



Traffic Impact Assessment

Construction of a Green Hydrogen Pipeline from Arandis to Farm 58

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1 Introduction and Background

1.1 Introduction

Cleanergy Solutions Namibia (Pty) Ltd is a joint venture between Ohlthaver & List (O&L) Group and CMB.Tech. The Ohlthaver & List (O&L) Group is the largest privately owned consortium in Namibia, with an operational track record spanning over a century and covering a diverse number of industries. CMB.TECH is a Belgium company specialising in the design, construction and operations of large marine and industrial modes of transportation that utilise hydrogen and ammonia. It forms an integral part of Compagnie Maritime Belge which is a family-owned shipping group, founded in 1895.

Cleanergy Solutions Namibia is intending on becoming a driving force in the growth of the Namibia's hydrogen economy, while contributing to the global shift for industrial decarbonisation. The organisation is in the process of finalising the construction of the first hydrogen demonstration plant in Namibia, with first production intended for the latter part of 2024.

The proposed green hydrogen pipeline forms a key part of the broader hydrogen and ammonia infrastructure development. It will be constructed between Arandis and Farm 58 in the Erongo Region. Three routes were proposed to connect the hydrogen demonstration plant near Arandis with the ammonia production plant on Farm 58. The three routes are being discussed in this report under:

- Swakopmund Hydrogen Pipeline Route Option
- Dorop Hydrogen Pipeline Route Option
- Naukluft Hydrogen Pipeline Route Option

The roads which might be affected by the construction and operation of these pipelines were investigated to determine the impact of the generated traffic on these roads. The roads identified for this study are the following:

- The High-volume sealed road, B2
- The High-volume sealed road, D1984
- The Low volume sealed road, C28
- The Salt Gravel Road, C28

The figure overleaf presents the different routes.



Figure 1 - Locality map of the project

1.2 Route Description

The study was based on the current road network; the expected affected routes between Arandis, Swakopmund and Walvis Bay; the present traffic operating and pavement conditions; and an evaluation of the impact of the proposed pipeline traffic generation on the existing road network.

The following road sections were identified which might be impacted by the new development:

Swakopmund Hydrogen Pipeline Route Option:

- The High-volume sealed road, B2
- The High-volume sealed road, D1984

Dorob Hydrogen Pipeline Route Option:

- The High-volume sealed road, B2
- The Low volume sealed road, C28
- The Salt Gravel Road, C28

Naukluft Hydrogen Pipeline Route Option:

- The High-volume sealed road, B2
- The Low volume sealed road, C28
- The Salt Gravel Road, C28

The B2 Road as well as the D1984 Road are bituminous surfaced roads, designed and constructed for high traffic volumes. Maintenance on these roads is carried out under the Roads Authority of Namibia. The C28

route consists of two sections. The first is a salt gravel road and the second section is a low volume bitumen surfaced road. The C28 provides access to the Dorop Park as well as the Langer-Heinrich Uranium Mine. These roads were evaluated in more detail during the study.

1.3 Objective of the study

Environmental Compliance Consultancy (ECC) needs a traffic impact assessment study for the proposed construction of an 80 km hydrogen pipeline from the hydrogen production plant near Arandis to Farm 58, Erongo region, Namibia. The project, owned by Cleanergy Solutions Namibia (Pty) Ltd., aims to connect a green hydrogen plant near Arandis to a green ammonia production plant on Farm 58.

2 Approach and Methodology

In line with the objectives of this study and with reference to the planned traffic expected to be generated by the construction and operation of the hydrogen pipeline from Arandis to Farm 58, the following methodology guided the Traffic Impact Assessment:

- A meeting was held with the Client to clarify and confirm the proposed route options, items discussed at the participation meeting regarding the road and traffic and items to be included in the study from ECC's side.
- Discussions were held with representatives of the Roads Authority to identify possible future upgrades.
- A site investigation was undertaken to evaluate the surface condition of the roads identified, observe existing traffic flow operations, identified dwellings along the routes, affected communities, safety concerns and possible problematic crossings.
- Traffic data from traffic counting stations located on B2, C28 and D1984 was obtained from the Road Management System of the Roads Authority. Traffic data was used to determine the average daily traffic (ADT) and annual average daily traffic (AADT).
- The expected generated traffic as received from Cleanergy Solutions Namibia were assigned to the road network and added to the existing traffic volumes.
- The effect that the expected additional generated traffic will have on the conditions of the transport routes was assessed.

The effect of the generated traffic on the affected communities were also assessed in terms of construction activities and additional traffic volumes.

3 Site Investigation

A site investigation was undertaken, and the following observations were recorded during the visit:

- **Access to the hydrogen production plant located at Arandis**

The options for access from Arandis to the hydrogen production plant was investigated as well as the impact on the Arandis town roads.

- **Existing Intersections affected by the Project**

An inventory of all the accesses to the farms and settlements were recorded. This information was used to provide an indication of the affected communities and stakeholders along the proposed transport routes.

- **Existing Pavement Condition**

The condition of the existing pavement was surveyed to determine the overall condition and the effect of what newly generated traffic will have.

- **Geometric Alignment Evaluation**

Sight distances at all accesses and intersections were investigated and assessed to ensure the safety of the public from any additional traffic.

- **Evaluation on traffic of Proposed Crossings**

An evaluation was done to determine how construction of pipe crossings will affect the existing traffic.

3.1 Access to Hydrogen Production Plant at Arandis

The start of the hydrogen pipeline is located just outside Arandis. During the construction and operation phases, access from the B2 Main Road to the site will be required. A potential route was identified, and the following intersections were assessed to determine the impact of the generated traffic from the construction and operation phases of the hydrogen pipeline:

- **Access from Main Road (B2) to Arandis**
- **Access to Arandis and Rossing Mine**
- **Access to Gravel Road (Trekkopje Mine Road)**
- **Possible Access to Hydrogen Production Plant**
- **Trekkopje Mine Access Road**



Figure 2 – Potential route from B2 Main Road to Arandis site

Access from Main Road (B2) to Arandis

The access from B2 to Arandis is a high traffic volume bitumen intersection with capacity to accommodate traffic from Rossing Mine, Trekkopje Mine as well as Arandis. The sight distance is adequate at the intersection and no safety concerns were identified. The intersection accommodates turning movements of heavy vehicles. Evaluating the current traffic volume at the intersection, additional traffic generated by the hydrogen pipeline construction and operation phases will have little to no impact on the traffic and upgrading of the existing infrastructure is not deemed necessary. The road surface is in a good condition.

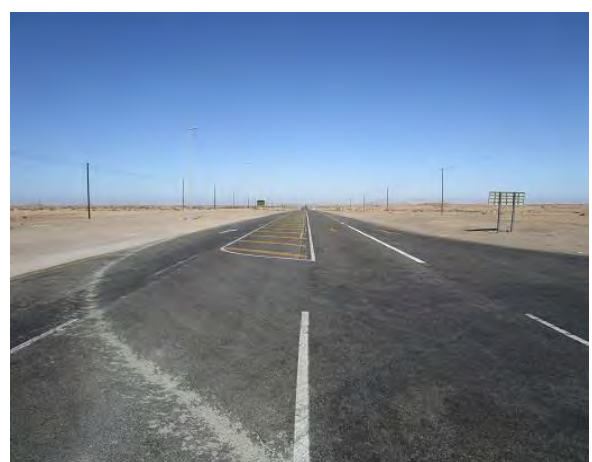


Figure 3 - Access from Main Road (B2) to Arandis

Access to Arandis Town

The second access towards Arandis from the B2 Main Road is a high traffic volume bitumen intersection with existing capacity to accommodate traffic from Rossing Mine, Trekkopje Mine as well as Arandis. The sight distance is adequate, and no safety concerns were identified. Evaluating the current high traffic volume at the intersection, additional generated traffic by the hydrogen pipeline construction and operation phases will have little to no impact on the traffic and upgrading of the existing infrastructure is not deemed necessary. The road surface is in a good condition with no major surface failures.



Figure 4 - Access to Arandis Town

Access to Gravel Road (Trekkopje Mine Road)

The intersection transitions from a bitumen surfaced road to a gravel road. The intersection and access road currently accommodate the Trekkopje Mine vehicles. The sight distance is adequate, and no safety concerns were identified. Evaluating the current traffic volume at the intersection, additional traffic added by the hydrogen pipeline construction and operation phases will have little to no impact on the traffic and upgrading of the existing infrastructure is not deemed necessary. The road surface is in a good condition.



Figure 5 - Access to Gravel Road (Trekkopje Mine Road)

Access to hydrogen production plant

Possible access, at an existing track to the proposed hydrogen production plant, was investigated. Access will be from a graded gravel road currently utilized by the Trekkopje Mine. Sight distances to both sides were investigated and found to be adequate. Additional traffic generated by the hydrogen pipeline construction and operation phases will have little to no impact on the existing traffic and upgrading of the existing infrastructure is not deemed necessary.



Figure 6 - Access to site Hydrogen Production Plant

Trekkopje Mine Access Road

The access road to the Trekkopje Mine is a graded gravel road with capacity for the mine vehicles. Permission can potentially be obtained from the Trekkopje Mine to use a section of their access road past the mine access point to connect with the proposed hydrogen production plant. The current road passes the proposed location for the hydrogen production plant. A short access road an intersection will have to be constructed.



Figure 7 - Trekkopje Mine Access Road

3.2 Existing Intersections affected by the Project

All existing intersections along the B2, C28 and D1984 roads were identified in the study area. These intersections provide communities and stakeholders access to the following:

- Homesteads
- Various Mines
- Pump Stations (NamWater)
- National Park (Dorob Park)
- Tourist Attractions (Goanikontes Oasis)
- Swakopmund Plots/Farms

The homesteads are mostly located around the Swakopmund town area with access to the Arandis Town also located in the study area. The Trekkopje Mine, Rossing Mine and Husab Mine all get access from the B2 Main Road from these identified intersections. Two NamWater pump stations, pumping water to the above-mentioned mines, are located along the B2 Main Road. Most of the tourist attractions along the study area consists of lookout points, with Goanikontes Oasis getting access from the B2 and C28 Roads. The Swakopmund plots/farms consist of farmhouses with added workers houses and small agriculture portions on some of them.

There are twelve intersections identified on the B2 Main Road, two intersections identified on the C28 Road and only one intersection identified on the D1984 Road. The locations of these intersections are located as shown in Figure 8 below.

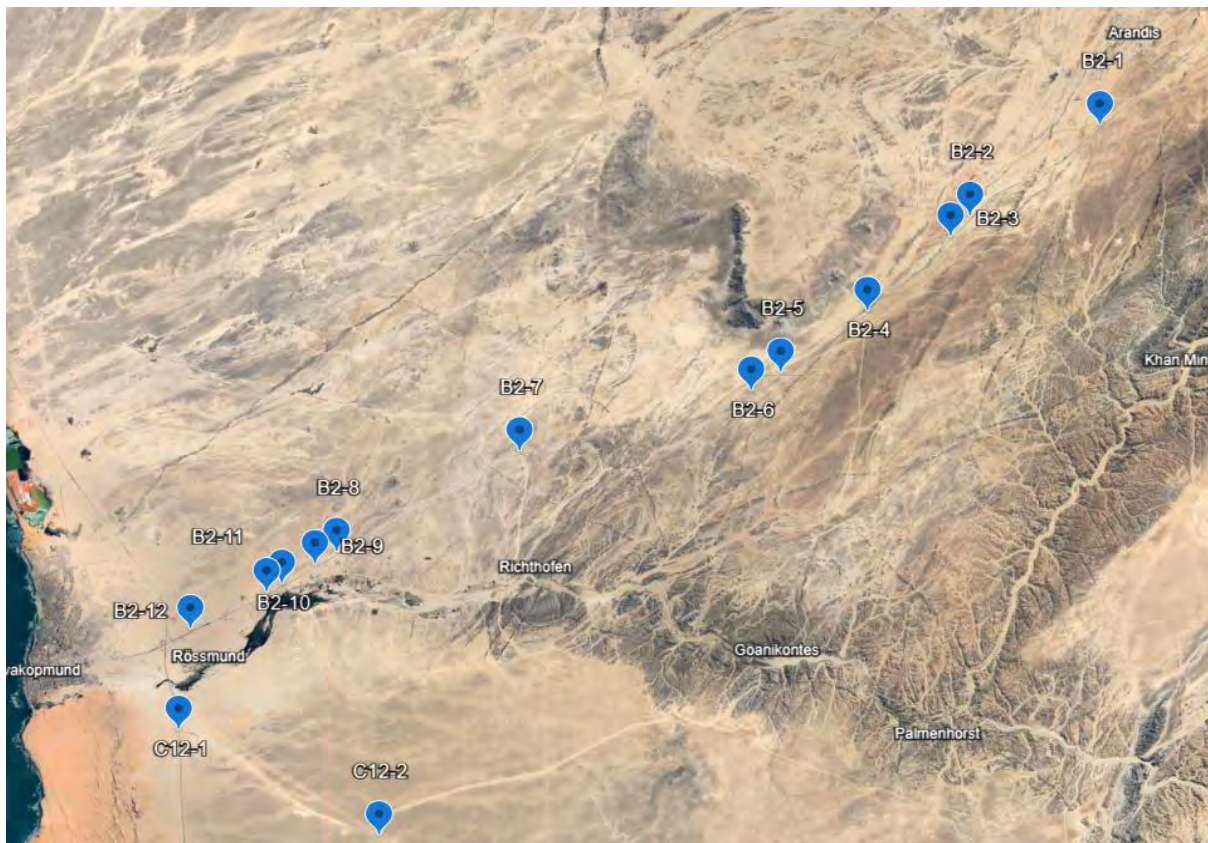


Figure 8 – Identified intersections along B2 and C28 Roads

The tables below indicate the location of the intersections, affected stakeholder as well as the condition of the intersections identified in the study area.

Table 1 - Intersections located on the B2 Road

Intersection No.	Location	Size	Stakeholder	Condition	Save sight Distance	Potential Access to Pipeline
B2-1	22°27'25" S 14°57'58" E	Minor, South side	Arandis Airport	Good	Yes	No
B2-2	22°29'36" S 14°54'47" E	Minor, South side	Unknown	Good	Yes	No
B2-3	22°30'05" S 14°54'18" E	Major, South side	Husab Mine	Excellent	Yes	No
B2-4	22°31'54" S 14°52'15" E	Minor, Both sides	Goanikontes Oasis	Good	No	Yes, North Side
B2-5	22°33'20" S 14°50'04" E	Minor, North side	Railway access	Good	Yes	Yes, North Side
B2-6	22°33'48" S 14°49'22" E	Minor, South side	NamWater Pumpstation	Good	Yes	No
B2-7	22°35'16" S 14°43'37" E	Minor, Both sides	Namib Lead and Zinc	Fair	Yes	Yes, North Side
B2-8	22°37'41" S 14°39'26" E	Minor, South side	Swakopmund River Plots	Good	Yes	No
B2-9	22°33'48" S 14°49'22" E	Minor, North side	Swakopmund Quarry	Fair	Yes	Yes, North Side
B2-10	22°38'27" S 14°37'44" E	Major, South side	Swakopmund River Plots	Excellent	Yes	No
B2-11	22°38'39" S 14°37'21" E	Major, South side	Nonidas	Excellent	Yes	No
B2-12	22°39'33" S 14°35'28" E	Major, South side	Rossmund Golf Estate	Excellent	Yes	No

The minor intersections along the B2 Main Road provide access to various stakeholders. During the site investigation it was found that only a small percentage of vehicles make use of these intersections. They are in a good to fair condition with minor defects identified at selected intersections. A selected few of the minor intersections can be utilized in future to provide potential access to the hydrogen pipeline during the construction and operation phases. Due to the high volume of traffic currently on the B2 Main Road, the additional traffic added by the proposed project should have little to no effect on the current traffic and infrastructure.

The major intersections along the B2 Main Road provide access to the Mines as well as the Swakopmund residents. These intersections are all in an excellent condition with no defects identified during the site investigation. All major intersections have the capacity to accommodate the current traffic generated from mining activities as well as the residents. Analyzing the current capacity as well as the high volume of traffic currently on the B2 Main Road, the generated traffic added proposed by the new project should have little to no effect on the current major Intersections.

Table 2 - Intersections located on the C12 and D1984 Road

Intersection No.	Location	Size	Stakeholder	Condition	Safe Sight Distance	Potential Access to Pipeline
C28-1	22°41'58"S 14°35'09"E	Major, Bridge	N/A	Excellent	Yes	Yes, East Side
C28-2	22°44'30" S 14°40'08" E	Minor, North side	Goanikontes Oasis	Good	Yes	N/A
D1984-1	22°57'11"S 14°36'14"E	Major, Bridge	Green Hydrogen Pilot Plant	Excellent	Yes	Yes, West Side

The minor intersection provides access to the Goanikontes Oasis and is mainly used by tourists to gain access to the Swakopmund River and moon landscapes. The minor intersection is in good condition. The two major intersections are newly constructed bridges with capacity for high volume traffic from the mines as well as the Walvis Bay Harbor. Analyzing the current capacity as well as the high volume of traffic currently on the B2 Main Road, the expected generated traffic by the proposed project should have little to no effect on the current major intersections.

3.3 Existing pavement conditions

This survey was conducted during August 2024. The condition of the three affected roads was inspected and the survey findings of the B2, C12 and D1984 Roads are briefly presented hereunder.

B2 Main Road

The 60km section of road between Swakopmund and Arandis is a high traffic volume sealed bitumen surfaced road. Most of the road section is in a good condition with minor defects identified on isolated sections listed below:

- Visual edge breaks
- Rutting near intersections
- Small potholes
- Visible Cracks



Figure 9 – Photos taken on section of the B2 Road (Cracks and Potholes)

Evidence of regular maintenance of the above-mentioned defects are clearly visible. During the site investigation a team from the Roads Authority of Namibia Maintenance division was busy with edge break repairs and the team informed that pothole and crack repairs were scheduled within the next year. The Roads Authority of Namibia plans to widen the B2 road, budget restraints could prolong this period.

C28 Road

The 13km section of road between the intersection connecting with the D1984 Road and the proposed hydrogen pipeline crossing is a combination of salt gravel road (8km) and a low volume sealed surfaced road (5km). Most of the road sections are in a good condition with the minor defects identified on the salt gravel road listed below:

- Small potholes
- Damaged wearing coarse



Figure 10 - Photos taken on section of the C28 Road

Additional maintenance is required on the gravel salt road section. The low volume sealed surfaced road was upgraded by the Roads Authority of Namibia to accommodate additional traffic from the Langer-Heinrich mine that is currently utilizing the C28 Road. There have been discussions by the Roads Authority of Namibia to upgrade the first 8km section of salt gravel road to accommodate the mine traffic.

D1984 Road

The D1984 road section between Swakopmund and Walvis Bay is currently being upgraded to bitumen standards. The road is upgraded to a dual carriage way with capacity to accommodate the future traffic from the Walvis Bay Port and is in an excellent condition.



Figure 11 - Photo taken on section of the D1984 Road

3.4 Geometric Alignment Evaluation

The geometric alignment of the three affected road sections was also evaluated. Sight distances at all the accesses and intersections were checked to determine if this conforms to minimum standards.

Existing Intersections

The accesses and intersections were found to have ample sight distance in both directions to ensure that the road users could safely use them.

Potential access to the hydrogen pipeline

Three existing Intersections were identified that could be potentially used in future to gain access to the hydrogen pipeline north of the B2 Main Road. As per Table 1, the Intersections are:

- **B2-5 (Railway access)**
- **B2-7 (Namib Lead and Zinc)**
- **B2-9 (Swakopmund Quarry)**

The above-mentioned intersections give access to the north of the B2 Main Road with railway crossings already constructed. All of them have sufficient sight distance in both directions to ensure that can safely be used during the construction and operation phase of the hydrogen pipeline.



Figure 12 - Railway Intersection (B2-5)



Figure 13 – Namib Lead and Zinc (B2-7)

A gravel road can be constructed to link the existing gravel access road to the hydrogen pipeline. With railroad crossing already constructed on some of the intersections it will minimize the cost if the proposed intersections are utilized during the construction and operation phases of the hydrogen pipeline.

3.5 Evaluation of Proposed Road Crossings

During the site investigation all the proposed hydrogen pipeline crossings were inspected, and the following was observed and recorded for each of them.

- Sight distance for potential new access
- Final Road level above natural ground level
- Potential Crossing Structures

- Surrounding landscape (Topography)
- Affected Services

Swakopmund Hydrogen Pipeline Route Option

1. Crossing between Swakopmund and Arandis:

Location: 22°31'49" S 14°52'21" E

At the proposed hydrogen pipeline crossing, the final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no alternative crossing structures (culverts/bridges) to utilize for the new pipeline crossing in the vicinity. The surrounding landscape is flat. The current proposed crossing will cross an existing water pipeline just south of the B2 Main Road. Overhead Telecom lines should also be taken into considered during the construction of the hydrogen pipeline.

The proposed crossing location has however enough sight distance in both directions should an intersection be constructed to provide access to the hydrogen pipeline during the construction and operation phases. It is however recommended that an existing intersection (B2-4 – Goanikontes Oasis) be utilized to provide access to the pipeline north of the B2 Main Road



Figure 14 – B2 Main Road crossing between Swakopmund and Arandis

2. Crossing at Swakopmund Intersection

Location: 22°31'49" S 14°52'21" E

The final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no alternative crossing structures (culverts/bridges) to utilize for the new pipeline crossing in the vicinity. The surrounding landscape is flat.

The proposed pipeline crossing is close to existing major intersection and the construction might have a big impact on the current traffic. The current position will cross five road lanes.



Figure 15 – B2 Main Road crossing at Swakopmund Intersection

3. Swakopmund River Bridge:

Location: 22°40'42" S 14°34'52" E

The crossing will have no impact on the current traffic as it can be facilitated by the existing Swakopmund River Bridge. The pipeline can be constructed underneath the bridge and provision needs to be made for future floods of the Swakopmund River, that the floods will not to damage the pipeline.

4. Green hydrogen Pilot Plant Crossing

The current gravel salt road is being upgraded to a bitumen standard sealed road, but no provision has been made for the new hydrogen pipeline crossing. There are no alternative crossing structures (culverts/bridges) to utilize for the new pipeline crossing. The proposed location has enough sight distance in both directions should an intersection be constructed to provide access to the hydrogen pipeline during the construction and operational phases, it is however recommended that the existing bridge is utilized to provide access. The surrounding landscape is flat. The proposed pipeline crossing is located near a newly constructed intersection/bridge. The current proposed crossing will cross an existing railway line just before it crosses the D1984 Road. Overhead NamPower powerlines should also be taken into consideration during the construction of the pipeline.



Figure 16 – D1984 Road crossing at the Green hydrogen Pilot Plant Crossing

Dorop Hydrogen Pipeline Route Option

Location: 22°45'58" S 14°44'07" E

The final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no alternative crossing structures (culverts/bridges) to utilize for the new pipeline crossing in the vicinity. The surrounding landscape is flat. The current proposed crossing will cross two existing water pipelines just north of the C12 Road. The proposed location has enough sight distance in both directions should an intersection be constructed to gain access to the pipeline during the construction and operation phases.



Figure 17 – C12 Road crossing, Dorop Hydrogen Pipeline Route Option

Naukluft Hydrogen Pipeline Route Option

Location: 22°45'05" S 14°41'44" E

The final road level will only accommodate an underground pipe crossing due to the limited height above ground level of the existing road. The crossing will pose challenges if the pipeline should run above ground. There are no alternative crossing structures (culverts/bridges) to utilize for the new pipeline crossing in the vicinity. The surrounding landscape is flat. The current proposed crossing will cross two existing water pipelines just north of the C12 Road. The proposed location does not have enough sight distance (blind crests) in both directions should an intersection be constructed to gain access to the pipeline during the construction and operation phases.



Figure 18 – C12 Road crossing, Naukluft Hydrogen Pipeline Route Option

4 Affected Communities

During the site investigation all the affected communities along the proposed route of the hydrogen pipeline were identified. The traffic impact on these communities were identified and assessed in the section below. The following communities were identified:

- Arandis Town Residents
- Swakopmund River Plots Residents
- Nonidas Residents - Swakopmund
- Swakopmund Golf Estate (Rössmund Golf Estate)
- Swakopmund Town Residents

Arandis Town Residents

If the proposed route in this report is utilized to gain access to the plant in Arandis, additional traffic will be added to the existing road infrastructure during the construction and operation phases of the hydrogen pipeline. The additional traffic during both phases will have little to no impact on the residents as the volume of vehicles from both the Rossing and Trekkopje Mines are high in comparison with the additional traffic to be added by the Arandis plant.



Figure 19 - Arandis Town, Residents

Swakopmund River Plots Residents

The additional traffic during both the construction and operation phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the processing plant during both phases. The intersection to gain access to the Swakopmund River plots has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.

Nonidas Residents – Swakopmund

The additional traffic during both the construction and operation phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the processing plant during both phases. The intersection to gain access to the Nonidas has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 20 – Swakopmund River Plots and Nonidas, Residents

Swakopmund Golf Estate (Rössmund Golf Estate)

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the processing plant during both phases. The intersection to gain access to the Swakopmund Golf Estate has been upgraded to accommodate the high-volume traffic on the B2 Main Road and to provide safe access for the residents.



Figure 21 - Swakopmund Golf Estate, Residents

Swakopmund Town Residents

The additional traffic during both the construction and operational phases will have little to no impact on the residents as the volume of vehicles currently using the B2 Main Road is high in comparison with the additional traffic to be added by the processing plant during both phases.

5 Traffic Assessment

5.1 Existing Traffic Data

Existing traffic data collected included available historic traffic data, moving traffic counts and estimated traffic data from the Roads Authority of Namibia. Below are the positions where traffic counts were taken:

- Permanent Counting Station 021 (RA St 021) on B2 Main Road ([364-day data, 2023](#))
- Permanent Counting Station 253 (RA St 253) on B2 Main Road (302-day data, 2023)
- Permanent Counting Station 334 (RA St 334) on C28 Road (365-day data, 2023)
- Permanent Counting Station 335 (RA St 335) on C28 Road (245-day data, 2023)
- Estimated Traffic D1991 Road, at B2 Main Road Intersection (Estimated from 2021 data)
- Estimated Traffic D1991 Road, at C28 Road Intersection (Estimated from 2021 data)

In Table 3 below, traffic data, as received from the Roads Authority and the moving traffic counts are being summarized. The Average Daily Traffic (A.D.T) has been presented in following table.

Table 3 - Average Daily Traffic Volumes per Link

Description	ADT Light	ADT Heavy	ADT Total
B2:			
RA Station 21 (2023) – Swakopmund to Arandis	2,339	951	3,290
RA Station 253 (2023) – Arandis to Usakos	1,766	841	2,607
C28:			
RA Station 334 (2023) – Goanikontes Turn-off	131	51	182
RA Station 335 (2023) – Langer Heinrich Mine	25	2	27
D1991:			
Estimated Traffic B2 Intersection (2021)	38	35	73
Estimated Traffic C28 Intersection (2021)	41	31	72
D1984:			
Moving Traffic Count	420	780	1200

The data from the moving vehicle count, has been converted to 24 hour counts by using the information from the permanent and ad hoc stations. The heavy vehicles as a percentage of the ADT for each section is listed below:

- 29% of the ADT on the B2 Main Road between Swakopmund and Arandis.
- 32% of the ADT on the B2 Main Road between Arandis and Usakos.
- 28% of the ADT on the C28 Road at Goanikontes turn-off
- 7% of the ADT on the C28 Road at Langer Heinrich Mine
- Estimated 48% of the ADT on the D1991 Road at B2 intersection
- Estimated 43% of the ADT on the D1991 Road at C28 intersection
- 65% of the ADT on the D1984 Road between Swakopmund and Walvis Bay.

Analysing the data from both RA Stations located on the B2 Main Road, the traffic volumes between Swakopmund and Arandis were found to be higher than the traffic volumes between Arandis and Usakos. This can be expected due to the traffic transporting people and goods from Swakopmund to all the Mines located around Arandis.

If the ADT from Station 334 (2023) and the estimated traffic (2021) is compared, the heavy vehicles counted are slightly higher than the estimated vehicles. The light vehicles however seem to be much more than the estimated vehicles. Using this data, it was assumed that the values for the estimated traffic (2021) at the D1991/C28 Road Intersection will also be higher by the same factor.

Most of the traffic on the C28 Road was recorded between Swakopmund and the Langer Heinrich Mine. Only a small number of traffic is recorded using the road past the Langer Heinrich Mine towards Windhoek on a daily basis.

5.2 Additional Traffic Data

The information from the draft scoping report was used to determine the additional traffic that will be added to the existing road infrastructure during the construction and operational phases of the project. Using the available data as well as estimating peak additional traffic contributions during both phases are summarised in the next sections.

Construction Phase Additional Traffic

The scoping report indicates that approximately 30 to 100 workers will be hired during the construction phase with two security guards on night duty. The workers will be transported from Arandis and Swakopmund to site using two busses on a daily basis.

A waste management plan will be implemented on site which may include a small truck to transport waste. Temporary waste bins will be available on-site varying in waste categories such as general household waste, plastic, steel, concrete and hazardous waste. It is assumed that removal of waste will be done on a daily basis by means of a small truck or LDV.

The Carbon Steel pipes will be transported to site during the construction phase and stored at various locations. The pipes will be transported in 12m segments of which will make up the total length of the 80km pipeline. Assuming a single truck can transport 192m of pipes with one load, a total of 417 truckloads will be required to transport all the pipe segments to site. There are 6 proposed intersections that can be utilized to gain access to the hydrogen pipeline along the B2 Road and each of the intersections will have to accommodate 70 truckloads during the construction phase. If two trucks are used to transport the pipes to site from Walvis Bay, on the peak it will add two trucks to the current traffic on a 4-hourly basis.

Additional materials will also be transported to site (cement, water, tools, ext.). The assumption was made that the delivery of these materials will be done once per day using a truck.

The construction supervision team as well as the foremen will travel to site on a daily basis to monitor all construction activities. This will be done by means of LDV's and it is estimated that a maximum of 5 LDV's will be utilized during the construction phase of the project.

Table 4 - Average Daily Traffic Volumes added during the Construction Phase

Description	ADT Light	ADT Heavy	ADT Total
B2:			
Vehicles added during construction phase	5	7	12
C28:			
Vehicles added during construction phase	5	7	12
D1984:			
Vehicles added during construction phase	5	7	12

It is recommended that during peak delivery of the carbon steel pipes, that the contractor makes use of temporary road signs as well as flag ladies. These resources can be stationed at the intersections along the B2 Main Road, C28 Road and D1984 Road to always ensure safe access of all construction and delivery vehicles.

Operational Phase Additional Traffic

The pipeline will transport 15 000 m³ hydrogen gas (with a mass flow of 10 tons/h) from the production plant to the ammonia production plant on Farm 58. It will also act as a buffer storage to maintain ammonia plant operations during the night. Trained personnel will continuously monitor operations and ensure safety procedures are followed.

There will be constant monitoring with a fibre optic cable of possible leakages points, pressure switches and vibrations (external digging). These systems will be monitored from Arandis and Farm 58. Infield surveys will also be conducted on a regular basis and/or when required. It is estimated that a maximum of 2 LDV's will be utilized during the operational phase of the project on a daily basis with a truck to transport material when repairs and maintenance is required.

Table 5 – Estimated Average Daily Traffic Volumes added during the Operational Phase

Description	ADT Light	ADT Heavy	ADT Total
B2:			
Vehicles added during operational phase	3	2	5
C28:			
Vehicles added during operational phase	3	2	5
D1984:			
Vehicles added during operational phase	3	2	5

5.3 Traffic Impact

The expected generated traffic was assigned to each road section of the affected routes and added to the existing traffic volumes as to ascertain the impact of the proposed project on the surrounding road network. To illustrate the impact of the additional traffic on receptors along the routes, the following log-graphs were developed. These graphs show the current traffic, generated traffic and the total traffic on each road section.

Construction Phase

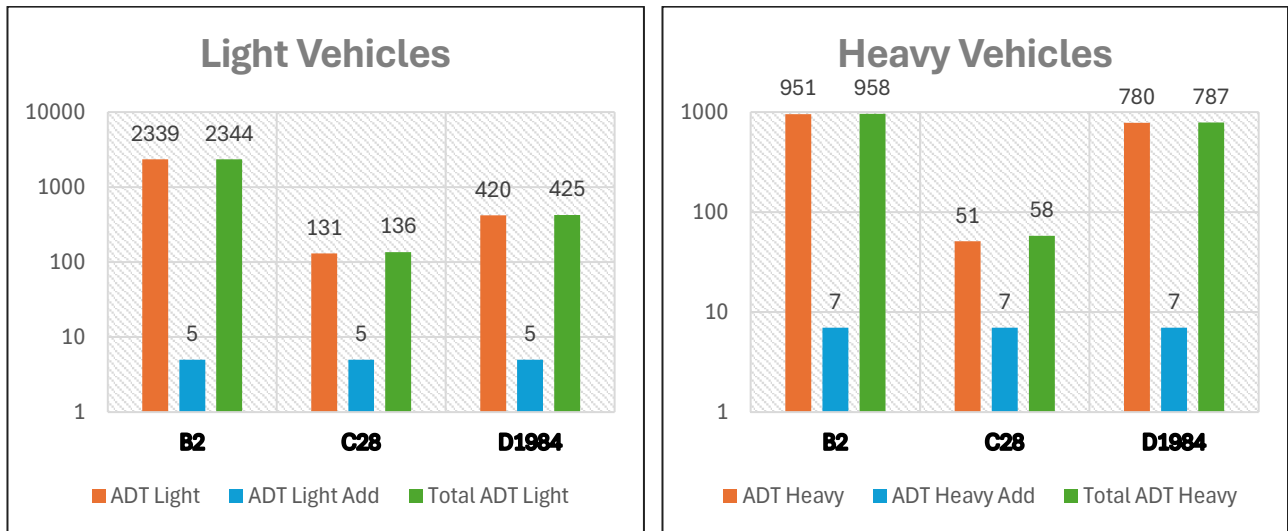


Figure 22 - Impact of generated light and heavy traffic during the construction phase

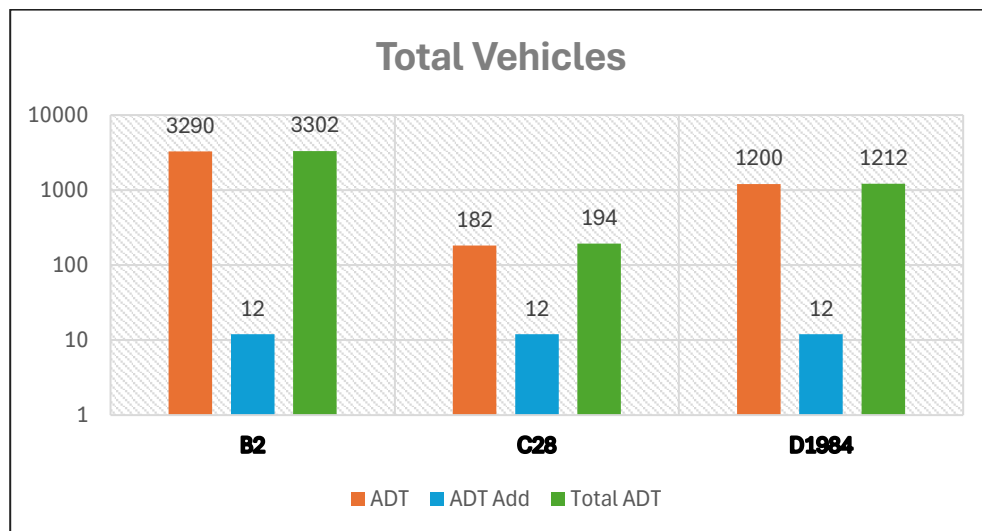


Figure 23 - Impact of Total generated traffic during the construction phase

Operational Phase

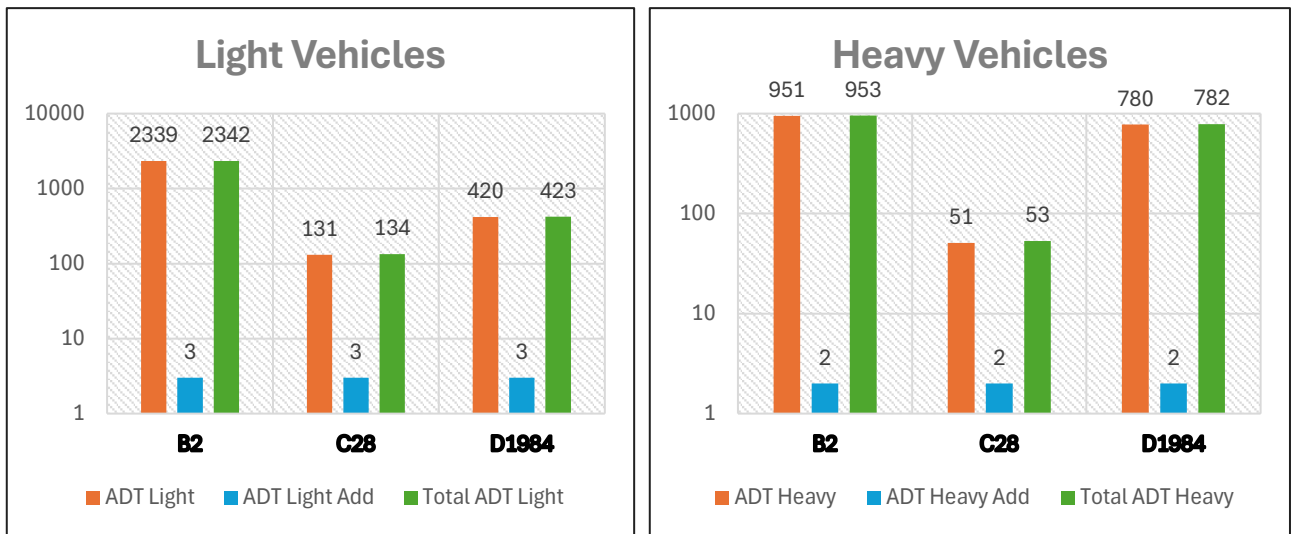


Figure 24 - Impact of generated light and heavy traffic during the construction phase

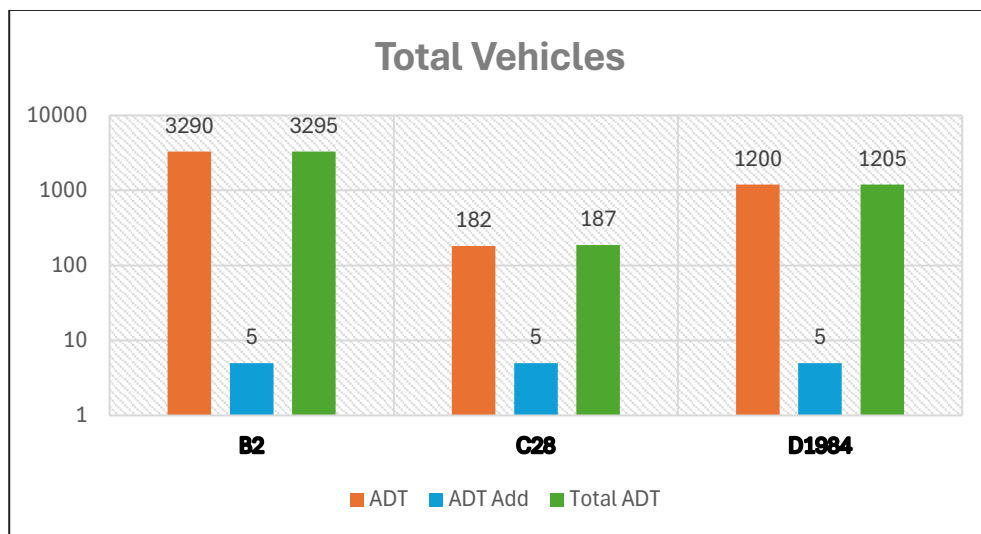


Figure 25 - Impact of Total generated traffic during the construction phase

5.4 Conclusion

Cleanergy Solutions Namibia is in the process of finalising the construction of the first hydrogen demonstration plant in Namibia, with first production intended for the latter part of 2024.

The proposed green hydrogen pipeline forms a key part of the broader hydrogen and ammonia infrastructure development. Three possible pipeline routes were proposed to connect the hydrogen demonstration plant near Arandis with the ammonia production plant on Farm 58. The roads, B2, C28, D1984, which might be affected by the construction and operation of these three pipelines were investigated to determine the impact of the generated traffic on these roads.

The Traffic Impact Assessment performed by Zutari Namibia covered the investigation into the current situation, including the current traffic, condition of the road infrastructure and the safety concerns on the current roads. The study further reported on the impact of additional traffic on the road infrastructure, affected communities along the route and the necessary mitigation and control measures.

It is concluded that:

- The road surface of the investigated roads and intersections are currently in a good condition.
- The geometry of the intersections is adequate for the current as well as the expected generated traffic.
- Sight distances of the intersections along the routes are adequate for the designed speed.
- The expected generated traffic will have little to no impact on the current traffic, road infrastructure as well as on the communities along the route.