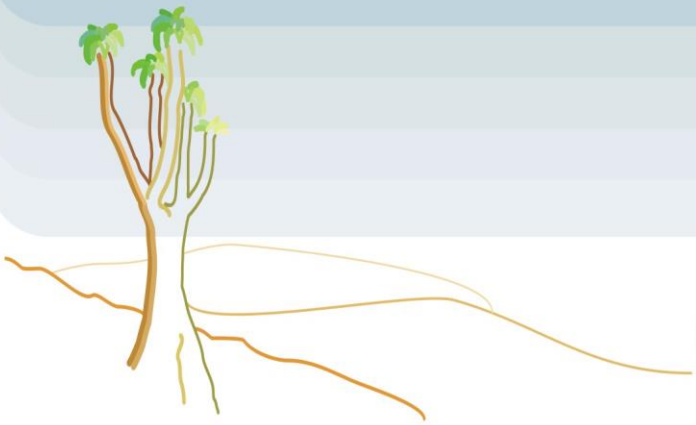

DPR
Ecologists & Environmental Services

Report on the ecological and biodiversity assessment for the proposed construction of a filling station situated between the settlements of Pampierstad and Hartswater, Northern Cape Province.

January 2023

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DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

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Author	**DP van Rensburg (Pr.Sci.Nat)**		**Jan'23**

Executive Summary

The site for the proposed filling station is situated along the tarred road between the two towns of Pampierstad and Hartswater which is situated within the border of the Northern Cape Province (Appendix A: Map 1). The site has an extent of approximately 4.5 hectares. The proposed filling station will be situated within an area extensively used for irrigation and the main land use here is associated with agriculture.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018) the site is indicated to fall within Schmidtsdrif Thornveld (SVk 6) with some affinities to Kimberley Thornveld (SVk 4) (Appendix A: Map 1 & 2). Both vegetation types are also currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1) which will also decrease the conservation value of remaining natural vegetation. According to the Northern Cape Critical Biodiversity Areas Plan (2016) the proposed site falls within an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2).

The Harts River with associated wetland areas situated approximately 400 meters to the north west (Appendix A: Map 1 & 2). It is therefore highly unlikely that the site will have any impacts on these surface water systems. In spite of this, it will be important to design and incorporate a comprehensive storm water system which should divert clean runoff around the development and retain dirty storm water on it, while also removing contaminants (oil separator or similar system) before storm water is released into the surrounding drainage pattern.

The site contains many specimens of the protected tree, *Vachellia erioloba* while a single specimen of the protected geophyte, *Harpagophytum procumbens* was also noted on the site. It is inevitable that the development will require the removal of most of these protected trees and the single specimen of protected geophyte and the necessary permits will have to be obtained to do so. However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development.

From the description of the vegetation on the site it is clearly quite modified and degraded from the natural condition. Consequently habitat and species diversity is also fairly low and infestation by exotic weeds and invasive trees are also significant. The conservation value of the site would therefore seem to be fairly low. In addition, the natural vegetation types in the area, Schmidtsdrif and Kimberley Thornveld are also not currently considered to be of high conservation concern and is listed as being of Least Concern (LC) (Appendix A: Map 1 & 2). Furthermore, the area is also listed as an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2). However, the presence of many specimens of protected *Vachellia erioloba* trees will have to be taken into consideration and development should endeavour to keep several of the larger specimens intact and incorporate these into the development. Therefore, in conclusion, although elements of conservation value do occur, overall the proposed site does not contain a high conservation value or unique features requiring exclusion and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

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Ecological and biodiversity assessment

1. INTRODUCTION

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered the development should be moved to another location or cease altogether.

South Africa has a large amount of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

Development around cities and towns are necessary to accommodate an ever-growing population. Areas along the boundaries of cities and towns are usually in a degraded state due to the impact of the large population these areas house. Though this may be the case in most situations there may still be areas that consist of sensitive habitats such as watercourses, wetlands or rare vegetation types that need to be conserved. These areas may also contain endangered fauna and flora.

The site for the proposed filling station is situated along the tarred road between the two towns of Pampierstad and Hartswater which is situated within the border of the Northern Cape Province (Appendix A: Map 1). The site has an extent of approximately 4.5 hectares. The proposed filling station will be situated within an area extensively used for irrigation and the main land use here is associated with agriculture. The site itself still contains remnants of natural vegetation though is in general quite heavily modified and degraded.

A site visit was conducted on 3 November 2022. The entire footprint of the development was surveyed over the period of one day. The survey was conducted during spring and as a result of recent years of good rainfall, the vegetation identification on the site was considered optimal.

For the above reasons it is necessary to conduct an ecological assessment of an area proposed for development.

The report together with its recommendations and mitigation measures should be used to minimise the impact of the proposed development.

1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

1.3 Details and expertise of specialist

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Professional registration:
South African Council for Natural Scientific Professions No. (400284/13) (Ecological Science).

Membership with relevant societies and associations:

- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years experience of conducting ecological assessments.
- Founded DPR Ecologists & Environmental Services (Pty) Ltd in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attend conferences and courses in order to stay up to date with current methods and trends:

  2017: Kimberley Biodiversity Symposium.
  2018: South African Association of Botanists annual conference.
  2018: National Wetland Indaba Conference.
  2019: SASS5 Aquatic Biomonitoring Training.
  2019: Society for Ecological Restoration World Congress 2019.
  2019: Wetland rehabilitation: SER 2019 training course.
  2020: Tools For Wetlands (TFW) training course.
  2022: National Wetland Indaba Conference.

2. SCOPE AND LIMITATIONS

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the development.
- To identify possible negative impacts that could be caused by the proposed development.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The amount of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Fauna

Aspects of the fauna that will be assessed include:

- A basic survey of the fauna occurring in the region using visual observations of species as well as evidence of their occurrence in the region (burrows, excavations, animal tracks, etc.).
- The overall condition of the habitat.
- A list of species that may occur in the region (desktop study).

2.3 Limitations

- Some geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.
- Some animal species may not have been observed as a result of their nocturnal and/or shy habits.
- Although a comprehensive survey of the site was done it is still likely that several species were overlooked.

3. METHODOLOGY

3.1 Several literature works were used for additional information.

General ecology:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- SANBI (2011): List of threatened ecosystems.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- National List of Protected Trees under the National Forest Act 84 of 1998.
- Northern Cape Nature Conservation Act No. 9 of 2009.
- Northern Cape Critical Biodiversity Areas Plan (2016).

Vegetation:
Field guides used for species identification (Adams 1976, Bromilow 1995, 2010, Coates-Palgrave 2002, Fish *et al* 2015, Gibbs-Russell *et al* 1990, Manning 2009, Roberts & Fourie 1975, Shearing & Van Heerden 2008, Van Oudtshoorn 2004, Van Rooyen 2001, Van Rooyen & Van Rooyen 2019, Van Wyk & Van Wyk 1997).

Terrestrial fauna:
Field guides for species identification (Smithers 1983, Child *et al* 2016, Cillié 2018).

3.2 Survey

The site was assessed by means of transects and sample plots.

- Noted species include rare and dominant species (Appendix B).
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Animal species were also noted as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements.
The state of the habitat was also assessed.

3.3 Criteria used to assess sites

Several criteria were used to assess the site and determine the overall status of the environment.

Vegetation characteristics
Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.

Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single nich – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas though, can vary significantly e.g. wetlands, drainage lines, ecotones, etc.
Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:
Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

Vegetation condition
The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practises (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between tree, shrub, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:
Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:
Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs shows signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.

Scoring: No or very little signs of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.

Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely.

3.4 Biodiversity sensitivity rating (BSR)

The total scores for the criteria above were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, six different classes are described to assess the suitability of the sites to be developed. The different classes are described in the table below:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Ideal (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low. The site is ideal for the proposed development.	29 – 30
Preferred (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low. The area is preferred for the proposed development.	26 – 28
Acceptable (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low. The area is acceptable for the proposed development.	21 – 25
Not preferred (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance. The area is not preferred for the proposed development.	11 – 20
Sensitive (1)	The vegetation is in a pristine or near pristine condition. Very little signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high. The area is regarded as sensitive and not suitable for the proposed development.	0 - 10

4. ECOLOGICAL OVERVIEW OF THE SITE

4.1 Overview of ecology and vegetation types

Refer to the list of species encountered on the powerline route and surroundings in Appendix B.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018) the site is indicated to fall within Schmidtsdrif Thornveld (SVk 6) though the site survey also indicated affinities with Kimberley Thornveld (SVk 4) (Appendix A: Map 1 & 2). Both these vegetation types are characterised by a well developed grass layer and a tree layer which varies from open to closed situated on deep red sands. Both vegetation types are also currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). Neither are currently under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation. In addition, natural vegetation on the site has clearly been quite heavily affected by previous land use which will further decrease the conservation value of the site.

The Northern Cape Critical Biodiversity Areas Plan (2016) has been published in order to identify areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA). The proposed site falls within an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2).

The site for the proposed filling station is situated along the tarred road between the two towns of Pampierstad and Hartswater which is situated within the border of the Northern Cape Province (Appendix A: Map 1). The site has an extent of approximately 4.5 hectares. The proposed filling station will be situated within an area extensively used for irrigation and the main land use here is associated with agriculture. The site itself still contains remnants of natural vegetation though is in general quite heavily modified and degraded. No watercourses or wetlands could be identified on or near the proposed site and is therefore highly unlikely to have any impact on surface water features.

The site is still dominated by indigenous vegetation, though when compared with surrounding natural areas the site has clearly been heavily modified (Appendix A: Map 1). Where the surrounding natural areas contain a well developed grass layer, dense shrub layer and open tree layer, the site contains a sparse grass layer, poorly developed shrub layer and open tree layer with many invasive tree species also prominent. This indicates a significant modification in terms of the vegetation structure on the site. The topography of the area is also uniform, consisting of deep, yellow to reddish coloured, loose sandy soils with flat plains containing no discernible slope gradient. As a result, there is no appreciable diversity in terms of habitat and vegetation composition on the site.

Figure 1: A comparison between surrounding natural areas (Top) and the site (Bottom) clearly illustrates how the vegetation on the site has become modified from the natural condition.

As indicated, the natural vegetation on the site itself has been quite heavily modified form the natural condition. The tree layer seems to be fairly intact, though significant infestation by invasive tree species is present. The shrub layer is heavily modified and has probably been removed at some time in the past. The soil surface also seems to be somewhat disturbed and areas of shallow excavation and general disturbance is present. A few buildings, dwellings and remains of previous habitation is present and also indicates the general disturbance of the area. The site therefore retains remnants of the natural vegetation but is clearly modified with signs of disturbance prominent.

Figure 2: Aerial view of the proposed site (Google Earth 2020). When compared to natural areas to the west, the site has clearly been modified, especially in terms of vegetation cover. Note also the adjacent irrigation areas.

Figure 3: A few dwellings and general surface disturbance indicate the generally degraded condition of the site.

Figure 4: General surface disturbance and the absence of the natural shrub layer indicate quite clear modification of the natural vegetation on the site.

As previously indicated, the topography of the site consists of a uniform, flat sandy plain without a discernible slope. The surface topography of the site has also been modified to a significant degree. As indicated, general surface disturbance including shallow excavations and soil dumps cause significant disturbance of the area. No watercourses or wetlands occur near the site and the site itself also does not contain any concentrated runoff patterns, wetlands or watercourses (Appendix A: Map 1 & 2). A remnant of a ditch or trench was noted on the site which may have been used previously for surface storm water runoff though is no longer functional. The Harts River is located approximately 800 meters to the west, with associated wetland areas situated approximately 400 meters to the north (Appendix A: Map 1 & 2). It is therefore highly unlikely that the site will have any impacts on these surface water systems. The site itself has an elevation of 1072 m along the southern border, decreasing slightly to 1071 m along the northern border and also indicates the absence of a discernible slope. In spite of the large distance between the site and surface water systems, the proposed development will still generate storm water and may contribute toward surface water contamination. It will therefore be important to design and incorporate a comprehensive storm water system which should divert clean runoff around the development and retain dirty storm water on it, while also removing contaminants (oil separator or similar system) before storm water is released into the surrounding drainage pattern.

Figure 5: Topography of the site is clearly flat and without any prominent landscape features.

The region has an approximate mean annual rainfall of 466 mm with most rainfall occurring in summer to autumn (Weather station C3E007: Gelukstad@Jan Kempdorp). This is considered

a relatively low rainfall and causes the area to form part of the semi-arid parts of South Africa. This therefore does not promote the formation of wetlands and watercourses in the area. The average maximum and minimum temperature ranges from 37.4˚C in January to -3.9˚C in July with frosts common in winter.

The geology and soils of the area is dominated by deep sandy soils of the Hutton soil form with sporadic surface or shallow limestone also being present.

The following description of the vegetation on the site should give a good indication of the condition of the ecology on it.

As previously indicated, the natural vegetation structure has been modified to a significant degree which will be clearly illustrated by the below description of the species composition. The grass layer is dominated by a mixture of pioneer and climax species which indicates a significant disturbance of this layer. The pioneer grass, *Cynodon dactylon* is especially dominant while climax species such as *Panicum coloratum, Schmidtia pappophoroides, Heteropogon contortus* and *Themeda triandra* remains as isolated specimens. A prominent herbaceous component is also imbedded within the grass layer though the majority of these consist of pioneer herbs which indicate disturbance. These include species such as *Salvia stenophylla, Nolletia sp., Helichrysum argyrosphaerum, Arctotis arctotheca, Commelina eckloniana* and *Gazania krebsiana*. Herbaceous species which are characteristic of this vegetation type and which are normally encountered within it, are still present but not well represented and also confirm a degraded natural vegetation layer. These species include *Senna italica, Hermannia quartiniana, Aptosimum albomarginatum, Pentzia calcarea* and *Crotalaria podocarpa*. The sandy soils of this region also promote the establishment of geophytic species (plants with an underground storage organ) and a few remain on the site though they are generally adapted to disturbed areas. These include *Talinum caffrum, Dipcadi viride, Ledebouria marginata, Trachyandra saltii* and *Harpagophytum procumbens*. The last named *H. procumbens*, is a widespread and relatively common species though is listed as a protected species and a permit will therefore have to be obtained to remove it from the site (a single specimen was noted) (Appendix C). As previously indicated, the shrub layer on the site has been quite heavily modified and is now largely represented by a few pioneer shrubs that often proliferate in degraded areas. These pioneer shrubs include *Vachellia hebeclada* and *Lycium hirsutum* while a few specimens of the more naturally occurring *Tarchonanthus camphoratus* and *Grewia flava* also remain on the site. The shrub layer also promotes the establishment of climbers, though because the shrub layer is so heavily modified, climbers on the site are poorly represented or remain as a few creepers. These include species such as *Coccinia sessilifolia* and *Clematis brachiata*. The tree layer on the site is still fairly intact and is dominated by *Vachellia karroo, Vachellia erioloba, Ziziphus mucronata* and *Searsia lancea.* Of these *V. erioloba* (Camel Thorn) is well known protected tree species and though they are widespread and relatively common they still retain some conservation value (Appendix C). The development should endeavour to keep a few of the larger specimens intact on the site though many of these trees will require removal. Where the development will therefore require the removal of any of these trees, the necessary permits will have to be obtained to do so. It should be clear that the vegetation on the site is heavily modified from the natural condition. This is also further confirmed by the establishment of many exotic weeds such as *Verbesina encelioides, Chenopodium carrinatum, Solanum eleagnifolium, Cestrum laevigatum, Conyza bonariensis, Datura ferox, Argemone ochroleuca* and *Tagetes minuta* while several invasive trees such as *Melia azedarach, Prosopis glandulosa, Eucalyptus camaldulensis* and *Populus deltoidea* are also prominent on the site (Appendix B). From the above description of the

vegetation on the site it is clearly quite heavily modified and degraded. Despite this high level of disturbance, many specimens of protected *V. erioloba* trees remain on the site and will require sufficient mitigation.

Figure 6: Panorama of the site which indicates a well developed, bit modified grass layer, a largely absent shrub layer and tree layer with several large specimens of protected Camel Thorn (*Vachellia erioloba*).

Figure 7: Another panorama of the site which also indicates the general disturbance.

Figure 8: Panorama of the site which also indicates several of the large protected Camel Thorn (*Vachellia erioloba*). The development should endeavour to retain several of these larger trees intact and incorporate them into the development.

Figure 9: A single specimen of protected *Harpagophytum procumbens* was noted on the site and a permit will have to be obtained to remove it.

Figure 10: The site contains several invasive tree species which includes from left to right; *Populus deltoidea, Melia azedarach* and *Eucalyptus camaldulensis*.

Endangered or Red Listed species are absent from the site and is considered unlikely to occur due to the modified and degraded condition of the site. The area is also not known for containing many Red Listed plant species. However, as indicated, the site contains many specimens of the protected tree, *Vachellia erioloba* while a single specimen of the protected geophyte, *Harpagophytum procumbens* was also noted on the site. It is inevitable that the development will require the removal of most of these protected trees and the single specimen of protected geophyte and the necessary permits will have to be obtained to do so. However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development. It is recommended that prior to construction a walkthrough is undertaken to count and mark all protected trees requiring removal and that applicable permits then be obtained for removal (Appendix C).

From the description of the vegetation on the site it is clearly quite modified and degraded from the natural condition. Consequently habitat and species diversity is also fairly low and infestation by exotic weeds and invasive trees are also significant. The conservation value of the site would therefore seem to be fairly low. In addition, the natural vegetation types in the area, Schmidtsdrif and Kimberley Thornveld are also not currently considered to be of high conservation concern and is listed as being of Least Concern (LC) (Appendix A: Map 1 & 2). Furthermore, the area is also listed as an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2). However, the presence of many specimens of protected *Vachellia erioloba* trees will have to be taken into consideration and development should endeavour to keep several of the larger specimens intact and incorporate these into the development (Appendix C). Therefore, in conclusion, although elements of conservation value do occur, overall the proposed site does not contain a high conservation value or unique features requiring exclusion and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

4.2 Overview of terrestrial fauna (actual & possible)

Tracks and signs of mammals are present on the site but given the degraded and modified condition of the site, would be heavily modified from the natural mammal population in the area. As a result, the mammal population on the site itself would be dominated by generalist species adapted to these high levels of disturbance. Natural areas occur to the west of the site where the mammal population would be more representative of the natural condition. In addition, mammal species which are rare and endangered are often habitat specific, sensitive to habitat change and avoids areas in close proximity to human activities. Given the proximity of agricultural areas and the current degraded condition of the site, it is therefore considered highly unlikely that such species would occur on the site.

The mammal survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. It is also considered likely that the area will also contain several other mammal species but these were not observed on the site. From the survey the following actual observations of mammals were recorded:

- Soil mounds of the Common Molerat (*Cryptomys hottentotus*) were observed in the sandy plains portion. This is a widespread species which has even become adapted to urban areas. It is a generalist species anticipated to occur in this area.

- Scat and quills of Porcupines (*Hystrix africaeaustralis*) were noted in the study area. This is also a generalist species, widespread and common in peri-urban areas. It is also able to inhabit disturbed habitats.

- Spoor of a small canid carnivore was also noted which is most likely that of a Black Backed Jackal (*Canis mesomelas*) which is also common in natural and disturbed habitats.

These species identified are all relatively widespread and common generalist species and confirm the anticipated mammal composition on the site. They do however indicate that mammals are still able to inhabit the site though it is unlikely that any species of conservation

concern will occur as a result of the degraded condition of the habitat and proximity of agricultural operations.

The impact that the proposed development will have is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, the survey has indicated that the available habitat is already fairly disturbed and modified and will most probably support a population of generalist mammals. The impact is therefore anticipated to be quite low. Furthermore, natural areas still occur to the west of the site and any mammals on the site are likely to vacate the site into these adjacent areas should development take place. The extent of the proposed development is also very small and the associated impact that it would have on mammals would accordingly also be relatively low.

In order to ensure no direct impact on the mammals on the site the hunting, capturing or trapping of mammals on the site should be strictly prohibited during construction of the development.

Table 2: List of mammal species previously recorded in the region (Mammalmap & Child *et al* 2016).

Order	Common name	Scientific name	Status
Macroscelidea	Eastern Rock Elephant Shrew	*Elephantulus myurus*	
Chiroptera	African Straw-colored Fruit Bat	*Eidolon helvum*	
	Cape Serotine	*Neoromicia capensis*	
	Egyptian Slit-Faced Bat	*Nycteris thebaica*	
	Egyptian Free-tailed Bat	*Tadarida aegyptiaca*	
Primates	Vervet Monkey	*Chlorocebus pygerythrus*	
Pholidota	Ground Pangolin	*Smutsia temminckii*	**Vulnerable (VU)**
Lagomorpha	Cape Hare	*Lepus capensis*	
	Scrub Hare	*Lepus saxatilis*	
Insectivora	Hedgehog	*Atelerix frontalis*	**Near Threatened (NT)**
	Swamp Musk Shrew	*Crocidura mariquensis*	**Near Threatened (NT)**
	Lesser Dwarf Shrew	*Suncus vailla*	
Rodentia	Namaqua Rock Mouse	*Aethomys namaquensis*	
	Cape Molerat	*Cryptomys hottentotus*	
	Gray African Climbing Mouse	*Dendromus melanotis*	
	Highveld Gerbil	*Gerbilliscus brantsii*	
	Bushveld Gerbil	*Gerbilliscus leucogaster*	

	Paeba Hairy-footed Gerbil	*Gerbilliscus paeba*	
	African Dormouse	*Graphiurus murinus*	
	Porcupine	*Hystrix aficaeaustralis*	
	Southern African Mastomys	*Mastomys coucha*	
	Desert Pygmy Mouse	*Mus (Nannomys) indutus*	
	Southern African Pygmy Mouse	*Mus minutoides*	
	Large-eared African Desert Mouse	*Malacothrix typica*	
	African White-tailed Rat	*Mystromys albicaudatus*	**Vulnerable (VU)**
	Southern African Vlei Rat	*Otomys auratus*	**Near Threatened (NT)**
	Springhare	*Pedetes capensis*	
	Xeric Four-striped Grass Rat	*Rhabdomys pumilio*	
	Southern African Pouched Mouse	*Saccostomus campestis*	
	Ground Squirrel	*Xeris inauris*	
Carnivora	African Clawless Otter	*Aonyx capensis*	**Near Threatened (NT)**
	Marsh Mongoose	*Atilax paludinosus*	
	Black-backed Jackal	*Canis mesomelas*	
	Caracal	*Caracal caracal*	
	Yellow Mongoose	*Cynictis penicillata*	
	Wildcat	*Felis silvestris*	
	Black-footed Cat	*Felis nigripes*	**Vulnerable (VU)**
	Common Genet	*Genetta genetta*	
	Cape Genet	*Genetta tigrina*	
	Slender Mongoose	*Herpestes sanguineus*	
	Brown Hyena	*Hyaena brunnea*	**Near Threatened (NT)**
	Striped Polecat	*Ictonyx striatus*	
	Serval	*Leptailurus serval*	**Near Threatened (NT)**
	Honey Badger	*Mellivora capensis*	
	Bat-eared Fox	*Otocyon megalotis*	
	African Striped Weasel	*Poecilogale albinucha*	**Near Threatened (NT)**
	Aardwolf	*Proteles cistatus*	
	Meerkat	*Suicata silicatta*	
	Cape Fox	*Vulpes chama*	
Tubulidentata	Aardvark	*Orycteropus afer*	
Hyracoidea	Rock Hyrax	*Procavia capensis*	
Artiodactyla	Impala	*Aepyceros melampus*	

	Springbok	*Antidorcas marsupialis*	
	Gemsbok	*Oryx gazella*	
	Warthog	*Phacochoerus aethiopicus*	
	Steenbok	*Raphicerus campestris*	
	Southern Reedbuck	*Redunca arundinum*	
	Duiker	*Sylvicapra grimmia*	
	Eland	*Tragelaphus oryx*	
	Koedoe	*Tragelaphus strepsiceros*	

Figure 11: Tracks and signs of mammals on the site include clockwise from top left; quill of a Porcupine (*Hystrix africaeaustralis*), track of a small carnivore, most likely Black Backed Jackal (*Canis mesomelas*) and soil mound of the Common molerat (*Cryptomys hottentotus*).

5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have is primarily concerned with the loss of habitat and species diversity.

As previously discussed, from the description of the vegetation on the site, it has already been transformed to a large degree. Consequently the loss of habitat and diversity as a result of the development would be quite low. In addition, the natural vegetation types in the area, Schmidtsdirf and Kimberley Thornveld are also not currently considered to be of high conservation concern and is listed as being of Least Concern (LC) (Appendix A: Map 1 & 2). Furthermore, the area is also listed as an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2). In addition, given the relatively small footprint of the development and the already degraded condition of the site, this will also further decrease the anticipated impact. Therefore, in conclusion, although elements of conservation value do occur, overall the proposed site is already largely transformed, does not contain a high conservation value or unique features requiring exclusion and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings. The loss of habitat and diversity is therefore anticipated to remain fairly low.

Endangered or Red Listed species are absent from the site and is considered unlikely to occur due to the modified and degraded condition of the site. The area is also not known for containing many Red Listed plant species. However, as indicated, the site contains many specimens of the protected tree, *Vachellia erioloba* while a single specimen of the protected geophyte, *Harpagophytum procumbens* was also noted on the site. It is inevitable that the development will require the removal of most of these protected trees and the single specimen of protected geophyte and the necessary permits will have to be obtained to do so. However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development. It is recommended that prior to construction a walkthrough is undertaken to count and mark all protected trees requiring removal and that applicable permits then be obtained for removal (Appendix C). The loss of protected trees is therefore inevitable which will therefore remain at least a moderate impact.

As previously indicated, the topography of the site consists of a uniform, flat sandy plain without a discernible slope and as a result, no watercourses or wetlands occur near the site and the site itself also does not contain any concentrated runoff patterns, wetlands or watercourses (Appendix A: Map 1 & 2). A remnant of a ditch or trench was noted on the site which may have been used previously for surface storm water runoff though is no longer functional. The Harts River is located approximately 800 meters to the west, with associated wetland areas situated approximately 400 meters to the north (Appendix A: Map 1 & 2). It is therefore highly unlikely that the site will have any impacts on these surface water systems. In spite of the large distance between the site and surface water systems, the proposed development will still generate storm water and may contribute toward surface water contamination. It will therefore be important to design and incorporate a comprehensive storm water system which should divert clean runoff around the development and retain dirty storm water on it, while also removing contaminants (oil separator or similar system) before storm water is released into the surrounding drainage pattern. Provided that adequate mitigation is implemented the anticipated impact on surface water sources should remain fairly low.

Due to the already degraded and transformed condition of the site it contains a variety of exotic weeds and invasive species, of which several are also known to be problematic in this region (Appendix B). Construction activities will also increase disturbance and therefore increase the susceptibility for the establishment of weeds and invasive species and their spread into the surroundings. It will therefore be important to remove these invasive species prior to construction, to adequately dispose of them and to monitor any re-establishment of these species on and around the site. Monitoring of weed establishment and eradication should therefore form a prominent part of management of the development. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004. Unmitigated this is anticipated to be at least a moderate impact, though should be easily decreased through adequate weed control.

The impact that the proposed development will have is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, the survey has indicated that the available habitat is already fairly disturbed and modified and will most probably support a population of generalist mammals. The impact is therefore anticipated to be quite low. Furthermore, natural areas still occur to the west of the site and any mammals on the site are likely to vacate the site into these adjacent areas should development take place. The extent of the proposed development is also very small and the associated impact that it would have on mammals would accordingly also be relatively low.

The impact significance has been determined and without mitigation a few impacts may be moderate. However, with adequate mitigation which in most cases could be easily applied, all impact can be decreased to at least low-moderate. The loss of protected tree species is however anticipated to remain a moderate impact since this will not be easily mitigated.

Please refer to Appendix D for the impact methodology.

Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Before Mitigation								
Loss of vegetation type and clearing of vegetation	2	5	1	2.6	3	3	3	7.8
Loss of protected species	4	5	1	3.3	5	4	4.5	14.8
Impact on watercourses	3	5	2	3.3	2	2	2	6.6
Infestation with weeds and invaders	3	4	3	3.3	4	3	3.5	11.5
Impact on Terrestrial fauna	1	4	1	2	2	3	2.5	5
After Mitigation								
Loss of vegetation type and clearing of vegetation	2	5	1	2.6	3	3	3	7.8
Loss of protected species	3	5	1	3	5	3	3.5	10.5
Impact on watercourses	2	5	1	2.6	2	1	1.5	3.9
Infestation with weeds and invaders	2	3	1	2	3	2	2.5	5
Impact on Terrestrial fauna	1	4	1	2	2	3	2.5	5

6. SITE SPECIFIC RESULTS

Habitat diversity and species richness:
The extent of the proposed site is fairly small while the habitat and vegetation has also been transformed and degraded to a large extent. The habitat on the site is also confined to a sandy plain with high levels of disturbance evident. As a result, the habitat and species diversity on the site is visibly low, especially when compared to surrounding natural areas.

Presence of rare and endangered species:
Endangered or Red Listed species are absent from the site and is considered unlikely to occur due to the modified and degraded condition of the site. The area is also not known for containing many Red Listed plant species. However, as indicated, the site contains many specimens of the protected tree, *Vachellia erioloba* while a single specimen of the protected geophyte, *Harpagophytum procumbens* was also noted on the site (Appendix C). Overall the presence of protected plant species on the site is therefore considered as moderate.

Ecological function:
The ecological function of the site has been modified to a large degree. The site functions as habitat for fauna, sustains a specific vegetation type, i.e. Schmidtsdrif and Kimberley Thornveld and also functions in terms of surface drainage and groundwater recharge (Appendix A: Map 1 & 2). The vegetation on the site has been significantly modified from the surrounding natural areas and is cleared heavily disturbed. As a result, the habitat provided to mammals are also heavily modified and will only support a generalist mammal population. The functioning of surface drainage will also be affected to some degree by a modified surface topography. Overall the ecological functioning of the area is therefore considered to be largely modified. Furthermore, the function of the site is not paramount to the continued functioning of the surrounding natural areas. In other words, development of the site should not impair the functioning of the surrounding area to a large extent.

Degree of rarity/conservation value:
The survey has confirmed that the area consists of within Schmidtsdrif Thornveld (SVk 6) and Kimberley Thornveld (SVk 4) (Appendix A: Map 1 & 2). These vegetation types are currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). Neither are currently under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation. In addition, natural vegetation on the site has clearly been quite heavily affected by previous land use which will further decrease the conservation value of the site. In addition, the proposed site falls within an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2). Overall, the conservation value of the site is therefore considered as low.

Percentage ground cover:
The percentage vegetation cover is visibly lower than the surrounding natural areas. The shrub, herbaceous and grass components have all clearly been modified to a significant degree and overall the percentage ground cover is considered to be largely modified.

Vegetation structure:
When compared to surrounding natural areas, the vegetation structure should consist of scattered large trees and a fairly dense shrub layer with well-developed grass layer interspersed. Currently the site consists of a layer of scattered large trees, while the shrub layer is largely absent and the grass layer is also not well developed. The natural vegetation structure can therefore be regarded as being largely modified.

Infestation with exotic weeds and invader plants:
Due to high levels of disturbance on the site, a variety of exotic weeds and invasive species are present (Appendix B). Construction activities will also increase disturbance and therefore increase the susceptibility for the establishment of weeds and invasive species and their spread into the surroundings. Overall the presence of exotic weeds and invasive species are therefore considered high.

Degree of grazing/browsing impact:
The area is utilised for grazing by domestic livestock but is currently still being regarded as having only a moderate impact. This was also confirmed by surrounding natural areas.

Signs of erosion:
Due to the flat topography and the absence of concentrated flow patterns the area is not affected by extensive erosion. However, a high level of disturbance on the site and the modification of the natural vegetation is likely to contribute to a moderate level of sheet erosion.

Terrestrial animals:
Tracks and signs of mammals are present on the site but given the degraded and modified condition of the site, would be heavily modified from the natural mammal population in the area. As a result, the mammal population on the site itself would be dominated by generalist species adapted to these high levels of disturbance. Natural areas occur to the west of the site where the mammal population would be more representative of the natural condition. In addition, mammal species which are rare and endangered are often habitat specific, sensitive to habitat change and avoids areas in close proximity to human activities. Given the proximity of agricultural areas and the current degraded condition of the site, it is therefore considered highly unlikely that such species would occur on the site. Overall, the mammal population on the site is considered to be heavily modified.

Table 3: Biodiversity Sensitivity Rating for the proposed filling station.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness	3		
Presence of rare and endangered species		2	
Ecological function	3		
Uniqueness/conservation value	3		
Vegetation condition			
Percentage ground cover	3		
Vegetation structure	3		
Infestation with exotic weeds and invader plants or encroachers	3		
Degree of grazing/browsing impact		2	
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species	3		
Sub total	21	6	0
Total		27	

7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 4: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
Hartswater filling station	27	Preferred	4

8. DISCUSSION AND CONCLUSION

The proposed site has been rated as being preferred for the proposed filling station development, mostly as a result of the already transformed condition of the site, compared to surrounding natural areas. The absence of elements of high conservation value and the small extent of the site also contributes towards its suitability for development. However, numerous protected Camel Thorn (*Vachellia erioloba*) trees on the site will still require suitable mitigation.

The site for the proposed filling station is situated along the tarred road between the two towns of Pampierstad and Hartswater which is situated within the border of the Northern Cape Province (Appendix A: Map 1). The site has an extent of approximately 4.5 hectares. The proposed filling station will be situated within an area extensively used for irrigation and the main land use here is associated with agriculture. The site itself still contains remnants of natural vegetation though is in general quite heavily modified and degraded. No watercourses or wetlands could be identified on or near the proposed site and is therefore highly unlikely to have any impact on surface water features.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018) the site is indicated to fall within Schmidtsdrif Thornveld (SVk 6) though the site survey also indicated affinities with Kimberley Thornveld (SVk 4) (Appendix A: Map 1 & 2). Both these vegetation types are characterised by a well developed grass layer and a tree layer which varies from open to closed situated on deep red sands. Both vegetation types are also currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). Neither are currently under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation. In addition, natural vegetation on the site has clearly been quite heavily affected by previous land use which will further decrease the conservation value of the site. The Northern Cape Critical Biodiversity Areas Plan (2016) has been published in order to identify areas which are essential to meeting conservation targets for specific vegetation types, i.e. Critical Biodiversity Areas (CBA). The proposed site falls within an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2).

The site is still dominated by indigenous vegetation, though when compared with surrounding natural areas the site has clearly been heavily modified (Appendix A: Map 1). Where the surrounding natural areas contain a well developed grass layer, dense shrub layer and open tree layer, the site contains a sparse grass layer, poorly developed shrub layer and open tree layer with many invasive tree species also prominent. This indicates a significant modification in terms of the vegetation structure on the site. The topography of the area is also uniform, consisting of deep, yellow to reddish coloured, loose sandy soils with flat plains containing no discernible slope gradient. As a result, there is no appreciable diversity in terms of habitat and vegetation composition on the site. The site therefore retains remnants of the natural vegetation but is clearly modified with signs of disturbance prominent.

The topography of the site consists of a uniform, flat sandy plain without a discernible slope and as a result, no watercourses or wetlands occur near the site and the site itself also does not contain any concentrated runoff patterns, wetlands or watercourses (Appendix A: Map 1 & 2). A remnant of a ditch or trench was noted on the site which may have been used previously

for surface storm water runoff though is no longer functional. The Harts River is located approximately 800 meters to the west, with associated wetland areas situated approximately 400 meters to the north (Appendix A: Map 1 & 2). It is therefore highly unlikely that the site will have any impacts on these surface water systems. In spite of the large distance between the site and surface water systems, the proposed development will still generate storm water and may contribute toward surface water contamination. It will therefore be important to design and incorporate a comprehensive storm water system which should divert clean runoff around the development and retain dirty storm water on it, while also removing contaminants (oil separator or similar system) before storm water is released into the surrounding drainage pattern. Provided that adequate mitigation is implemented the anticipated impact on surface water sources should remain fairly low.

Endangered or Red Listed species are absent from the site and is considered unlikely to occur due to the modified and degraded condition of the site. The area is also not known for containing many Red Listed plant species. However, as indicated, the site contains many specimens of the protected tree, *Vachellia erioloba* while a single specimen of the protected geophyte, *Harpagophytum procumbens* was also noted on the site. It is inevitable that the development will require the removal of most of these protected trees and the single specimen of protected geophyte and the necessary permits will have to be obtained to do so. However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development. It is recommended that prior to construction a walkthrough is undertaken to count and mark all protected trees requiring removal and that applicable permits then be obtained for removal (Appendix C).

Tracks and signs of mammals are present on the site but given the degraded and modified condition of the site, would be heavily modified from the natural mammal population in the area. As a result, the mammal population on the site itself would be dominated by generalist species adapted to these high levels of disturbance. In addition, mammal species which are rare and endangered are often habitat specific, sensitive to habitat change and avoids areas in close proximity to human activities. Given the proximity of agricultural areas and the current degraded condition of the site, it is therefore considered highly unlikely that such species would occur on the site. The impact that the proposed development will have is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. However, the survey has indicated that the available habitat is already fairly disturbed and modified and will most probably support a population of generalist mammals. The impact is therefore anticipated to be quite low. Furthermore, natural areas still occur to the west of the site and any mammals on the site are likely to vacate the site into these adjacent areas should development take place. The extent of the proposed development is also very small and the associated impact that it would have on mammals would accordingly also be relatively low.

The impact significance has been determined and without mitigation a few impacts may be moderate. However, with adequate mitigation which in most cases could be easily applied, all impact can be decreased to at least low-moderate. The loss of protected tree species is however anticipated to remain a moderate impact since this will not be easily mitigated.

From the description of the vegetation on the site it is clearly quite modified and degraded from the natural condition. Consequently habitat and species diversity is also fairly low and infestation by exotic weeds and invasive trees are also significant. The conservation value of the site would therefore seem to be fairly low. In addition, the natural vegetation types in the area, Schmidtsdrif and Kimberley Thornveld are also not currently considered to be of high

conservation concern and is listed as being of Least Concern (LC) (Appendix A: Map 1 & 2). Furthermore, the area is also listed as an Other Natural Area (ONA) which indicates that the area is considered to still consist of natural vegetation though is not considered essential to meeting conservation targets and has an overall low conservation value (Appendix A: Map 2). However, the presence of many specimens of protected *Vachellia erioloba* trees will have to be taken into consideration and development should endeavour to keep several of the larger specimens intact and incorporate these into the development. Therefore, in conclusion, although elements of conservation value do occur, overall the proposed site does not contain a high conservation value or unique features requiring exclusion and should not result in any high impacts on the vegetation and ecology of the site and immediate surroundings.

9. RECOMMENDATIONS

- The site contains numerous protected trees and one protected geophytic species which, although widespread, has significant conservation value and will require mitigation (Appendix B & C).
    - A suitably qualified practitioner should undertake a walkthrough survey of the site prior to construction to identify, count and mark all protected trees and plants that will be affected by construction.
    - Where protected Camel Thorns (*Vachellia erioloba*) will be affected and will require removal, the necessary permits will have to be obtained to do so. The majority of the site will have to be cleared and it is therefore inevitable that most of these trees will be affected.
    - However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development.
    - One protected geophytic plant (plants with an underground storage organ) occur on the site, namely *Harpagophytum procumbens.* This species is widespread and fairly common in this region and is therefore of limited conservation value. However, a permit should still be obtained to remove it from the site.
    - Protected trees are listed as such under the National Forests Act of 1998 (Act No. 84 of 1998) while protected geophytic species are listed as protected under the Northern Cape Nature Conservation Act of 2009 (Act No. 9 of 2009).

- In spite of the large distance between the site and Hartsriver system (Approximately 400 meters to the north west), the proposed development will still generate storm water and may contribute toward surface water contamination (Appendix A: Map 1 & 2). The following measures should be implemented in order to ensure the runoff generated by the development does not contribute to any measurable impacts on this river system:
    - In order to prevent contamination of surface and groundwater the fuel storage tanks and facility itself should be designed and constructed to such a standard so that any spills are managed on site and prevented from entering the surrounding sub-catchment which will eventually affect the Hartsriver system to the north west of the site.
    - An oil separation system should be designed and implemented to ensure that contaminated storm water on the site is treated before being released into the natural drainage pattern.
    - The principles of the separation of clean and dirty storm water must be implemented and runoff generated in the surrounding natural areas should be diverted around the site and storm water generated on the site footprint itself should be contained on the site and treated before being released into the natural drainage pattern.
    - A comprehensive storm water management system will therefore have to be designed to ensure that storm water released from the site does not adversely affect the sub-catchment and eventually the Hartsriver system to the north west.
    - All structures and mitigation measures should be maintained throughout the lifetime of the development.
    - It will also be of paramount importance to implement a comprehensive monitoring programme so that any leakages and contamination of surface or

groundwater is prevented before it can cause deterioration of the sub-catchment or Hartsriver system to the north west of the site.

- The footprint of disturbance and clearance of vegetation must always be kept to a minimum. This is especially relevant to surrounding natural areas which should not be disturbed during construction of the site.

- Adequate monitoring of weed and invasive species establishment and their continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

- The hunting, capturing and trapping of fauna should be prevented by making this a punishable offense during the construction phase of the development.

- Open excavations may act as pitfall traps to mammals, reptiles and amphibians and trenches should be daily monitored for trapped animals which should be removed promptly.

- In the event of poisonous snakes or other dangerous animals encountered on the site an experienced and certified snake handler or zoologist must remove these animals from the site and re-locate them to a suitable area.

- No littering must be allowed and all litter must be removed from the site.

- Monitoring of construction and compliance with recommended mitigation measures must take place.

- After construction has ceased all construction materials should be removed from the area.

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Annexure A: Maps

Locality map for the proposed filling station situated between the settlements of Pampierstad and Hartswater, Northern Cape Province.

Preparred for:
Turn 180 Environmental Consultants
Suite 221, Private Bag X01
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Legend:

- Site boundary
- Watercourses
- Wetlands and impoundments
- Schmidtsdrif Thornveld

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:10 000

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Map 1: Locality map of the proposed filling station between the Pampierstad and Hartswater. Areas of remaining Schmidtsdrif Thornveld vegetation is indicated. The surroundings contain large transformed areas while large natural areas are also still present to the west of the site. Though the site itself is indicated to still be natural, the site survey has indicated significant modification. Note also a significant lower vegetation cover compared to natural areas to the west. The Hartsriver and associated wetland areas are also visible to the north and west of the site.

Northern Cape Critical Biodiversity Areas Plan map for the proposed filling station between the settlements of Pampierstad and Hartswater, Northern Cape Province.

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Legend:

- Site boundary
- Watercourses
- Wetlands and impoundments
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area
- Other Natural Area
- Protected Areas
- Other
- NPAES Focus Areas
- Threatened Ecosystems

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:10 000

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Map 2: Northern Cape Critical Biodiversity Areas Plan map of the proposed filling station between Pampierstad and Hartswater. The area and surroundings still consist of natural vegetation but is regarded as being Other Natural Areas which indicates that it is not considered essential for meeting conservation targets and has an overall lower conservation value. An Ecological Support Area is associated with the Hartsriver to the west and north.

Appendix B: Species list

Species indicated with an * are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
**Argemone ochroleuca*	Herb
**Cestrum laevigatum*	Shrub
**Chenopodium carrinatum*	Herb
**Conyza bonariensis*	Herb
**Datura ferox*	Herb
**Eucalyptus camaldulensis*	Tree
**Lactuca seriola*	Herb
**Melia azedarach*	Tree
**Populus deltoidea*	Tree
**Prosopis glandulosa*	Tree
**Solanum eleagnifolium*	Herb
**Tagetes minuta*	Herb
**Verbesina encelioides*	Herb
Aptosimum albomarginatum	Herb
Arctotis arctotoides	Herb
Asparagus suaveolens	Dwarf shrub
Clematis brachiata	Climber
Coccinia sessilifolia	Climber
Commelina eckloniana	Herb
Crotalaria podocarpa	Herb
Cynodon dactylon	Grass
Diospyros lycioides	Shrub
Dipcadi viride	Geophyte
Eragrostis lehmanniana	Grass
Eragrostis pallens	Grass
Gazania krebsiana	Herb
Grewia flava	Shrub
Harpagophytum procumbens	Geophyte
Helichrysum argyrosphaerum	Herb
Hermannia quartiniana	Herb
Heteropogon contortus	Grass
Ledebouria marginata	Geophyte
Lycium hirsutum	Shrub
Nolletia sp.	Dwarf shrub
Panicum coloratum	Grass
Pentzia calcarea	Dwarf shrub
Salvia stenophylla	Herb
Schmidtia pappophoroides	Grass
Searsia lancea	Tree
Senna italica	Herb

Talinum caffrum	Geophyte
Tarchonanthus camphoratus	Shrub
Themeda triandra	Grass
Trachyandra saltii	Geophyte
Vachellia erioloba	Tree
Vachellia hebeclada	Dwarf shrub
Vachellia karroo	Tree
Vigna sp.	Herb
Wahlenbergia androsaceae	Herb
Ziziphus mucronata	Tree

Appendix C: Protected species on the site

Protected species on the site may not be limited to these species but these species have identified on and around the site. Additional sources should be consulted to confirm the presence of protected species.

Harpagophytum procumbens
Devil's Claw/Duiwelsklou

Protected in the Northern Cape Province under the Northern Cape Nature Conservation Act of 2009 (Act No. 9 of 2009) and also listed as National TOPS: Protected Medicinal Species.

National Red List Status: **Least Concern (LC)**

Method: **Only one specimen observed on the site. Where they are affected by construction a permit should be obtained and the plant removed.**

Vachellia erioloba
Camel Thorn/Kameeldoring

Listed as a protected tree species under the National Forests Act of 1998 (Act No. 84 of 1998).

National Red List Status: **Least Concern (LC)**

Method: **Many specimens scattered over the site. Where they will be affected and will require removal, the necessary permits will have to be obtained to do so. However, the development should also endeavour to keep several of the larger specimens of *V. erioloba* intact and to incorporate these into the development.**

Appendix D: Impact methodology

The environmental significance assessment methodology is based on the following determination:
Environmental Significance = Overall Consequence x Overall Likelihood

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 below and in tables 6, 7, 9 and 10.

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.
Table 7 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 7: 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 8: Rating of Duration

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

Determination of Extent/Spatial Scale
Extent refer to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 9: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

Determination of Overall Consequence
Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 10: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

Likelihood
The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 11 and Table 12.

Determination of Frequency
Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 11: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

Determination of Probability
Probability refers to how often the activity/even or aspect has an impact on the environment.

Table 12: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-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 13: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

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-MEDIUM, MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 14: 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 15: 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.