APPENDIX F:

Impact Assessment

TURN180
ENVIRONMENTAL CONSULTANTS

REGISTRATION NUMBER: 2018/110720/07

IMPACT ASSESSMENT

THE PROPOSED ESTABLISHMENT OF A PUBLIC FILLING STATION AND A GENERAL BUSINESS AREA ON AGRICULTRUAL HOLDING 312 IN THE VAAL-HARTS SETTLEMENT B, HARTSWATER, NORTHERN CAPE PROVINCE

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Prepared By:

Turn 180 Environmental Consultants

Company Director	Louis De Villiers
Environmental Assessment Practitioner (EAP)	Marguerite Cronje
Assistant to the EAP and project contact person	Fébé Jansen van Vuuren
Postal Address	Suite 221 Private Bag X01 Brandhof 9324
Physical Address	3A Conde Street Bayswater Bloemfontein 9301
Cell	078 329 3459 072 967 7962
E-mail	admin@turn180.co.za louis@turn180.co.za margueritecronje@gmail.com

Applicant:

Thula ya Batho (Pty) Ltd

Applicant Contact Person	Mr. GP Olivier
Postal Address	P.O. Box 789 Hartswater 8570
Cell	082 948 2114
E-mail	gpolivier001@gmail.com

Site Information:

Erf Number	Erf 312 – Vaal-Harts Settlement B
21 Digit Surveyors Code	C00700070000031200000
District Municipality	Frances Baard District Municipality
Local Municipality	Phokwane Local Municipality
Site coordinates (Centre of site)	27°47'21.29"S 24°43'3.49"E

Executive Summary

The Impact Assessment assesses all activities associated with the proposed project for their environmental impacts. Mitigation measures that will decrease the impact on the environment are proposed for each impact and activity. Activities that may impact the environment were identified and subsequent impacts assessed in terms of severity, duration, extent, probability, and frequency. From these, the significance of each impact was calculated. A quantitative value of between 1 and 25 was obtained, 1 being the least significant and 25 being the most significant.

Activities which will take place during the construction phase were assessed separately from those that will take place during the operational phase.

The following activities and consequent impacts were identified and evaluated for the proposed project (fuel filling station near Pampierstad in the Northern Cape). Mitigation measures for each activity and impact are proposed and listed.

1) Summary of Impacts

Construction Phase:

Summary of Impacts: Construction Phase	**Significance**	
Activity	**Without Mitigation**	**With Mitigation**
Clearance of Vegetation o Loss of naturally occurring vegetation o Destruction of Habitat o Loss of animal species o Establishment of alien and invasive species o Loss of Topsoil o Soil Erosion o Dust generation o Loss of culturally significant resources	7,40 Low - Moderate	3,50 Low
Excavation and Construction Activities o Generation of dust and emissions o Generation of noise o Change in soil characteristics o Accidental loss of Animal Species o Loss of Land Use o Loss of culturally significant resources	7,17 Low - Moderate	4,53 Low
Storage and handling of hazardous substances o Soil Contamination o Contamination of Water Sources	7,00 Low - Moderate	2,75 Low
Generation and Disposal of Hazardous Waste o Soil Contamination o Water Contamination o Negative Aesthetic Impact	7,67 Low - Moderate	2,33 Low
Generation and Disposal of Waste (excluding hazardous waste) o Water Contamination o Negative Aesthetic Impact	9,75 Low - Moderate	2,50 Low
Wastewater (sewage) disposal o Contamination of Water	9,00 Low - Moderate	4,00 Low

Abstraction of Groundwater o Decrease of reserve capacity	15,00 Moderate - High	9,33 Low - Moderate

Operational Phase:

Summary of Impacts: Operational Phase	**Significance**	
Activity	**Without Mitigation**	**With Mitigation**
Generation and Disposal of Hazardous Waste o Contamination of Soil o Water Contamination	9,00 Low - Moderate	3,00 Low
Generation and Disposal of Waste (excluding hazardous waste) o Surface Water Contamination o Negative Aesthetic Impact	11,67 Moderate - High	3,50 Low
Wastewater (sewage) disposal o Water contamination o Negative Aesthetic Impact	9,42 Moderate - High	3,75 Low
Storage and Handling of Hazardous Substances o Groundwater Contamination o Surface Water Contamination o Soil Contamination	15,00 Moderate - High	4,00 Low
Abstraction of Groundwater o Decrease of reserve capacity	15,00 Moderate - High	9,33 Low - Moderate

2) Conclusion

In conclusion, the overall impact of this development with the appropriate mitigation measures will have Low significance or, in the worst case, Moderate to High significance. No impacts will have a high significance.

When considering the overall impacts of each activity, the generation and disposal of hazardous waste and the abstraction of groundwater will have the greatest impact on the environment during the construction phase.

During the Operational Phase the storage and handling of hazardous substances and the abstraction of groundwater will have the greatest impact on the environment. However, with proper mitigation the impacts will be minimized.

A positive socio-economic impact is anticipated regarding employment opportunities and economic activity in the surrounding area in the planning, construction, and operational phases.

Table of Contents

Impact Assessment Report

1) Assessment methodology

The environmental significance assessment methodology is based on the following determination:

Environmental Significance = Overall Consequence x Overall Likelihood.

2) Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information, and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen Severity/Intensity, Duration and Extent/Spatial Scale. Each factor is assigned a rating of 1 to 5, as described in the tables below.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment is (Table 1).

Table 1 Rating of severity

Type of criteria	Rating				
	1	2	3	4	5
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant Non-harmful	Small Potentially harmful	Significant Harmful	Great Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable I&AP satisfied	Slightly tolerable Possible objections	Intolerable Sporadic complaints	Unacceptable Widespread complaints	Totally unacceptable Possible legal action
Irreversibility	Very low cost to mitigate. High potential to mitigate impacts to level of insignificance. Easily reversible	Low cost to mitigate	Substantial cost to mitigate. Potential to mitigate impacts. Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate. Little or no mechanism to mitigate impact. Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change/ deterioration or disturbance	Moderate change/ deterioration or disturbance	Significant change/ deterioration or disturbance	Very significant change/ deterioration or disturbance	Disastrous change/ deterioration or disturbance

Determination of Duration

Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g., remedial action takes place (Table 2).

Table 2 Rating of Duration

Rating	Description
1 Low	1 Month
2 Low-Moderate	1 – 3 Months
3 Moderate	More than 3 Months
4 Moderate-High	5 – 10 Years
5 High	More than 10 Years

Determination of Extent/Spatial Scale

Extent refers to the spatial influence of an impact, be it contained to the immediate surroundings (site), extending to the surrounding area, regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders) (Table 3).

Table 3 Rating of Extent / Spatial Scale

Rating	Description
1 Low	Immediate, fully contained area (site)
2 Low-Moderate	Surrounding Area
3 Moderate	Regional
4 Moderate-High	National
5 High	International

Determination of Overall Consequence

Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 3 (Table 4).

Table 4 Example of calculating Overall Consequence

Consequence	Rating
Severity	4
Duration	2
Extent	10
SUBTOTAL	4 +2 +10 = 16
TOTAL CONSEQUENCE (Subtotal divided by 3)	16/3 = 5.3

3) Determination of Likelihood

The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described and in Tables 5 and 6.

Determination of Frequency

Frequency refers to how often the specific activity, related to the event, aspect or impact is undertaken (Table 5).

Table 5 Rating of frequency

Rating	Description
1 Low	Once a year / once during construction
2 Low-Moderate	Once / more in 6 Months
3 Moderate	Once / more a Month
4 Moderate-High	Once / more a Week
5 High	Daily

Determination of Probability

Probability refers to how often the activity/event or aspect has an impact on the environment (Table 6).

Table 6 Rating of probability

Rating	Description
1 Low	Almost never / almost impossible
2 Low-Moderate	Very seldom / highly unlikely
3 Moderate	Infrequent / unlikely / seldom
4 Moderate-High	Often / regularly / likely / possible
5 High	Daily / highly likely / definitely

Overall Likelihood

Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2 (Table 7).

Table 7 Example of calculating the overall likelihood.

Likelihood	Rating
Frequency	4
Probability	5
SUBTOTAL	4 + 5 = 9
TOTAL LIKELIHOOD (Subtotal divided by 2)	9/2 = 4.5

4) Determination of Overall Environmental Significance

The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW - MODERATE, MODERATE, MODERATE - HIGH or HIGH, as shown in the table below (Table 8).

Table 8 Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance

This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision-making process associated with this event, aspect or impact (Table 9).

Table 9 Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible improve	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.

Environmental Impact Assessment

The Environmental Impact Assessment for this development was conducted to determine the significance (positive or negative) of the impacts on the environment. Socio-economic factors are also addressed. For this assessment, the construction and operational phases are considered. The planning phase does not have a physical impact. This development will be permanent and therefore decommissioning and rehabilitation is not expected. The Construction Phase is addressed first. All activities that will take place during the construction phase are assessed for the potential impacts it may have on the environment. Mitigation measures which may lessen the significance of each impact is considered.

5) Construction Phase

The following activities will take place during the construction phase of the proposed development and may have an adverse impact on the environment. Each activity is assessed for the potential impacts it may have on the environment.

Clearance of Vegetation

The development will require natural vegetation on the footprint area (approximately 3 ha) to be removed. According to the Ecological Assessment (Van Rensburg, 2023), the vegetation type (Schmidtsdrif Thornveld) can be classified as Least Concern according to the National List of Threatened Ecosystems (Notice 1477 of 2009; National Environmental Management Act, 2004). Additionally, the vegetation is in a degraded condition. Two Protected Species, *Vachelia erioloba* and *Harpagophytum procumbens*, are present on the site. An ecological specialist study was undertaken for the site in November 2022. Refer to the Report on the Ecological and biodiversity Assessment (Van Rensburg, 2023) in Appendix D. The report by Van Rensburg (2023) was consulted in the preparation of this impact assessment. Further recommendations and mitigation measures can be viewed in there. Clearance of vegetation will result in the loss of habitat for plant and animal species.

Due to the degraded condition of the site, it is unlikely that Red Listed animal species will be encountered. Generalist mammalian species may be present and signs of them were observed. However, the site is adjacent to a natural area that is less degraded. It is expected that most animal species will relocate to the natural area when clearance of vegetation takes place.

Alien and/or invasive species easily establish on disturbed areas. With the clearance of vegetation, alien and/or invasive species may increase on the cleared site as there will be little competition from indigenous vegetation. This may, in turn, lead to the increased spread of alien and/or invasive species in the area.

In addition to the above, topsoil may also be lost through wind and water erosion as it becomes exposed. Soil erosion of both topsoil and subsoil may take place as the vegetation layer, which keeps soil in place, is removed. As a result, dust generation can take place which in turn, may lead to lower visibility and poorer air quality at the location than in the surrounding area. A further result may be increased sedimentation of the surface water system as an additional load of sediment reaches the system.

No culturally significant resources were observed on the site and therefore it is not expected that this impact will occur. However, should any such resources be encountered, the situation will be dealt with in order to preserve the resource.

- According to the impact assessment for the clearance of vegetation (Table 1), the activity without any mitigation measures will have a low to moderate significance. With mitigation measures the overall impact can be lowered to Low significance.

The following mitigation measures are advised:

- Obtain the necessary permits for the removal or relocation of protected species.
- Clearly delineate the area for vegetation clearance to minimise the footprint.
- Clearly delineate the areas designated for stockpiling development's footprint.
- Clearly delineate the areas where vehicles and machinery may operate to minimise the disturbance footprint.
- Incorporate several of the protected species, *Vachellia erioloba*, into the design and do not remove them.
- Relocate the protected geophytic species, *Harpagophytum procumbens*, to a suitable location.
- Plant a number of *V. erioloba* trees in the adjacent natural area or in another area of the same vegetation type where rehabilitation is required to offset the impact of those removed at this site.
- Do not allow fires on the site as it may increase the impacts of this activity.
- Any animals found on the site should be relocated to a suitable and safe area.
- Do not allow hunting of animals in the area.

- Remove alien vegetation regularly from the site to prevent its establishment and spread.
- Remove all topsoil from the site and stockpile it neatly to be used for levelling and gardens.
- Keep the topsoil stockpiles low to limit wind erosion and instability of stockpiles which may lead to the loss of topsoil.
- Clearly delineate the area where topsoil removal should take place to prevent the unnecessary removal of topsoil.
- Implement adequate stormwater management measures to prevent soil erosion.
- No topsoil may be used for construction purposes.
- Mitigation measures according to the Heritage Impact Assessment by Loudine Phillips (2023) should be implemented to prevent the loss of culturally significant resources.

Table 1 Impact Assessment for the Clearance of Vegetation

Activity	**Clearance of Vegetation**	The development of the proposed project requires the removal of vegetation and topsoil from the site. This may impact on the vegetation of the area leading to loss of biodiversity, establishment of invasive and alien plant species, destruction of habitat, loss of animal species, topsoil availability and quality, increased surface runoff, soil erosion (wind and water), dust generation and potentially the loss of culturally significant resources.						
Phase	Construction Phase							
Potential Impact	**Loss of naturally occurring vegetation**	The vegetation type is classified as Least Concern and is in a degraded condition, however two protected species were encountered on site. The site is adjacent to cultivated land on the northern and eastern boundary and to the tarred road (Kolong Street) on the southern boundary. Only the western boundary is adjacent to natural vegetation.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2,00	5,00	1,00	2,67	3,00	3,00	3,00	**7,80**
With Mitigation	2,00	5,00	1,00	2,67	3,00	3,00	3,00	**7,80**
Mitigation Measures	Obtain necessary permits to remove all identified protected species before construction							

	Limit clearance of vegetation to the area under construction								
	Keep several of the larger Camel Thorn trees intact and incorporate them into the design								
	Keep the protected geophytic species, *Hapragophytum procumbens*, on site if possible, or relocate it to a suitable and safe location.								
	Plant a number of Camel Thorn trees as offset for the impact of the trees removed from the site in a natural but disturbed area to promote rehabilitation in that area. It should be noted that the adjacent natural area to the west of the site is in a much better condition and has a high density of Camel Thorn trees.								
Reversal of Impact	No	It is not anticipated that the development will be decommissioned, and that rehabilitation will take place. The development will be permanent. Should it be rehabilitated in future, natural vegetation should be re-established.							
Irreplaceable loss of resources	Yes	As decommissioning and rehabilitation is not anticipated, the loss of naturally occurring vegetation will be permanent. Should it be rehabilitated in future, natural vegetation should be re-established.							
Cumulative Impact	Yes	The surrounding area is comprised of cultivated agricultural land and developed land (e.g., ER Motswaledi Primary School). Therefore, the development contributes to the cumulative impact of loss of vegetation in the area.							
Potential Impact	**Destruction of Habitat**	The removal of vegetation in will lead to the loss of habitat for plant and animal species. It may add to fragmentation of this habitat type. However, according to the Ecological and Biodiversity Assessment (Van Rensburg, 2023), it is highly unlikely that endangered or Red Listed species occurs on the site, as the site is disturbed and degraded, and most probably support generalist mammals. It is therefore already a degraded habitat.							
Duration of Impact	During the Construction Phase								
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**	
Without Mitigation	3	3,00	2,00	2,67	5,00	2,00	3,50	**9,33**	
With Mitigation	2	2,00	1,00	1,67	4,00	2,00	3,00	**5,00**	

Mitigation Measures	Clearly delineate the area where vegetation may be removed, where material may be stockpiled and where machinery and vehicles may be operated to minimize the size of the habitat subject to destruction.							
	No open fires are allowed as it may lead to veld fires and further destruction of habitat.							
Reversal of Impact	No	Decommissioning and rehabilitation is not anticipated, therefore the destructed habitat will not be restored.						
Irreplaceable loss of resources	Yes	The habitat lost cannot be replaced, although offset measures can be taken to alleviate the loss.						
Cumulative Impact	Yes	The surrounding area is comprised of cultivated agricultural land and developed land (e.g., ER Motswaledi Primary School). Therefore, the development contributes to the cumulative impact of loss of habitat in the area.						
Potential Impact	**Loss of animal species**	The clearance of vegetation may chase away animal species on the site and may lead to the accidental killing of some animals. However, according to the Ecological and Biodiversity Assessment (Van Rensburg, 2023), it is highly unlikely that endangered or Red Listed species occurs on the site, as the site is disturbed and degraded, and most probably support generalist mammals. Additionally, the site borders natural vegetation on the western side, which will allow animals to vacate the site into the natural areas.						
Duration of Impact	During the Construction and Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	1,00	4,00	1,00	2,00	2,00	3,00	2,50	**5,00**
With Mitigation	1,00	4,00	1,00	2,00	2,00	3,00	2,50	**5,00**
Mitigation Measures	Any animals found on site will be relocated to a suitable and safe area (e.g., the natural area adjacent to the site)							
	No open fires will be allowed							
	No hunting of animals in the area will be allowed							
Reversal of Impact	Yes	Animal species removed from site will not be lost. Animals will not be killed and will therefore not be lost.						

Irreplaceable loss of resources	No	Animal species removed from site will not be lost. Animals will not be killed and will therefore not be lost.						
Cumulative Impact	No	Animal species removed from site will not be lost. Animals will not be killed and will therefore not be lost. Consequently, this impact does not add to a possible cumulative impact taking place in the area.						
Potential Impact	**Establishment of alien and invasive species**	The clearance of vegetation will disturb the site and may lead to the establishment of invasive alien species.						
Duration of Impact	During the Construction and Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3,00	4,00	3,00	3,33	4,00	3,00	3,50	**11,67**
With Mitigation	2,00	3,00	1,00	2,00	3,00	2,00	2,50	**5,00**
Mitigation Measures	Regular removal of alien vegetation during site maintenance and inspection throughout the construction and operational phase.							
Reversal of Impact	Yes	Regular removal and diligent maintenance of alien vegetation can reverse the impact.						
Irreplaceable loss of resources	No	The establishment of alien and invasive vegetation will not lead to the Irreplaceable loss of resources as natural vegetation (the relevant resource) will already have been cleared from the site. With diligent removal of alien vegetation, the probability of complete take-over by alien and invasive plants are minimal.						
Cumulative Impact	Yes	The establishment of alien vegetation may contribute to the encroachment of alien vegetation in the area as the disturbances in the area (cultivated lands, development of infrastructure) already led to the establishment of alien vegetation in the area.						
Potential Impact	**Loss of Topsoil**	Topsoil may be lost due to the removal of vegetation, during removal, stockpiling and storage of topsoil and during levelling of the site through wind and water erosion						
Duration of Impact	During the Construction Phase							

	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	3	3,00	1,00	2,33	4,00	2,00	3,00	**7,00**
With Mitigation	2	1,00	1,00	1,33	3,00	2,00	2,50	**3,33**
Mitigation Measures	All topsoil should be stockpiled neatly to be used for levelling and in gardens							
	Topsoil stockpiles should be kept low (<1,5 m) to limit wind erosion and instability of stockpiles.							
	Removal of topsoil should be clearly delineated and minimized to prevent the unnecessary removal of topsoil.							
	Topsoil stockpiles should be covered with a tarp or canvas to prevent its losses through wind or water erosion, especially before heavy rainfall events or if strong winds are expected.							
	Appropriate stormwater measures should be implemented to avoid erosion.							
	No topsoil may be used for construction purposes.							
Reversal of Impact	Yes	Topsoil can be sourced from other areas at high expense. It is unlikely that the impact will be significant with or without mitigation.						
Irreplaceable loss of resources	No	Topsoil can be sourced from other areas at high expense.						
Cumulative Impact	Yes	Should topsoil be lost, it can add to the loss of topsoil during the cultivation of land and development in the area.						
Potential Impact	**Soil Erosion**	The removal of vegetation will lead increased surface runoff across the area, which may turn lead to lower infiltration into the soil, subsoil and underlying aquifer and cause soil erosion on and around the site.						
Duration of Impact	During the Construction and Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**

Without Mitigation	2	3,00	2,00	2,33	3,00	2,00	2,50	**5,83**
With Mitigation	1	1,00	1,00	1,00	3,00	2,00	2,50	**2,50**
Mitigation Measures	Construct berms and trenches around all sides of the site to lower the velocity of runoff, allow sufficient time for infiltration and prevent erosion.							
Reversal of Impact	Yes	Preferential drainage channels that form can be levelled to reverse the impact of soil erosion. The soil that is lost cannot be reversed.						
Irreplaceable loss of resources	No	Resources will not be irreplaceably lost as soil can be sourced externally.						
Cumulative Impact	No	The area surrounding the site is cultivated land which should have sufficient permeability. The same applies for the natural area to the west of the site.						
Potential Impact	**Dust generation**	Due to the loss of the vegetation layer and the movement, dust generation will take place which can impact air quality and visibility in the area.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	2,00	2,00	2,33	4,00	2,00	3,00	**7,00**
With Mitigation	1	1,00	1,00	1,00	3,00	2,00	2,50	**2,50**
Mitigation Measures	Imposing a speed limit on vehicles to limit dust generation							
	Using machinery as little as possible during windy conditions							
	If the above measures are insufficient, dust suppression by spraying water where machinery operates will be considered.							
Reversal of Impact	Yes	The impact can be counteracted by mitigation measures.						

Irreplaceable loss of resources	No	No resources will be irreplaceably lost due to dust generation.						
Cumulative Impact	Yes	The agricultural activity in the area likely contributes to dust generation in the area already. This is deemed to be a very small impact.						
Potential Impact	**Loss of culturally significant resources**	Any culturally significant resources (archaeological artefacts, fossils) may be uncovered or lost during the clearance of vegetation. This impact is unlikely due to the location and history of the site. A Paleontological Impact Assessment and a Heritage Impact Assessment were conducted for the site according to the National Heritage Resources Act (NHRA) and did not find any heritage material.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	5,00	1,00	2,67	1,00	2,00	1,50	**4,00**
With Mitigation	1	5,00	1,00	2,33	1,00	2,00	1,50	**3,50**
Mitigation Measures	If any archaeological or palaeontological remains are found during construction activities, work in the area of the find(s) must cease with immediate effect and the ECO informed. The ECO must inform SAHRA and, depending on the nature of the find, contact an archaeologist and/or palaeontologist to assess the importance and determine the actions required. Work may only resume once permission to do so has been obtained from SAHRA. If fossil remains are discovered during any phase of construction, either on the surface or uncovered by excavations the ECO and site manager in charge of these developments must be notified immediately and inform the South African Heritage Resources Association (SAHRA). These discoveries must be secured and the ECO/site manager must alert SAHRA so that appropriate mitigation (documented and collection) can be undertaken by a professional palaeontologist. The specialist would need a collection permit from SAHRA. Fossil material must be curated in an approved collection (museum or university) and all fieldwork and reports must meet the minimum standards for palaeontological impact studies developed by SAHRA (Banzai Environmental, 2023).							
Reversal of Impact	No	Culturally significant resources that are lost cannot be replaced.						

Irreplaceable loss of resources	Yes	Should the culturally significant resources be lost, it cannot be replaced.						
Cumulative Impact	No	It is not expected that this impact occurs or is occurring in the region.						
Potential Impact	**Loss of Land Use**	Once the construction phase commence, the property will not be available for any other type of land use.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	1,00	1,00	1,33	1,00	2,00	1,50	**2,00**
With Mitigation	2	1,00	1,00	1,33	1,00	2,00	1,50	**2,00**
Mitigation Measures	The development footprint will be minimized to prevent the loss of any area that is not part of the development so as to prevent the further loss of land use.							
Reversal of Impact	No	Once the development took place, the impact cannot be reversed.						
Irreplaceable loss of resources	No	The surrounding area is used for agricultural purposes and the development will not lead to an irreplaceable loss of agricultural land.						
Cumulative Impact	Yes	Should development in and around Pampierstad continue, a cumulative impact of loss of land use may be experienced.						

Table 2 Overall impact of the activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**

Loss of naturally occurring vegetation	8,00	8,00
Destruction of Habitat	9,33	5,00
Loss of animal species	5,00	5,00
Establishment of alien and invasive species	11,67	5,00
Loss of Topsoil	7,00	3,33
Soil Erosion	5,83	2,50
Dust generation	7,00	2,50
Loss of culturally significant resources	4,00	3,50
Loss of land use	2,00	2,00
Grand Average Total	**7,15**	**3,25**
	Low - Moderate	**Low**

Excavation and Construction

During the excavation and construction process of this development, dust and other air emissions, and noise will be generated, as typically associated with construction activities. Dust and emissions may have an impact on visibility in the area and on the local air quality. These will however be temporary impacts and only last for the duration of the construction phase. According to the impact assessment, the overall impact of this activity (Table 3) will have Low to Moderate significance without mitigation measures, which can be lowered to Low significance with mitigation measures.

Regarding the loss of culturally significant resources, a First Phase Heritage Impact Assessment and Paleontological Study was conducted according to the National Heritage Resources Act (Act 25 of 1999) by Banzai Environmental as the site is not considered to be a sensitive area in terms of paleontological resources.

In order to mitigate these impacts, the following measures are advised:

- Imposing a speed limit for machinery and vehicles on site to limit dust generation.
- Minimising the use of machinery during windy conditions.
- Spray water where machinery is operational to suppress dust.
- Clearly delineate the area where excavation and construction may take place to limit the footprint of the development.

Table 3 Impact Assessment for the Excavation and Construction of the Site.

Activity	**Excavation and Construction of the Site**	Excavation and construction of the site refers to the process where the site is prepared for infrastructure to be installed and to the installation of infrastructure itself at the site
Phase	Construction Phase	
Potential Impact	**Generation of dust and emissions**	The operation of machinery leads to the generation of dust and atmospheric emissions which can impact the local air quality.
Duration of Impact	During the Construction Phase	

	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Without Mitigation	2	2,00	2,00	2,00	3,00	4,00	3,50	7,00
With Mitigation	1	1,00	1,00	1,00	3,00	4,00	3,50	3,50
Mitigation Measures	Imposing a speed limit on vehicles to limit dust generation.							
	Using machinery as little as possible during windy conditions.							
	If the above measures are insufficient, dust suppression by spraying water where machinery operates will be considered.							
Reversal of Impact	No	Although the impact cannot be reversed, it is insignificant when considering the amount of emissions that will take place.						
Irreplaceable loss of resources	No	Resources will not be irreplaceably lost due to this impact.						
Cumulative Impact	No	There are very little to no other activities in the area that leads to air emissions.						
Potential Impact	**Generation of noise**	The operation of machinery leads to the generation of noise. No neighbours are nearby and this will unlikely have a negative effect on the surrounding environment.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	1	1,00	1,00	1,00	4,00	5,00	4,50	4,50
With Mitigation	1	1,00	1,00	1,00	4,00	5,00	4,50	4,50
Mitigation Measures	Noise generation is inevitable. However, this development is far from neighbours and is not likely to disturb them regarding noise generated. Construction will be limited to daytime hours to minimize disturbance.							
Reversal of Impact	No	This impact cannot be reversed.						

Irreplaceable loss of resources	No	This impact will not lead to the Irreplaceable loss of resources						
Cumulative Impact	No	There are very little to no other activities in the area that leads to noise generation.						
Potential Impact	**Change in Soil Characteristics**		A change in soil characteristics (structure, permeability, aeration) may occur due to disturbance of the soil and compaction from machinery.					
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	4,00	4,00	4,00	9,33
With Mitigation	2	1,00	1,00	1,33	3,00	3,00	3,00	4,00
Mitigation Measures	Delineate areas where machinery may drive to prevent unnecessary areas from being compacted.							
	Minimize the footprint of machinery and stockpiles to limit compaction of the subsoil.							
Reversal of Impact	Yes	Soil can be ripped to break compaction. However, this site is anticipated to remain permanently. Should the site be rehabilitated, the soil needs to be assessed for its characteristics and its suitability for the end land-use.						
Irreplaceable loss of resources	No	The soil will not be lost irreplaceably due to compaction.						
Cumulative Impact	No	Other areas are not subjected to a similar impact.						
Potential Impact	**Accidental loss of Animal Species**		Animals may get killed accidentally during construction which can lead to a loss of animal life.					
Duration of Impact	Construction							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	1	1,00	1,00	1,00	2,00	1,00	1,50	1,50

With Mitigation	1	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Mitigation Measures	If any animals are encountered, they should be removed from the site and placed in a suitable area.							
Reversal of Impact	No	Should an animal get killed, the impact cannot be reversed.						
Irreplaceable loss of resources	No	Resources will not be irreplaceably lost due to this impact.						
Cumulative Impact	No	This impact is regarded to have singular occurrences.						
Potential Impact	**Loss of Land Use**	The site will lose its potential to be used for any other purpose.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	5,00	2,00	3,33	5,00	5,00	5,00	**16,67**
With Mitigation	2	5,00	1,00	2,67	5,00	3,00	4,00	**10,67**
Mitigation Measures	Clearly delineate the area that will be developed to minimize to footprint of the development.							
Reversal of Impact	No	The proposed development will be permanent and therefore decommissioning and rehabilitation is not expected. Consequently, the impact cannot be reversed.						
Irreplaceable loss of resources	No	Even though the potential to use the land for other activities will be taken away, most likely permanently, the site is small and degraded and the impact will be small on the larger scale.						
Cumulative Impact	Yes	The development of this site will contribute to the overall impact of loss of potential land uses in the region.						
Potential Impact:	**Loss of culturally significant resources**	Culturally significant resources (archaeological artefacts, fossils) may be uncovered or lost during the clearance of vegetation. This impact is highly unlikely due to the location and history of the site.						
Duration of Impact:	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	5,00	1,00	2,67	1,00	2,00	1,50	**4,00**
With Mitigation	1	5,00	1,00	2,33	1,00	2,00	1,50	**3,50**

Mitigation Measures	Should any heritage artefact be uncovered, a heritage specialist should be contacted to determine the significance of the uncovering. The artefact should be protected and/or incorporated into the development plan.	
Reversal of Impact	No	Culturally significant resources that are lost cannot be replaced.
Irreplaceable loss of resources	Yes	Should the culturally significant resources be lost, it cannot be replaced.
Cumulative Impact	No	It is not expected that this impact occurs or is occurring in the region.

Table 4 Overall Impact of the Activity.

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Generation of dust and emissions	7,00	3,50
Generation of noise	4,50	4,50
Change in soil Characteristics	9,33	4,00
Accidental loss of Animal Species	1,50	1,00
Loss of Land Use	16,67	10,67
Loss of culturally significant resources	4,00	3,50
Grand Average Total	**7,17**	**4,53**
	Low - Moderate	**Low**

Storage and handling of hazardous substances

During the construction phase, various materials and substances which may be hazardous will be stored and handled on site. These substances are typically associated with construction activities. The storage and handling of hazardous substances may spill and contaminate the soil or water sources (groundwater or surface water). According to Table 5 and Table 6, the activity will have a Low to Moderate significance without any mitigation measures, which can be lowered to a Low impact with the implementation of mitigation measures.

The following mitigation measures to prevent spills and leaks, and to handle accidental spills and leaks, are advised:

- All hazardous substances should be stored in a bunded area with an impermeable surface. The bund should have the capacity to hold 110% of the stored volume.
- Bunds and containers containing hazardous substances should regularly be inspected for leaks or faults to prevent spills or leaks from occurring.
- Vehicles and machinery should regularly be serviced to prevent leaks or spills. Major services should, however, not take place on site.
- Handling of hazardous substances should always take place on an impermeable surface.
- All stationary vehicles should be fitted with drip trays to contain potential spills.
- Any spills should immediately be cleaned by removing the contaminated soil and disposing it as hazardous waste.

Table 5 Impact Assessment for the Storage and Handling of Hazardous Substances.

Activity	**Storage and handling of hazardous substances**		Hazardous substances like diesel, oil, grease, paint, cement, and other construction associated substances will be stored and handled on site which may lead to spills.					
Phase	Construction							
Potential Impact	**Soil Contamination**		Should spills or leaks occur on site, hazardous substances can contaminate the soil.					
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**

Without Mitigation	3	2,00	2,00	2,33	2,00	3,00	2,50	5,83
With Mitigation	1	1,00	1,00	1,00	2,00	3,00	2,50	2,50
Mitigation Measures	Store all hazardous substances in bunds with impermeable surfaces.							
	Inspect bunds and containers regularly to ensure there are no leaks or compromises.							
	Vehicles and machinery should be serviced regularly to prevent spills.							
	Handle petrochemical substances on impermeable surfaces							
	All stationary vehicles should be fitted with drip trays to contain potential spills.							
	Any spills should immediately be cleaned by removing the contaminated soil and disposing it as hazardous waste							
Reversal of Impact	Yes	The impact can be reversed by limiting the occurrence of spills and leakages and by immediately cleaning such spills.						
Irreplaceable loss of resources	No							
Cumulative Impact	No	It is highly unlikely that the surrounding land uses lead to the contamination of soil with hazardous substances.						
Potential Impact	**Contamination of Water Sources**		Hazardous substances may spill or leak, and wash into the surface water system or seep into the groundwater leading to the contamination of surface or groundwater sources.					
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	2,00	2,00	2,33	3,00	4,00	3,50	8,17
With Mitigation	1	1,00	1,00	1,00	2,00	4,00	3,00	3,00

Mitigation Measures	Store all hazardous substances in bunds with impermeable surfaces.	
	Inspect bunds and containers regularly to ensure there are no leaks or compromises.	
	Vehicles and machinery should be serviced regularly to prevent spills.	
	Handle petrochemical substances on impermeable surfaces	
	All stationary vehicles should be fitted with drip trays to contain potential spills.	
	Any spills should immediately be cleaned by removing the contaminated soil, cleaning the contaminated surface, and disposing it as hazardous waste to prevent it from washing into the surface water system or seeping into the groundwater system.	
Reversal of Impact	Yes	The impact can be reversed by limiting the occurrence of spills and leakages and by immediately cleaning such spills.
Irreplaceable loss of resources	No	
Cumulative Impact	Yes	The surface water and groundwater system may become contaminated with hazardous substances related to agriculture due to the large extent of cultivated lands in the area, to which this impact will contribute should such contamination occur.

Table 6 Overall Impact of the Activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Soil Contamination	5,83	2,50
Contamination of Water Sources	8,17	3,00

Grand Average Total	**7,00**	**2,75**
	Low - Moderate	**Low**

Generation and Disposal of Hazardous Waste

During the construction phase, hazardous waste will be generated. Hazardous waste includes any item that came into contact with a hazardous substance. It includes empty containers of hazardous substances and items used to clean or handle hazardous substances (e.g., oil rags). Hazardous waste will only have negative environmental impacts if it is poorly managed and not properly disposed (Table 7). The overall impacts (Table 8) of this activity has Low to Moderate significance with no mitigation measures, which can be lowered to Low significance with the proper mitigation measures.

The following mitigation measures are recommended to minimise the impact of hazardous waste on soil and water sources.

- Implement a comprehensive Waste Management Plan in which the procedure of handling, storing, and disposing hazardous waste is clearly described for both the construction and operational phase.
- Minimise the generation of hazardous waste through good planning, induction to employees and using substances only when necessary.
- Appoint a certified service provider (e.g., Enviroserv) to provide the site with a skip or skips for the temporary storage of hazardous waste and to replace the skip(s) regularly for the disposal of the hazardous materials. Hazardous waste skips should be placed on an impermeable surface.
- Store wastewater in a designated flow bin or container inside a bund to prevent spills or leaks.
- In the event that contamination occur, the area should be cleaned properly, and the contaminated soil and material disposed as hazardous waste.
- Good housekeeping should be practiced to keep the site neat and clean and prevent a negative aesthetic impact on the site.

Table 7 Impact Assessment of the Generation and Disposal of Hazardous Waste.

Activity	**Generation and Disposal of Hazardous Waste**		Hazardous waste will be generated during the construction phase as hazardous substances will be used.					
Phase	Construction							
Potential Impact	**Soil Contamination**		Should hazardous waste come into contact with soil, the soil can become contaminated					
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	2,00	2,00	2,33	3,00	4,00	3,50	8,17
With Mitigation	1	1,00	1,00	1,00	2,00	3,00	2,50	2,50
Mitigation Measures	The generation of hazardous waste should be minimized as far as possible							
	Hazardous waste should be stored in a designated skip or in bins inside a bund to prevent its seepage into the soil							
	Hazardous waste skips or bins should be emptied frequently by a certified service provider that can dispose of the waste at the appropriate site in the appropriate manner.							
	Should contamination occur, the area should be cleaned properly and all waste, including the contaminated soil, stored in a designated skip.							
Reversal of Impact	Yes	Contamination due to hazardous waste can be cleaned up to reverse the impact on the soil.						
Irreplaceable loss of resources	No							
Cumulative Impact	No	It is unlikely that soil contamination due to the disposal and generation of hazardous waste is prevalent in the area.						
Potential Impact	**Water Contamination**		Hazardous waste can enter the surface water system leading to its contamination, or it can cause seepage into the groundwater system, contaminating it.					

Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	2,00	2,00	2,33	3,00	4,00	3,50	8,17
With Mitigation	1	1,00	1,00	1,00	2,00	3,00	2,50	2,50
Mitigation Measures	The generation of hazardous waste should be minimized as far as possible							
	Hazardous waste should be stored in a designated skip or in bins inside a bund to prevent its seepage into the groundwater or its washing into the surface water system							
	Hazardous waste skips or bins should be emptied frequently by a certified service provider that can dispose of the waste at the appropriate site in the appropriate manner.							
	Should contamination occur, the area should be cleaned properly and all waste, including the contaminated soil, stored in a designated skip.							
Reversal of Impact	Yes	Proper clean-up will reverse the impact of soil contamination through hazardous waste						
Irreplaceable loss of resources	No							
Cumulative Impact	No							
Potential Impact	**Negative Aesthetic Impact**	Hazardous waste that is not stored properly is unsightly. The site is visible from the road between Pampierstad and Hartswater, therefore care should be taken to keep hazardous waste to a minimum and properly stored and disposed.						
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**

Without Mitigation	2	2,00	1,00	1,67	3,00	5,00	4,00	6,67
With Mitigation	1	1,00	1,00	1,00	1,00	3,00	2,00	2,00
Mitigation Measures	Hazardous solid waste should be stored in the appropriate skips or bunded bins.							
	Hazardous waste, like contaminated water or oil, should be stored in a designated flow-bin, inside a bund, which is serviced by a certified service provider.							
	Hazardous waste (all) should be removed from site regularly by a certified service provider.							
Reversal of Impact	Yes	The impact can be reversed by proper clean-up and organisation measures.						
Irreplaceable loss of resources	No							
Cumulative Impact	No							

Table 8 Overall Impact of the Activity.

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Soil Contamination	8,17	2,50
Water Contamination	8,17	2,50
Negative Aesthetic Impact	6,67	2,00
Grand Average Total	**7,67**	**2,33**
	Low - Moderate	**Low**

Generation and Disposal of Waste (excluding hazardous waste)

General and recyclable waste will be generated during the construction phase and, if poorly managed, may lead to water contamination and have a negative aesthetic impact on the surrounding area.

Provision should be made for the disposal of general waste. Bins or skips should be available. Designated bins should be available for recyclable waste. The separation of waste streams is an important aspect of good waste management practices.

Table 9 indicates the significance of each impact of the generation and disposal of waste. Table 10 indicates that the overall impact of this activity without mitigation measures will have Low to Moderate significance, while it will have Low significance with mitigation measures.

The following mitigation measures are recommended to ensure Low significance of the impact.

- Implement a comprehensive Waste Management Plan that clearly describes the procedure for general waste management, including disposal, storage and removal.
- Appoint a certified service provider for the removal of waste as this service is likely not provided by the local municipality in this area (outside of the town boundaries).
- Ensure the separation of different waste streams (construction waste, general waste and recyclable waste).
- Ensure bins and skips are available and always has capacity.
- Ensure the regular removal of waste from the site by a certified service provider.
- Ensure regular clean-up of the site for waste that may not be contained in the appropriate bin.
- Store wastewater that is not hazardous in a designated flow bin to be removed by a certified service provider.
- By practicing good housekeeping, keep the site clean and neat and prevent a negative aesthetic impact.

Table 9 Impact Assessment on the Generation and Disposal of Waste.

Activity	**Generation and Disposal of Waste (excluding hazardous waste)**	General, Recyclable and Construction waste will be generated on site and can lead to negative environmental impacts.
Phase	Construction	

Potential Impact	**Water Contamination**							
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	2,00	2,00	2,00	4,00	5,00	4,50	9,00
With Mitigation	1	1,00	1,00	1,00	4,00	4,00	4,00	4,00
Mitigation Measures	Store waste according to type in designated and clearly marked bins or skips to prevent it from entering the surface water system.							
	Have the bins frequently emptied by a certified service provider to dispose the waste in the appropriate manner to prevent it from entering the surface water system.							
Reversal of Impact	Yes	Proper clean-up procedures will reverse the impact						
Irreplaceable loss of resources	No							
Cumulative Impact	Yes	Should poor waste management take place in the surrounding area, this impact will contribute to the environmental effect of different types of waste contaminating the surface water system.						
Potential Impact	**Negative Aesthetic Impact**		Poor waste management will have a negative impact on the aesthetic value of the site.					
Duration of Impact	Construction							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	4,00	5,00	4,50	10,50
With Mitigation	1	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Mitigation Measures	Store waste in designated areas according to its type (e.g., construction, recyclable and general)	
	Have the bins frequently emptied by a certified service provider to dispose the waste in the appropriate manner to prevent it from entering the surface water system.	
Reversal of Impact	Yes	Proper clean-up procedures will reverse the impact
Irreplaceable loss of resources	No	
Cumulative Impact	No	

Table 10 Overall Impact of the Activity.

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Water Contamination	9,00	4,00
Negative Aesthetic Impact	10,50	1,00
Grand Average Total	**9,75**	**2,50**
	Low - Moderate	**Low**

Abstraction of Water from a Resource

The construction phase of the proposed development will make use of groundwater as the main source of water at the site. Excessive abstraction may lead to the reduction or (worst case) depletion of the groundwater resource at the site. This will also have an impact on the surrounding area. However, with proper management and mitigation, this impact may be reduced or minimised. Table 11 indicates that this activity will have an

impact of Moderate significance without any mitigation measures, while it will have an impact with Low to Moderate Significance if mitigation measures are implemented.

The following mitigation measures are advised:

- Practice water conservation.
- Use infrastructure that conserves water.
- Regulate water abstraction to prevent over abstraction.
- Ensure all employees are aware of water conservation measures.

Table 11 Impact Assessment of the Abstraction of Groundwater.

Activity	**Abstraction of Groundwater**		Groundwater will be abstracted as the main water source for the project. Groundwater will be used for the employees' daily needs, and for all processes that require water during the construction phase.					
Phase	Construction							
Potential Impact	**Decrease of reserve capacity**		Abstraction of groundwater from the underlying aquifer may lead to the depletion or a decrease in the groundwater reserve of the area.					
Duration of Impact	During the Construction Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	5,00	2,00	3,33	4,00	5,00	4,50	15,00
With Mitigation	2	4,00	1,00	2,33	3,00	5,00	4,00	9,33
Mitigation Measures	Practice water conservation							
	Install infrastructure that contributes to water conservation							
	Regulate water abstraction to prevent over abstraction							
Reversal of Impact	Yes	By minimizing water abstraction, the groundwater reserve can be allowed recharge						
Irreplaceable loss of resources	No	If remediation measures are implemented the resource lost (groundwater) can be replaced.						

Cumulative Impact	Yes	Agricultural, commercial and residential activities in the surrounding area may also make use of groundwater abstraction. This activity will therefore contribute to a decrease in the water level or groundwater reserve.

Table 12 Overall Impact of the Activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Decrease of reserve capacity	15,00	9,33
Grand Average Total:	**15,00**	**9,33**
	Moderate - High	**Low - Moderate**

6) Operational Phase

The Operational Phase refers to the part of the development where all construction is finalised and the facilities are open for public utilisation – the development is operates as its intended purpose. This phase will also have environmental impacts. As this is a permanent development, decommissioning and rehabilitation is not expected for this development.

Abstraction of Groundwater

The operational phase of the proposed development will make use of groundwater as the main source of water at the site. Excessive abstraction may lead to the reduction or (worst case) depletion of the groundwater resource at the site. This will also have an impact on the surrounding area. However, with proper management and mitigation, this impact may be reduced or minimised. Table 11 indicates that this activity will has an impact of Moderate significance without any mitigation measures, while it will have an impact with Low to Moderate Significance if mitigation measures are implemented.

The following mitigation measures are advised:

- Practice water conservation.
- Use infrastructure that conserves water.
- Regulate water abstraction to prevent over abstraction.
- Ensure all employees are aware of water conservation measures.

Table 13 Impact Assessment of the Abstraction of Groundwater

Activity:	**Abstraction of Groundwater**	Groundwater will be abstracted as the main water source for the project. Groundwater will be used for ablution facilities, convenience store, restaurant, take-away shop and at the filling station if a Water Use Licence is issued accordingly.
Phase	Operation	
Potential Impact	**Decrease of reserve capacity**	Abstraction of groundwater from the underlying aquifer may lead to the depletion or a decrease in the groundwater reserve of the area.

Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	5,00	2,00	3,33	4,00	5,00	4,50	15,00
With Mitigation	2	4,00	1,00	2,33	3,00	5,00	4,00	9,33
Mitigation Measures	Practice water conservation							
	Install infrastructure that contributes to water conservation							
	Regulate water abstraction to prevent over abstraction							
Reversal of Impact	Yes	By minimizing water abstraction, the groundwater reserve can be allowed recharge						
Irreplaceable loss of resources	No	If remediation measures are implemented the resource lost (groundwater) can be replaced.						
Cumulative Impact	Yes	Agricultural, commercial, and residential activities in the surrounding area may also make use of groundwater abstraction. This activity will therefore contribute to a decrease in the water level or groundwater reserve.						

Table 14 Overall Impact of the Activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Decrease of reserve capacity	15,00	9,33
Grand Average Total	**15,00**	**9,33**
	Moderate - High	**Low - Moderate**

Generation and Disposal of Hazardous Waste

The Operational Phase may generate hazardous waste as hazardous substances (petrol, diesel and paraffin) will be stored and handled on the site. Without any mitigation measures, the impact () of this activity may have Low to Moderate significance. However, with proper mitigation measures, the impact can be reduced to Low significance.

The following mitigation measures are recommended:

- A designated bin or skip for hazardous waste must be available on site for the storage of hazardous waste.
- All material that contains or came into contact with a hazardous substance should be disposed as hazardous waste.
- A certified service provider must be contracted to remove and dispose of hazardous waste at regular intervals.
- Wastewater should run through an oil separator before it is stored in the wastewater tank.
- A certified service provider must be contracted to remove and recycle wastewater at regular intervals.

Table 15 Impact Assessment of the Generation and Disposal of Hazardous Waste

Activity	**Generation and Disposal of Hazardous Waste**		Hazardous waste will be generated as hazardous substances will be stored and handled on site, which may lead to contamination of water sources or soil contamination					
Phase	Operation							
Potential Impact	**Contamination of Soil**		The generation and disposal of hazardous waste may lead to soil contamination if it comes into contact with soil.					
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	4,00	2,00	3,00	3,00	3,00	3,00	9,00
With Mitigation	1	1,00	1,00	1,00	3,00	3,00	3,00	3,00

Mitigation Measures	Hazardous waste should be stored in a designated skip or bin in a bunded area							
	All materials that contain or came into contact with a hazardous substance should be disposed as hazardous waste.							
	Hazardous waste skips or bins should regularly be emptied by a certified service provider that can dispose of it appropriately.							
Reversal of Impact	Yes	Soil contamination can be reversed by proper clean-up measures.						
Irreplaceable loss of resources	No	Soil becomes contaminated and can be cleaned but is not irreplaceably lost.						
Cumulative Impact	Yes	Soil contamination may occur due to agricultural, residential, or commercial activities in the area to which this activity may contribute.						
Potential Impact	**Water Contamination**	Hazardous waste may lead to surface and/or groundwater contamination if it is not properly managed.						
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	3,00	3,00	3,00	7,00
With Mitigation	1	1,00	1,00	1,00	2,00	3,00	2,50	2,50
Mitigation Measures	Hazardous waste should be stored in a designated skip or bin in a bunded area							
	All materials that contain or came into contact with a hazardous substance should be disposed as hazardous waste to prevent it from coming into contact with clean water.							
	Hazardous waste skips or bins should regularly be emptied by a certified service provider that can dispose of it appropriately.							
	Contaminated water should run through an oil separator to remove any petrochemical substances							

Reversal of Impact	Yes	Contaminated water can be cleaned, and measures can be taken to reverse the impact of water contamination in the environment
Irreplaceable loss of resources	No	
Cumulative Impact	Yes	Water contamination may occur in the surrounding area due to agricultural, residential, and commercial activities to which this activity will contribute.

Table 16 Overall Impact of the Activity.

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Contamination of Soil	9,00	3,00
Water Contamination	7,00	2,50
Grand Average Total	**9,00**	**3,00**
	Low - Moderate	**Low**

Generation and Disposal of Waste (excluding hazardous waste)

During the Operational Phase waste from products of the convenience store, restaurant and take away shops will be generated, as well as from the operation of the filling station and ablution facilities. Waste can become problematic if it is not managed properly. Without mitigation measures, the impact of this activity will have a Moderate impact. However, with mitigation measures, the impact can be reduced to have Low significance.

The following mitigation measures are recommended:

- Separate waste streams into different storage areas.
- Provide a sufficient number of general and recyclable waste bins at each area of the development (filling station, truck stop, ablution facilities, convenience store, restaurant and take-away shop).
- Appoint a certified service provider for the regular removal and disposal of general and recyclable waste.

Activity	**Generation and Disposal of Waste (excluding hazardous waste)**			General and recyclable waste will be generated through the operation of the filling station, convenience store, restaurant and take-away shop which may lead to surface water contamination and have a negative aesthetic impact.				
Phase	Operational							
Potential Impact	**Surface Water Contamination**			Waste products may end up in the surrounding environment, including the surface water system leading to its contamination.				
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	5,00	5,00	5,00	11,67
With Mitigation	1	1,00	1,00	1,00	3,00	4,00	3,50	3,50
Mitigation Measures	Separate bins for the disposal of general and recyclable waste should be available on site for customers and employees to separate and dispose of their waste to prevent waste from entering the surrounding environment and potentially contaminating the surface water system.							
	General waste bins should regularly be emptied, and its contents disposed of by a service provider.							
Reversal of Impact	Yes	The impact can be reversed by diligent cleaning operation.						
Irreplaceable loss of resources	No							

Cumulative Impact	Yes	Residential, commercial and agricultural activities in the surrounding area may also cause surface water contamination due to poor waste management and this activity can contribute to the impact.						
Potential Impact	**Negative Aesthetic Impact**		Poor general and recyclable waste management will decrease the aesthetic value of the environment.					
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	3,00	5,00	4,00	9,33
With Mitigation	1	1,00	1,00	1,00	3,00	5,00	4,00	4,00
Mitigation Measures	Separate bins for the disposal of general and recyclable waste should be available on site for customers and employees to separate and dispose of their waste to prevent waste from entering the surrounding environment and potentially contaminating the surface water system.							
	General waste bins should regularly be emptied, and its contents disposed of by a service provider.							
Reversal of Impact	Yes	Diligent clean-up measures will reverse the impact.						
Irreplaceable loss of resources	No							
Cumulative Impact	Yes	Poor waste management in the surrounding area will have a negative aesthetic impact on the area and will be increased should this activity also contribute to it.						

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**

Surface Water Contamination	11,67	3,50
Negative Aesthetic Impact	9,33	4,00
Grand Average Total	**11,67**	**3,50**
	Moderate	**Low**

Storage and Handling of Hazardous Substances

Hazardous substances (petrol, diesel and paraffin) will be stored in underground storage tanks. These tanks will be refuelled frequently and the contents handle daily when customers at the filling station are served. The tanks may leak or fail, and hazardous substances may spill when refuelling or serving customers. According to the Impact Assessment (Table 17) this activity may have an impact of Moderate to High significance, but if mitigation measures are implemented, the significance of the impact can be lowered to Low.

- Place the storage tanks in underground bunds with impermeable surfaces (e.g., concrete walls and floor). The bunds should have the capacity to store 110% of the potential volume of the tanks.
- Regularly inspect the bunds for leaks or faults.
- Install leak detection mechanisms in the tanks and bunds.
- Inspect nozzles, valves, and pipes for defects before refuelling the storage tanks.
- Use drip trays when refuelling storage tanks to prevent spills by using drip trays to contain any small spillages.
- Immediately clean any spillages that occur.
- Ensure all employees are familiar with the procedures of refuelling safely and without spilling.

Table 17 Impact Assessment of the Storage and Handling of Hazardous Substances

Activity:	**Storage and Handling of Hazardous Substances**		Between 80 and 500 cubic metres of hazardous substances will be stored in underground bunded tanks on the site. Should leaks or spills occur, environmental impacts may occur.					
Phase	Operation							
Potential Impact	**Groundwater Contamination**		Underground bunded storage tanks may fail and leak, causing hazardous substances to seep into groundwater sources leading to groundwater contamination. Handling of hazardous substances may lead to spills, which can seep into the groundwater sources leading to its contamination.					
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	4	4,00	2,00	3,33	2,00	5,00	3,50	11,67
With Mitigation	2	2,00	1,00	1,67	1,00	5,00	3,00	5,00
Mitigation Measures	Store hazardous substances (petrol, diesel, paraffin) in underground bunds with impermeable surfaces that has the capacity to store 110% of the total tank volume							
	Install leak detection mechanisms in the tanks and bunds							
	Regularly inspect the bunds to ensure they are intact							
	When a spill or leak is noticed in the tank, bund or on the ground, immediately implement containment and clean-up measures (remove contaminated soil and dispose as hazardous waste) and rectify the leak as a matter of great urgency to prevent hazardous substances from reaching the groundwater source.							
	When refuelling storage tanks, prevent spills by using drip trays to contain any small spillages.							
	Inspect nozzles, pipes, and valves for defects before refuelling storage tanks							
	Ensure all employees are familiar with procedures of refuelling safely without spilling							

	Regularly inspect pump, nozzles, and valves for defects							
Reversal of Impact	Yes	The impact can be reversed if proper maintenance and management is kept up to detect failures early on and prevent severe groundwater contamination.						
Irreplaceable loss of resources	No	Groundwater contamination will not lead to the irreplaceable loss of resources as the impact can be managed and reversed with proper management.						
Cumulative Impact	Yes	this impact may contribute to groundwater contamination in the area that may occur due to agricultural activities in the surrounding area.						
Potential Impact	**Surface Water Contamination**	Storage and handling of hazardous substances may lead to the surface water contamination if leaks occur. Spilled hazardous substances may wash into the surface water system.						
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	2,00	2,00	2,33	3,00	5,00	4,00	9,33
With Mitigation	1	1,00	1,00	1,00	2,00	5,00	3,50	3,50
Mitigation Measures	Store hazardous substances (petrol, diesel, paraffin) in underground bunds with impermeable surfaces that has the capacity to store 110% of the total tank volume							
	Should a leak or spill occur, immediately clean it up by removing the contaminated soil or material and dispose it as hazardous waste to prevent it from washing into the surface water system.							
	Stormwater management measures (channels, culverts) should be in place and maintained to divert clean stormwater around the site to prevent it from becoming contaminated. Dirty stormwater should be contained on site to prevent the dirty water from entering the surface water system.							
	Stormwater management measures should be implemented to manage runoff generated on site. This runoff should be contained on site to prevent contaminants from leaving the site							

	Oil separators should be installed on site.							
	Dirty stormwater must go through oil separators to remove contaminants before it leaves the site.							
	The site should be levelled to prevent any ponding from occurring on the site.							
	When refuelling storage tanks, prevent spills by using drip trays to contain any small spillages.							
	Inspect nozzles, pipes, and valves for defects before refuelling storage tanks							
	Ensure all employees are familiar with procedures of refuelling safely without spilling							
	Regularly inspect pump, nozzles, and valves for defects							
Reversal of Impact	Yes	Should contamination occur, the impact can be reversed by diligent clean-up and by implementing correct clean-up procedures.						
Irreplaceable loss of resources	No							
Cumulative Impact	Yes	Surface water contamination may occur due to agricultural, residential, and commercial activities in the surrounding area, to which this activity can contribute leading to a greater impact.						
Potential Impact	**Soil Contamination**		**The storage and handling of hazardous substances may lead to soil contamination should spills or leaks occur.**					
Duration of Impact	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	3	5,00	2,00	3,33	4,00	5,00	4,50	15,00
With Mitigation	1	1,00	1,00	1,00	3,00	5,00	4,00	4,00

Mitigation Measures	Should a leak or spill occur, immediately contain it and clean it up by removing the contaminated soil or material and dispose it as hazardous waste to prevent it from spreading to a larger area.	
	Prevent spills by storing hazardous substances in bunded areas with impermeable surfaces that has the capacity of 110% of the stored volume.	
	Store hazardous substances (petrol, diesel, paraffin) in underground bunds with impermeable surfaces that has the capacity to store 110% of the total tank volume.	
	When refuelling storage tanks, prevent spills by using drip trays to contain any small spillages.	
	Inspect nozzles, pipes, and valves for defects before refuelling storage tanks.	
	Ensure all employees are familiar with procedures of refuelling safely without spilling.	
	Regularly inspect pump, nozzles, and valves for defects.	
Reversal of Impact	Yes	Contaminated soil can be cleaned up properly to reverse the impact.
Irreplaceable loss of resources	No	Contaminated soil can be cleaned up properly.
Cumulative Impact	Yes	This impact may contribute to soil contamination in the area that may occur due to agricultural, residential, and commercial activities in the surrounding area.

Table 18 Overall Impact of the Activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Groundwater Contamination	11,67	5,00
Surface Water Contamination	9,33	3,50
Soil Contamination	15,00	4,00

Grand Average Total:	**15,00**	**4,00**
	Moderate – High	**Low**

Generation of Wastewater

Wastewater will be generated at the site during the operational phase at the ablution facilities, convenience store, restaurant and take-away shop. Additionally runoff from the filling station and activities like cleaning will also generate wastewater. Sewage will be stored in a conservancy tank which will regularly be service and emptied. Stormwater generated on site should be regarded as wastewater as the site is considered a 'dirty area' and runoff should not leave the site. When considering the Impact Assessment (Table 19) the activity will have a Low to Moderate significance without mitigation measures, which can be lowered to Low significance with mitigation measures.

The following mitigation measures are recommended:

- The conservancy tank and wastewater tanks should regularly be emptied by a certified service provider.
- Rigorous stormwater management measures must be implemented to contain all runoff generated on the site and not allow it to enter the surrounding environment.
- All runoff generated on site should pass through an oil separator before it is stored in the wastewater tank.
- The site should be levelled to prevent ponding on the site.
- All storage tanks (sewage and wastewater) should be stored in bunds with impermeable walls.
- All storage tanks should regularly be inspected for leaks and rectified with urgency if any are found.

Table 19 Impact Assessment of the Generation of Wastewater

Activity:	**Generation of Wastewater**		Ablution facilities, stormwater, and other operations on the site will generate wastewater which can lead to ground- and surface water contamination, soil contamination and have a negative aesthetic impact.					
Phase	Operation							
Potential Impact:	**Water contamination**		The conservancy tank at the ablution facilities may leak or overflow. Washing operations may generate wastewater. Should this wastewater seep into the groundwater or wash into the surface water system, contamination may occur.					
Duration of Impact:	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**

Without Mitigation	3	3,00	2,00	2,67	3,00	5,00	4,00	10,67
With Mitigation	1	1,00	1,00	1,00	3,00	5,00	4,00	4,00
Mitigation Measures	The conservancy tank will regularly be serviced and emptied to prevent it from overflowing to prevent water contamination.							
	Stormwater management measures (channels, culverts) should be in place and maintained to divert clean stormwater around the site to prevent it from becoming contaminated. Dirty stormwater should be contained on site to prevent the dirty water from entering the surface water system.							
	Stormwater management measures should be implemented to manage runoff generated on site. This runoff should be contained on site to prevent contaminants from leaving the site							
	Oil separators should be installed on site.							
	Dirty stormwater must go through oil separators to remove contaminants before it leaves the site.							
	The site should be levelled to prevent any ponding from occurring on the site.							
	The conservancy tank will regularly be inspected for leaks which will be fixed as a matter of urgency upon occurrence to prevent water contamination.							
	Wastewater from other activities will be collected in a tank or flow-bin where it will go through an oil separator before it is released into the environment, or it will be stored and serviced similarly to the conservancy tank to prevent water contamination.							
Reversal of Impact	Yes	Diligent clean-up procedures can reverse the impact.						
Irreplaceable loss of resources	No							
Cumulative Impact	Yes	Other activities in the area may also lead to water contamination and this activity will contribute to it.						
Potential Impact:	**Negative Aesthetic Impact**	Wastewater that is not contained in tanks and not stored neatly will have a negative aesthetic impact.						
Duration of Impact:	During the Operational Phase							
	Severity	**Duration**	**Extent**	**Consequence**	**Probability**	**Frequency**	**Likelihood**	**Significance**
Without Mitigation	2	3,00	2,00	2,33	2,00	5,00	3,50	8,17

With Mitigation	1	1,00	1,00	1,00	2,00	5,00	3,50	3,50
Mitigation Measures	The conservancy tank will regularly be serviced and emptied to prevent it from overflowing as good housekeeping practices.							
	The conservancy tank will regularly be inspected for leaks which will be fixed as a matter of urgency upon occurrence as good housekeeping practices.							
	Wastewater from other activities will be collected in a tank or flow-bin where it will go through an oil separator before it is released into the environment, or it will be stored and serviced similarly to the conservancy tank as good housekeeping practices.							
Reversal of Impact	Yes	Diligent clean-up procedures can reverse the impact.						
Irreplaceable loss of resources	No	The impact can be reversed by diligent clean-up procedures						
Cumulative Impact	No							

Table 20 Overall Impact of the Activity

Summary of impacts		
Construction Phase		
Potential Impacts	**Without Mitigation**	**With Mitigation**
Water contamination	10,67	4,00
Negative Aesthetic Impact	8,17	3,50
Grand Average Total:	**9,42**	**3,75**
	Low - Moderate	**Low**

Positive Impacts

The proposed development will have significant positive socio-economic impacts as employment opportunities will be created in the planning, construction and operational phases. It is estimated that approximately 12 indirect employment opportunities will be contributed to by the proposed development during the planning phase. Approximately 150 direct and indirect employment opportunities will be created during the construction phase. This includes construction, retail, manufacturing, and services provided during the construction phase. During the operational phase 20 direct employment opportunities will be created, while additional indirect employment opportunities will be contributed to (retail, manufacturing, delivery, maintenance services, etc.).

The development may stimulate further economic growth and creates the opportunity for additional businesses to develop in the surrounding area. It is also expected that the development will encourage travellers to stop in the town (Pampierstad or Hartswater) where economic activity will be stimulated.

7) Summary of Impacts

Summary of Impacts Construction Phase	**Significance**	
Activity	**Without Mitigation**	**With Mitigation**
Clearance of Vegetation	7,40	3,50
	Low - Moderate	Low
Excavation and Construction of the Site	7,17	4,53
	Low - Moderate	Low
Storage and handling of hazardous substances	7,00	2,75
	Low - Moderate	Low

Summary of Impacts Operational Phase	**Significance**	
Activity	**Without Mitigation**	**With Mitigation**
Generation and Disposal of Hazardous Waste	9,00	3,00
	Low - Moderate	Low
Generation and Disposal of Waste (excluding hazardous waste)	11,67	3,50
	Moderate - High	Low
Generation of Wastewater (sewage)	9,42	3,75
	Moderate - High	Low

Generation and Disposal of Hazardous Waste	7,67	2,33
	Low - Moderate	Low
Generation and Disposal of Waste (excluding hazardous waste)	9,75	2,50
	Low - Moderate	Low
Generation of Wastewater (sewage)	9,00	4,00
	Low - Moderate	Low
Abstraction of Groundwater	15,00	9,33
	Moderate - High	Low - Moderate

Storage and Handling of Hazardous Substances	15,00	4,00
	Moderate - High	Low
Abstraction of Groundwater	15,00	9,33
	Moderate - High	Low - Moderate

Conclusion

In conclusion, the overall impact of this development with the appropriate mitigation measures will have Low significance or, in the worst case, Moderate to High significance. No impacts are expected to have a high significance.

When considering the overall impacts of each activity, the generation and disposal of hazardous waste and the abstraction of groundwater will have the greatest impact on the environment during the construction phase.

During the Operational Phase the storage and handling of hazardous substances and the abstraction of groundwater will have the greatest impact on the environment. However, with proper mitigation the impacts will be minimized.

A positive socio-economic impact is anticipated regarding employment opportunities and economic activity in the surrounding area in the planning, construction and operational phase.