
Internal Roads:	Width of internal roads – Between 4mand 5m, up to 6m around vertical curves Length of internal roads – Approximately 8km.
Cables:	Communication, AC and DC cables.
IPP site substation and battery energy storage system (BESS):	Total footprint will be up to 6.5ha in extent (5ha for the BESS and 1.5ha for the IPP portion of the substation). The substation will consist of a high voltage substation yard to allow for multiple (up to) 132kV feeder bays and transformers, control building, telecommunication infrastructure, access roads, etc. The associated BESS storage capacity will be up to 100MW/400MWh with up to four hours of storage. It is proposed that Lithium Battery Technologies, such as Lithium Iron Phosphate, Lithium Nickel Manganese Cobalt oxides or Vanadium Redox flow technologies will be considered as the preferred battery technology. The main components of the BESS include the batteries, power conversion system and transformer which will all be stored in various rows of containers.

CAMDEN I GREEN HYDROGEN AND AMMONIA PRODUCTION FACILITY

Camden Green Energy RF (Pty) Ltd, a special purpose vehicle (“SPV”), has been established for the sole purpose of developing, owning, and operating a green hydrogen and ammonia facility (the facility). The footprint of the proposed Camden facility will be ~ 25 ha. Two alternative site options, Alternative 1 and 2 have been identified. Alternative 1 is located on Farm 322/2 Welgelegen. Alternative 2 is located on Farm 322/1 Welgelegen. The site of the hydrogen facility is still to be determined, as it is highly dependent on the location of the Camden I main site substation.

“Green” hydrogen and ammonia production differs from traditional production technologies in that the process relies exclusively on renewable resources (renewable energy) and for input air and water (feedstock), to produce commercially usable green hydrogen and ammonia. The only solid waste stream is the production of brine from the water treatment plant. Ammonia spillages may occur however these will be accidental and mitigation measures will be developed and implemented.

A gaseous ‘waste’ is oxygen generated from the electrolyses process. Another source of gaseous ‘wastes’ is from the Air Separation Unit. This is where nitrogen is removed from the air and the other natural gases are expelled back to the environment.

The details of the production process and various components of the site is described at length in the EIA. Refer to Table 1-3 for the facility summary.

Table 1-3: Technical details of the Camden I Green Hydrogen & Ammonia facility

Facility Name	Camden Green Hydrogen & Ammonia facility
Applicant	Camden I Green Hydrogen & Ammonia facility (RF) Propriety Limited
Municipalities	Msukaligwa Local Municipality of the Gert Sibande District Municipality
Footprint	Up to 25 ha

1.4 PHASING OF THE DEVELOPMENT

For the purpose of the impact assessment, it was assumed that the facilities will be developed in a simultaneous, single phase with an estimated construction period of 2 years as follows:

- Camden I Wind Energy Facility – 24 months construction
- Camden I Solar PV Facility – 18 months construction
- Camden I Green hydrogen and ammonia production facility – 24 months construction

1.5 APPROVAL OF SUBMISSIONS

This report will be subject to approval from the relevant authorities and will be submitted as part of the Environmental Impact Assessment process.

2 DATA COLLECTION

2.1 SITE VISITS

Site visits were undertaken by WSP staff to assess the local road network and vehicle accesses intersections along the primary road network. No other specific transport related site visits were required.

2.2 ROAD NETWORK & MASTER PLANNING

There are no known local, provincial or national roads planned in the vicinity of the site or the greater study area that will be impacted by the WEF, Solar PV, green Hydrogen and Ammonia Facilities or vice-versa.

2.3 LATENT DEVELOPMENTS

Refer to Section 8: Cumulative Transport Impact Assessment.

3 SITE LOCATION & SURROUNDING ROAD NETWORK

3.1 SITE LOCATION

The Camden I facilities will be located approximately 6km west of Camden, and 12km south of Ermelo in Msukaligwa Local Municipality of the Gert Sibande District Municipality in Mpumalanga.

The facilities will be located on the following farm portions:

— An up to200 MW (Maximum) Wind Energy Facility
  - Klipfontein 442 IS (Portion 0, 1 and 3)
  - Welgelegen 322 IT (Portion 1 and 2)
  - Uitkomst 292 IT (Portion 2 and 10)
  - Langverwacht 293 IT (Portion 3)
  - Mooiplaats 290 IT (Portion 14)

  Klipbank 295 IT (Portion 3)

— An up to 100MW Solar PV facility
  - Portion 1 of Welgelegen Farm No. 322

— A green hydrogen and ammonia production facility.
  - Camden Power Station 329 IT (Portion 0)
  - Uitkomst 292 IT (Portion 2)
  - Mooiplaats 290 IT (Portion 14 and 20)
  - Welgelegen 322 IT (Portion 1 and 2)

Refer to Figure 3-1 for the locality map, Figure 3-2 for the aerial image of the farm portions and Figure 3-3 for the proposed wind turbine, solar and green hydrogen and ammonia facility locations.

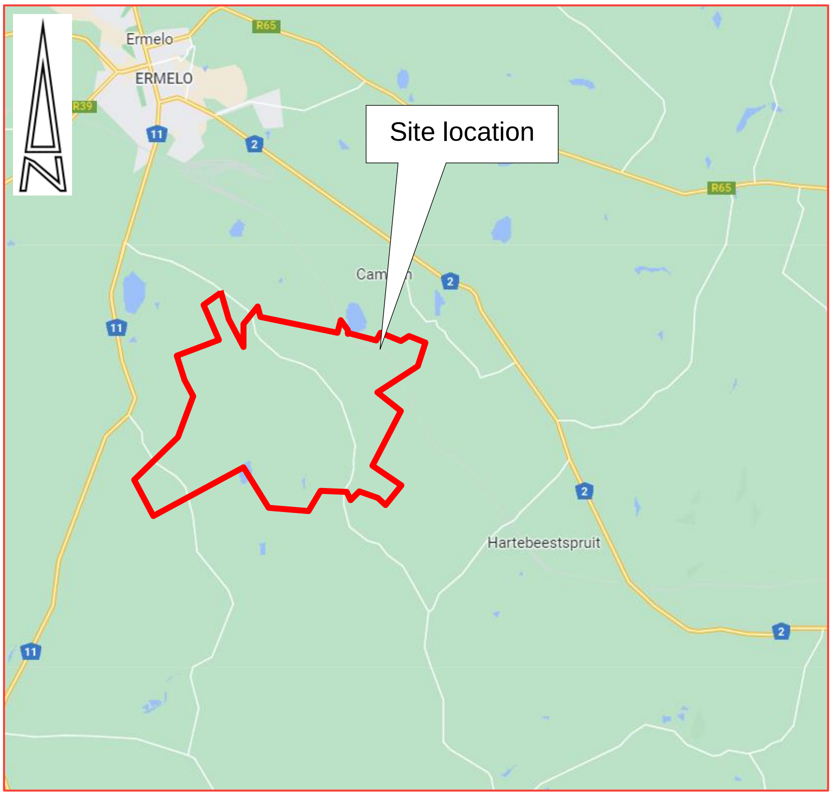

Figure 3-1 Locality map of the broader Camden I project site (within which is contained the WEF, solar PV and hydrogen & ammonia facilities)

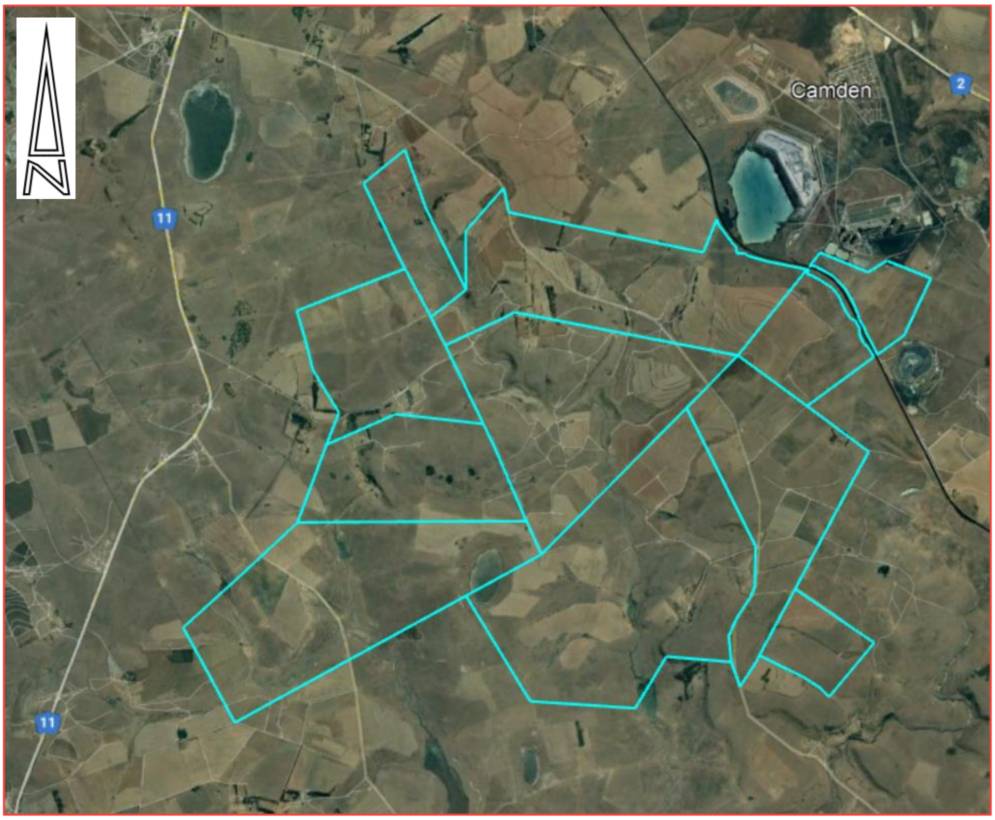

Figure 3-2 Site aerial image and cadastrals of the farm portions

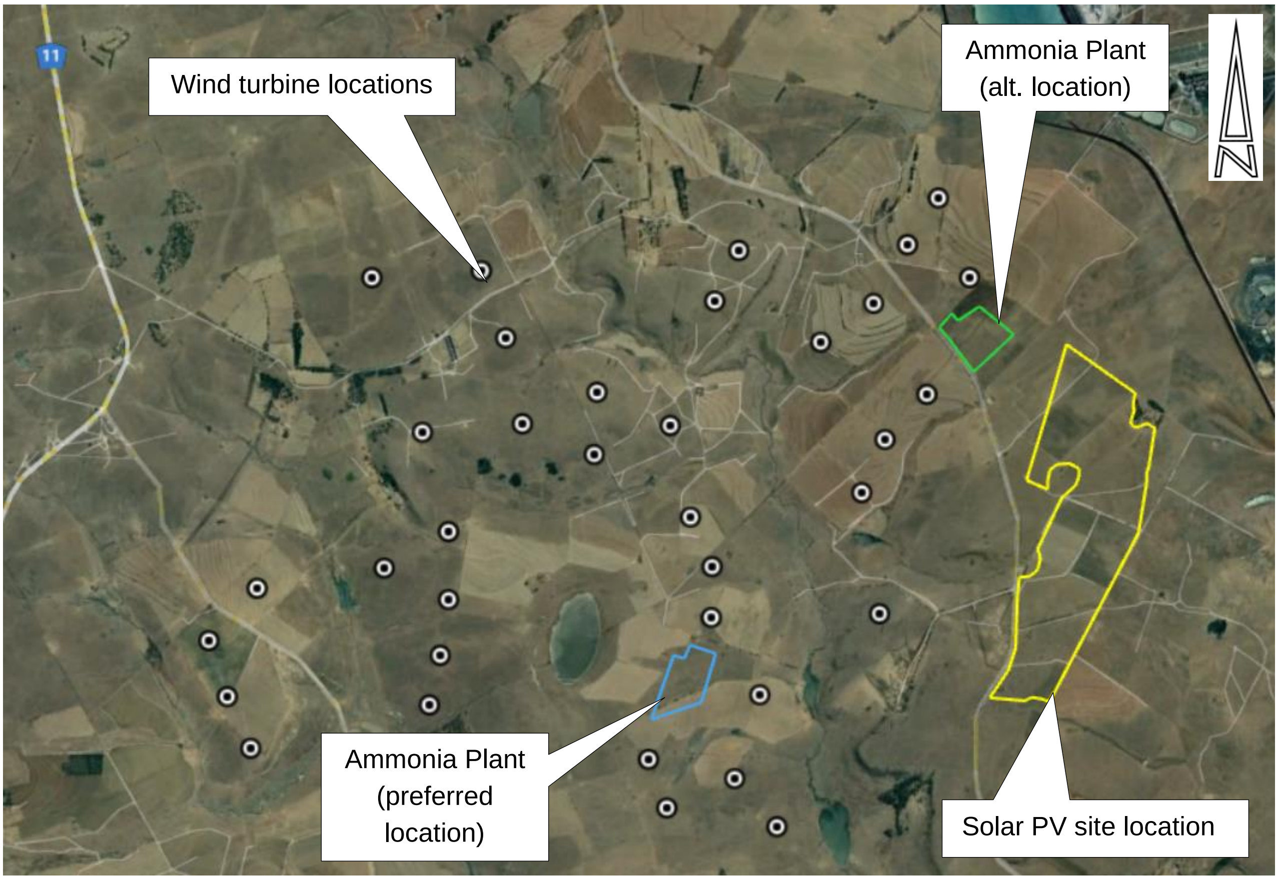

Figure 3-3 WEF wind turbine, solar PV and hydrogen/ammonia plant locations

3.2 ROAD NETWORK DESCRIPTION

The respective Camden I facilities will be located south-west Camden and National Road N2, and to the west of National Road N11.

- The N2 is the primary road link between Ermelo and Richards Bay and south to Durban. In the vicinity of the site, the N2 is a single carriageway with 1 lane per direction and gravel shoulders.
- The N11 is the primary road link between Ladysmith and Newcastle in Kwa-Zulu-Natal, through Ermelo to Middelburg and beyond. In the vicinity of the site, the N11 is a single carriageway with 1 lane per direction and gravel shoulders.

The site area is traversed by two district roads, refer to Figure 3-4 for the alignment of these roads as shown on the Mpumalanga Road network map:

- The D260 is a district collector from the N11 and follows a roughly southerly alignment beyond its intersection with the D1264. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11.
- The D1107 is a district collector between the N11 and Road D1329/D261. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N11.

In addition, the D1264 is a district collector between the D260 and the N2, located to the south of the site. It is a single carriageway 2-way unsurfaced road (1 lane per direction), with no shoulders. It has a priority Stop controlled T-junction on the N2, and a grade separated crossing (road over rail), over the main railway line between Mpumalanga and Richards Bay.

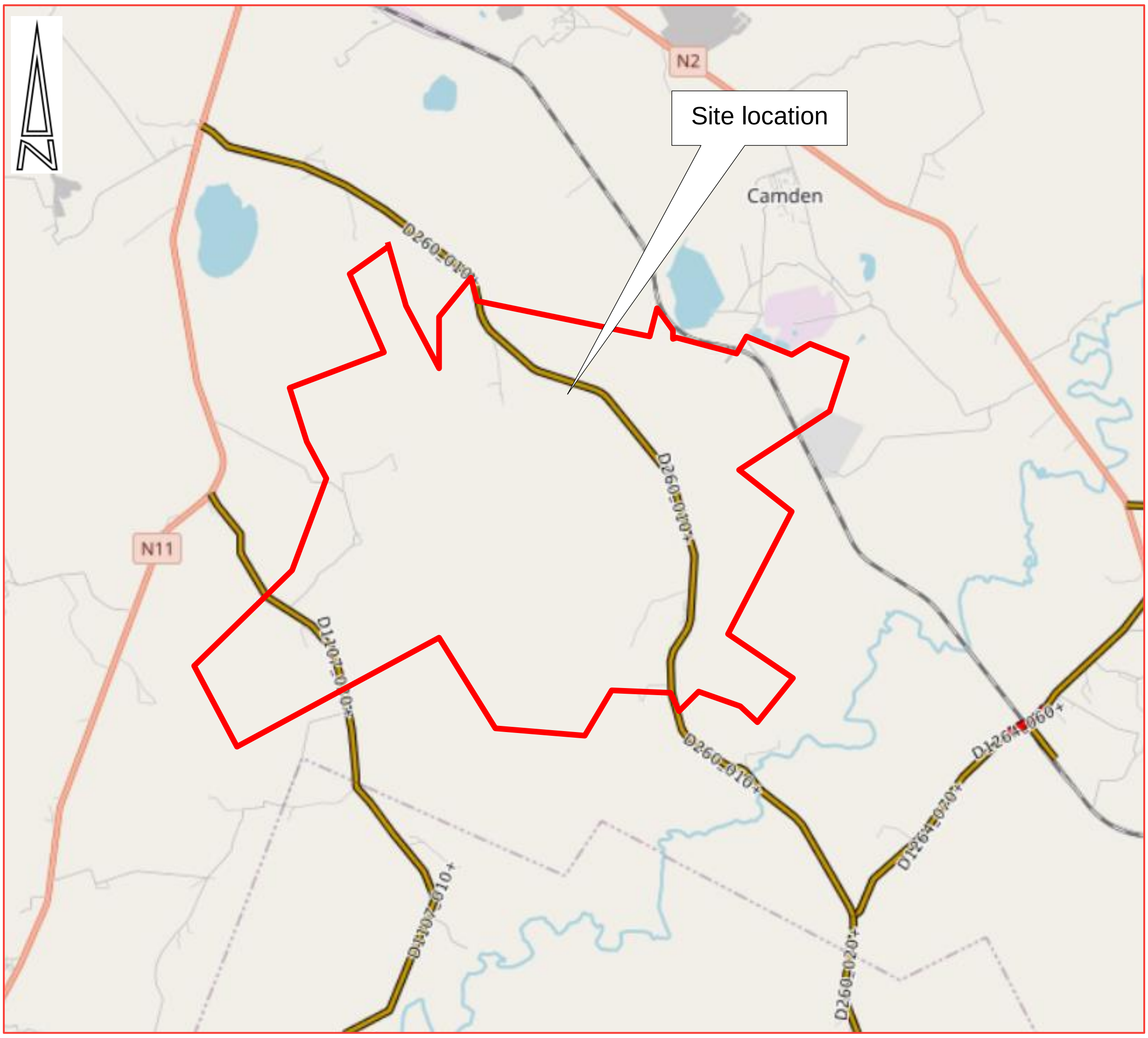

Figure 3-4 Mpumalanga Province road network

Source: Mpumalanga Road Assess Management - http://mp-rams.co.za/rams/rams.html

3.3 SITE ACCESS

It is recommended that access to the respective Camden I facilities for the construction and operation phase be obtained via either the D260 or D1107 off the N11 or the D1264 off the N2. Refer to Figure 3-5. These routes have accesses to the Class 1 National road network. The use of these roads and accesses off the national roads will not require an application for temporary or permanent access of the National roads.

If an alternate access off the National roads is required for the construction and/or operational phases, the access location/s will require assessment in terms of sight distance, topography, access geometry and overall safety and suitability. This assessment will require a formal access application and approval from SANRAL.

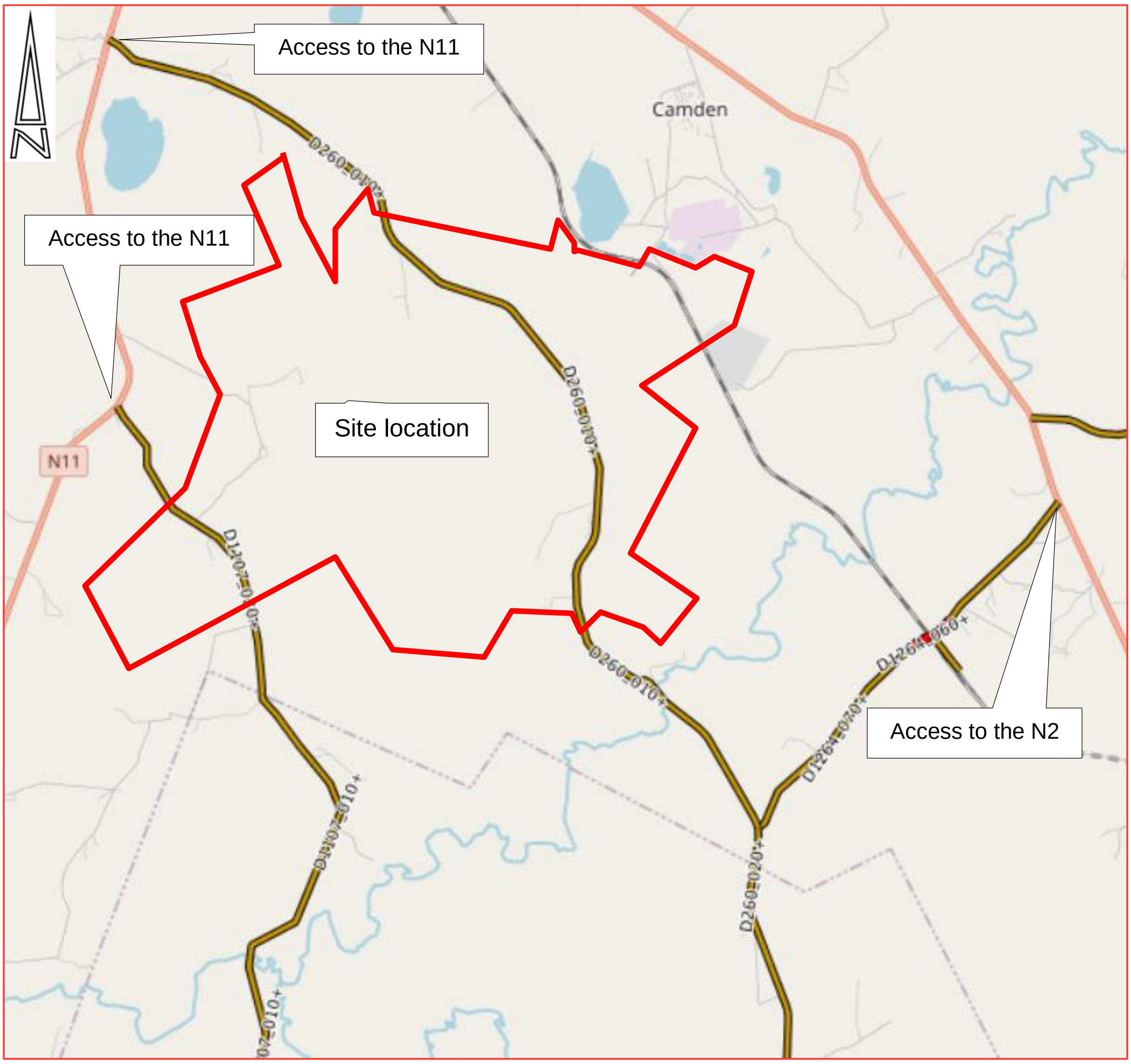

Figure 3-5 Potential site accesses

3.4 INTERNAL SITE ACCESS ROADS

The internal access roads are shown in Figure 3-6. These roads will take direct access off the D1107 and D260 at T-junctions and 4-way crossings. Due to the low construction and operation traffic volumes, these intersections are expected to operate far below capacity. No additional analysis is therefore required.

The expected traffic increase on the district roads during the construction phase may result in deterioration of the roads, as they are not designed for abnormal loads. The cost of maintaining and repairing these gravel roads during the construction phase should be borne by the developer.

The expected traffic increase on the district roads during the operation phase is substantial, refer to Section 6.3.2.

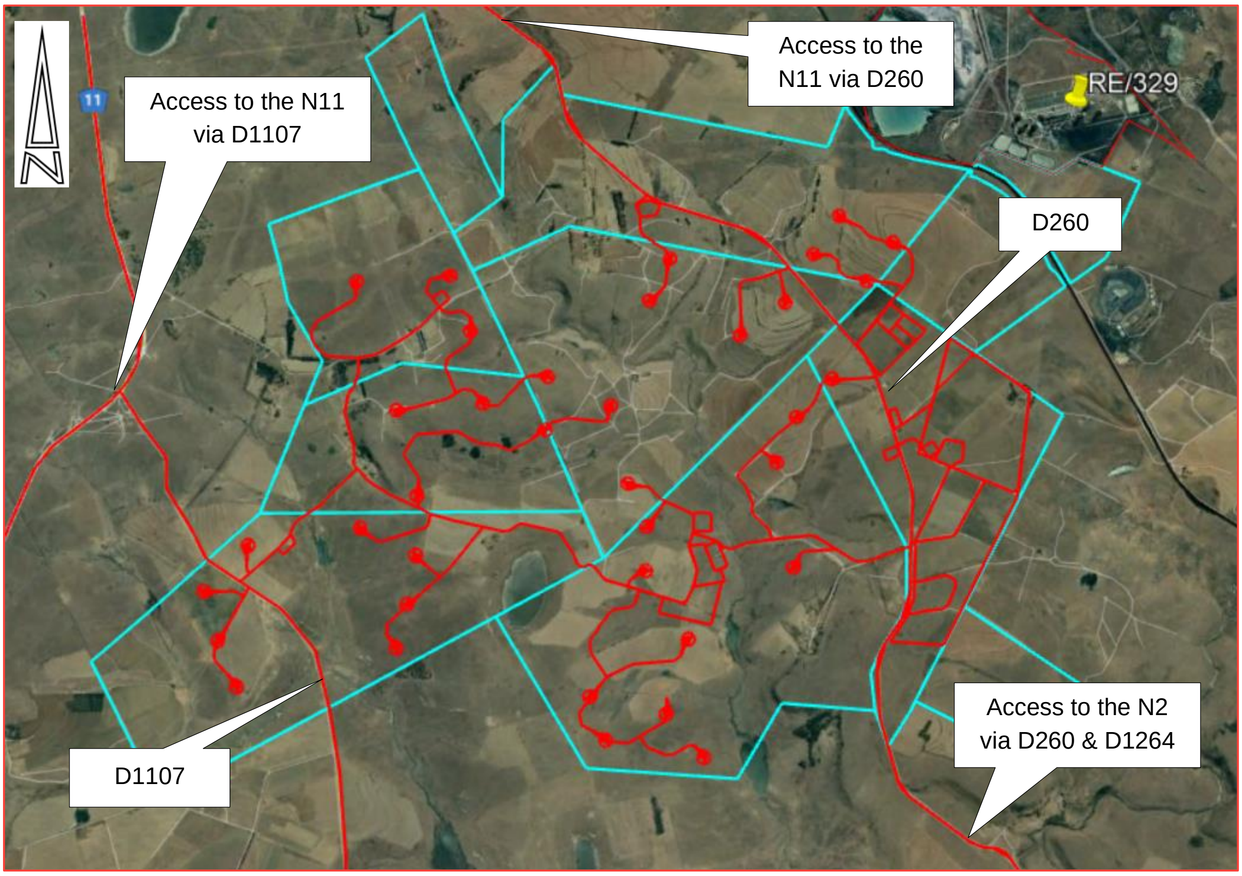

Figure 3-6 Proposed internal access roads to the various facilities

4 PARKING ASSESSMENT

The proposed on-site parking provision will be limited to the following:

- Construction phase – temporary parking for construction staff and construction deliveries.
- Operational phase – parking for operational & maintenance staff vehicles.

All parking will be accommodated on-site.

5 PUBLIC & NON-MOTORISED TRANSPORT ASSESSMENT

In terms of the National Land Transport Transition Act (NLTTA) 22 of 2000, section 29, it is a requirement that an assessment of public and non-motorised transport be included in a transport impact assessment.

Due to the remote location of the site on private farms, public access will not be allowed or required during the construction or operational phases of the project. There is therefore no need for public transport or non-motorised transport infrastructure.

There will be a need for limited public transport services for staff during the construction phase, refer to Section 6. These services can be provided by local operators from Ermelo or other local towns, if required.

6 TRAFFIC FLOWS & TRIP GENERATION

6.1 EXISTING TRAFFIC FLOWS

The existing traffic volumes on the National and District roads were not surveyed, as it falls outside the scope of work and is not required.

6.2 LATENT TRAFFIC

Refer to Section 8: Cumulative Transport Impact Assessment.

6.3 DEVELOPMENT TRIP GENERATION

The South African Trip Data Manual (TMH17) does not contain estimates for expected trip generation of a wind or solar energy facility, or the construction of an ammonia production plant. The following sections estimates the expected trip generation from Client provided information.

6.3.1 CONSTRUCTION PHASE TRAFFIC

WEF FACILITY

The construction phase of the WEF facility will generate notable traffic volumes that requires assessment. Construction traffic will include vehicles for material and component deliveries, construction staff and all other associated personnel. Trips will include the delivery of over-sized components such as the rotor blades, mast sections and generators.

The route/s between the origin of the material and components and the facility may be National, Provincial or Local roads, and each authority will be required to provide the necessary permits for the transportation of any oversized or weight components.

The construction phase traffic was estimated based on the assumptions listed per traffic type below.

<u>Construction staff transport for the WEF</u>

- An estimated construction period of 24 months, with a variable number of staff required depending on the construction phase.
- An absolute maximum of 250 workers could be on-site during the peak construction period, however the conservative estimate is 100 to 150 personnel. The maximum number was used for calculation purposes.
- Workers will not be accommodated on-site.
- 90% of the work force (unskilled and semi-skilled workers) is expected to utilise public transport to site from neighbouring towns, most notably Ermelo which is located approximately 30km away.

- It is unlikely that bus transport will be available, therefore all public transport trips will be via minibus taxi, with an average 16 person per vehicle occupancy.
- Staff will not utilise non-motorised transport (NMT), such as cycling or walking to site due to the excessive distances to the closest towns.
- 10% of the work force is expected to travel to site by private car, with an average occupancy of 1.5 persons.
- It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and again depart during the AM and PM peaks.

Refer to Table 6.1 for the maximum trip generation for the construction staff for the WEF facility.

Table 6-1: Total peak hour trip generation – WEF construction staff

Staff type	***Total persons per day***		
Unskilled/Semi-skilled staff (Maximum workers per day)	225		
Skilled staff (Maximum workers per day)	25		
Total (Maximum workers per day)	**250**		
Trip type	**Total (veh/hr)**	**In (veh/hr)**	**Out (veh/hr)**
AM Peak hour per mini-bus trips	30	15	15
AM Peak hour private vehicle trips	17	17	
Total AM peak hour trips	**47**	**32**	**15**

<u>Construction material deliveries for the WEF</u>

- It is proposed to construct a maximum of 37 wind turbines and support buildings.
- The turbine towers are expected to have a hub height of up to 200m, with a rotor diameter of up to 200m.
- Each 200m diameter turbine rotor will require 3 blades of up to 100m long each (maximum). Rotor blades will be manufactured abroad and imported via the most suitable Port. The dimensions of the blades, their point of origin and the resultant route between the Port and the site will determine the vehicle type and special permits that may be required for the transportation of these blades. The most feasible import point is the Port of Richards Bay, approximately 400km away, with direct access via the N2 Freeway.
- The tower masts may be constructed of tubular steel, concrete, and/or hybrid (steel/concrete) type.
- The trip generation of the steel mast option was assessed, as these will have the highest number of abnormal loads to site, and associated impact on the local road network.
- Steel mast components will be manufactured off-site in sections up to 30m, and are lifted into place on site. Similar to the blades, the type of tower mast components (steel, concrete, hybrid) will determine their origin, port of entry (if imported) and delivery route to the site.

- The route/s between the origin (port of entry) of the oversize/weight components and the site may be National, Provincial or Local roads. The transportation of any oversized or overweight freight along these routes will require authorisation from all the relevant road authorities.
- It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry are confirmed. This plan will cover all aspects such as horizontal and vertical vehicle requirements, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.
- The trip generation for the delivery of building materials for the operations and maintenance building will be negligible. These deliveries will occur throughout a working day and will not be concentrated during the workday peak hours. These trips were therefore not assessed due to their negligible impact.

Assumptions were made to estimate the expected trip generation of the WEF construction phase, refer to Table 6.2.

- For trip generation purposes, only the steel mast option was assessed, as these will have the highest number of abnormal loads to site, and associated impact on the local road network.
- Each mast will consist of 7 x 29 m steel segments. One segment can be delivered per vehicle trip.
- One rotor blade can be transported on an abnormal size vehicle.
- The foundation per tower will be approximately 25.0m diameter by 4.5m deep, which is approximately 1473m³ of concrete reinforced with 100 tons of steel.
- A volume of 2500m³ concrete per foundation was utilised for calculation purposes (higher conservative volume).
- The foundation dimensions may vary as required by the geotechnical conditions.
- Concrete foundation will be constructed to support a mounting ring.
- Excavation of approximately 1000m^2 per foundation will be required in sandy soils due to access requirements and safe slop stability requirements.
- Concrete will be batched on-site at a temporary plant. Gravel, sand and cement will be transported to site via the local road network, in 45 ton loads per truck, and then stored on site until required.
- Steel is transported in 40 ton loads on standard flatbed vehicles.
- Component and material deliveries will take place over a period of 24 months. It is assumed that deliveries will take place on 80% of all working days for a conservative trip generation estimate.
- A total of 10 041 delivery trips (Total in & out) will be required during the 24 months of construction, which is approximately 27 trips a day (Total in & out).
- The delivery of materials during the AM and PM peak hours will therefore be low, as trucks will arrive and depart throughout the day. If a conservative maximum 10% of the daily trips are generated during the AM and PM peaks, a maximum of 3 trips (in & out) per peak hour is expected, which is negligible.

Table 6-2 Estimated maximum material delivery trip generation – Camden I WEF

	Mast components (no.)	Rotor blades (no.)	Rotor	Nacelle	Generator	Foundation material	
						Concrete (m^3)	Steel (tons)
No. of turbines: 1	7 x 29 m sections	3 x 100m	1	1	1	2 500	100
No. of turbines: 37	259	111	37	37	37	92 500	3700
No. of vehicle trips (in & out)	**518**	**222**	**74**	**74**	**74**	**8 894**	**185**
Total no. of trips: (in & out)	**10 041**						
Total no. of trips per workday (in & out)	**27**						
Total no. of trips per workday peak hour (in & out)	**3**						

SOLAR PV FACILITY

The construction phase of the solar PV facility will generate notable traffic volumes that requires assessment. Construction traffic will include vehicles for the delivery of the PV panel modules, foundation materials for the PV panels, electrical infrastructure such as inverters and wiring, batteries and transformers; and construction staff transport.

The construction phase traffic was estimated based on the assumptions listed per traffic type below.

<u>Construction staff transport for the Solar PV facility</u>

— An estimated construction period of 18 months, with a variable number of staff required depending on the construction phase.
— An absolute maximum of 150 workers could be on-site during the peak construction period, however the conservative estimate is 100 to 150 personnel. The maximum number was used for calculation purposes.
— Workers will not be accommodated on-site.
— 90% of the work force (unskilled and semi-skilled workers) is expected to utilise public transport to site from neighbouring towns, most notably Ermelo which is located approximately 30km away.
— It is unlikely that bus transport will be available, therefore all public transport trips will be via minibus taxi, with an average 16 person per vehicle occupancy.
— Staff will not utilise non-motorised transport (NMT), such as cycling or walking to site due to the excessive distances to the closest towns.
— 10% of the work force is expected to travel to site by private car, with an average occupancy of 1.5 persons.
— It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and again depart during the AM and PM peaks.

Refer to Table 6-6 for the total trip generation for the construction staff transport for the Solar PV facility.

Table 6-3: Total peak hour trip generation – Solar PV construction staff

STAFF TYPE	TOTAL PERSONS PER DAY		
Unskilled/Semi-skilled staff (Maximum workers per day)	135		
Skilled staff (Maximum workers per day)	15		
Total (Maximum workers per day)	**150**		
TRIP TYPE	**TOTAL (VEH/HR)**	**IN (VEH/HR)**	**OUT (VEH/HR)**
AM Peak hour per mini-bus trips	18	9	9
AM Peak hour private vehicle trips	10	10	
Total AM peak hour trips	**28**	**19**	**9**

Construction material deliveries for the Solar PV facility

Assumptions were made to estimate the expected trip generation of the construction phase, refer to Table 6-4.

— A maximum of 200 000 PV panel modules will be transported to site in standard containers. 840 modules are loaded per container, therefore a total of 239 containers will be delivered. Note this is a conservative estimate that may change, pending the final specifications of the panels. Note that up to 900 modules can be delivered on a standard truck, therefore the more conservative transport with container was utilised.
— The concrete required for the solar PV panel module foundations was estimated from literature (Jean, Brown, Jaffe, Buonassisi and Bulovic, 2015).) at approximately 60.7 tonnes per MW, therefore a total of 6070 tonnes of concrete. Each module of +/- 33 solar PV panels will require a pre-cast concrete foundations of 0.6m wide by 0.6 m long by 1.3m deep, approximately 1.01 tonnes each. The total number of foundations is approximately 6010. The foundation will therefore require 2812m^3 (or 6082 tonnes) of concrete. Note this is a conservative estimate that may change, pending the final specifications of the panels and the soil conditions for each foundation.
— Concrete for the foundations will be batched on-site at a temporary plant. Gravel, sand and cement will be transported to site via the local road network, in 45 ton loads per truck, and then stored on site until required.
— The steel frames required to mount the PV panel modules is estimated from literature (Jean, Brown, Jaffe, Buonassisi and Bulovic, 2015) at approximately 67.9 tonnes per MW, therefore a total of 6790 tonnes of steel will be required.
— Steel for the PV panel frames will be transported in 40 ton loads on standard flatbed vehicles.
— The battery requirement for the facility is approximately 1 pack of per 1.78MW, therefore 56 battery unit will be required for the 100Mw facility. Each battery unit weight up to 25,4 tonnes. It is therefore assumed that 1 battery unit per heavy vehicle will be delivered to site.
— The trip generation for the delivery of building materials for the operations and maintenance building will be negligible. These deliveries will occur throughout a working day and will not be concentrated during the workday peak hours. These trips were therefore not assessed due to their negligible impact.

— Component and material deliveries will take place over a period of 18 months. It is assumed that deliveries will take place on 80% of all working days for a conservative trip generation estimate.
— The maximum number of delivery trips per day is only 4 trips (Total in & out).
— The delivery of materials during the AM and PM peak hours will therefore be lower, as trucks will arrive and depart throughout the day. If a conservative maximum 10% of the daily trips are generated during the AM and PM peaks, a maximum of 1 trips per peak hour is expected, which is negligible.

Table 6-4 Estimated maximum material delivery trip generation – Camden I Solar PV

	PV panels (no. of containers)	Foundation material - Concrete (m^3)	Steel frames (tonnes)	Battery units (no.)
Solar PV panel modules materials requirement	238	6,082	6,790	56
No. of vehicle trips (in & out)	**477**	**274**	**340**	**112**
No. of vehicle trips (Total in & out)	**1202**			
Total no. of trips per workday (in & out)	**4**			
Total no. of trips per workday peak hour (in & out)	**1**			

GREEN AMMONIA PLANT

The construction phase of the green Ammonia plant will generate notable traffic volumes that requires assessment. Construction traffic will include vehicles for the delivery of components and construction materials for the support infrastructure to house the following:

— Water Reservoir (concrete, to be constructed on site)
— Water Treatment Unit (to be delivered to site in modular units)
— Electrolyser Unit (to be delivered to site in modular units)
— Air Separation Unit (to be delivered to site in modular units)
— Ammonia Processing Unit (to be delivered to site in modular units)
— Liquid Air Storage System (LAES) (to be delivered to site in modular units)
— Liquid Ammonia Storage Tank (to be delivered to site in modular units)
— Hydrogen Storage Tank (to be delivered to site in modular units)

The construction phase traffic was estimated based on the assumptions listed per traffic type below.

<u>Construction staff transport for the Ammonia plant</u>

— An estimated construction period of 24 months, with a variable number of staff required depending on the construction phase.
— An estimated maximum of 200 workers will be on-site every day during the peak construction period.
— Workers will not be accommodated on-site.

- 90% of the work force (unskilled and semi-skilled workers) is expected to utilise public transport to site from neighbouring towns, most notably Ermelo which is located approximately 30km away.
- It is unlikely that bus transport will be available, therefore all public transport trips will be via minibus taxi, with an average 16 person per vehicle occupancy.
- Staff will not utilise non-motorised transport (NMT), such as cycling or walking to site due to the excessive distances to the closest towns.
- 10% of the work force is expected to travel to site by private car, with an average occupancy of 1.5 persons.
- It is assumed that the public transport vehicles will not remain on-site during the workday, therefore all these vehicles will arrive and again depart during the AM and PM peaks.

Refer to Table 6-5 for the total trip generation for the construction staff transport for the ammonia plant.

Table 6-5: Total peak hour trip generation – Camden I ammonia plant

STAFF TYPE	*TOTAL PERSONS PER DAY*		
Unskilled/Semi-skilled staff (Maximum workers per day)	180		
Skilled staff (Maximum workers per day)	20		
Total (Maximum workers per day)	**200**		
TRIP TYPE	**TOTAL (VEH/HR)**	**IN (VEH/HR)**	**OUT (VEH/HR)**
AM Peak hour per mini-bus trips	24	12	12
AM Peak hour private vehicle trips	14	14	
Total AM peak hour trips	**38**	**26**	**12**

Construction material deliveries for the Ammonia plant

Assumptions were made to estimate the expected trip generation of the construction phase.

- The size and number of units cannot be determined at this stage, therefore conservative estimates were undertaken for these deliveries, as follows:
  - Water Reservoir (to be delivered to site) –1 vehicle trip
  - Water Treatment Unit (to be delivered to site in modular units) - 4 vehicle trips
  - Electrolyser Unit (to be delivered to site in modular units) – 8 vehicle trips
  - Air Separation Unit (to be delivered to site in modular units) - 10 vehicle trips
  - Ammonia Processing Unit (to be delivered to site in modular units) - 20 vehicle trips
  - Liquid Air Storage System (LAES) (to be delivered to site in modular units) - 10 vehicle trips
  - Liquid Ammonia Storage Tank (to be delivered to site in modular units) -1 vehicle trip
  - Hydrogen Storage Tank (to be delivered to site in modular units) -) –1 vehicle trip

- Concrete for foundations (cement, sand, stone deliveries to batching plant) – 20 000 m³ = 1926 trips (total In & out)
- Total – 2036 trips (in & out)

— The transportation of any overweight/size freight to the site is limited to batteries and transformers, and the volumes are expected to be negligible. The route/s between the origin (port of entry) of the oversize/weight components and the site may be National, Provincial or Local roads. The transportation of any overweight freight to the site is limited to generators, and the volumes are expected to be negligible.

— It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry are confirmed. This plan will cover all aspects such as horizontal and vertical vehicle requirements, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.

— Component and material deliveries will take place over a period of 24 months. It is assumed that deliveries will take place on 80% of all working days for a conservative trip generation estimate.

— A total of 2036 delivery trips (Total in & out) will be required during the 24 months of construction, which is less than 6 trips a day (Total in & out).

— The delivery of materials during the AM and PM peak hours will therefore be low, as trucks will arrive and depart throughout the day. If a conservative maximum 10% of the daily trips are generated during the AM and PM peaks, a maximum of 1 trip per peak hour is expected, which is negligible.

TRIP GENERATION SUMMARY – CONSTRUCTION PHASE

Refer to Table 6-6 for the expected combined construction phase trip generation for the Camden I Ammonia, WEF and Solar PF facilities.

Table 6-6: Total maximum peak hour trip generation – Camden I Ammonia, WEF and Solar PF facilities

Facility	Vehicle Trips per Peak hour								
	Staff			Material deliveries			Total		
	In	Out	Total	In	Out	Total	In	Out	Total
WEF	32	15	**47**	2	1	**3**	34	16	**50**
Solar PV	19	9	**28**	1	0	**1**	20	9	**29**
Ammonia Plant	26	12	**38**	1	0	**1**	27	12	**39**
Total	77	36	**113**	4	1	**5**	81	37	**118**

Engineers opinion: The above trip generation estimate represents a conservative (high) calculation, from the available information.

Due to the numerous accesses off the National roads that can be utilised during construction, the traffic impact during the workday AM and PM peak hours are expected to be negligible during the construction phase.

6.3.2 OPERATIONAL PHASE TRAFFIC

WIND AND SOLAR PV FACILITIES

The operational phase of the wind and solar facilities will require a low number of permanent staff. The vehicle trips that will be generated by the personnel accessing the site for maintenance and other purposes will therefore be low, and the associated transport impact on the surrounding road network will be negligible.

GREEN AMMONIA PLANT

Staff trips

The number of permanent and support staff that will work on-site is only 25 persons. If it is assumed that each person arrives in a private vehicle, the staff trip generation will be negligible.

Product transportation trips

The transportation of the manufactured liquid ammonia from the plant may occur either be via road, rail or a combination of the two. Transport via road may be with Standard pressurised road tankers or ISOtainers. Transport by rail may be with pressured rail containers (ISOtank).

Rail transport

Rail transportation of the ammonia will reduce the traffic loading on the greater road network. The closest rail facility to the ammonia plant is located outside of Ermelo. This rail facility is primarily used to load coal for transport to the Richards Bay coal terminal. There may be an opportunity to load ammonia at this facility, however this has not been assessed. It is assumed that the ammonia will have to be transported via road from site to the Ermelo railway facility, if transport by rial is feasible.

The option to build a rail loading facility on the railway line outside Camden, closer to the ammonia plant, is not regarded as feasible due to expected cost.

Therefore the impact on the district roads and sections of the N2 and/or N11 to transport the ammonia to the Ermelo rail facility or the greater market will be high, depending on the type of road tankers that will be utilised. Refer to the assessment below.

Road transport - ISOtainers

ISOtainers can transport 12 tons of ammonia per 20ft pressurised tank , with 2 tanks per vehicle. For a production capacity of 100 000 tons per annum, approximately 8 334 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 34 trips (Total In & out) will be required per day. These trips may occur on any of the district roads, therefore the total per route will be even less, with a lower impact per road.

This very low daily trip generation is expected to have a negligible impact on the Provincial district and National roads. It should be noted that the unsurfaced district roads from the plant to the N11 and/or the N2 may require more regular maintenance. Given these low volumes the Provincial Road authority should be responsible for this routine maintenance.

Road transport – standard pressurised tankers

Standard pressurised road tankers can transport 1.1 tons of ammonia per 40ft pressurised tank, with 1 tank per vehicle. For a production capacity of 100 000 tons per annum, approximately 181 818 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of 725 trips (Total In & out) will be required per day. The final location of the plant will determine the route/s to the National Road network (N11 and N2). The total volume of traffic per route may therefore be less. It is however a substantial volume of heavy vehicle traffic that should ideally not use unsurfaced district roads.

Refer to Table 6-7 for a summary of the disadvantages/advantages per transport mode.

Table 6-7: Ammonia transport assessment via road and rail

Transport type	Advantages	Disadvantages	Summary
Road & Rail transport	• Low impact on local district roads due to lowest heavy vehicle volumes • Low impact on local National roads district roads due to lowest heavy vehicle volumes • No impact on National road network beyond Ermelo rail facility	Isotainer transport from plant to rail facility: • District roads between plant and National road access/es may require more regular maintenance, or upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution pending final vehicle routes/volumes Pressurised road tankers from plant to rail facility: • Highest impact on local road network due to highest daily heavy vehicle volumes • District roads between plant and National road access/es may require upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution • Access of district roads onto N11 and N2 may require upgrade for capacity and safety reasons pending final vehicle routes/volumes	• Recommended • Not recommended
Road transport only with ISOtainers	• Low impact on local and regional road network due to lowest heavy vehicle volumes	• District roads between plant and National road access/es may require more regular maintenance, or upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution pending final vehicle routes/volumes	• Recommended
Road transport only with Standard pressurised tankers	• None	• Highest impact on local road network due to highest heavy vehicle volumes • District roads between plant and National road access/es may require an upgrade to surfaced standard to reduce long term maintenance cost and dust/noise pollution • Access of district roads onto N11 and N2 may require an upgrade for capacity and safety reasons pending final vehicle routes/volumes	• Not recommended

Recommendation

It is recommended that only ISOtainers via road is utilised to transport the ammonia from the site to the greater road network and or the Ermelo or other feasible rail facilities.

The Client has confirmed that only ISOtainers will be utilised for road transport of the ammonia.

Summary

The Client has stated that they will commit to the following with regards to potential road and intersection upgrades:

— Engage the provincial roads authority to see determine if they are required to assist with the maintenance of any roads.
— Grading and minor works to repair the district roads, if required, provided it is not intrusive on the Provincial mandate.
— Undertake intersection upgrades to the required standards, provided all approvals can be obtained from Province/SANRAL.

6.3.3 DECOMMISIONING PHASE TRAFFIC

Following the initial 20-year operational period of the facility, its continued economic viability will be investigated. If it is still deemed viable its life may be extended; if not, it will be decommissioned. If it is completely decommissioned, all the components will be disassembled, reused and recycled or disposed of.

It is not possible to determine the volume of traffic that will be generated during the decommissioning phase. It is however expected that the volumes will be lower than during the construction phase, and the resultant transport impact on the local road network will be lower than during the Construction phase. Any damage to the unsurfaced access roads caused by the decommissioning phase traffic should be repaired at the cost of the developer.

6.4 CAPACITY ANALYSIS

A capacity analysis of the two potential access intersections off the N11 and the access off the N2 could not be undertaken due to the following:

— The final Ammonia plant location has not been confirmed, this location will inform the final route/s between the facility and the National Road network.
— The type/s of tankers to transport the ammonia products via road cannot be determined at this stage. This will inform the expected traffic volumes that will utilise the accesses.
— The Provincial Roads authority and SANRAL should inform these capacity analysis requirements, if any, based on the final volumes and local routes to transport the ammonia.

Note that the capacity and safety of these access intersections may be affected due to the expected increase in heavy vehicle volumes from the ammonia plant.

— The intersection of the D260 and the D1107 off the N11 has a short right-turn lane off the N11 northbound and a short left-slip off the N11 southbound. No intersection upgrades are required if ISOtainer transport is exclusively utilised, due to the lower peak hour and daily traffic volumes.

- The intersection of the D1264 off the N2 has no turning lanes, and this intersection may require an upgrade for capacity and safety improvement purposes, if the increased traffic volumes justifies it. No intersection upgrades are required if ISOtainer transport is exclusively utilised, due to the lower peak hour and daily traffic volumes.

6.5 INTERSECTION SAFETY ASSESSMENT

The following recommendations are made to improve the safety of the access intersections off the N11 and N2 during the construction and operation phases, pending the final increased traffic volumes from the various Camden I facilities. Note these upgrades should be the responsibility of the Provincial Road Authority and SANRAL, as these are general safety improvements. The developer has however stated that they will undertake these upgrades, if permitted to do so by the relevant authorities.

N11 / D260

Should approval be granted by the relevant authority, provide additional warning signs as follows:

- Install a Stop Signs (R1.1) on the D260 at the intersection with the N11
- Install a side road junction warning signs (W108) on the southern approach of the N11, located approximately 100m from the intersection.
- Install truck crossing warning sign (W345) with the W108 sign.
- Install truck crossing warning sign (W345) with the staggered junction warning sign located on the northern approach of the N11.

N11 / D1170

Should approval be granted by the relevant authority, provide additional warning signs as follows:

- Ensure that the Stop Signs (R1.1) on the D1170 at the intersection with the N11 is visible.
- Install a truck crossing warning sign (W345) with the W107 sign located on the northern approach of the N11.
- Install a truck crossing warning sign (W345) with the W108 junction warning sign located on the southern approach of the N11.

N2 / D1264

Should approval be granted by the relevant authority, provide additional warning signs as follows:

- Install a Stop Signs (R1.1) on the D1264 at the intersection with the N2
- Install a truck crossing warning sign (W345) with the W108 sign located on the northern approach of the N2.
- Install a truck crossing warning sign (W345) with the W107 junction warning sign located on the southern approach of the N2.

7 ENVIRONMENTAL IMPACT ASSESSMENT: TRANSPORT

7.1 IMPACT ASSESSMENT METHODOLOGY

7.1.1 INTRODUCTION

The EIA for the proposed facility, of which this TIA is an informant, uses a methodological framework developed by WSP to meet the combined requirements of international best practice and NEMA, Environmental Impact Assessment Regulations, 2014 (GN No. 982) (the “EIA Regulations”).

7.1.2 ASSESSMENT OF IMPACTS AND MITIGATION

The assessment of impacts and mitigation evaluates the likely extent and significance of the potential impacts on identified receptors and resources against defined assessment criteria, to develop and describe measures that will be taken to avoid, minimise or compensate for any adverse environmental impacts, to enhance positive impacts, and to report the significance of residual impacts that occur following mitigation.

The key objectives of the risk assessment methodology are to identify any additional potential environmental issues and associated impacts likely to arise from the proposed project, and to propose a significance ranking. Issues / aspects will be reviewed and ranked against a series of significance criteria to identify and record interactions between activities and aspects, and resources and receptors to provide a detailed discussion of impacts. The assessment considers direct[1], indirect[2], secondary[3] as well as cumulative[4] impacts.

A standard risk assessment methodology is used for the ranking of the identified environmental impacts pre-and post-mitigation (i.e. residual impact). The significance of environmental aspects is determined and ranked by considering the criteria[5] presented in Table 7-1.

[1] Impacts that arise directly from activities that form an integral part of the Project.
[2] Impacts that arise indirectly from activities not explicitly forming part of the Project.
[3] Secondary or induced impacts caused by a change in the Project environment.
[4] Impacts are those impacts arising from the combination of multiple impacts from existing projects, the Project and/or future projects.
[5] The definitions given are for guidance only, and not all the definitions will apply to all the environmental receptors and resources being assessed. Impact significance was assessed with and without mitigation measures in place.

Table 7-1: Impact Assessment Criteria and Scoring System

CRITERIA	SCORE 1	SCORE 2	SCORE 3	SCORE 4	SCORE 5
Impact Magnitude (M) The degree of alteration of the affected environmental receptor	Very low: No impact on processes	Low: Slight impact on processes	Medium: Processes continue but in a modified way	High: Processes temporarily cease	Very High: Permanent cessation of processes
Impact Extent (E) The geographical extent of the impact on a given environmental receptor	Site: Site only	Local: Inside activity area	Regional: Outside activity area	National: National scope or level	International: Across borders or boundaries
Impact Reversibility (R) The ability of the environmental receptor to rehabilitate or restore after the activity has caused environmental change	Reversible: Recovery without rehabilitation		Recoverable: Recovery with rehabilitation		Irreversible: Not possible despite action
Impact Duration (D) The length of permanence of the impact on the environmental receptor	Immediate: On impact	Short term: 0-5 years	Medium term: 5-15 years	Long term: Project life	Permanent: Indefinite
Probability of Occurrence (P) The likelihood of an impact occurring in the absence of pertinent environmental management measures or mitigation	Improbable	Low Probability	Probable	Highly Probability	Definite
Significance (S) is determined by combining the above criteria in the following formula:	$[S = (E + D + R + M) \times P]$ $Significance = (Extent + Duration + Reversibility + Magnitude) \times Probability$				
IMPACT SIGNIFICANCE RATING					
Total Score	**4 to 15**	**16 to 30**	**31 to 60**	**61 to 80**	**81 to 100**
Environmental Significance Rating (Negative (-))	**Very low**	**Low**	**Moderate**	**High**	**Very High**
Environmental Significance Rating (Positive (+))	**Very low**	**Low**	**Moderate**	**High**	**Very High**

7.1.3 IMPACT MITIGATION

The impact significance without mitigation measures will be assessed with the design controls in place. Impacts without mitigation measures in place are not representative of the proposed development's actual extent of impact and are included to facilitate understanding of how and why mitigation measures were identified. The residual impact is what remains following the application of mitigation and management measures and is thus the final level of impact associated with the development. Residual impacts also serve as the focus of management and monitoring activities during Project implementation to verify that actual impacts are the same as those predicted in this report.

The mitigation measures chosen are based on the mitigation sequence/hierarchy which allows for consideration of five (5) different levels, which include avoid/prevent, minimise, rehabilitate/restore, offset and no-go in that order. The idea is that when project impacts are considered, the first option should be to avoid or prevent the impacts from occurring in the first place if possible, however, this is not always feasible. If this is not attainable, the impacts can be allowed, however they must be minimised as far as possible by considering reducing the footprint of the development for example so that little damage is encountered. If impacts are unavoidable, the next goal is to rehabilitate or restore the areas impacted back to their original form after project completion. Offsets are then considered if all the other measures described above fail to remedy high/significant residual negative impacts. If no offsets can be achieved on a potential impact, which results in full destruction of any ecosystem for example, the no-go option is considered so that another activity or location is considered in place of the original plan.

The mitigation sequence/hierarchy is shown in Figure 7-1.

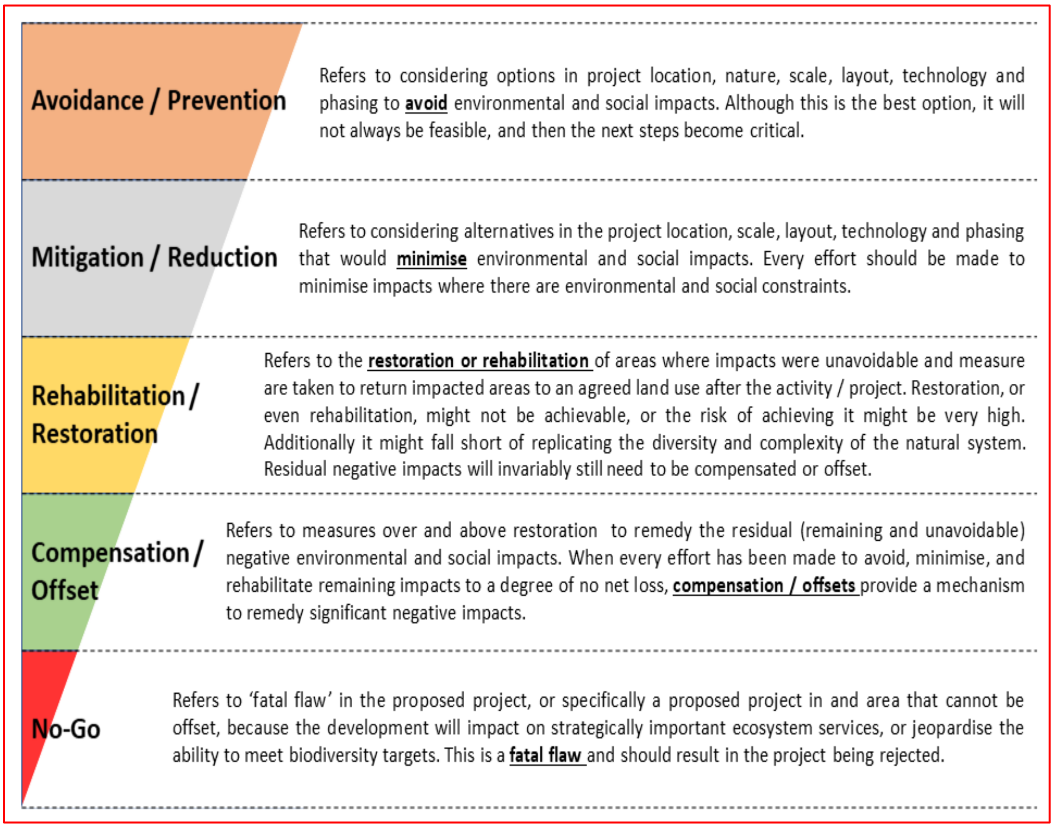

Figure 7-1 Mitigation Sequence/Hierarchy

7.2 ASSESSMENT RESULTS

— Refer to Table 7-2 for the Construction Phase traffic related environmental impact assessment of the proposed Camden I Ammonia, Solar PV and WEF facilities.

— The Operational phase traffic impact of the Solar PV and WEF facilities were not assessed, as the trip generation during this phase will be negligible, with a negligible impact.

The Operational phase traffic impact of the Ammonia plant was assessed based on the Client confirmation that the ammonia will be transport from site via road to the railway facility outside Ermelo with ISOtankers. Refer to

— Table 7-3.

- The Decommissioning phase traffic impact will be similar to the Construction Phase traffic for all the facilities, and was not assessed separately. Note that the decommissioning phases may not occur concurrently, if ever.

Table 7-2: Impact assessment - Construction phase: Camden I Ammonia, Solar PV and WEF facilities.

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation							Mitigation Measures
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating	
1:	Noise, dust & exhaust pollution due to vehicle trips on-site	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Construction	Negative	Easy	2	1	1	1	5	**25**	**N2**	1	1	1	1	2	**8**	**N1**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N2 - Low**							**N1 - Very Low**							
2:	Noise, dust & exhaust pollution due to additional trips on the national and district roads	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Construction	Negative	Easy	2	2	1	1	5	**30**	**N2**	1	2	1	1	2	**10**	**N1**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N2 - Low**							**N1 - Very Low**							

Table 7-3: Impact assessment - Operation phase: Camden I Ammonia facility - ISOtainers transport of ammonia from site to railway facility and/or national roads

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation							Mitigation Measures
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating	
1:	Noise, dust & exhaust pollution due to vehicle trips on-site	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Operation	Negative	Easy	3	2	3	4	4	**48**	**N3**	2	2	1	4	3	**27**	**N2**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N3-Moderate**							**N2 - Low**							
2:	Noise, dust & exhaust pollution due to additional trips on the national and district roads	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Operation	Negative	Moderate	3	3	3	4	4	**52**	**N3**	2	3	1	4	3	**30**	**N2**	• ~~District road/s that will be utilised for ammonia transport to be upgraded to surfaced standard~~ • District roads will require more regular maintenance • All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N3-Moderate**							**N2 - Low**							

7.3 SUMMARY

CONSTRUCTION PHASE

The overall significance of each impact during the Construction Phase of the Camden I facility as detailed in Table 7-2 is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.

The proposed mitigating measures are easy to implement and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads.

OPERATION PHASE - ISOTAINER TRANSPORT OF AMMONIA FROM SITE TO RAILWAY FACILITY OR REGIONAL/NATIONAL MARKET

The overall significance of each impact during the Operation Phase of the Camden I facility as detailed in

Table 7-3 is Moderate without mitigation, and Low with mitigation. The impacts are for the duration of the Project life, site/local and regional, and fully reversible.

The potential mitigating measure with regards to the gravel roads is more regular maintenance. This will assist to reduce the impacts of increased dust generation.

The recommended mitigating measures with regards to vehicle operations (roadworthiness, loading) are standard requirements for all vehicles operating on public roads, and must always be adhered to. These measures will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and road damage due to overloaded vehicles.

8 CUMULATIVE TRANSPORT IMPACT ASSESSMENT

8.1 BACKGROUND

The DFFE requested that a cumulative transport impact assessment be undertaken of the latent power facilities in the vicinity of the Camden I facility.

8.2 POTENTIAL DEVELOPMENTS

The only known potential development in the vicinity of Camden I is the Camden II WEF. This facility can also take access off the N2 and/or N11 via the district roads during its construction and operational phases.

Refer to the WSP report: Camden II WEF Transportation Impact Assessment, dated June 2022. The location of the Camden I and Camden II facilities are shown in

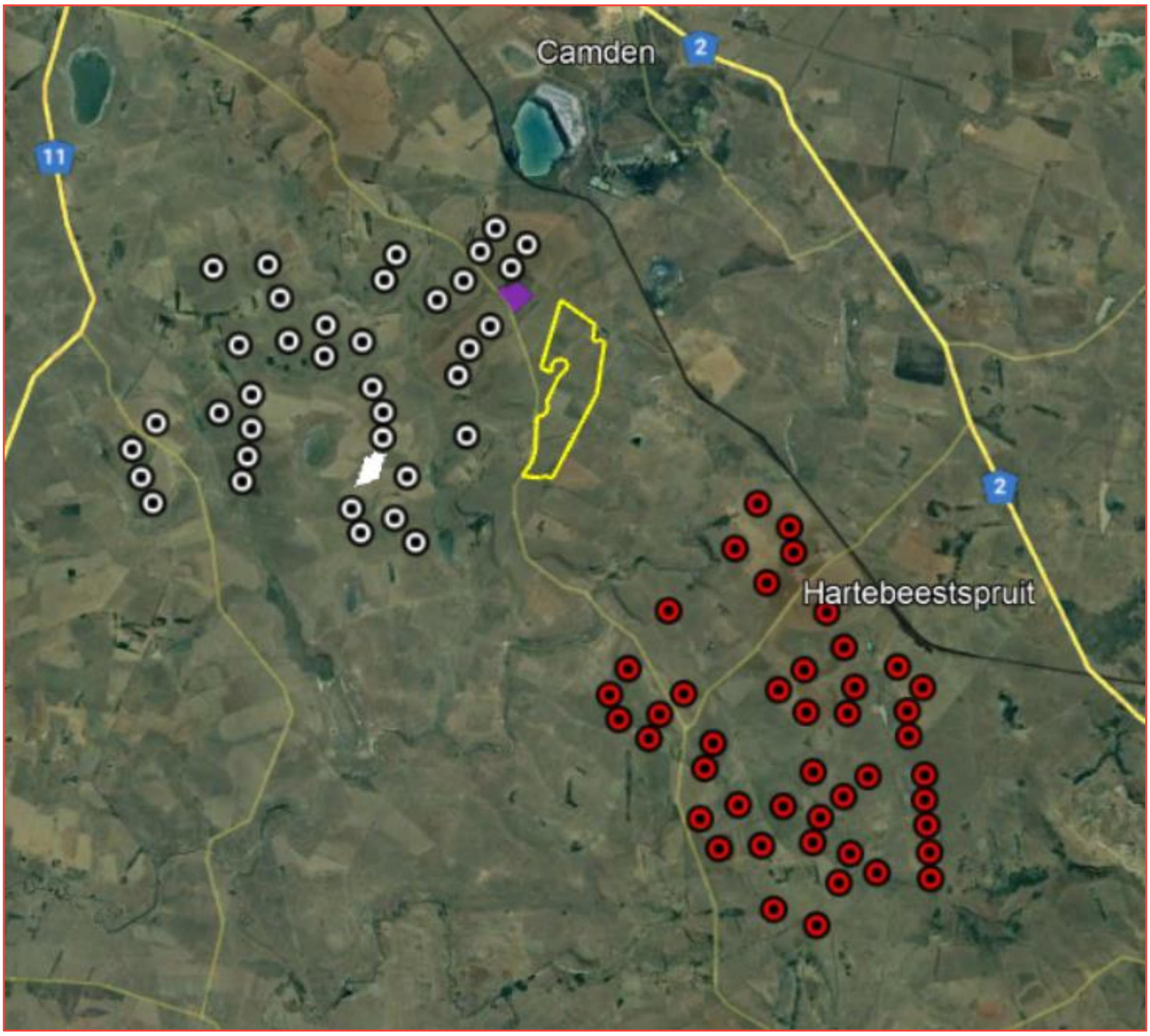

Figure 8-1.

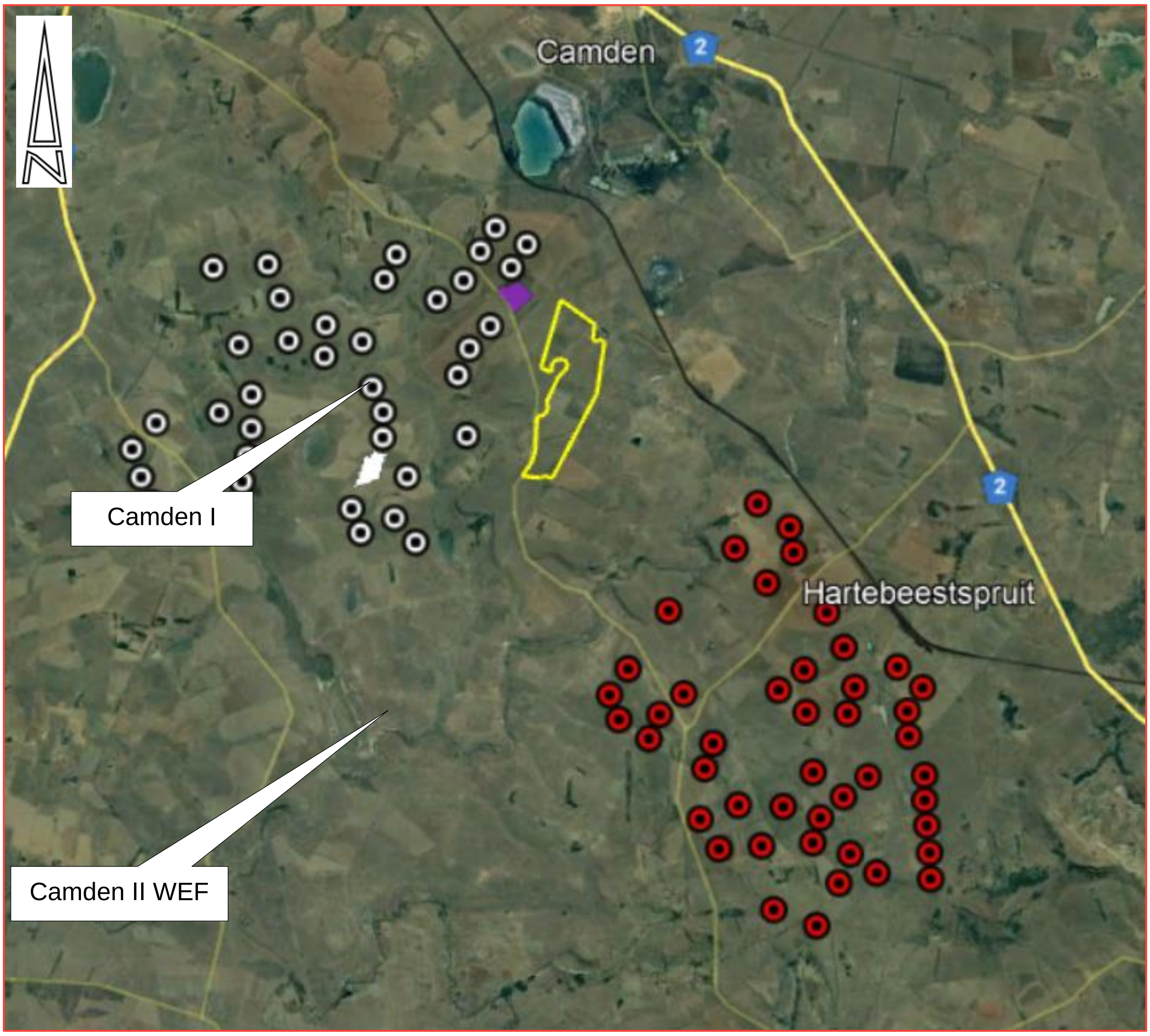

Figure 8-1 Location of Camden I & II facilities

8.3 CUMULATIVE TRANSPORT IMPACTS

Refer to Table 8-1 and Table 8-2 for the expected cumulative transport impacts on the local road network due to the latent Camden II facility.

Table 8-1: Cumulative impact assessment - Construction phase: Camden I Ammonia, Solar PV, WEF facilities & Camden II WEF

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation							Mitigation Measures
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating	
1:	Noise, dust & exhaust pollution due to vehicle trips on both the Camden I & II sites	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Construction	Negative	Easy	2	1	1	1	5	**25**	**N2**	1	1	1	1	2	**8**	**N1**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N2 - Low**							**N1 - Very Low**							
2:	Noise, dust & exhaust pollution due to additional trips on the national and district roads	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Construction	Negative	Easy	2	2	1	1	5	**30**	**N2**	1	2	1	1	2	**10**	**N1**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N2 - Low**							**N1 - Very Low**							

Table 8-2: Cumulative impact assessment – Operation phase: Camden I Ammonia, Solar PV, WEF facilities & Camden II WEF

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation							Mitigation Measures
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating	
1:	Noise, dust & exhaust pollution due to vehicle trips on both the Camden I & II sites	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Operation	Negative	Easy	3	2	3	4	4	**48**	**N3**	2	2	1	4	3	**27**	**N2**	• All unsurfaced roads must be regularly sprayed with water to prevent dust generation • All vehicles that travel on-site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel on-site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N3-Moderate**							**N2 - Low**							
2:	Noise, dust & exhaust pollution due to additional trips on the national and district roads	• Vehicle engine noise • Vehicle tyre noise • Dust generation on unsurfaced roads • Vehicle exhaust fumes	Operation	Negative	Moderate	3	3	3	4	4	**52**	**N3**	2	3	1	4	3	**30**	**N2**	• Unsurfaced district roads will require more regular maintenance • All vehicles that travel to site must be roadworthy to ensure noise and emissions levels comply to national vehicle standards, thereby minimising noise/exhaust pollution • All vehicles that travel to site must not be overloaded, and abnormal vehicles must comply to relevant legislation for overweight loads, to ensure lowest possible road surface damage.
Significance						**N3-Moderate**							**N2 - Low**							

8.4 SUMMARY

- The maximum traffic generation of the Camden I and Camden II facilities will occur during the concurrent construction phases. The cumulative impact will be very low on the site and local road network during construction, with the implementation of the recommended mitigations.
- The maximum traffic generation of the Camden I and Camden II facilities are expected to occur at the same time for the operation phase, as the facilities will be operated concurrently. The cumulative impact will be low on the site and local road network during the operation phase, with the implementation of the recommended mitigations.
- It should be noted that the Significance of the transport impact of the Camden II facility is far lower than the expected significance of the Camden I facilities for the construction and operation phases.
- The cumulative impact of the decommissioning phases of the Camden I and Camden II facilities were not assessed, as it cannot be determined if these phases will occur concurrently, if ever.

9 CONCLUSIONS & RECOMMENDATIONS

Based on this study, the following key conclusions and recommendations are relevant:

- The proposed Camden I Wind Energy, Solar PV Energy and Green Hydrogen and Ammonia Facilities will be located 6.0 km west of Camden, and 12km south of Ermelo in the Msukaligwa Local Municipality of the Gert Sibande District Municipality in Mpumalanga Province.
- The Camden I facility with the proposed Camden II WEF will form part of the Camden Renewable Energy Complex.
- The Camden I facilities will be located over the following farm portions, with a total area of 6000 ha:
- Wind Energy Facility
  - Klipfontein 442 IS (Portion 0, 1 and 3)
  - Welgelegen 322 IT (Portion 1 and 2)
  - Uitkomst 292 IT (Portion 2 and 10)
  - Langverwacht 293 IT (Portion 3)
  - Mooiplaats 290 IT (Portion 14)
  - Klipbank 295 IT (Portion 3)
- Solar PV facility
  - Portion 1 of Welgelegen Farm No. 322
- A green hydrogen and ammonia production facility.
  - Camden Power Station 329 IT (Portion 0)
  - Uitkomst 292 IT (Portion 2)
  - Mooiplaats 290 IT (Portion 14 and 20)
  - Welgelegen 322 IT (Portion 1 and 2)
- The WEF will have an up to200 MW capacity with a maximum of 37 turbines, each with a 200m diameter rotor, 3 x 100m long blades and a 200m hub height.
- The Solar PV will have an up to 100 MW capacity.
- The ammonia plant will have numerous plant and process buildings, storage tanks and support infrastructure over a 25ha site.
- The Scope of the TIA was informed by the Committee of Transport Officials' South African Traffic Impact and Site Traffic Assessment Manual, TMH16, Vol. 1, Version 1, August 2012.
- A concurrent construction phase was assumed to ensure a conservative traffic generation and impact analysis.
- There are no known planned new roads or road upgrades in the study area.
- There are no known large scale latent developments in the vicinity of the site that may have an impact on the local road network, except for the proposed Camden II WEF. It was assessed as part of the Cumulative Impact Assessment.
- Access to the site will be via the existing access of the D260 and D1107 to the N11 and the D1264 to the N2.
- Construction and operational phase parking will be accommodated on-site.
- There is no need for dedicated public transport or non-motorised transport infrastructure to serve the site during the construction and operational phases.

- The estimated peak construction trip generation of all the facilities will be 118 veh/hr during the weekday AM and PM peaks. This trip generation estimate represents a conservative (high) calculation. Due to the site accesses to the facility off low to medium trafficked National roads, and low trafficked district roads, the traffic impact during the workday AM and PM peak hours are expected to be negligible.
- The expected traffic increase on the district roads during the construction phase could result in damage to the unsurfaced roads, as they are not designed for abnormal vehicles. The repairs, if required, should be the responsibility of the Contractor and the Provincial road authority.
- The transport route/s of the wind turbine components, solar PV modules, batteries, transformers and ammonia plant components between their origin of manufacture to the site may be National, Provincial or Local roads; and each authority will be required to provide the necessary permits for the transportation of any oversized or abnormally heavy components.
- It is recommended that an abnormal vehicle route management plan be undertaken when the port/s of entry of the tower components (masts, blades, rotor nacelles, generators, etc.) are known. These plans should include all aspects such as horizontal and vertical requirements along the routes, bridges along the route, speed limits, etc. These plans and the application for the abnormal permits is normally the responsibility of the logistics company that will transport the components to site.
- The Operational phase trip generation of the Wind WEF, Solar PV and Green ammonia plant is expected to be negligible due to the low number of permanent staff trips. The associated transport impact on the surrounding road network will be negligible.
- The transportation of the manufactured liquid ammonia from the plant will be via road to the market, or via road to a rail facility for further distribution, or a combination of the two.
- Road transport will be by means of ISOtainers. ISOtainers are road-based tankers that can transport 12 tons of ammonia per 20ft pressurised tank, 2 tanks per vehicle. For a production capacity of 100 000 tons per annum, approximately 8 334 two-way trips are required per annum. If the ammonia is transported during workdays only, 251 days a year, a total of only 34 trips (Total in & out) will be required per day. This low trip generation is expected to have a low impact on the road network and surrounds.
- There may be a requirement for more regular maintenance of the provincial district roads during the operation phase of the ammonia plant. This should be the responsibility of the Provincial road authority.
- Rail transport of the ammonia will be with pressured rail containers (ISOtank). Rail transportation will reduce the traffic loading on the greater road network. The closest rail facility to the ammonia plant is located outside of Ermelo. This rail facility is primarily used to load coal for transport to the Richards Bay coal terminal. It is the intention to transport some or all of the ammonia to this facility via road for further distribution. The option to build a rail loading facility on the railway line outside Camden, closer to the ammonia plant, is not regarded as feasible due to the cost.
- The safety of the intersections off the National roads may be compromised due to the increase in especially heavy vehicle volumes. It is recommended that additional temporary and permanent road signage is installed at the intersections of the D260/N11, the D1107/N11 and the D1264/N2 to improve the safety of the intersections. The developer has undertaken to implement the required signage to the relevant Provincial and SANRAL standards, if allowed to do so.
- It is not possible to determine the volume of traffic that will be generated during the decommissioning phases of the three facilities. It can however be expected that the volumes will be lower than during the construction phase, these trips may not occur concurrently, and the resultant transport impact on the local access roads will therefore be lower than during the Construction phase.
- The overall significance of each impact during the Construction Phase of the facility detailed in Table 7-2 is Low without mitigation, and Very Low with mitigation. The impacts are limited to the peak construction period only, site only/local or regional, and fully reversible.
- The proposed mitigating measures are easy to implement and will assist to either prevent or reduce the impacts of increased vehicle engine and tyre noise, exhaust fumes and generation of dust on unsurfaced roads and unnecessary road damage.
- The maximum traffic generation of the Camden I and Camden II facilities are expected to occur at the same time for the construction phase, as the facilities will be developed concurrently. The cumulative impact will be very low on the site and local road network during construction, with the implementation of the recommended mitigations.

- The maximum traffic generation of the Camden I and Camden II facilities are expected to occur at the same time for the operation phase, as the facilities will be operated concurrently. The cumulative impact will be low on the site and local road network during the operation phase, with the implementation of the recommended mitigations.
- It should be noted that the Significance of the transport impact of the Camden II facility is far lower than the expected significance of the Camden I facilities for the construction and operation phases.
- The cumulative impact of the decommissioning phases of the Camden I and Camden II facilities were not assessed, as it cannot be determined if these phases will occur concurrently, if ever.

It is concluded that the proposed Camden I Facility will have a low transport impact on the adjacent road network, if the recommended upgrades and mitigation measures are implemented, and it is recommended that the TIA should be accepted as part of the EIA application.

BIBLIOGRAPHY

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APPENDIX