**Appendix D – Specialist Studies**

**Appendix D1 – Terrestrial Ecological Assessment Report**

# PROPOSED DUVHA ASH DAM SEEPAGE INTERCEPTION DRAINS

## Terrestrial Ecological Assessment Report

July 2017

Prepared for: Eskom Holdings SOC Ltd


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# Executive Summary

Eskom Holdings SOC (Ltd) has appointed Nemai Consulting as an Independent Environmental Assessment Practitioner to conduct an Environmental Authorisation Process for the proposed Duvha ash dam seepage interception drains. The ash dam, which receives wet ash from the Duvha Power Station, is contaminating groundwater and potentially the Witbank Dam due to seepage. Seepage interception drains have been proposed to mitigate seepage and prevent contamination of the Witbank Dam.

A Terrestrial Ecological Assessment was undertaken as part of the Basic Assessment process in order to assess the impacts that the proposed construction activities will have on the receiving environment. The objective of this study was to identify sensitive species and their habitats on the four proposed sites. The current ecological status and conservation priority of vegetation on the four sites were assessed. Potential faunal habitats were investigated on each site and all mammals, birds, reptiles and amphibians known to occur on site or observed on site were recorded. Red Data species (both fauna and flora) that are known to occur on site were also inspected.

The four proposed ash dam seepage interception drain sites fall within the grassland biome and have been categorised as Eastern Highveld Grassland and Rand Highveld Grassland vegetation units, of which both are listed as endangered. The Grassland biome has a high biodiversity, ranked only below the Fynbos biome in terms of biodiversity in South Africa. It is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant.

According to the data from South African National Biodiversity Institute (SANBI), Eastern Highveld Grassland and Rand Highveld Grassland threatened terrestrial ecosystems were recorded on the proposed sites and these ecosystem types have a vulnerable status. Even though the vegetation types and threatened ecosystems are listed as endangered and vulnerable respectively, the proposed sites have been highly transformed and disturbed due to ash dams, alien plant infestation and mining activities. According to the Mpumalanga Biodiversity Conservation Plan, the proposed development sites fall within the "*CBA Optimal"*, "*Heavily modified"* and *"Moderately modified- Old lands".*

During the field survey, no threatened species were observed on sites but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato) and this species is listed as *Declining.* It is therefore recommended that prior to construction, this species must be rescued and relocated to a safer place with suitable survival and growth-enabling conditions. Following construction activities, the species can be re-established at the sites.

During the field assessment, mammal species diversity was very low and this could be attributed to anthropogenic disturbances observed on sites such as habitat transformation and mining activities. Only seven mammal species were recorded on sites during the field assessment**.** The species recorded have a wide distribution range. Mammals are sensitive to disturbances and as such few were expected to occur on sites. No Red Data mammal species were recorded on site. The proposed development sites will have an insignificant impact on mammal conservation in the region. Species such as Blesbok were recorded in abundance on site.

Conservation and planning tools were reviewed for relevancy in terms of the project area, and it was found that the study area did not contain or form part of any Important Bird & Biodiversity areas (IBAs). The unprotected IBA closest to the study area is situated approximately 40km away, namely Amersfoort-Bethal-Carolina IBA. An avifaunal study indicated that large stands of *Eucalyptus* trees and grasslands should provide natural habitats for bird species, however no Red Data bird species were observed on the study sites. Previous studies conducted near the study sites indicated that Red data birds species such as Southern Bald Ibis has been recorded near the High level dam servitude. Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation. Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide. Due to high levels of habitat transformation, the site offers limited suitable habitat for any larger terrestrial birds as well as certain smaller raptor species.

Large areas surrounding the study sites have resulted in increased habitat modification and transformation and are all causal factors in the alteration and disappearance of reptile diversity in the area. Only one reptile species was noted on site, this being the Montane Speckled Skink (*Trachylepis punctatissima*). This species is found in a variety of habitats, wet and dry, from

grassland and savanna to shrubland, including rock outcrops. It is not considered to be of significant importance from a conservation perspective.

The non-perennial river on the proposed Low level dam servitude site holds water on a temporary basis and is likely an important breeding habitat for most of the frog species which occur in the region. During the field assessment, only one frog species was recorded, namely Queckett's River Frog (*Amietia quecketti*). It is a common species found on the banks of slow-flowing streams or other permanent bodies of water in a wide range of wetland habitats in grassland, savannah and forest fringe. It frequently inhabits garden ponds and water features.

From a broad and preliminary evaluation of the study sites, it is evident that the proposed development will have minimal impacts on the receiving environment. The study sites are not unique and do not contain any rare habitats or species, and therefote it is unlikely that any species that potentially occurs will experience a large or disproportionate negative impact as a direct result of the proposed construction of seepage interception drains. The proposed development should proceed subject to the above, and mitigation measures must be employed to minimise potential impacts from the project activities.

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# 1 BACKGROUND AND INTRODUCTION

Eskom Holdings SOC (Ltd) has appointed Nemai Consulting as an Independent Environmental Assessment Practitioner to conduct an Environmental Authorisation Process for the proposed Duvha ash dam seepage interception drains. The ash dam, which receives wet ash from the Duvha Power Station, is contaminating groundwater and potentially the Witbank Dam due to seepage. Seepage interception drains have been proposed to mitigate seepage and prevent contamination of the Witbank Dam.

A Terrestrial Ecological Assessment was undertaken as part of the Basic Assessment process in order to assess the impacts that the proposed construction activities will have on the receiving environment. The objective of this study was to identify sensitive species and their habitats on the four proposed sites. The current ecological status and conservation priority of vegetation on the four sites were assessed. Potential faunal habitats were investigated on each site and all mammals, birds, reptiles and amphibians known to occur on sites or seen on sites were recorded. Red Data species (both fauna and flora) that are known to occur on site were also inspected.

## 1.1 Objectives of the survey

In order to achieve the aim stated above, the following objectives are to be achieved:

- To apply relevant literature to determine the diversity and eco-status of the plants, mammals, birds, reptiles and amphibians on the four proposed seepage interception drain sites;
- To carry out a field survey to gain an understanding of the diversity and eco-status of taxa which inhabit the proposed study area, as well as the presence of unique habitats that might require further investigation or protection;
- To assess the current habitat and conservation status of plant and animal species on the study sites;
- To comment on ecological sensitive species/areas;
- To assess the possible impact of the proposed project on these taxa and/or habitats;

- To list the species on site and to recommend necessary actions in case of occurrence of endangered, vulnerable or rare species or any species of conservation importance; and

- To provide management recommendations to mitigate negative and enhance positive impacts on the four proposed sites.

# 2 RELEVANT LEGISLATION AND GUIDELINES

The following pieces of legislation are relevant to this project:

- The Constitution, 1996 (Act 108 of 1996) – Section 24;
- Environment and Conservation Act 1989 (Act No. 73 of 1989);
- Conservation of Agricultural Resources Act 1983 (Act No. 43 of 1983);
- The white paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997);
- National Environmental Management Act 1998 (Act No. 107 of 1998);
- National Environmental Management Biodiversity Act 2004 (Act No. 10 of 2004);
- Mpumalanga Tourism and Parks Agency requirements for assessing and mitigating Environmental Impacts of development applications; and
- Mpumalanga Biodiversity Sector Plan, 2013.

# 3 STUDY AREA

Eskom Holdings SOC (Ltd) proposes to construct four seepage interception drains sites within the Duvha Power Station, located on the farm Duvha Kragstasie 337JS, in Mpumalanga Province (**Figures 1** and **2**). Duvha Power Station is located approximately 15 km east of Witbank. The collage of photographs taken on the four proposed ash dam seepage interception drains sites are indicated in **Figures 3, 4, 5 and 6**.

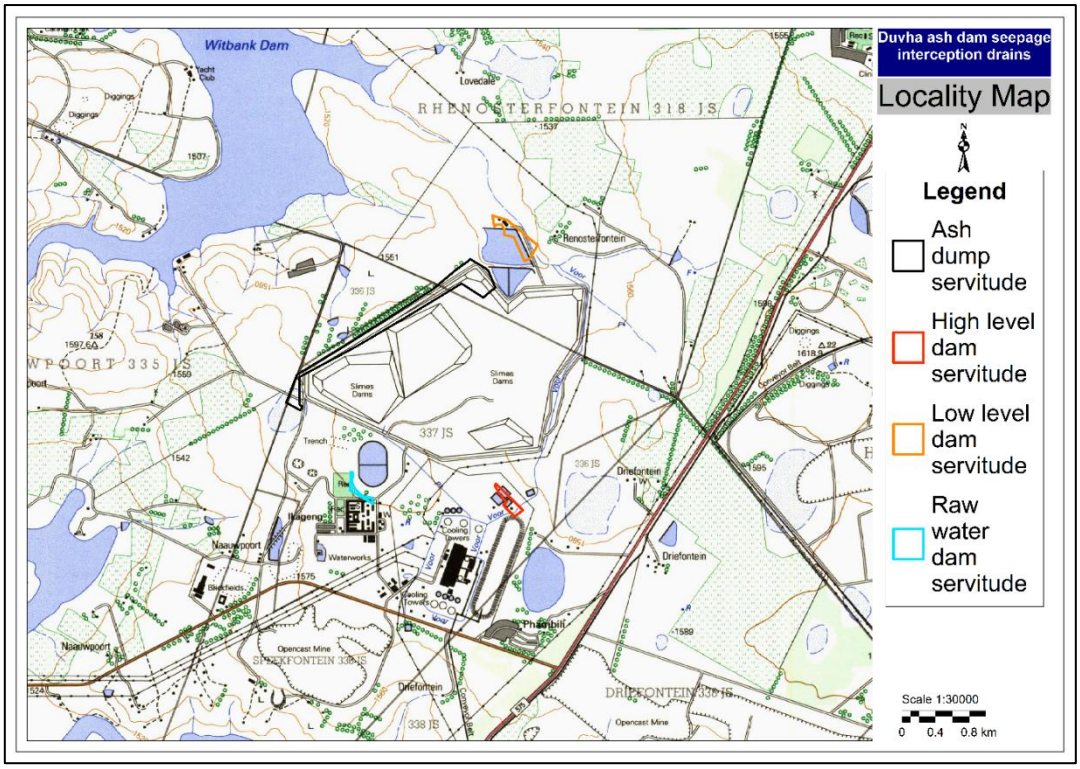


**Figure 1: Locality Map**


**Figure 2: Google Earth Map of Proposed Development Sites**

**Figure 3: Photos of the Ash Dam Servitude**

**Figure 4: Photos of the Low Level Dam Servitude**

**Figure 5: Photos of the High Level Dam Servitude**

**Figure 6: Photos of the Raw Water Dam Servitude**

# 4 MPUMALANGA BIODIVERSITY SECTOR PLAN-TERRESTRIAL CRITICAL BIODIVERSITY AREAS

A regional conservation plan was produced by the Mpumalanga Tourism and Parks Agency (MTPA). This plan indicated several areas requiring some level of conservation within the strategic premise to either systematically include these areas into conservation areas or to protect these areas from irresponsible development. The Mpumalanga Biodiversity Sector Plan has divided the distribution of the Province's biodiversity into the following 9 categories in the table below (**Table 1**) (MTPA, 2013).

**Table 1. MBCP Categories (MTPA, 2013)**

| Category | | Description |
|---|---|---|
| 1 | Protected areas | These are protected areas that were used to meet biodiversity targets in MBSP 2013. |
| 2 | Critical Biodiversity Area: Irreplaceable | This category comprises areas considered critical for meeting biodiversity targets and thresholds, and which are required to ensure the persistence and of species and the functioning of ecosystems. Such biodiversity or landscape facets is usually at risk of being lost due to the remaining distribution being below target. For example, only known sites for certain threatened species, or areas of high connectivity value which have high risk of having connectivity disrupted (i.e. critical corridor linkages in the landscape). |
| 3 | Critical Biodiversity Area: Optimal | The CBA Optimal Areas, previously referred to as Important & Necessary in MBCPv1, are the best localities out of a larger selection of available PUs as they are optimally located to meet both the various biodiversity targets and the criteria defined by either the Marxan design or cost layers. These areas have an irreplaceability (or frequency selection score) of less than 80%. In Marxan, this is categorised as the "Best" solution and is essentially the most efficient and thus optimal solution to meet all biodiversity conservation targets while avoiding high cost areas as much as possible. |
| 4 | Ecological Support Area: Landscape-scale corridors | These corridors represent the ideal or best route option to support existing biodiversity and allow them to adapt to the impacts of climate change. The functionality of these corridors to support biodiversity connectivity needs to be maintained. |
| 5 | Ecological Support Area: Local-scale corridors | These are fine scale connectivity pathways that contribute to connectivity between climate change focal areas. They represent alternative pathways for movement, and thus lessen the effect of critical linkages and provide networks that are more robust to disturbance. The ecological functionality of these corridors to support biodiversity connectivity needs to be maintained. |
| 6 | Ecological Support Area: Species Specific | These are areas required for the persistence of specific species. Although these areas are frequently transformed, a change in current land use, to anything other than rehabilitated land, would most likely result in a loss of that feature from the area identified. Only one area, an important over-wintering site for Blue Crane shared with Gauteng, and which comprises a matrix of natural and cultivated lands, was identified by expert opinion. |

| Category | | Description |
|---|---|---|
| 7 | Ecological Support Area: Protected Area buffers | These are areas around our Protected Areas where changes in land-use may affect the ecological functioning or tourism potential of the PAs. The purpose of buffer zones is to mediate the impacts of undesirable land-uses that have a negative effect on the environment. This zone also offers tourism opportunities. Changes in land use usually have either direct impacts, such as cultivating virgin land, or both direct and indirect impacts, such as light and noise pollution in addition to a change in land cover. The nature of the impacts needs to be assessed and appropriate land-uses supported. The buffer distances applied, include:<br>• National Parks: National biodiversity and tourism asset. A 10 km buffer applied as indicated in Listing Notice 3. Undesirable land-uses must be avoided.<br>• Protected Areas (Nature Reserves): Nature reserves have both biodiversity and tourism value, and any undesirable changes in land-use should be avoided. A 5 km buffer distance has been applied around nature reserves as indicated in Listing Notice 3.<br>• Protected Environments: Usually production landscapes with biodiversity friendly management. Management plans in place for improvement of biodiversity. A 1 km buffer is applied around Protected Environments. |
| 8 | Other Natural Areas (ONA) | Natural areas which are not identified to meet biodiversity pattern or process targets, provided that CBAs or ESAs are not lost. ONA will most likely provide a range of ecosystem services from their ecological infrastructure in varying efficiency and effectiveness. Although these areas are not essential for ensuring the persistence of biodiversity or landscape targets, they are still important repositories of species and play an important role in society as ecological infrastructure. They are however, not prioritized for immediate conservation action. |
| 9 | Heavily Modified | Includes areas currently transformed where biodiversity and ecological function has been lost to the point that it is not worth considering for conservation at all. |
| 10 | Moderately Modified – Old Lands: | Includes areas which were modified within the last 80 years but were at some point abandoned, including old mines and old cultivated lands, collectively termed “old Lands”. They are areas where biodiversity and function have been seriously compromised in the past, but may still play an important role in the provisioning of ecosystem services. |

The proposed Ash dam servitude and Low level dam servitude site fall within the *CBA Optimal, Heavily modified* and *Moderately modified- Old lands.* The High level dam servitude falls within *Heavily modified* and *Moderately modified- Old lands.* The Raw water dam servitude falls within the *CBA Optimal* and *Heavily modified* (**Figure 7**).

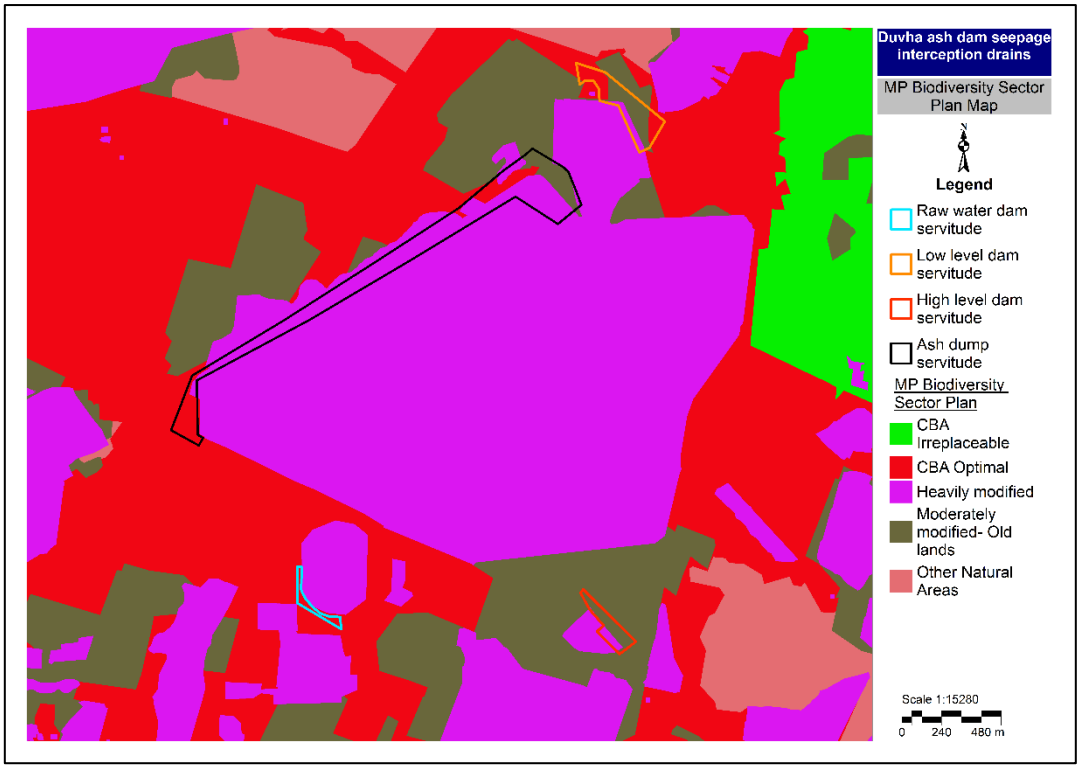


**Figure 7. Mpumalanga Biodiversity Sector Plan Map in relation to the proposed development sites**

# 5 LIMITATIONS AND GAPS

The constraints or limitations to the survey included:

- Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage and Nemai Consulting can thus not accept responsibility for conclusions and mitigation measures made in good faith based on information gathered or databases consulted at the time of the investigation.

# 6 REGIONAL VEGETATION

The four proposed ash dam seepage interception drain sites fall within the Grassland biome (SANBI, 2012) (**Figure 8**) and this Biome is found mainly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. Grasslands are dominated by a single layer of grasses. Trees are absent, except in a few localised habitats and geophytes are often abundant (Low and Rebelo, 1996). SANBI (2012) classified the study

sites as falling within the Eastern Highveld Grassland and Rand Highveld Grassland vegetation type units, as indicated in **Figure 9** below.


**Figure 8. Biome in relation to the proposed development sites**

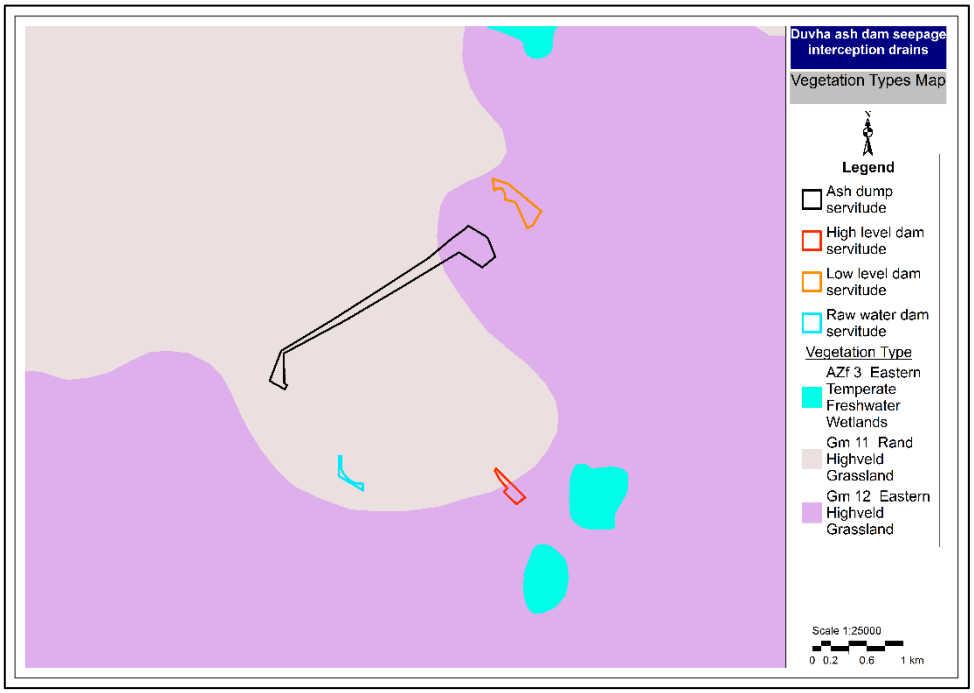


**Figure 9. Vegetation type occurring in the study sites**

The description of the vegetation types follows below:

## 6.1 Eastern Highveld Grassland

The Eastern Highveld Grassland is recorded on the plains between Belfast in the east and the eastern side of Johannesburg in the west, extending southwards to Bethal, Ermelo and west of Piet Retief within the Mpumalanga and Gauteng Provinces of South Africa. This Grassland is found on slightly to moderately undulating plains, including some low hills and pan depressions and consist of short, dense grassland, dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya etc*) with small, scattered rocky outcrops with wiry, sour grasses and some woody species. Woody species include *Acacia caffra, Celtis africana, Diospyros lycioides* subsp*. lycioides, Parinari capensis, Protea caffra* and *Rhus magalismontana* (Mucina and Rutherford, 2006).

The conservation status is described as **Endangered** with a conservation target of 24%. Approximately 44% of the Eastern Highveld Grassland has been transformed, primarily by cultivation, plantations, mining, urbanization and building of dams. Erosion is very low and no serious alien infestation is reported, although species such as *Acacia mearnsii* can become dominant in disturbed places (Mucina and Rutherford, 2006). No remnants of this vegetation type still exist on the four proposed sites due to mining activities.

## 6.2 Rand Highveld Grassland

The Rand Highveld Grassland vegetation type is found in Gauteng, North-West, Free State and Mpumalanga Provinces. It occurs in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as west of Krugersdorp centred in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is species-rich, wiry, sour grassland alternating with low, sour shrub land on rocky outcrops and steeper slopes. Most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High diversity of herbs, many of which belong to the Asteraceae family, is also a typical feature. Rocky hills and ridges carry sparse (savannoid) woodlands with *Protea caffra subsp. caffra, Protea welwitschii, Acacia caffra, Celtis africana, Searsia magalismonata*) (Mucina and Rutherford, 2006).

The conservation status is described as **Endangered** with a conservation target of 24%. It is poorly conserved (with only 1%). Small patches are protected in statutory reserves

(Kwaggavoetpad, Van Riebeeck Park, Bronkhorstspruit, Boskop Dam Nature Reserves) and in private conservation areas (*e.g*. Doornkop, Zemvelo, Rhenosterpoort and Mpopomeni). Almost half has been transformed mostly by cultivation, plantations, urbanisation or dam-building. Cultivation may also have had an impact on an additional portion of the surface area of the unit where old lands are currently classified as grasslands in land-cover classifications and poor land management has led to degradation of significant portions of the remainder of this unit (D.B. Hoare, personal observation). Scattered aliens (most prominently *Acacia mearnsii*) occur in about 7% of this unit. Only about 7% has been subjected to moderate to high erosion levels (Mucina and Rutherford, 2006).

# 7 TERRESTRIAL THREATENED ECOSYSTEMS

The South African National Biodiversity Institute (SANBI), in conjunction with the Department of Environmental Affairs (DEA), released a draft report in 2009 entitled “Threatened Ecosystems in South Africa: Descriptions and Maps”, to provide background information on the above List of Threatened Ecosystems (SANBI, 2009). The purpose of this report was to present a detailed description of each of South Africa’s ecosystems and to determine their status using a credible and practical set of criteria. The following criteria were used in determining the status of threatened ecosystems:

- Irreversible loss of natural habitat;
- Ecosystem degradation and loss of integrity;
- Limited extent and imminent threat;
- Threatened plant species associations;
- Threatened animal species associations; and
- Priority areas for meeting explicit biodiversity targets as defined in a systematic conservation plan.

In terms of section 52(1) (a), of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), a national list of ecosystems that are threatened and in need of protection was gazetted on 9 December 2011 (Government Notice 1002) (Driver *et al.* 2004). The list classified all threatened or protected ecosystems in South Africa in terms of four

categories; Critically Endangered (CR), Endangered (EN), Vulnerable (VU), or Protected. The purpose of categorising these ecosystems is to prioritise conservation areas in order to reduce the rates of ecosystem and species extinction, as well as preventing further degradation and loss of structure, function, and composition of these ecosystems. It is estimated that threatened ecosystems make up 9.5% of South Africa, with critically endangered and endangered ecosystems accounting for 2.7%, and vulnerable ecosystems 6.8% of the land area. It is therefore vital that Threatened Terrestrial Ecosystems inform proactive and reactive conservation and planning tools, such as Biodiversity Sector Plans, municipal Strategic Environmental Assessments (SEAs) and Environmental Management Frameworks (EMFs), Environmental Impact Assessments (EIAs) and other environmental applications (Mucina *et al*. 2006).

According to the data from SANBI, two terrestrial threatened ecosystem are recorded on site, namely the Eastern Highveld Grassland and Rand Highveld Grassland, as shown in **Figure 10**. These threatened ecosystems are listed as *Vulnerable* (Mucina *et al.* 2006).

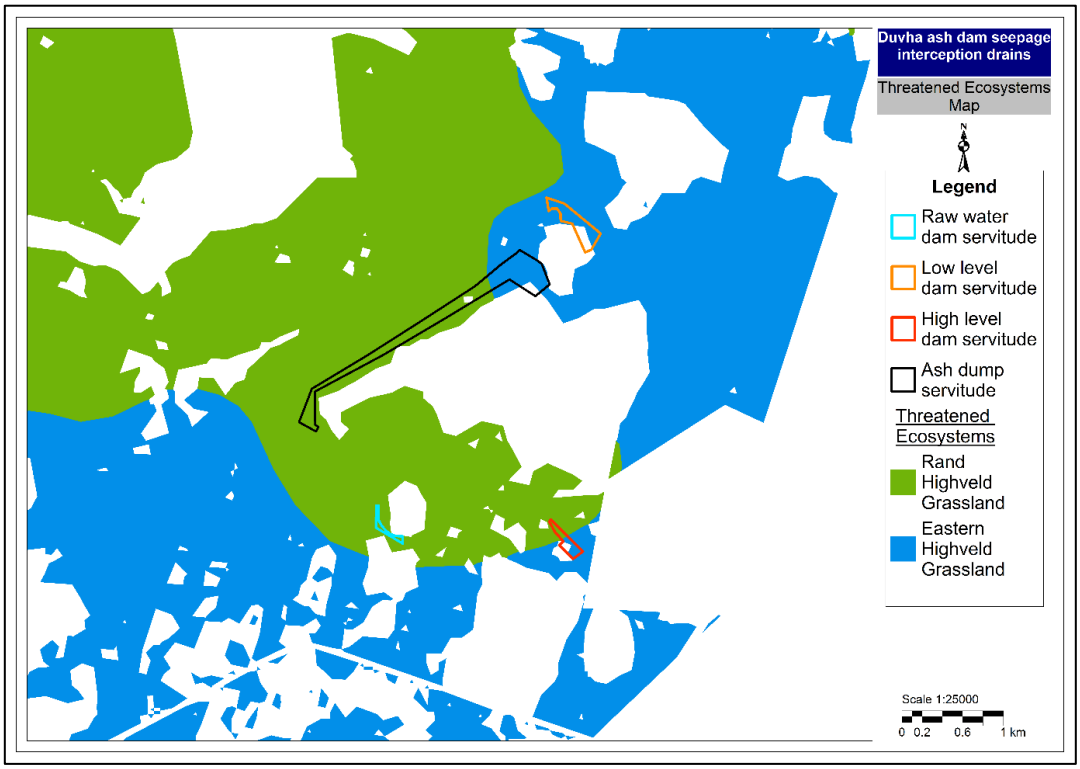


**Figure 10. Terrestrial Threatened Ecosystem occurring on the proposed development routes**

# 8 METHODOLOGY

The White Paper on the Conservation and Sustainable Use of South Africa's Biological Diversity (1997) and the National Environmental Management Act 1998 (Act No 107 of 1998) specify that due care must be taken to conserve and avoid negative impacts on biodiversity, as well as the sustainable, equitable and efficient use of biological resources.

## 8.1 Flora

The flora assessment consisted of two complementary approaches:

- A desktop analysis, which included literature review, topographical maps, and Google Earth imagery; and
- A site visit was conducted in April 2017.

Satellite imagery of the area was obtained from Google Earth and was studied in order to acquire a three dimensional impression of the topography and land use and also to identify potential "hot-spots" or specialized habitats such as watercourses on or near the four proposed sites.

The Pretoria Computerised Information System (PRECIS) list of Red Data plants recorded in the 2529CD quarter degree grid square was obtained from SANBI. The list was consulted to verify the record of occurrence of the plant species seen in the vicinity of the four proposed sites. The sites sampled are also only a very small portion of the whole grid and so habitats suitable for certain species in the PRECIS list may not be present at the areas sampled. The vegetation map published in Mucina and Rutherford (2006) was consulted to identify vegetation units that are found in the study sites. The desktop component of the study of the habitats of the Red Data listed plants was conducted before the site visit.

The habitats on the proposed development sites were inspected in a random zigzag fashion, paying particular attention to areas that at first sight appeared to be sensitive. All general observations were noted such as grasses, herbs (forbs), shrubs and trees. The habitats suitable for Red Data listed species known to occur in the quarter degree grid square were examined intensively for the presence of such species. Attention was also paid to the occurrence of medicinal, alien and declared weed species. Field guides such as van Wyk *et*

*al.* (1997), Pooley (1998), van Oudshoorn (1999) and Manning (2009) were utilised during the field works.

Exotic and invasive plant species were categorised according to the framework laid out by The Conservation of Agricultural Resources Act (CARA) (Act 43 of 1983). CARA defines weeds as alien plants, with no known useful economic purpose that should be eradicated. Invader plants, also considered by the Act, can also be of alien origin but may serve useful purposes as ornamental plants, as sources of timber, or other benefits such as medicinal uses (Henderson, 2001). These plants need to be managed and prevented from spreading.

Invasive species are controlled by the National Environmental Management: Biodiversity Act, 2004 (Act no. 10 of 2004) - Alien and Invasive Species (AIS) Regulations which became law on 1 October 2014. The AIS Regulations list four (4) different categories of invasive species that must be managed, controlled or eradicated from areas where they may cause harm to the environment, or that are prohibited to be brought into South Africa.

Invasive plant species are divided into four categories:

- Category 1a: Invasive species which must be combatted and eradicated. Any form of trade or planting is strictly prohibited.
- Category 1b: Invasive species which must be controlled and wherever possible, removed and destroyed. Any form or trade or planting is strictly prohibited.
- Category 2: Invasive species, or species deemed to be potentially invasive, in which a permit is required to carry out a restricted activity. Category 2 species include commercially important species such as pine, wattle and gum trees.
- Category 3: Invasive species which may remain in prescribed areas or provinces. Further planting, propagation or trade, is however prohibited.

According to van Oudtshoorn (1999), a grass species reacts to grazing in one of two ways: it can either become more or less abundant. **Table 2** describes the classification of grasses.

**Table 2. Classification of grasses (van Oudtshoorn, 1999).**

| Class | Description | Examples |
|---|---|---|
| Decreasers | Grasses that are abundant in good veld, but that decrease in number when the veld is overgrazed or undergrazed. | *Themeda trianda, Digitaria eriantha* |
| Increaser 1 | Grasses that are abundant in underutilised veld. These grasses are usually unpalatable, robust climax species that grow without any defoliation | *Hyperthelia dissoluta, Trachypogon spicatus* |
| Increaser 2 | Grasses that are abundant in overgrazed veld. These grasses increase due to the disturbing effect of overgrazing and include mostly pioneer and subclimax species | *Aristida adscensionis, Eragrostis rigidor* |
| Increaser 3 | Grasses that are commonly found in overgrazed veld. These are usually unpalatable, dense climax grasses | *Sporobolus africanus, Elionurus muticus* |
| Invaders | All plants that are not indigenous to an area. These plants are mostly pioneer plants and are difficult to eradicate | *Arundo donax* |

## 8.2 Mammals

A mammal site visit was conducted in April 2017 and during this site visit, the observed and presence of mammals associated with the recognized habitat types of the study sites were recorded during the day. No night surveys were undertaken. Adjoining properties were also scanned for important faunal habitats. During the sites visits, mammals were identified by spoor, burrow and visual sightings through random transect walks.

## 8.3 Avifauna

An avifauna site visit was conducted in April 2017 in order to record the presence of bird species associated with the habitat systems on the studied sites and to identify possible sensitive areas. The study sites were surveyed on foot and any bird species seen or heard were recorded. Adjoining properties were also scanned for important bird species and/or habitats. Birds were identified visually using 10X42 Bushnell Waterproof binoculars where necessary, by call and from feathers. Where necessary, identifications were verified using Sasol Birds of Southern Africa (Sinclair *et al.* 2002) and the Chamberlain Guide to Birding Gauteng (Marais and Peacock, 2008).

## 8.4 Reptiles

The reptile assessment was conducted in April 2017 and this was during the day. During the field visit, the observed and derived presence of reptiles associated with the recognised habitat types of the study sites was recorded. This was done with due regard to the known distributions of Southern African reptiles. Reptiles were identified by sightings during random transect walks. Possible burrows or other reptile retreats were inspected for any inhabitants.

### 8.5 Amphibians

According to Carruthers (2001), amphibians are extremely sensitive to habitat transformation and degradation. The adjoining properties were scanned for important amphibian habitats. Amphibians were identified by their vocalisations. A CD with frog calls by Du Preez and Carruthers (2009) was used to identify species by their calls when applicable. Sites were walked, covering as many habitats as possible.

## 9 RESULTS AND DISCUSSION

### 9.1 Flora

#### 9.1.1 Desktop study results

The proposed sites are located within the 2529CD Quarter Degree Square (QDS) in terms of the 1:50 000 grid of South Africa. SANBI used this grid system as a point of reference to determine any Red Data plant species or any species of conservation importance occurring in South Africa. This can be used to determine the list of species which could potentially occur within an area. **Table 3** provides details on the Red Data plant species which have been recorded in 2529CD grid cell. **Table 4** indicates the Red Data plant species that were previously recorded in 2529CD by Mpumalanga Tourism and Parks Agency (MTPA). The definitions of the conservation status are provided in **Table 5**. Due to the fact that threatened species have been historically noted in the region as mentioned in **Tables 3** and **4**, it is imperative, during the construction phase, that detailed searches for these rare/threatened and protected species are made during the appropriate time of year when plants are likely to be more visible.

**Table 3. Floral species of conservational significance recorded from the QDS of 2529CD**

| Family | Species | Threat status | Growth forms |
|---|---|---|---|
| Amaryllidaceae | *Crinum bulbispermum* (Burm.f.) Milne-Redh. & Schweick. | Declining | Geophyte, hydrophyte |
| Amaryllidaceae | *Crinum macowanii* Baker | Declining | Geophyte |
| Apocynaceae | *Pachycarpus suaveolens* (Schltr.) Nicholas & Goyder | VU | Herb, succulent |
| Aquifoliaceae | *Ilex mitis* (L.) Radlk. var. *mitis* | Declining | Shrub, tree |
| Asteraceae | *Callilepis leptophylla* Harv. | Declining | Herb |
| Hypoxidaceae | *Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall. | Declining | Geophyte |

| Family | Species | Threat status | Growth forms |
|---|---|---|---|
| Mesembryanthemaceae | *Khadia carolinensis* (L.Bolus) L.Bolus | VU | Succulent |
| Rubiaceae | *Pavetta zeyheri* Sond. subsp. *middelburgensis* (Bremek.) P.P.J.Herman | Rare | Dwarf shrub |
| Zamiaceae | *Encephalartos lanatus* Stapf & Burtt Davy | NT | Shrub, tree |

*Note: NT=Near Threatened, VU=Vulnerable*

**Table 4. Farm Names where the Red Data Plant species were recorded, which could potentially occur in the study area (MTPA data)**

| Farm Name/Town | Scientific Name | Conservation RSA | MTPA | Endemic |
|---|---|---|---|---|
| Kalbasfontein 284 JS | *Encephalartos lanatus* | NT | NT | SA |
| Middelburg | *Encephalartos lanatus* | NT | NT | SA |
| | *Eucomis autumnalis* | Declining | Declining | FSA |
| Middelburg Dist.; Middelburg | *Hypoxis hemerocallidea* | LC | LC | NOT |
| Middelburg Town and Townlands | *Brachycorythis conica* subsp *transvaalensis* | CR | CR | SA |
| Middelburg Town and Townlands 287 JS | *Brachycorythis conica* subsp *transvaalensis* | CR | CR | SA |
| Middelburg; Pokwani | *Callilepis leptophylla* | Declining | Declining | FSA |
| Naauwpoort 335 JS | *Frithia humilis* | EN | EN | SA |
| Olifants River | *Pachycarpus suaveolens* | VU | VU | FSA |
| Rietfontein 314 JS | *Habenaria schimperiana* | LC | Rare | NOT |
| Springs; Geduld golf course. | *Habenaria bicolor* | NT | | NOT |
| Vaalbank 289 JS | *Anacampseros subnuda* subsp. *lubbersii* | VU | VU | SA |
| | *Boophone disticha* | LC | LC | NOT |
| | *Callilepis leptophylla* | Declining | Declining | FSA |
| | *Hypoxis hemerocallidea* | LC | LC | NOT |
| Witbank Municipal Area | *Anacampseros subnuda* subsp. *lubbersii* | VU | VU | SA |

*Note: CR= Critically Endangered, EN= Endangered, VU=Vulnerable, NT=Near Threatened*

**Table 5. Definitions of Red Data status (Raimondo *et al*. 1999)**

| Symbol | Status | Description |
|---|---|---|
| CR | Critically Endangered | A taxon is Critically Endangered when the best available evidence indicates that it meets any of the five International Union for Conservation of Nature (IUCN) criteria for Critically Endangered, and is therefore facing an extremely high risk of extinction in the wild. |

| Symbol | Status | Description |
|---|---|---|
| EN | Endangered | A taxon is Endangered when the best available evidence indicates that it meets any of the five IUCN criteria for Endangered, and is therefore facing a very high risk of extinction in the wild. |
| VU | Vulnerable | A taxon is Vulnerable when the best available evidence indicates that it meets any of the five IUCN criteria for Vulnerable and it is therefore considered to be facing a high risk of extinction in the wild. |
| NT | Near Threatened | A taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future. |
| N/A | Declining | A taxon is Declining when it does not meet any of the five IUCN criteria and does not qualify for the categories Critically Endangered, Endangered, Vulnerable or Near Threatened, but there are threatening processes causing a continuing decline in the population. |
| N/A | Rare | A taxon is rare when it meets any of the four South African criteria for rarity, but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to the five IUCN. |

### 9.1.2 Plant species recorded in the four proposed ash dam seepage interception drains sites

The proposed development sites occur within areas consisting of gum trees, grasslands and are situated near ash dams. Grasses on the proposed sites include species such as *Cynodon dactylon and Eragrostis curvula*. The herb layer is dominated by species such as *Berkheya setifera, Conyza bonariensis* and *Verbena bonariensis*. The tree latey is mostly dominated by *Eucalyptus* sp. All of the species recorded on the proposed development sites area are listed in **Table 6** below.

**Table 6. Plant species recorded in the proposed development sites**

| Scientific Name | Common Name | Ecological status | Form |
|---|---|---|---|
| *Acacia karroo* | Sweet thorn | | Shrub |
| *Vachellia (Acacia) xanthophloea* | Fever tree | Medicinal | Herb |
| *Acalypha angustata* | | | Herb |
| *Acacia mearnsii* | Black wattle | Invader 2 | Shrub |
| *Alternanthera pungens* | Khakhiweed | Weed | Herb |
| *Aristida bipartata* | Rolling Three-awned Grass | | Grass |
| *Argemone ochroleuca* | White-flowered poppy | Category 1b | Herb |
| *Bidens formosa* | Cosmos | Weed | Herb |
| *Bidens pilosa* | Common Black-jack | Weed | Herb |
| *Berkheya setifera* | Buffalo-tongue Berkheya | Medicinal | Herb |
| *Berkheya radula* | | | Herb |
| *Brunsvigia* sp | | | Herb |
| *Campuloclinium macrocephalum* | Pom pom weed | Category 1b | Herb |

| Scientific Name | Common Name | Ecological status | Form |
|---|---|---|---|
| *Cirsium vulgare* | Scotch Thistle | Category 1b | Herb |
| *Chloris virgata* | Feather-top chloris | Increaser 2 | Grass |
| *Cortaderia selloana* | | Category 1b | Grass |
| *Conyza bonariensis* | Flax-leaf Fleabane | Weed | Herb |
| *Cynodon dactylon* | Couch Grass | Increaser 2 | Grass |
| *Cyperus esculentus* | Yellow Nut Sedge | Medicinal | Sedge |
| *Cymbopogon excavatus* | Broad-leaved Turpentine Grass | Increaser 1 | Grass |
| *Cyperus longus* | Waterbiesie | Medicinal | Sedge |
| *Datura ferox* | Large thorn apple | Category 1b | Shrub |
| *Datura stramonium* | Common Thorn Apple | Category 1b | Herb |
| *Eucalyptus camaldulensis* | River Red Gum | Invader 2 | Tree |
| *Eucalyptus cinerea* | Argyle apple | Invader 2 | Tree |
| *Eucalyptus grandis* | Saligna gum | Invader 2 | Tree |
| *Eragrostis curvula* | Weeping Love Grass | Increaser 2 | Grass |
| *Eragrostis plana* | Tough love grass | Increaser 2 | Grass |
| *Gomphocarpus (Asclepias) fruticosus* | | | Herb |
| *Haplocarpha scaposa* | False gerbera | Medicinal | Herb |
| *Helichrysum aureonitens* | Golden everlasting | Medicinal | Herb |
| *Hibiscus trionum* | Bladder Hibiscus | Medicinal | Herb |
| *Hyparrhenia hirta* | Common Thatching Grass | Increaser 1 | Grass |
| *Hypochaeris radicata* | Hairy wild lettuce | Weed | Herb |
| *Hypoxis rigidula* | Farmer's String | Medicinal | Herb |
| ***Hypoxis hemerocallidea*** | **African star grass or African potato** | **Declining** | **Herb** |
| *Imperata cylindrica* | Cottonwool grass | Increaser 1 | Grass |
| *Ledebouria ovatifolia* | | Medicinal | Herb |
| *Leonotis leonurus* | Wild Dagga | Medicinal | Herb |
| *Lopholaena coriifolia* | Leather-leaved Fluff-bush | | Herb |
| *Melia azedarach* | Persian Lilac/Syringa | Category 1b | Tree |
| *Oxalis obliquifolia* | Oblique-leaved sorrel | | Herb |
| *Panicum maximum* | Guinea Grass | Decreaser | Grass |
| *Plantago major* | Broadleaved Ribwort | Weed/Medicinal | Herb |
| *Paspalum dilatatum* | Dallis grass | Exotic | Grass |
| *Phragmites australis* | Common reed | Thatching | Reed |
| *Pogonarthria squarrosa* | Sickle grass | | Grass |
| *Populus deltoides* | Cottonwood | Invader 3 | Tree |
| *Prunus persica* | Peach tree | Exotic | Tree |
| *Pseudognaphalium luteo-album* | Jersey Cudweed | Medicinal | Herb |
| *Robinia pseudoacacia* | Black locust | Invader 2 | Tree |
| *Richardia brasiliensis* | Tropical Richardia | Weed | Herb |
| *Rumex acetosella* | Sheep's sorrel | | Herb |
| *Salix babylonica* | Weeping willow | Invader 2 | Tree |
| *Schoenoplectus corymbosus* | | | Sedge |
| *Searsia pyroides* | | | Shrub |
| *Setaria sphacelata* var. *sphacelata* | Common Bristle Grass | Decreaser | Grass |
| *Schkuhria pinnata* | Dwarf marigold | Weed | Herb |
| *Sida cordifolia* | | Medicinal | Herb |
| *Solanum mauritianum* | Bugweed | Category 1b | Herb |
| *Solanum sisymbriifolium* | Sticky nightshade | Category 1b | Herb |
| *Sonchus asper* | Spiny sowthistle | Weed | Shrub |
| *Sporobolus africanus* | Ratstail Dropseed | Increaser 3 | Grass |

| Scientific Name | Common Name | Ecological status | Form |
|---|---|---|---|
| *Striga bilabiata* | Small Witchweed | | Heb |
| *Seriphium plumosum (=Stoebe vulgaris)* | Bankrupt bush/zigzag bush | | Shrub |
| *Tagetes minuta* | Tall Khaki Weed | Weed | Herb |
| *Taraxacum officinale* | Common dandelion | | Herb |
| *Typha capensis* | Bulrush | | Aquatic herb |
| *Urochloa mossambicensis* | Bushveld signal grass | Increaser 2 | Grass |
| *Verbena bonariensis* | Tall Verbena | Weed | Herb |
| *Verbena officinalis* | | Weed | Herb |
| *Xanthium strumarium* | Large cocklebur | Category 1b | Herb |

### 9.1.3 Alien invasive species recorded in the proposed development sites

Alien invader plants are species that are of exotic, non-native or of foreign origin that typically invade undeveloped or disturbed areas. Invaders are a threat to our ecosystem because by nature they grow fast, reproduce quickly and have high dispersal ability (Henderson, 2001). This means that invader plants and seeds spread rapidly and compete for growing space with indigenous plants. If these invader plants out-compete indigenous plants there is a shift in the species composition of the area and the changing of plant communities causes a decline in species richness and biodiversity (Henderson, 2001). Many factors allow alien invasive plants to succeed, particularly the absence of their natural enemies. This makes it difficult to control invasive plants without bringing in natural enemies and eliminating the high competition they have over the indigenous vegetation (Bromilow, 2010). Alien invasive plant species within the study area were observed to occur in clumps, scattered distributions or as single individuals on site. Invader and weed species must be controlled to prevent further infestation and it is recommended that all individuals of invader species (especially Category 1) must be removed and eradicated (Henderson, 2001). Species such as *Cirsium vulgare* (**Figure 11**) *Datura stramoinum* (**Figure 12**) *Solanum mauritianum* (**Figure 13**) and *Solanum sisymbrofilium* (**Figure 14**) (Category 1b*)* were common in the study sites.

**Figure 11. Alien plant *Cirsium vulgare* recorded on the proposed development sites**

**Figure 12. Alien plant *Datura stramonium* recorded on the proposed development sites**

**Figure 13. Alien plant species *Solanum mauritianum* recorded on the proposed development sites**

**Figure 14. Alien plant *Solanum sisymbriifolium* recorded on the proposed development sites**

It is important that the Environmental Management Programme (EMPr) takes into account suitable methods to ensure that alien invasive plant species are controlled in areas affected by the construction activities.

### 9.1.4 Threatened Species and Species of Conservation Concern and medicinal plants recorded in the proposed development sites

According to the National Environmental Management Biodiversity Act 2004 (Act 10 of 2004 as amended), there is a dire need to conserve biodiversity in each province and as such, all natural and/or indigenous resources must be utilised sustainably. At the proposed development sites, there are a number of plants that are used to provide medicinal products (**Table 6**). In some cases there is merit in protecting or translocating them before the proposed development commences. While many of these plants are indigenous or exotic weeds that have medicinal value (and for which no action is necessary with respect to conservation), their economic value means that they are considered to be in need of protection.

According to the South African Red Data list categories done by SANBI (**Figure 15**), **threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered, Endangered or Vulnerable is a threatened species whereas **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare, Declining and Data Deficient - Insufficient Information (DDD).

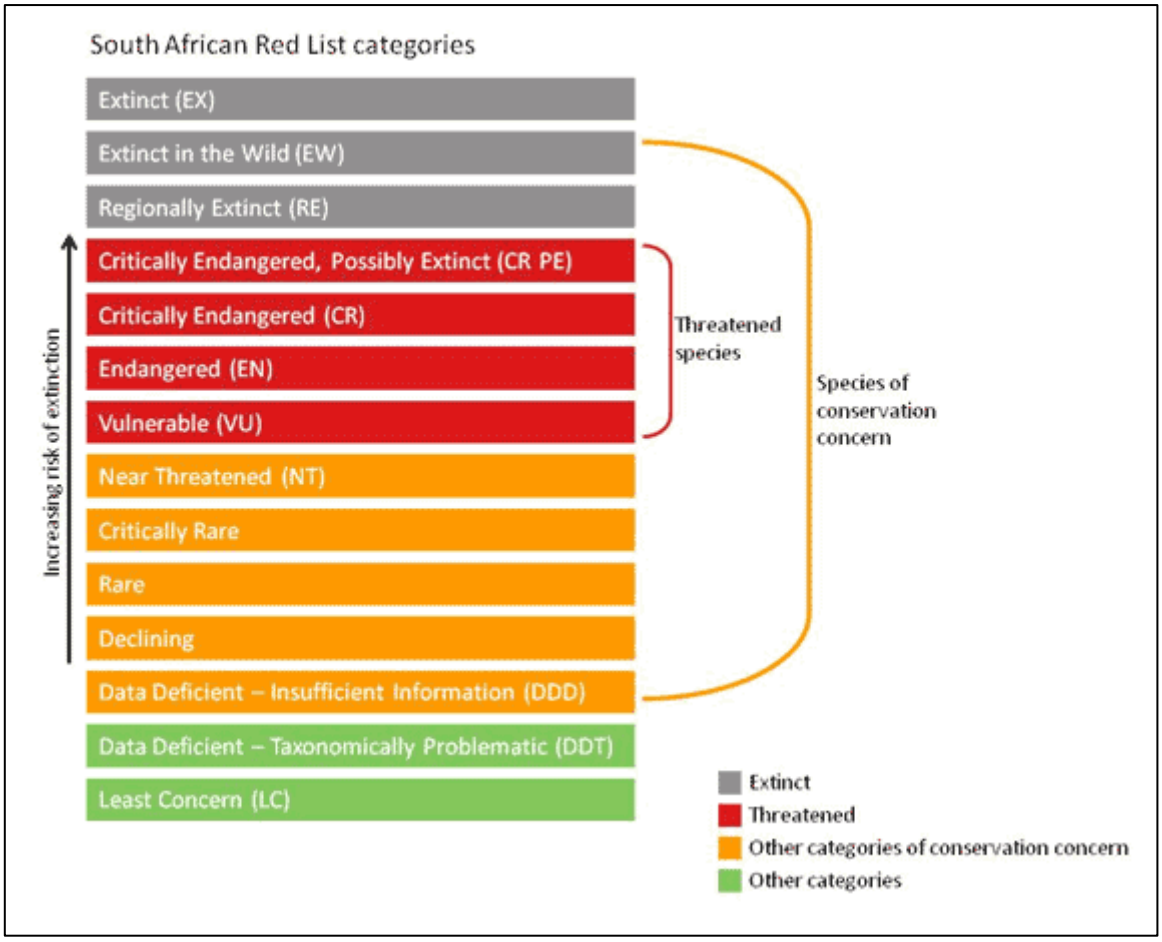


**Figure 15. South African Red Data list categories (SANBI website)**

During the field survey, no threatened species were observed on site but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato)). Raimondo *et al.* (2009) listed this species as *Declining.*

*Hypoxis hemerocallidea* (Star flower/African potato) (**Figure 16**) occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo). It is used to treat headaches, dizziness, mental disorders, cancers, inflammation and HIV (Pooley, 1998). The distribution of *Hypoxis hemerocallidea* plant species in the proposed development sites is shown in **Figures 17.**

**Figure 16. Star flower/African potato recorded in the study area**


**Figure 17. The distribution of *Hypoxis hemerocallidea* recorded on site**

### 9.1.5 Habitat available for species of conservation importance

Data sourced from SANBI and MTPA indicated plant species on the Red Data List that are known to occur in or surrounding the proposed development sites; as well as their probability of occurrence (indicated in **Table 7)**. The probability of occurrence is based on the suitable habit where the species is likely to occur.

**Table 7. Red Data Listed plant species which could potentially occur in the proposed development sites.**

| Species | Threat status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|
| *Crinum bulbispermum* (Burm.f.) Milne-Redh. & Schweick. | Declining | Occurs in grasslands and Savanna, on the banks of freshwater rivers, streams, dams, seasonal pans, permanent to seasonal swampy grasslands and in damp depressions, in deep soils | High |
| *Crinum macowanii* Baker | Declining | Occurs in in mountain grasslands, stony slopes, hard dry shale, gravelly soil and sandy flats | Low |
| *Pachycarpus suaveolens* (Schltr.) Nicholas & Goyder | VU | Short or annually burnt grasslands | High |
| *Ilex mitis* (L.) Radlk. var. *mitis* | Declining | Along rivers and streams in forest and thickets, sometimes in the open. Found from sea level to inland mountain slopes. | Low |
| *Callilepis leptophylla* Harv. | Declining | Grassland or open woodland, often on rocky outcrops or rocky hill slopes. | Low |
| *Hypoxis hemerocallidea* Fisch., C.A.Mey. & Avé-Lall. | Declining | It occurs in open grassland and woodland and is widespread in South Africa in the eastern summer rainfall provinces (Eastern Cape, Free State, KwaZulu-Natal, Mpumalanga, Gauteng and Limpopo). | **FOUND** |
| *Khadia carolinensis* (L.Bolus) L.Bolus | VU | Well-drained, sandy loam soils among rocky outcrops, or at the edges of sandstone sheets, Highveld Grassland, | Low |
| *Pavetta zeyheri* Sond. subsp. *middelburgensis* (Bremek.) P.P.J.Herman | Rare | Outcrops of rocks and boulders or rocky sheets. | Low |
| *Encephalartos lanatus* Stapf & Burtt Davy | NT | Sheltered, wooded ravines in sandstone ridges, | Low |
| *Eucomis autumnalis* | Declining | Damp, open grassland and sheltered places | Medium |

| Species | Threat status | Suitable habitat | Probability of Occurrence |
|---|---|---|---|
| *Brachycorythis conica* subsp *transvaalensis* | CR | Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite | Medium |
| *Frithia humilis* | EN | It is found predominantly in shallow, sandy gravel on large, flat, rock plates of the coarse sandstone sediments of the Irrigasie Formation of the Ecca Group of the Karoo Sequence | Low |
| *Habenaria bicolor* | NT | Well-drained grasslands at around 1600 m | Medium |
| *Anacampseros subnuda* subsp. *lubbersii* | VU | Grassland, on rhyolite boulders | Low |
| *Boophone disticha* | Declining | Occurs in dry grassland and rocky areas | Low |

## 9.2 Fauna

The evaluation of faunal presence is based on the presence/ absence of mammals, birds, reptiles and amphibians at the proposed development sites. The survey determined the current status of threatened animal species occurring, or likely to occur within the proposed development sites, describing the available and sensitive habitats. Faunal data was obtained during a field survey assessment of the proposed development sites, which was carried out on foot. The data was supplemented by previous surveys conducted in similar habitats, literature investigations, and historic data. Different habitats were explored to identify any sensitive or endangered species which are present on site. Mammal nomenclature is referred to using Stuart & Stuart, (1998), Skinner and Chimimba (2005), Friedman and Daly (2004); bird names by Hockey *et al.* (2005); reptile names by Branch (1988), Branch (2001) and Amphibian names by Minter *et al.* 2004.

### 9.2.1 Mammals

#### 9.2.1.1 Desktop survey results

The potential mammal species that could be found on the proposed development sites are those which have been recorded in the grid cell 2529CD (ADU, 2017) and are listed in **Table 8** below. According to this list, no mammal species of conservation importance are known to occur in the region. Due to the habitat disturbance, the list is likely to overestimate the occurrence of mammal species in the area and thus should be viewed with a degree of caution. Species such as Leopard and Brown Hyaena were excluded from the assessment as they are commonly found in protected areas. **Table 9** indicates the Red Data mammal species that were previously recorded in 2529CD by MTPA.

**Table 8: Mammal species recorded in the grid cell 2529CD (ADU, 2017), which could potentially occur on the proposed development sites**

| Family | Genus | Species | Subspecies | Common name | Red list category | Atlas region endemic |
|---|---|---|---|---|---|---|
| Bovidae | *Antidorcas* | *marsupialis* | | Springbok | Least Concern | Yes |
| Bovidae | *Connochaetes* | *gnou* | | Black Wildebeest | Least Concern | Yes |
| Bovidae | *Damaliscus* | *pygargus* | *phillipsi* | Blesbok | Least Concern | |
| Bovidae | *Kobus* | *ellipsiprymnus* | | Waterbuck | Not listed | Yes |
| Bovidae | *Oryx* | *gazella* | | Gemsbok | Least Concern | Yes |

| Family | Genus | Species | Subspecies | Common name | Red list category | Atlas region endemic |
|---|---|---|---|---|---|---|
| Bovidae | *Ourebia* | *ourebi* | | Oribi | Endangered | Yes |
| Bovidae | *Tragelaphus* | *strepsiceros* | | Greater Kudu | Least Concern | Yes |
| Canidae | *Vulpes* | *chama* | | Cape Fox | Least Concern | Yes |
| Cercopithecidae | *Cercopithecus* | *pygerythrus* | *pygerythrus* | Vervet Monkey | Least Concern | |
| Erinaceidae | *Atelerix* | *frontalis* | | Southern African Hedgehog | Near Threatened | Yes |
| Felidae | *Panthera* | *pardus* | | Leopard | Least Concern | Yes |
| Herpestidae | *Cynictis* | *penicillata* | | Yellow Mongoose | Least Concern | Yes |
| Herpestidae | *Herpestes* | *sanguineus* | | Slender Mongoose | Least Concern | Yes |
| Herpestidae | *Suricata* | *suricatta* | | Meerkat | Least Concern | Yes |
| Hyaenidae | *Hyaena* | *brunnea* | | Brown Hyena | Near Threatened | Yes |
| Leporidae | *Pronolagus* | *randensis* | | Jameson's Red Rock Hare | Least Concern | Yes |
| Procaviidae | *Procavia* | *capensis* | | Rock Hyrax | Least Concern | Yes |
| Viverridae | *Genetta* | *maculata* | | Rusty-spotted Genet | Not listed | Yes |

**Table 9. Red Listed bird species which could potentially occur in the proposed sites (MTPA)**

| Farm Name | Common Name | Scientific Name | Conservation RSA | MTPA |
|---|---|---|---|---|
| Elandspruit 291 JS | Oribi | *Ourebia ourebi ourebi* | EN | EN |
| Kalbasfontein 284 JS | Oribi | *Ourebia ourebi ourebi* | EN | EN |
| Mooifontein 285 JS | Brown hyaena | *Hyaena brunnea* | NT | NT |
| Zeekoewater 311 JS | Southern African hedgehog | *Atelerix frontalis* | NT | NT |

#### 9.2.1.2 Mammals recorded on the proposed development sites

During the field assessment, mammal species diversity was very low and this could be attributed to anthropogenic disturbances observed on sites such as habitat transformation and mining activities. Only seven mammal species were recorded on sites during the field assessment (**Table 10**)**.** The species recorded have a wide distribution range. Mammals are sensitive to disturbances and as such few were expected to occur on sites. No Red Data mammal species were recorded on sites. The proposed development sites will have an

insignificant impact on mammal conservation in the region. Species such as Blesbok were recorded in abundance on site (**Figure 18**).

**Table 10. Mammals recorded on the four proposed development sites**

| Scientific name | English name | Status |
|---|---|---|
| *Sylvicapra grimmia* | Common Duiker | LC |
| *Hystrix africaeaustralis* | Cape Porcupine | LC |
| *Damaliscus pygargus phillipsi* | Blesbok | LC |
| *Equus quagga* | Plains zebra | LC |
| *Lepus saxatilis* | Scrub hare | LC |
| *Cryptomys hottentotus* | African Mole Rat | LC |
| *Galerella sanguinea* | Slender mongoose | LC |

***NOTE: LC= Least Concern***

**Figure 18. Blesbok recorded in abundance in the proposed development sites**

### 9.2.1.3 Habitat available for species of conservation importance

**Table 11** below indicates the suitable habitat of the Red Data mammal species, together with the probability of occurrence (the probability of occurrence is based on the presence of suitable habit where the species is likely to occur).

**Table 11. Red Data Listed mammal species which could potentially occur on site with suitable habitats and their probability of occurrence (Skinner and Chimimba, 2005)**

| Common name | Red list category | Suitable habitat | Probability of occurrence |
|---|---|---|---|
| Southern African Hedgehog | Near Threatened | Prefers grass and bushveld that is not too damp and with a good covering of leaves and other debris. They have generally been recorded from scrub brush, western Karoo, grassland and suburban gardens | Low |
| Oribi | Endangered | Inhabits floodplains, grasslands, open plains and montane grasslands, and marginally in light bushland | Low |

### 9.2.2 Avifauna

As previously mentioned, the study area falls within the Grassland biome and this biome is considered home to 52 of the 122 Important Bird and Biodiversity Area (IBA) in South Africa (O' Connor and Bredenkamp, 1997). Of South Africa's 841 bird species, 350 occur in the Grassland Biome. This includes 29 species of conservation concern, 10 endemics, and as many as 40 specialist species that are exclusively dependent on grassland habitat. Threatened grassland bird species range from Little brown jobs (LBJs) (such as Yellow-breasted Pipit, Rudd's Lark and Botha's Lark) to the larger charismatic species (such as Secretarybird, Denham's Bustard, African Grass-Owl and Southern Bald Ibis) (Barnes, 1998). This is why the grasslands hold priority IBAs.

#### 9.2.2.1 Desktop survey results

The IBA programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that are globally threatened, have a restricted range and are restricted to specific biomes/vegetation types. Several conservation and planning tools were consulted for relevancy for the project, including IBAs. No IBA occurs in the study site, but the unprotected IBA closest to the study area is situated approximately 40km away, namely Amersfoort-Bethal-Carolina IBA (**Figure 19**). **Table 12** below indicates the Red Data bird species that were previously recorded in 2529CD by MTPA.

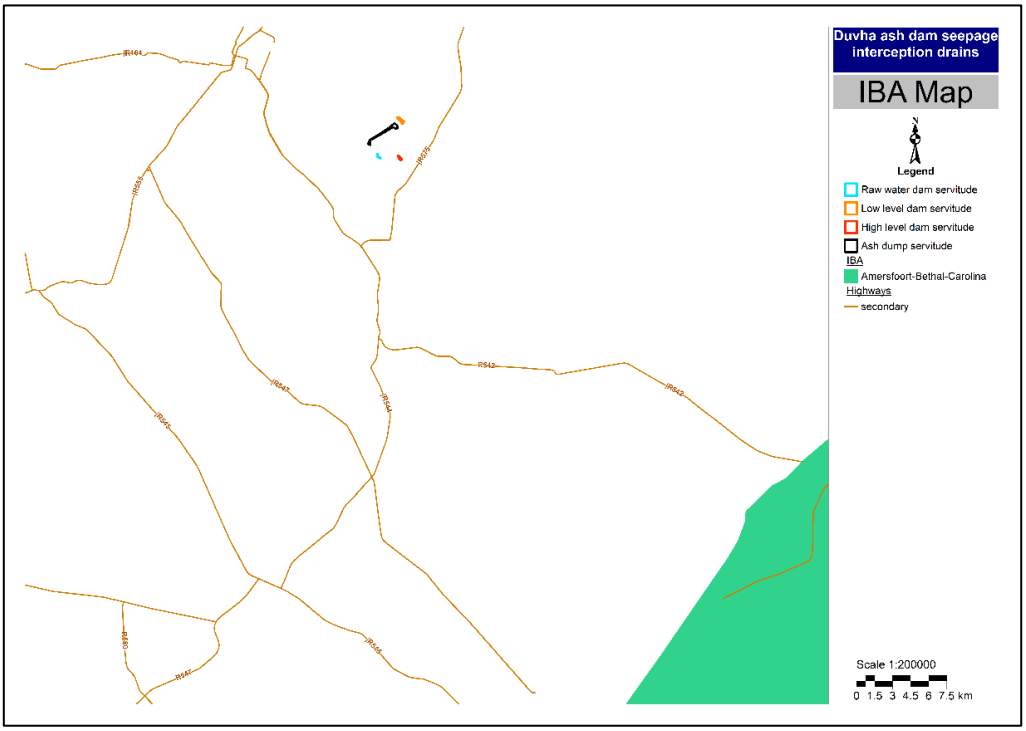


**Figure 19. Amersfoort-Bethal-Carolina IBA recorded east of the study sites**

**Table 12. Red Listed bird species which could potentially occur in the proposed sites (MTPA)**

| Farm Name | Common Name | Scientific Name | MTPA | Endemic |
|---|---|---|---|---|
| Middelburg | Black Stork | *Ciconia nigra* | NT | |
| Doornpoort 312 JS | Lanner Falcon | *Falco biarmicus* | NT | |
| | Secretarybird | *Sagittarius serpentarius* | NT | |
| Goedehoop 315 JS | African Grass-Owl | *Tyto capensis* | VU | |
| Middelburg Town and Townlands 287 JS | African Grass-Owl | *Tyto capensis* | VU | |
| | Lesser Kestrel | *Falco naumanni* | VU | |
| | Southern Bald Ibis | *Geronticus calvus* | VU | RSA |
| Middleburg; Kameldoorn Olifants River | Broad-tailed Warbler | *Schoenicola brevirostris* | NT | |
| Naauwpoort 335 JS | African Grass-Owl | *Tyto capensis* | VU | |
| Rhenosterfontein 318 JS | Pallid Harrier | *Circus macrourus* | NT | |
| Rietfontein 314 JS | African Grass-Owl | *Tyto capensis* | VU | |

#### 9.2.2.2 Field work results

A numbers of bird species in South Africa have declined mainly due to massive habitat transformation and degradation from mining, industrial and commercial and agricultural activities as well as increased levels of human disturbances. Human activity has transformed grasslands in South Africa to a point where few pristine examples exist (Low & Rebelo 1996). Factors such as increased pasture management (overgrazing), decrease in grassland management due to frequent fires, and land-use alteration (urbanisation) also contribute in the decline of species. More intensive surveys conducted over longer periods over several seasons are required in order to ascertain the current status of the above-mentioned threatened bird species on and surrounding the site. Many avifaunal species are adaptable as they are habitat generalists and can therefore accommodate a certain degree of habitat degradation and transformation (Harrison *et al*., 1997). Other species are extremely habitat specific and have to rely on certain habitat units for breeding, hunting or foraging and roosting. Habitat-specific species are sensitive to environmental change, with destruction of habitat being the leading cause of species decline worldwide (Barnes, 2000). Due to high levels of habitat transformation, the sites offers limited suitable habitat for any larger terrestrial birds as well as certain smaller raptor species.

An avifaunal study indicated that the canals/ash dams, stands of *Eucalyptus* trees and patches of grasslands should provide natural habitats for bird species, however no Red Data bird species were observed on the study sites. *Eucalyptus* species were recorded on site (**Figure 20**) and although they are invader species, they have become important refuges for certain species of raptors. Large *Eucalyptus* trees are used by the migratory Lesser Kestrels for

roosting purposes (Harrison *et al*. 1997), although no known roost sites exist on the study sites.

**Figure 20. Large *Eucalyptus* trees are commonly used by the migratory Lesser Kestrels for roosting purposes**

Areas with reeds, sedges or grassy tangles are suitable for Common Waxbills (*Estrilda astrilda*) and various warblers (Marais and Peacock, 2008). Plant species such as the Common Reed provides nesting and roosting sites for bird species (**Figure 21**).

**Figure 21. Common reeds growing along the ash dams provide nesting and roosting sites for bird species**

The grassland areas (**Figure 22**), represent a significant feeding area for many bird species in the area. The Blue Crane (*Anthropoides africana*) and African Grass-Owl (*Tyto capensis*) are amongst the RDL species recorded from the area that readily utilize this habitat unit. It is therefore highly unlikely that these species could occur in the grassland remaining on the site due to mining activities taking place. Factors such as habitat loss and fragmentation are responsible for the decline in Grass owl population (Barnes, 2000). Frequent burning of habitat can cause major impacts due to reduced or affected foraging, roosting, and nesting sites. Non-threatened species that may from time to time frequent the grassland habitat in the study area are Swainson's Spurfowl (*Pternistis swainsonii*), African Pipit (*Anthus cinnamomeus*), Cape Longclaw (*Macronyx capensis*), several cisticola species, Long-tailed Widowbird (*Euplectes progne*), Rufous-naped Lark (*Mirafra africana*), and Black-shouldered Kite (*Elanus caeruleus*) (Harrison *et al*. 1997). Open grasslands not associated with wetland habitat also form an important habitat unit to support diversity that also include various RDL species.

**Figure 22. Patches of open grassland areas represent a significant feeding area for many bird species**

Twenty Eight (28) bird species (**Table 13)** were recorded during the field surveys. Species recorded were common and widespread and typical of grassland environment. Species such as Black-headed heron (**Figure 23**), Haded ibis (**Figure 24**) and Crowned Lapwing (**Figure 25**) were observed in abundance on site.

**Table 13. Bird species recorded on the proposed development sites**

| Species number | Common name | Scientific name |
|---|---|---|
| 58 | Reed Cormorant | *Phalacrocorax africanus* |
| 63 | Black-headed Heron | *Ardea cinerea* |
| 71 | Cattle Egret | *Bubulus ibis* |
| 91 | African Sacred Ibis | *Threskiornis aethiopicus* |
| 94 | Hadeda Ibis | *Bostrychia hagedash* |
| 102 | Egyptian Goose | *Alopochen aegyptiacus* |
| 127 | Black-shouldered kite | *Elanus caerulus* |
| 199 | Swainson's Spurfowl (Francolin) | *Pternistis swainsonii* |
| 203 | Helmeted Guineafowl | *Numida meleagris* |
| 255 | Crowned Lapwing (Plover) | *Vanellus coronatus* |
| 258 | Blacksmith Lapwing (Plover) | *Vanellus armatus* |
| 349 | Rock Pigeon | *Columba guinea* |
| 352 | Red-eyed Dove | *Streptopelia semitorquata* |
| 355 | Laughing Dove | *Streptopelia senegalensis* |
| 451 | African Hoopoe | *Upupa africana* |

| Species number | Common name | Scientific name |
|---|---|---|
| 518 | Barn Swallow | *Hirundo rustica* |
| 548 | Pied Crow | *Corvus albus* |
| 568 | Red-eyed Bulbul | *Pycnonotus nigricans* |
| 596 | African (Common) Stonechat | *Saxicola torquatus* |
| 732 | Common Fiscal (Fiscal Shrike) | *Lanius collaris* |
| 758 | Common (Indian) Myna | *Acridotheres zeylonus* |
| 764 | Cape Glossy Starling | *Lamprotornis nitens* |
| 801 | House Sparrow | *Passer domesticus* |
| 803 | Cape Sparrow | *Passer melanurus* |
| 814 | Southern Masked-Weaver | *Ploceus velatus* |
| 824 | Southern Red Bishop | *Euplectes orix* |
| 826 | Yellow-crowned Bishop | *Euplectes afer* |
| 932 | Long-tailed Widowbird | *Euplectes progne* |

**Figure 23. Black-headed Heron on an ash dam**

**Figure 24. Hadeda Ibis on site**

**Figure 25. Crowned Lapwing (Plover) on site**

#### 9.2.2.3 Red Data bird species occurring in Duvha Power Station

During this field assessment, no Red Data bird species were observed on site but the report compiled by Hooton and de Beer (2015) indicated that Southern Bald Ibis (*Geronticus calvus*), listed as Vulnerable, was recorded near the High level dam servitude, as indicated in **Figure 26**. The presence of this species on site indicates that it can adapt to several environments. Even though this bird species wasn't encountered during the field surveys, there are possibilities for them to forage the proposed sites.

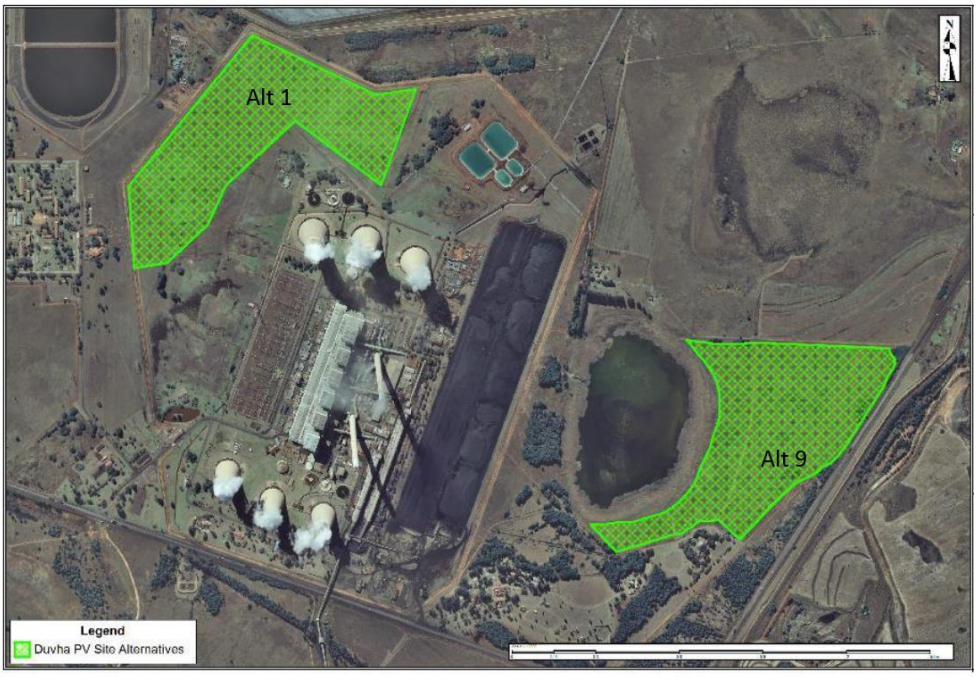


**Figure 26. Red Data Southern Bald Ibis recorded near Alt 1, which is situated near the High level dam servitude**

#### 9.2.2.4 Habitat requirements for Red Data bird species

**Table 14** below provides an important guideline of what could potentially be encountered anywhere in the study area in suitable habitat, and should not be used as a guideline for actual densities on the ground. In addition it must be pointed out that the species below could have been recorded anywhere within the square of 2529CD, and not necessarily within the exact proposed study sites.

**Table 14. Red Data Bird species recorded in grid cell 2529CD which could potentially occur in the study sites (SABAP 1) (Harrison *et al*. (1997), Barnes (2000), SABAP2, Ansara, (2004) and Tarboton *et al*. 1987)**

| Common Name | Conservation Status | Suitable Habitat | Probability of occurrence |
|---|---|---|---|
| White-headed Vulture | *Aegypius occipitalis* | It is found in open savannahs and thorn bush. | Low |
| African Grass-Owl | *Tyto capensis* | Likely to be found in rank grass adjacent to wetlands. | Medium |
| Blue Crane | *Anthropoides paradiseus* | Can be present in the pockets of remaining grassland and wetlands. | Medium |
| African Marsh Harrier | *Circus ranivorus* | It is found in the Southern African wetlands, riverine forests and moist grasslands. | Low |

### 9.2.3 Reptiles

Trees and grasslands on site provide suitable habitats for reptile species. The majority of reptile species are sensitive to severe habitat alteration and fragmentation and the mining construction activities near the proposed development sites have a major impact on the absence of reptiles' activities in the region.

#### 9.2.3.1 Desktop survey results

According to O' Connor and Bredenkamp (1997), the grassland biome houses 22% of South Africa's endemic reptiles. The Field Guide to the Snakes and other Reptiles of Southern Africa (Branch, 2001) and South African Red Data Book Reptiles (Branch, 1988) were books used during the field surveys. **Table 15** lists reptile species which are recorded in the grid cell 2529CD based on the South African Reptile Conservation Assessment (ADU, 2017). According to the list, no species of conservation importance are known to occur in the vicinity of the proposed development sites. **Table 16** below indicates the Red Data reptile species that were previously recorded in 2529CD by MTPA.

**Table 15. Reptile species recorded in grid cell 2529CD which could occur on the study sites (ADU, 2017)**

| Family | Genus | Species | Subspecies | Common name | Red list category | Atlas region endemic |
|---|---|---|---|---|---|---|
| Agamidae | *Agama* | *atra* | | Southern Rock Agama | Least Concern (SARCA 2014) | |
| Chamaeleonidae | *Chamaeleo* | *dilepis* | *dilepis* | Common Flap-neck Chameleon | Least Concern (SARCA 2014) | |
| Colubridae | *Telescopus* | *semiannulatus* | *semiannulatus* | Eastern Tiger Snake | Least Concern (SARCA 2014) | |
| Cordylidae | *Cordylus* | *vittifer* | | Common Girdled Lizard | Least Concern (SARCA 2014) | |
| Elapidae | *Hemachatus* | *haemachatus* | | Rinkhals | Least Concern (SARCA 2014) | |
| Gekkonidae | *Hemidactylus* | *mabouia* | | Common Tropical House Gecko | Least Concern (SARCA 2014) | |
| Gekkonidae | *Lygodactylus* | *capensis* | *capensis* | Common Dwarf Gecko | Least Concern (SARCA 2014) | |
| Gekkonidae | *Pachydactylus* | *affinis* | | Transvaal Gecko | Least Concern (SARCA 2014) | Yes |
| Gerrhosauridae | *Gerrhosaurus* | *flavigularis* | | Yellow-throated Plated Lizard | Least Concern (SARCA 2014) | |
| Lamprophiidae | *Aparallactus* | *capensis* | | Black-headed Centipede-eater | Least Concern (SARCA 2014) | |
| Lamprophiidae | *Atractaspis* | *bibronii* | | Bibron's Stiletto Snake | Least Concern (SARCA 2014) | |
| Lamprophiidae | *Boaedon* | *capensis* | | Brown House Snake | Least Concern (SARCA 2014) | |
| Lamprophiidae | *Lycodonomorphus* | *rufulus* | | Brown Water Snake | Least Concern (SARCA 2014) | |
| Scincidae | *Trachylepis* | *punctatissima* | | Speckled Rock Skink | Least Concern (SARCA 2014) | |
| Scincidae | *Trachylepis* | *varia* | | Variable Skink | Least Concern (SARCA 2014) | |
| Testudinidae | *Stigmochelys* | *pardalis* | | Leopard Tortoise | Least Concern (SARCA 2014) | |
| Typhlopidae | *Afrotyphlops* | *bibronii* | | Bibron's Blind Snake | Least Concern (SARCA 2014) | |
| Viperidae | *Causus* | *rhombeatus* | | Rhombic Night Adder | Least Concern (SARCA 2014) | |

**Table 16. Red Listed reptile species which could potentially occur in the proposed sites (MTPA)**

| Farm Name | Common Name | Scientific Name | Conservation RSA | MTPA | Endemic |
|---|---|---|---|---|---|
| Middelburg | Coppery Grass Lizard | *Chamaesaura aenea* | NT | NT | RSA |
| | Striped harlequin snake | *Homoroselaps dorsalis* | NT | NT | RSA |

9.2.3.2 Reptiles recorded on the proposed development sites

Large areas surrounding the proposed development sites have resulted in increased habitat modification and transformation and these are all causal factors in the alteration and disappearance of reptile diversity in the area (Jacobsen, 2005).

Only one reptile species was noted on site, this being the Montane Speckled Skink (*Trachylepsis punctatissima*). This species is found in a variety of habitats, wet and dry, from grassland and savanna to shrubland, including rock outcrops (Branch, 1998). It is not considered to be of significant importance from a conservation perspective. From the field results, it is evident that transformation of land was responsible for the low number of observations.

9.2.3.3 Habitat requirements for Red Data reptile species

The data sourced from MTPA indicates that only two species of conservation concern are known to occur in the vicinity of the proposed development area. **Table 17** below provides an important guideline of what could potentially be encountered anywhere in the study area in suitable habitat, and should not be used as a guideline for actual densities on the ground.

**Table 17. Red Data reptile species recorded in grid cell 2529CD which could potentially occur in the study sites (MTPA data)**

| Common Name | Conservation Status | Suitable Habitat | Probability of occurrence |
|---|---|---|---|
| Coppery Grass Lizard | NT | Open grassland. Rocky ridges and slopes | Low |
| Striped harlequin snake | NT | The favoured habitats of this snake are moist savanna and grasslands. It is known to inhabit old termitaria in grassland habitat. | Low |

### 9.2.4 Amphibians

Amphibians are an important component of South Africa's exceptional biodiversity and are such worthy of both research and conservation effort (Siegfried, 1989). This is made additionally relevant by international concern over globally declining amphibian populations, a phenomenon currently undergoing intensive investigation but is still poorly understood (Wyman, 1990 & Wake, 1991). This decline seems to have worsened over the past 25 years and amphibians are now more threatened than either mammals or birds, though comparisons with other taxa are confounded by a shortage of reliable data.

#### 9.2.4.1 Desktop survey results

Frogs are useful environmental bio-monitors (bio-indicators) and may act as an early warning system for the quality of the environment. Frogs and tadpoles are good species indicators on water quality, because they have permeable, exposed skins that readily absorb toxic substances. Tadpoles are aquatic and greatly exposed to aquatic pollutants (Blaustein, 2003). The presence of amphibians is also generally regarded as an indication of intact ecological functionality and therefore construction activities within these habitat units should be undertaken in an ecologically-sensitive manner.

According to Frog Atlas of Southern African (ADU, 2017), only one frog species of conservation importance has been recorded in grid cell 2529CD. **Table 18** indicates frogs that were recorded in grid cell 2529CD. **Table 19** below indicates the Red Data bird species that were previously recorded in 2529CD by MTPA.

**Table 18: Amphibian species recorded in the grid cell 2529CD (ADU, 2017), which could potentially occur on the proposed development sites**

| Family | Genus | Species | Common name | Red list category | Atlas region endemic |
|---|---|---|---|---|---|
| Bufonidae | *Schismaderma* | *carens* | Red Toad | Least Concern | |
| Bufonidae | *Sclerophrys* | *capensis* | Raucous Toad | Least Concern | |
| Bufonidae | *Sclerophrys* | *gutturalis* | Guttural Toad | Least Concern | |
| Hyperoliidae | *Kassina* | *senegalensis* | Bubbling Kassina | Least Concern | |
| Hyperoliidae | *Semnodactylus* | *wealii* | Rattling Frog | Least Concern | |
| Phrynobatrachidae | *Phrynobatrachus* | *natalensis* | Snoring Puddle Frog | Least Concern | |
| Ptychadenidae | *Ptychadena* | *porosissima* | Striped Grass Frog | Least Concern | |
| Pyxicephalidae | *Amietia* | *delalandii* | Delalande's River Frog | Least Concern | Yes |
| Pyxicephalidae | *Cacosternum* | *boettgeri* | Common Caco | Least Concern | |
| Pyxicephalidae | *Pyxicephalus* | *adspersus* | Giant Bull Frog | Near Threatened | |
| Pyxicephalidae | *Strongylopus* | *fasciatus* | Striped Stream Frog | Least Concern | |
| Pyxicephalidae | *Tomopterna* | *cryptotis* | Tremelo Sand Frog | Least Concern | |
| Pyxicephalidae | *Tomopterna* | *natalensis* | Natal Sand Frog | Least Concern | |

**Table 19. Red Listed bird species which could potentially occur in the proposed sites (MTPA).**

| Farm Name | Common Name | Scientific Name | Conservation RSA | MTPA |
|---|---|---|---|---|
| Elandspruit 291 JS | African bullfrog | *Pyxicephalus adspersus* | NT | VU |
| Rietfontein 286 JS | African bullfrog | *Pyxicephalus adspersus* | NT | VU |

#### 9.2.4.2 Field work results

The non-perennial river (**Figure 27**) on the proposed Low level dam servitude site holds water on a temporary basis and is likely an important breeding habitat for most of the frog species which occur in the region. During the field assessment, only one frog species was recorded, namely Queckett's River Frog (*Amietia quecketti*) (**Figure 28**). It is a common species found on the banks of slow-flowing streams or other permanent bodies of water in a wide range of wetland habitats in grassland, savannah and forest fringes. It frequently inhabits garden ponds and water features (du Preez and Carruthers (2009).

**Figure 27. The Non-perennial River on the Low level dam servitude**

**Figure 28. River Frog recorded on the Low level dam servitude**

9.2.4.3 Habitat requirements for Red Data amphibian species

The Giant Bullfrog usually breeds within the Grassland biome, but also has been shown to breed within savanna wetlands. They are explosive breeding frogs which utilise ephemeral pans or inundated grasslands for their short duration reproductive cycles. The proposed development sites do not offer any suitable habitat for this species to occur in the study area. According to the IUCN Red List category (Minter *et al*. 2004), this species is currently assigned a *Near-Threatened* status. Globally, it is listed as *Least Concern* (du Preez and Cook, 2004). According to Gauteng C-Plan (2011), the Giant Bullfrog (*Pyxcicephalus adspersus*) species is not truly Near Threatened in South Africa and the most recent evaluation of the status of the Giant Bullfrog in December 2009 did not consider the species sufficiently threatened to be listed as Near Threatened (Prof. Louis du Preez). As per the C-Plan approach, the conservation of the Giant Bullfrog and of amphibians in general will be met by the protected area network as well as the designation of priority habitats *i.e.,* pans or quaternary catchments, with associated restrictions on land use. Bullfrogs emerge from their underground burrows in years of sufficient rainfall and return to their burrows soon after breeding (Cook, 2007). Habitat fragmentation and transformation arising from mining activities are leading causes of frog population declines and the most suitable bullfrog habitats have now been transformed. No Giant Bullfrogs were identified on or within the vicinity of the study area and the only suitable

habitat present for this species is the watercourses habitat associated with Low level dam servitude site.

# 10 TERRSTRIAL ECOLOGICAL SENSITIVITY ANALYSIS OF THE STUDY AREA

The ecological function describes the intactness of the structure and function of the vegetation communities which in turn support faunal communities. It also refers to the degree of ecological connectivity between the identified vegetation communities and other systems within the landscape. Therefore, systems with a high degree of landscape connectivity among each other are perceived to be more sensitive.

**High** – Sensitive vegetation communities with either low inherent resistance or resilience towards disturbance factors or vegetation that are considered important for the maintenance of ecosystem integrity. Most of these vegetation communities represent late succession ecosystems with high connectivity with other important ecological systems.

**Medium** – Vegetation communities that occur at disturbances of low-medium intensity and representative of secondary succession stages with some degree of connectivity with other ecological systems.

**Low** – Degraded and highly disturbed vegetation with little ecological function.

A terrestrial ecological analysis was also carried out to determine which areas in the study site are considered as most sensitive areas. The sensitivity map (**Figure 29**) was based on the following criteria:

- Terrestrial threatened ecosystem (High) and
- CBA Optimal (Medium)

All the areas denoted as High in terms of ecological sensitivity must be taken into account when the final layout is designed.

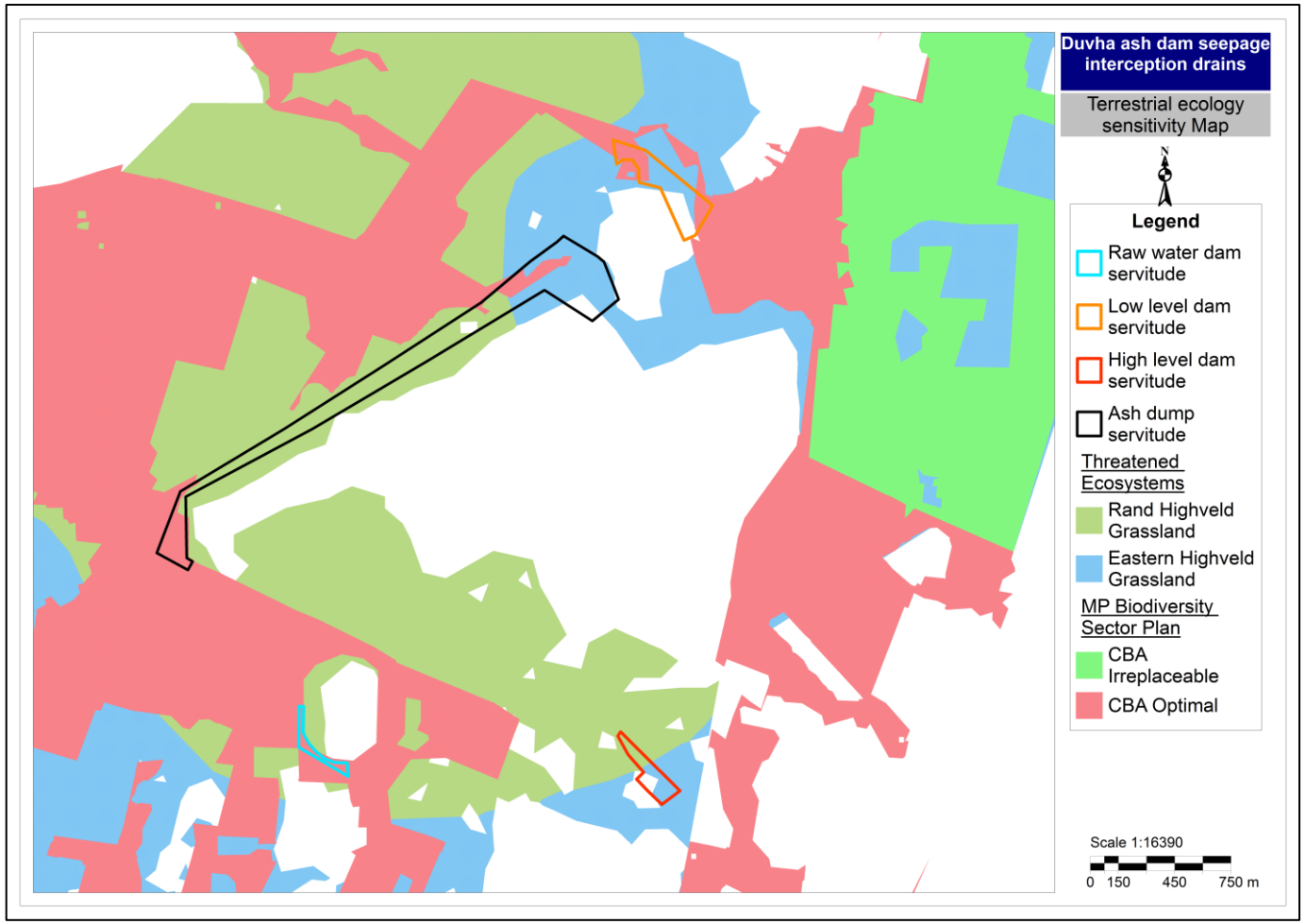


**Figure 29: Terrestrial ecological sensitivity map of the proposed development sites**

# 11 ENVIRONMENTAL IMPACT ASSESSMENT

## 11.1 Methodology

All impacts are analysed in the section to follow (**Table 20**) with regard to their nature, extent, magnitude, duration, probability and significance. The following definitions apply:

**Nature (/Status)**
The project could have a positive, negative or neutral impact on the environment.

**Extent**

- Local – extend to the site and its immediate surroundings.
- Regional – impact on the region but within the province.
- National – impact on an interprovincial scale.
- International – impact outside of South Africa.

**Magnitude**

Degree to which impact may cause irreplaceable loss of resources.

- Low – natural and social functions and processes are not affected or minimally affected.
- Medium – affected environment is notably altered; natural and social functions and processes continue albeit in a modified way.
- High – natural or social functions or processes could be substantially affected or altered to the extent that they could temporarily or permanently cease.

**Duration**

- Short term – 0-5 years.
- Medium term – 5-11 years.
- Long term – impact ceases after the operational life cycle of the activity either because of natural processes or by human intervention.
- Permanent – mitigation either by natural process or by human intervention will not occur in such a way or in such a time span that the impact can be considered transient.

**Probability**

- Almost certain – the event is expected to occur in most circumstances.
- Likely – the event will probably occur in most circumstances.
- Moderate – the event should occur at some time.
- Unlikely – the event could occur at some time.

- Rare/Remote – the event may occur only in exceptional circumstances.

**Significance**

Provides an overall impression of an impact's importance, and the degree to which it can be mitigated. The range for significance ratings is as follows-

- 0 – Impact will not affect the environment. No mitigation necessary.
- 1 – No impact after mitigation.
- 2 – Residual impact after mitigation.
- 3 – Impact cannot be mitigated.

## 11.2 Assessment of Environmental Impacts and Suggested Mitigation Measures

Only the environmental issues identified during the appraisal of the receiving environment and potential impacts are assessed below (**Table 20**). Mitigation measures are provided to prevent (first priority), reduce or remediate adverse environmental impacts.

**Table 20. Recommended mitigation measures with significance rating before and after mitigation of the proposed ash dam seepage drain sites**

| FLORA<br>PRE – CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Loss of plant species of conservation concern | | | | • It is recommended that prior to construction, the *Hypoxis hemerocallidea,* a plant species recorded on site must be searched and rescued and then following construction activities, they can be re-established at the site.<br>• Given that the species of conservation importance were observed, it is important that species of conservation importance and threatened species which may occur on the proposed development sites are addressed through a search and rescue plan. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Low | Short-term | Likely | 1 |

| FLORA<br>PRE – CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Destruction of indigenous flora | | | | • Indigenous plants naturally growing on the proposed development sites that would be otherwise destroyed during clearing for development purposes should be incorporated into landscaped areas.<br>• Vegetation clearing should be kept to a minimum, and this should only occur where it is absolutely necessary. The use of a brush-cutter is highly preferable to the use of earth-moving equipment.<br>• Rehabilitate all disturbed areas as soon as the construction is completed within the proposed development areas.<br>• Ensure that all personnel have the appropriate level of environmental awareness and competence to ensure continued environmental due diligence and on-going minimisation of environmental harmThis can be achieved through provision of appropriate awareness to all personnel. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Low | Short-term | Likely | 1 |

| FAUNA<br>PRE – CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | Mitigation | | | |
| Loss and displacement of animals on site. | | | • Prior to construction, animals of conservation concern must be rescued and relocated. An experienced person who knows the animals in the region well will identify any possible Red Data fauna on site and acquire the necessary permits to relocate fauna if avoidance is not possible.<br>• Training of construction workers to recognise threatened animal species will reduce the probability of fauna being harmed unnecessarily.<br>• The contractor must ensure that no faunal species are disturbed, trapped, hunted or killed during the construction phase.<br>• Vehicles must adhere to a speed limit, 30-40 km/h is recommended for light vehicles and a lower speed for heavy vehicles.<br>• All construction and maintenance vehicles must stick to properly demarcated and prepared roads. Off-road driving should be strictly prohibited.<br>• No fires should be allowed at the sites.<br>• No dogs or other domestic pets should be allowed at the sites. | | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Low | Short-term | Likely | 1 |

| FLORA AND FAUNA<br>PRE – CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | Mitigation | | | |
| Loss of Habitat and Habitat Fragmentation | | | • The most significant way to mitigate the loss of habitat is to limit the footprint within the natural habitat areas remaining.<br>• No structures should be built outside the area demarcated for the development.<br>• Although it is unavoidable that sections of the proposed developments will need to traverse areas of potential sensitivity, the construction of the interceptions drains should be constructed in such cases so as to avoid further impact to these areas. | | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | Mitigation | | | |
| Loss of vegetation due to fuel and chemical spills | | | • Appropriate measures should be implemented in order to prevent potential soil pollution through fuel and oil leaks and spills and then compliance monitored by an appropriate person.<br>• Make sure construction vehicles are maintained and serviced to prevent oil and fuel leaks.<br>• Emergency on-site maintenance should be done over appropriate drip trays and all oil or fuel must be disposed of according to waste regulations. Drip-trays must be placed under vehicles and equipment when not in use.<br>• Implement suitable erosion control measures. | | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Introduction of alien species. | | | | • During construction, the construction areas and immediate surroundings should be monitored regularly for emergent invasive vegetation.<br>• Promote awareness of all personnel.<br>• The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation.<br>• Proliferation of alien and invasive species is expected within the disturbed areas and they should be eradicated and controlled to prevent their spread into the Power Station.<br>• Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Destruction of alien vegetation | | | | • All alien seedlings and saplings must be removed as they become evident for the duration of construction phase.<br>• Manual / mechanical removal is preferred to chemical control. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Increased soil erosion | | | | • Topsoil should be stored in such a way that does not compromise its plant-support capacity.<br>• Topsoil from the construction activities should be stored for post-construction rehabilitation work and should not be disturbed more than is absolutely necessary.<br>• Protect topsoil in order to avoid erosion loss on steep slopes.<br>• Protect topsoil from contamination by aggregate, cement, concrete, fuels, litter, oils, domestic and wastes.<br>• An ecologically-sound stormwater management plan must be implemented during construction and appropriate water diversion systems put in place. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Loss of habitat of the Eastern Highveld Grassland, Rand Highveld, and CBA Optimal. | | | | • Vehicles and construction workers should under no circumstances be allowed outside the site boundaries to prevent impact on the surrounding vegetation.<br>• Where possible, natural vegetation must not be cleared and encouraged to grow.<br>• All stockpiles, construction vehicles, equipment and machinery should be situated away from the natural vegetation.<br>• Disturbance of vegetation must be limited only to areas of construction.<br>• Prevent contamination of natural grasslands by any pollution.<br>• Areas cleared of vegetation must be re-vegetated prior to contractor leaving the site. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Damage to plant life outside of the proposed development sites | | | | • Construction activities should be restricted to the development footprint area and then the compliance in terms of footprint can be monitored by Environmental Control Officer (ECO).<br>• Areas which could be deemed as no go should be clearly marked. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FAUNA<br>CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | Mitigation | | | | | |
| Disturbance to animals | • Animals residing within the designated area shall not be unnecessarily disturbed.<br>• During construction, refresher training can be conducted to construction workers with regards to littering and poaching.<br>• The Contractor and his/her employees shall not bring any domestic animals onto site.<br>• Toolbox talks should be provided to contractors regarding disturbance to animals. Particular emphasis should be placed on talks regarding handling of snakes.<br>• Illegal hunting is prohibited in the Power Station.<br>• Any fauna (mammal, bird, reptile and amphibian) that becomes trapped in the trenches or in any construction or operational related activity may not be harmed and must be placed rescued and relocated by an experienced person. | | | | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>OPERATIONAL PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| The proposed construction activities may affect biodiversity through the encroachment of exotic vegetation following soil disturbance, in addition the maintenance of the area would disturb naturalised species within the area. | | | | Newly cleared soils will have to be re-vegetated and stabilised as soon as construction has been completed and there should be an on-going monitoring program to control and/or eradicate newly emerging invasives. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Low | Short-term | Likely | 1 |

| FLORA<br>CONSTRUCTION/POST CONSTRUCTION PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | Mitigation | | | | | |
| Loss of habitat due to construction activities | • All areas to be affected by the proposed project will be rehabilitated after construction and all waste generated by the construction activities will be stored in a temporary demarcated storage area, prior to disposal thereof at a licensed registered landfill site.<br>• As much vegetation growth as possible should be promoted within the proposed development site in order to protect soils and to reduce the percentage of the surface area which is left as bare ground. In this regard special mention is made of the need to use indigenous vegetation species as the first choice during landscaping. In terms of the percentage of coverage required during rehabilitation and also the grass mix to be used for rehabilitation, the EMPr will be consulted for guidance. However, the plant material to be used for rehabilitation should be similar to what is found in the surrounding area. | | | | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Negative | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Low | Short-term | Likely | 1 |

| FAUNA<br>OPERATIONAL PHASE | | | | | | |
|---|---|---|---|---|---|---|
| Potential Impact | | | | Mitigation | | |
| Disturbance of faunal species | | | | • The disturbance of fauna should be minimized.<br>• Animals residing within the designated area shall not be unnecessarily disturbed. | | |
| Without Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Medium | Medium-term | Almost certain | 2 |
| With Mitigation | Nature | Extent | Magnitude | Duration | Probability | Significance |
| | Positive | Local | Low | Short-term | Likely | 1 |

# 12 CONCLUSION AND RECOMMENDATIONS

The proposed seepage interception drain sites fall within the grassland biome, within the endangered Eastern Highveld Grassland and Rand Highveld vegetation units. These vegetation types on site have already undergone major transformation mostly by serious alien plant infestation and mining activities, with little or no remnants of these vegetation types remaining on sites. At the time of the specialist visit, the general aspect on the sites were one of severe degradation, primarily on account of anthropogenic disturbance at the site. As a consequence of the high levels of disturbance, the dominant habitat structure comprised primarily of weeds and/or alien invasive plant species. Even though the vegetation types and threatened ecosystems are listed as endangered and vulnerable respectively, the study area has been highly transformed and disturbed due to ash dams. According to the Mpumalanga Biodiversity Conservation Plan, the proposed development sites fall within the "*CBA Optimal"*, "*Heavily modified"* and *"Moderately modified- Old lands".*

During the field survey, no threatened species were observed on sites but only one plant species of conservation concern was noted, namely *Hypoxis hemerocallidea* (Star flower/African potato)) and this species is listed as *Declining.* It is therefore recommended that prior to construction, this species must be rescued and relocated to a safer place with suitable survival and growth-enabling conditions and then following construction activities, they can be re-established at the sites.

No fauna of conservation importance were recorded on the proposed development sites during the site visit, even though Red Data birds species such as Southern Bald Ibis has been recorded near the High level dam servitude. The habitat transformation, mining activities and associated disturbances taking place usually have a detrimental impact on fauna species (especially mammals and snakes) in the area.

The establishment of pioneer species should be considered with the natural cycle of rehabilitation of disturbed areas, which assists with erosion control, dust and establishment of more permanent species. This can be controlled during construction phase and thereafter more stringent measures should be implemented during the rehabilitation and post rehabilitation. Larger exotic species that are not included in the Category 1b list of invasive species could also be allowed to remain for aesthetic purposes. The proposed development

should proceed subject to the above, and mitigation measures must be employed to minimise potential impacts from the project activities.

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environmental affairs

Department
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

Proposed Duvha Ash Dam Seepage Interception Drains

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Nemaii Consulting (Pty) Ltd | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | 1 | Percentage Procurement recognition | |
| Specialist name: | Avhafarei Phamphe | | | |
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## 2. DECLARATION BY THE SPECIALIST

I, AVHAFAREI PHAMPHE, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

NEMAI CONSULTING

Name of Company:

22/05/2019

Date

3. **UNDERTAKING UNDER OATH/ AFFIRMATION**

I, AUHAFALEI PHAMPHILES swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

NEMAI CONSULTING

Name of Company

22/05/2019

Date

7213650-2 CST.

Signature of the Commissioner of Oaths

2019-05-22

Date

SOUTH AFRICAN POLICE SERVICE
COMMUNITY SERVICE CENTRE
2019 -05- 22
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**Appendix D2 – Riparian Habitat and Wetland Delineation Impact Assessment**

# Riparian Habitat and Wetland Delineation Impact Assessment for the Proposed Seepage Interception Drains at Duvha Power Station

# Mpumalanga

June 2017

**REFERENCE**

10628


**Prepared for:**

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| | | |
|---|---|---|
| **Report Name** | **Riparian Habitat and Wetland Delineation Impact Assessment for the Proposed Seepage Interception Drains at Duvha Power Station** | |
| **Reference** | **10628** | |
| **Submitted to** | **Nemai Consulting** | |
| **Report writer** | **Andrew Husted** |  |
| **Report Reviewer** | **Wayne Jackson** |  |

## Table of Contents



# Tables



# Figures

**DECLARATION**

I, Andrew Husted, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of Section 24F of the Act.

Andrew Husted

Wetland Specialist

The Biodiversity Company

2 June 2017

# 1 INTRODUCTION

The Biodiversity Company was commissioned to conduct a wetland assessment as part of the Basic Assessment (BA) and Water Use Licence Application (WULA) process for the proposed Seepage Interception Drains for the Duvha Power Station. A single dry season survey was conducted in early June 2017.

## 1.1 The project

Duvha Power Station has been in operation for a period of 36 years. Duvha produces wet ash that gets pumped to the Ash Dam. The settled water is then decanted to the low-level Ash water return dam (LLAWRD) from where it gets pumped back to the station to produce more wet ash slurry. The Power Station dams are experiencing seepage water which is polluting the ground water towards the Witbank Dam and mitigation measures have to be taken to prevent the continuous groundwater seepage. A multi-disciplinary concept design to prevent seepage water is to be carried out to support the Basic Assessment and Water Use Licence Application processes as the drain would be within 500m of wetlands. Construction of the Seepage Interception Drains at the various dams are necessary as the Department of Environmental Affairs instructed Eskom to mitigate and prevent the groundwater pollution.

Eskom propose to install seepage interception drains in four areas near the Duvha Power Station, Mpumalanga Province.

## 1.2 Background

A baseline wetland assessment was completed by EnviRoss CC (February, 2017) which has been considered to supplement the requirements of this study. The Scope of Work for the EnviRoss survey included the following:

*"To identify the **hydrogeomorphic forms** and the **outer boundaries** of the wetland units, which would enable the designation of prescribed conservation buffers. The **present ecological state** (PES) and degree of **functionality** of the wetland and aquatic habitat units were also to be ascertained."*

## 1.3 Objectives

The aim of the assessment is to compile a wetland specific report, and to assess the risks posed by the proposed drains. The following objective specifics were considered:

- The delineation and assessment of wetlands within 500m of the project area (EnviRoss, 2017);
- A risk assessment for the proposed development; and
- The prescription of mitigation measures and recommendations for identified risks.

# 2 KEY LEGISLATIVE REQUIREMENTS

## 2.1 National Water Act (NWA, 1998)

The Department of Water and Sanitation (DWS) is the custodian of South Africa's water resources and therefore assumes public trusteeship of water resources, which includes watercourses, surface water, estuaries, or aquifers. The National Water Act (NWA) (Act No. 36 of 1998) allows for the protection of water resources, which includes:

- The maintenance of the quality of the water resource to the extent that the water resources may be used in an ecologically sustainable way;
- The prevention of the degradation of the water resource; and
- The rehabilitation of the water resource.

A watercourse means:

- A river or spring;
- A natural channel in which water flows regularly or intermittently;
- A wetland, lake or dam into which, or from which, water flows; and
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

The NWA recognises that the entire ecosystem, and not just the water itself, and any given water resource constitutes the resource and as such needs to be conserved. No activity may therefore take place within a watercourse unless it is authorised by the DWS.

For the purposes of this project, a wetland area is defined according to the NWA (Act No. 36 of 1998): "Land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil".

Wetlands have one or more of the following attributes to meet the NWA wetland definition (DWAF, 2005):

- A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil;
- Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils; and
- The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

## 2.2 National Environmental Management Act (NEMA, 1998)

The National Environmental Management Act (NEMA) (Act 107 of 1998) and the associated Regulations as amended in April 2017, states that prior to any development taking place within a wetland or riparian area, an Environmental Authorisation process needs to be followed. This could follow either the Basic Assessment Report (BAR) process or the EIA process depending on the scale of the impact.

# 3 PROJECT AREA

The project area (Figure 1) is associated with the Duvha Power Station, Mpumalanga. The area is located in the Highveld aquatic ecoregion. It falls within the B11G quaternary catchment of the Olifants Water Management Area (WMA 2).

The main watercourses draining the quaternary catchment are the Tweefonteinspruit and the Noupoort River that drain toward the Olifants (North) River, with Witbank Dam having been constructed at the confluence of these three rivers within the WMA (EnviRoss, 2017).

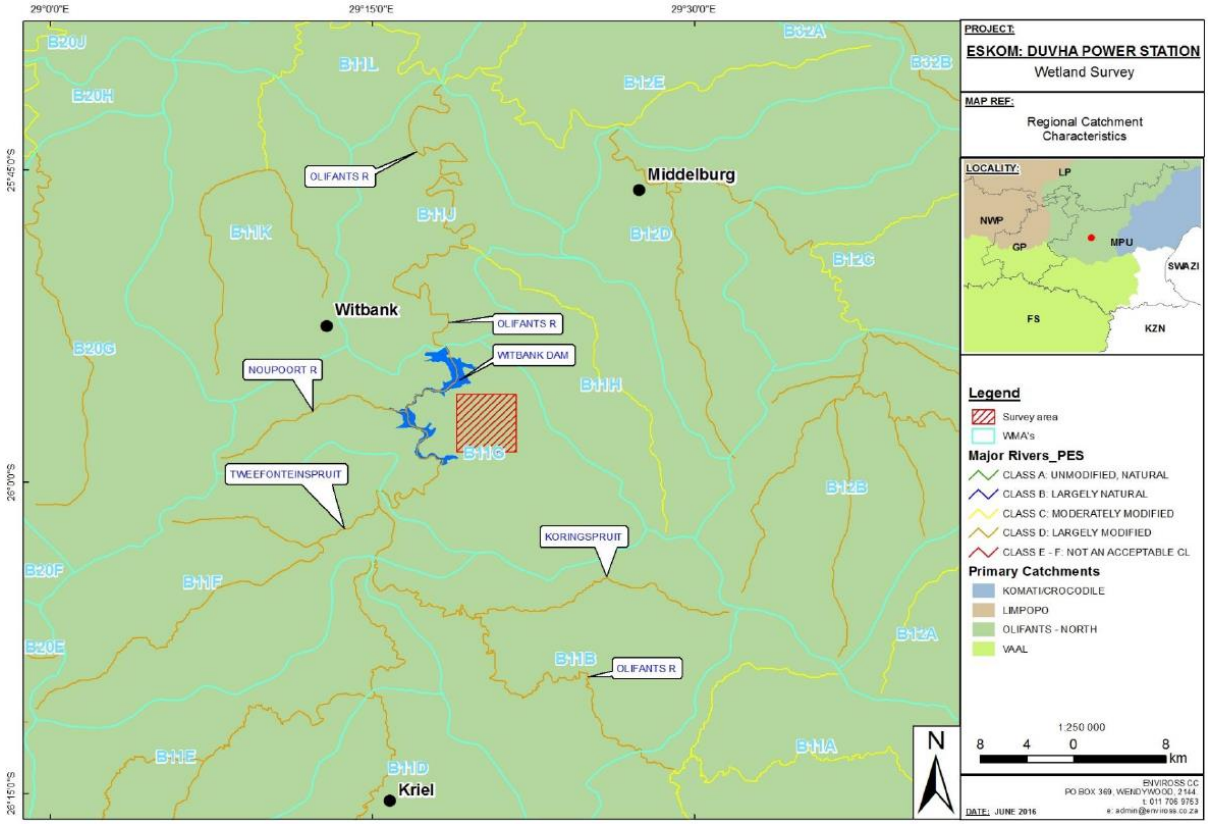



**Figure 1: Locality map showing the project area (EnviRoss, 2017)**

# 4 LIMITATIONS

The following aspects were considered as limitations for the water resource assessment:

- A baseline study was completed by EnviRoss CC (2017), and information from the study has been deemed true and accurate. A rapid site inspection was conducted to verify selected aspects of the baseline data.
- Details pertaining to the proposed drains was somewhat limited at the time of compiling this report, and as a result the risk study assessed likely or expected risks stemming from the project and the associated activities. It may be likely that project aspects "unknown" at the time of compiling this report may not have been assessed.
- Supporting studies such as groundwater, surface water and water quality were not available for the risk assessment.

# 5 METHODOLOGY

## 5.1 Wetland Assessment

A baseline ecological study was completed by EnviRoss (2017) and does not form part of this project.

## 5.2 Risk assessment

The matrix assesses impacts in terms of consequence and likelihood. Consequence is calculated based on the following formula:

**Consequence = Severity + Spatial Scale + Duration**

Whereas likelihood is calculated as:

**Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection**

Significance is calculated as:

**Significance\Risk= Consequence X Likelihood**

The significance of the impact is calculated according to Table 1.

**Table 1: Significance ratings matrix**

| Rating | Class | Management Description |
|---|---|---|
| 1 – 55 | (L) Low Risk | Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded. |
| 56 – 169 | M) Moderate Risk | Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded. |
| 170 – 300 | (H) High Risk | Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. |

# 6 RESULTS & DISCUSSIONS

## 6.1 Wetland Assessment

The baseline study competed by EnviRoss (2017) identified and delineated seven (7) hydro-geomorphic (HGM) units for the area, these were labelled A to G. Figure 2 presents the HGM units that are considered to be applicable for this project, due to the potential risks posed by the proposed seepage drains. The HGM units that have been considered for the study are as follows:

- HGM B – Channelled valley bottom;
- HGM C – Hillslope seep zone;

- HGM D – Channelled valley bottom; and
- HGM E – Hillslope seep zone.

The wetland characteristics and ecological significance as discussed by EnviRoss (2017) are presented (in summary) in the subsequent sections.

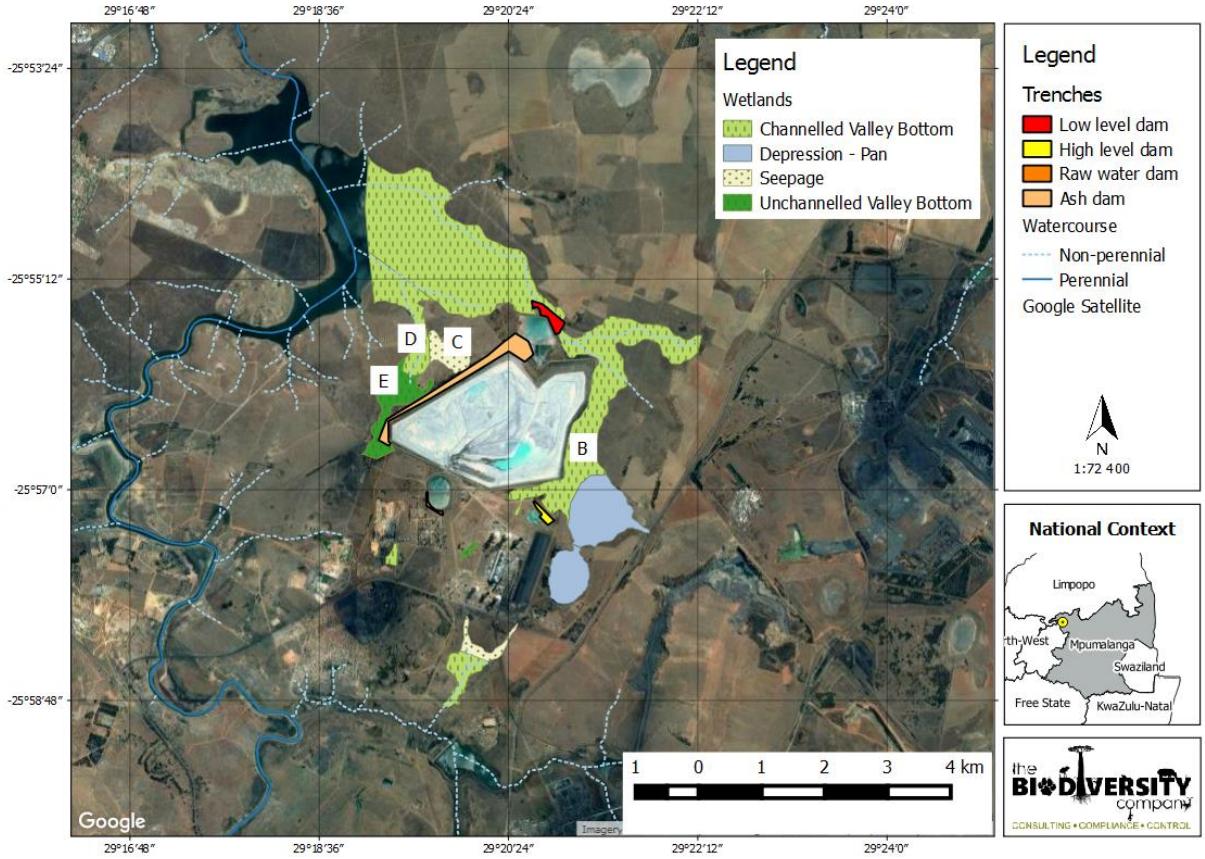



**Figure 2: The HGM units considered for this risk assessment**

### 6.1.1 HGM B

This wetland is a channelled valley bottom that carries water northwards toward a small tributary stream of the Olifants River. Under natural conditions this would have been a poorly-developed wetland unit. The water volume has been supplemented by large volumes of seepage water that emanate from the north west of the ash dams, where a section of unlined channel between the power station and the low-level dam allows for seepage.

This wetland unit, although a modified system, presently functions as a well-established wetland system that offers all of the goods and services of a natural wetland of its kind. This wetland unit is closely associated with the southern and eastern boundaries of the ash disposal facility and receives a lot of water through seepage from the ash dam, water conveyance infrastructure failure or through natural seepage zones.

### 6.1.2 HGM C

This wetland unit is naturally a seep zone connected to the main channel that supports a seasonal wetland unit. There was a trench excavated to drain clean storm water from the area

to avoid pooling. This would have an insignificant effect on the hydrological functioning of the wetland unit due to limited volumes. Upon enquiry, this was deemed a temporary measure and not usual management practice to release water in this manner into the environment.

### 6.1.3 HGM D

This wetland unit is regarded as a channelled valley bottom wetland. It is largely fed through a seepage wetland (HGM E). This is a well-established wetland associated with the western boundary of the ash dam facility, draining water directly toward the Witbank Dam in the north. Roads and some impoundments along the watercourse have impacted the overall functionality of this wetland unit. Permanent and seasonal zones are well represented within this wetland unit.

### 6.1.4 HGM E

This is a seep zone wetland that originates within the southern area of the power station and feeds into HGM D. It is a temporary wetland feature that gains momentum as it moves along the watercourse. There is an impoundment along the watercourse, presumably that was used for agricultural purposes. This has since become derelict and of no significant consequence to the functionality of the wetland.

## 6.2 Present Ecological State

EnviRoss (2017) concluded that all the wetlands within the project area are Moderately modified (Class C). Owing to the method that was implemented for the study, the ecological status of HGM C was not determined.

- These ratings are largely driven by the impacts that occur within the local catchment (agriculture and the ash dam facility) as well as within the wetland units themselves, such as landscaping, excavated channels and impoundments.
- Vegetation structures are generally good, although cattle activity and grazing within the wetland units have influenced the overall integrity of this feature.
- Geomorphological and hydrological characteristics are generally linked as channel formation generally drives erosion features and sediment transport and deposition.
- Channel excavations that artificially drain wetland units (decrease retention time of the water within the wetland unit) and small-scale impoundments that increase this retention time are the main drivers of unit transformation.
- Water seepage from the ash dam generally is high in salts and other toxicants. Agriculture within the local catchment means that runoff water that enters into the wetlands will be high in nutrients and toxicants (from agro-chemicals) and sediments that will increase the turbidity of the water.
- Overall, however, the wetland units were seen to be largely functional and no wetland units were singled out as particularly problematic. This is largely due to the wetland units themselves being self-regulating and remaining relatively undisturbed. This is largely due to vegetation units that are generally healthy.

### 6.2.1 Ecological Importance & Sensitivity

The EIS was undertaken according to the methods outlined in WET-EcoServices (Kotze, *et al*, 2009) for all applicable units, and was therefore not applicable to HGM C.

After application of the methods in WET-Ecoservices, the wetlands averaged out at between 1.3 and 2.0 out of a possible 4. This is viewed as a moderate to high ecological service level, which, as per the definition, is regarded as Wetlands *that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.*

### 6.2.2 Conclusion (EnviRoss, 2017)

Following the completion of the wetland survey, the following conclusions and recommendations were offered:

- The wetlands that surround the power station facility are influenced by the management practices of the facility as well as those activities of the surrounding land users. They are therefore subject to a multitude of pressures and drivers of ecological change;
- Overall, the wetland units were found to have retained relatively good ecological functionality;
- The capacity that the surrounding wetlands have to purify contaminated water depends on the protection of the ecological integrity of the systems. This includes vegetation density and structure as well as geomorphological features (protection from erosion and factors that will enhance erosion features);
- At present, erosion features are being enhanced through defining the watercourses through excavations as well as activity of livestock within the wetland zones. These are two aspects that should be addressed, which will require coordination with surrounding land users/owners;
- It is recommended that any effluents that are discharged into the surrounding wetland units be tested for harmful contaminants to ensure that no significant impacts to the supported biodiversity will take place. Cross referencing the effluent quality to the present DWS target water quality guidelines should be undertaken;
- The use of the wetlands for water volume and quality management pertaining to the Duvha Power Station can be possible in a sustainable way and these wetlands can offer ecological services and functions that can reduce the costs of artificial water purification and volume management.

# 7 RISK ASSESSMENT

The construction of seepage interception drains is proposed for four (4) dams, these are presented in Figure 3. The wetland areas (and HGM units) that will be directly affected by the proposed drains are also presented in Figure 3. Photographs of the four (4) dams that were investigated for the risk assessment are presented in Figure 4.

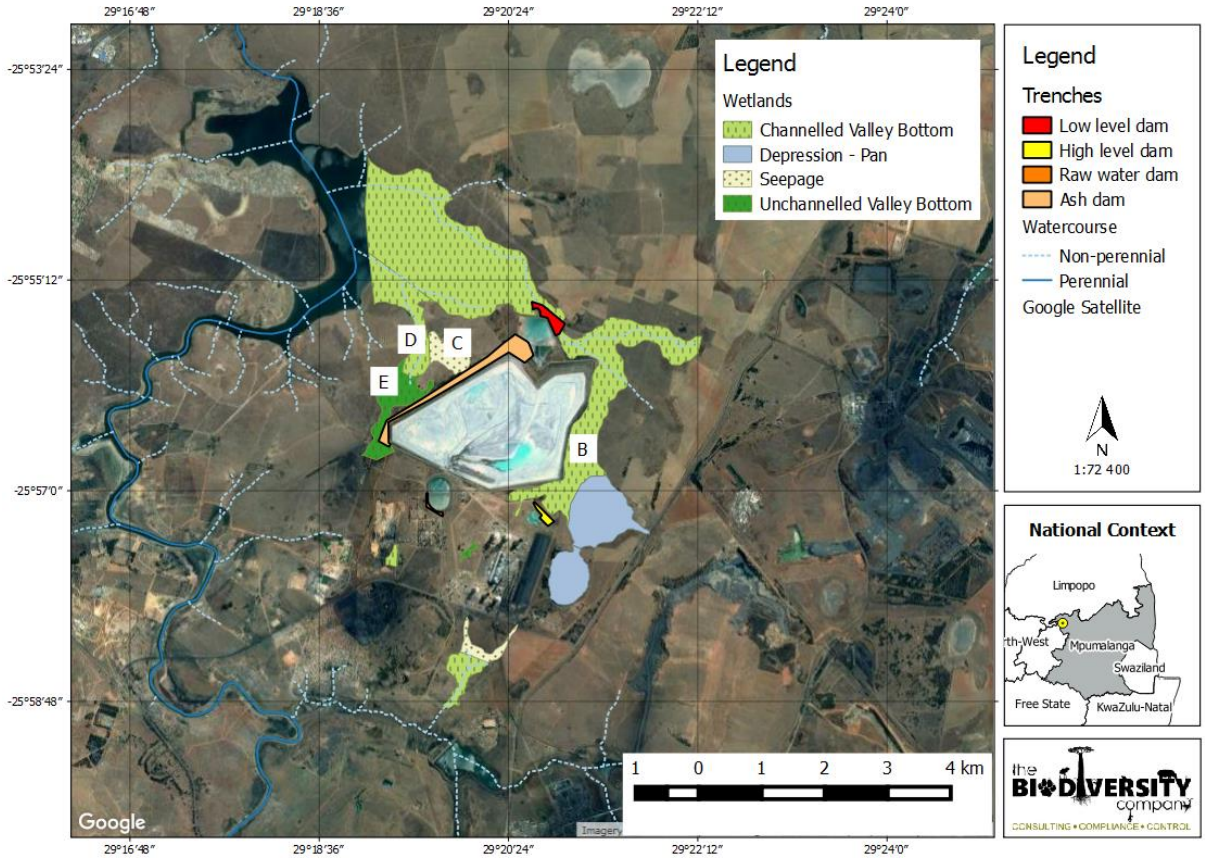



**Figure 3: The HGM units considered for this risk assessment**


**Figure 4: Photographs of the four dams**

It is worth noting that the drain proposed for the raw water dam will not have a direct impact on the delineated wetland areas, and the risks posed by the drain for this dam are expected to be low. In addition to this, there is no preferential flow path that stems from the raw water dam to a wetland area. As a result of this, no risk assessment was conducted for the raw water dam. Table 2 presents an expected risk scenario for each drain, and a discussion with reference to any local wetland areas likely to be affected by the project.

**Table 2: Expected level of risk and discussions**

| Dam | Level of risk | Discussion | Illustration |
|---|---|---|---|
| Raw water dam | No direct impacts posed by the drain. | No wetlands are within 500m of the proposed drain, and the expected level of risk is low (or negligible). |  |
| High level dam | No direct impacts posed by the drain. | The drain is proposed to be constructed in an already disturbed / developed area. The drain can be designed to enable the polishing of water and allow discharge into the adjacent wetland area. |  |
| Ash dam | Direct impacts posed by the drain. | The south-west portion of the drain will encroach into an unchanneled valley bottom area. |  |
| Low level dam | Direct impacts posed by the drain. | The drain will be constructed in a channelled valley bottom wetland, with the position of the drain likely to pose a risk to the hydrology across the system due to possible flow obstructions. |  |

A National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution) Digital Elevation Model (DEM) was obtained from the United States Geological Survey (USGS) Earth Explorer website. Basic terrain analysis was performed on this DEM using the SAGA GIS software that encompassed a slope and channel network analyses in order to detect catchment areas and potential drainage lines respectively. The identified DEM and channel flow network are presented in Figure 5 and Figure 6.

The DEM and channel network data provides an indicating of the direction hydrology across the catchment, and the risks posed by the proposed drains to obstructing flow through the wetlands.

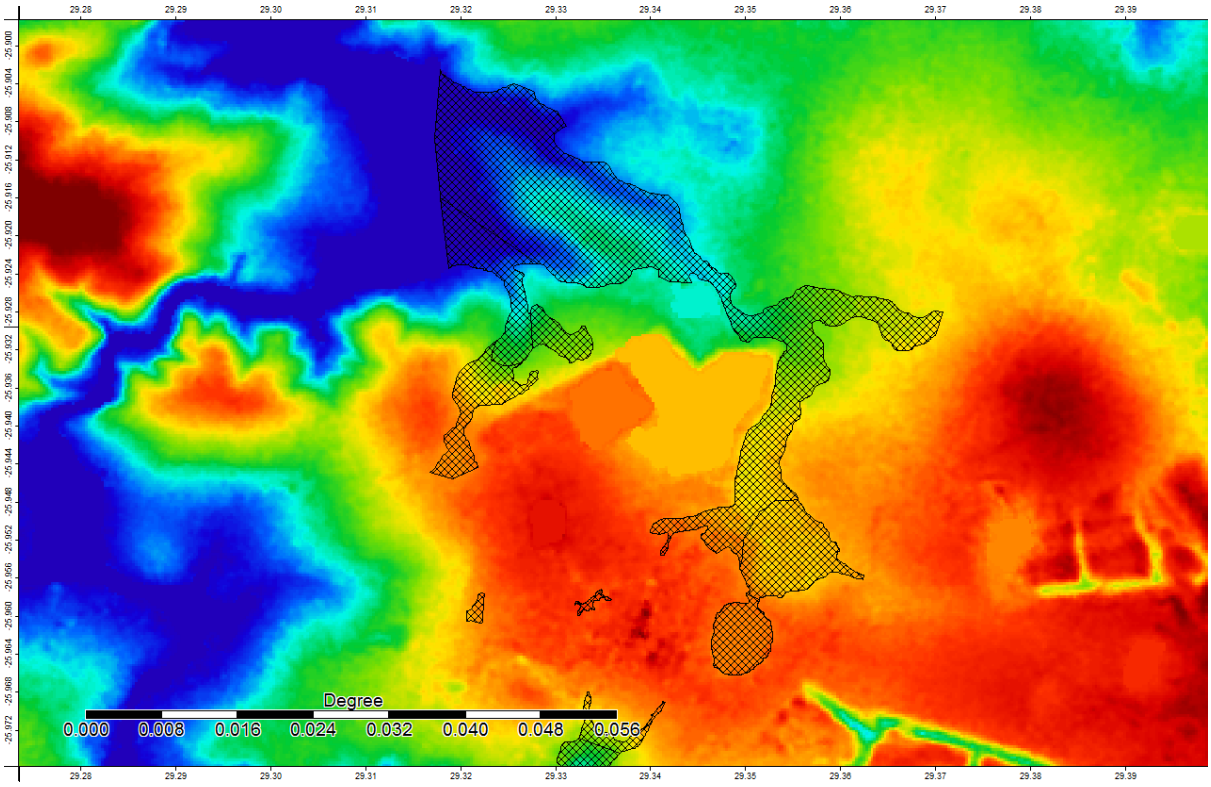



**Figure 5: The DEM processed for the project area**

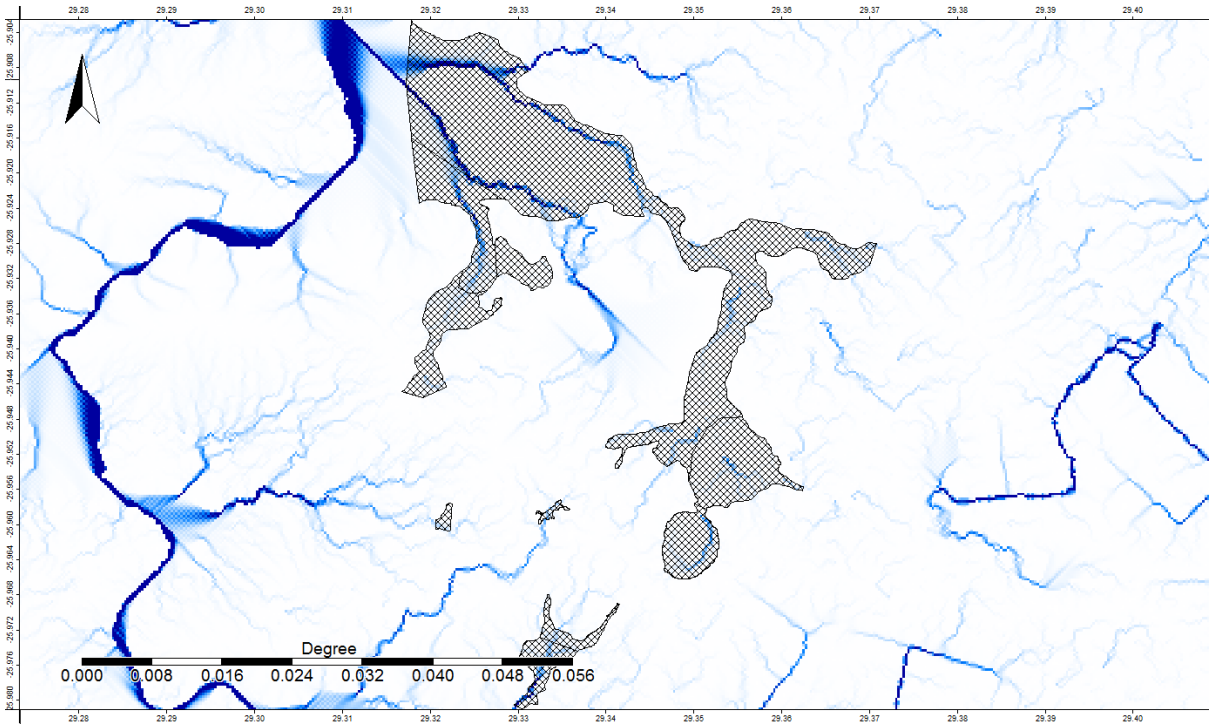



**Figure 6: The channel flow network identified for the project area**

## 7.1 Current impacts

The current impacts observed within the project are listed below. Photographic evidence of a selection of these impacts is shown in Figure 7.

- Commercial agriculture;
- Power station dams / impoundments;
- Excavated drains in wetlands;
- Developments (access routes, working areas, pipelines);
- Alien and/or Invasive Plants (AIP);
- Impaired water quality;
- Storm water management; and
- Erosion.

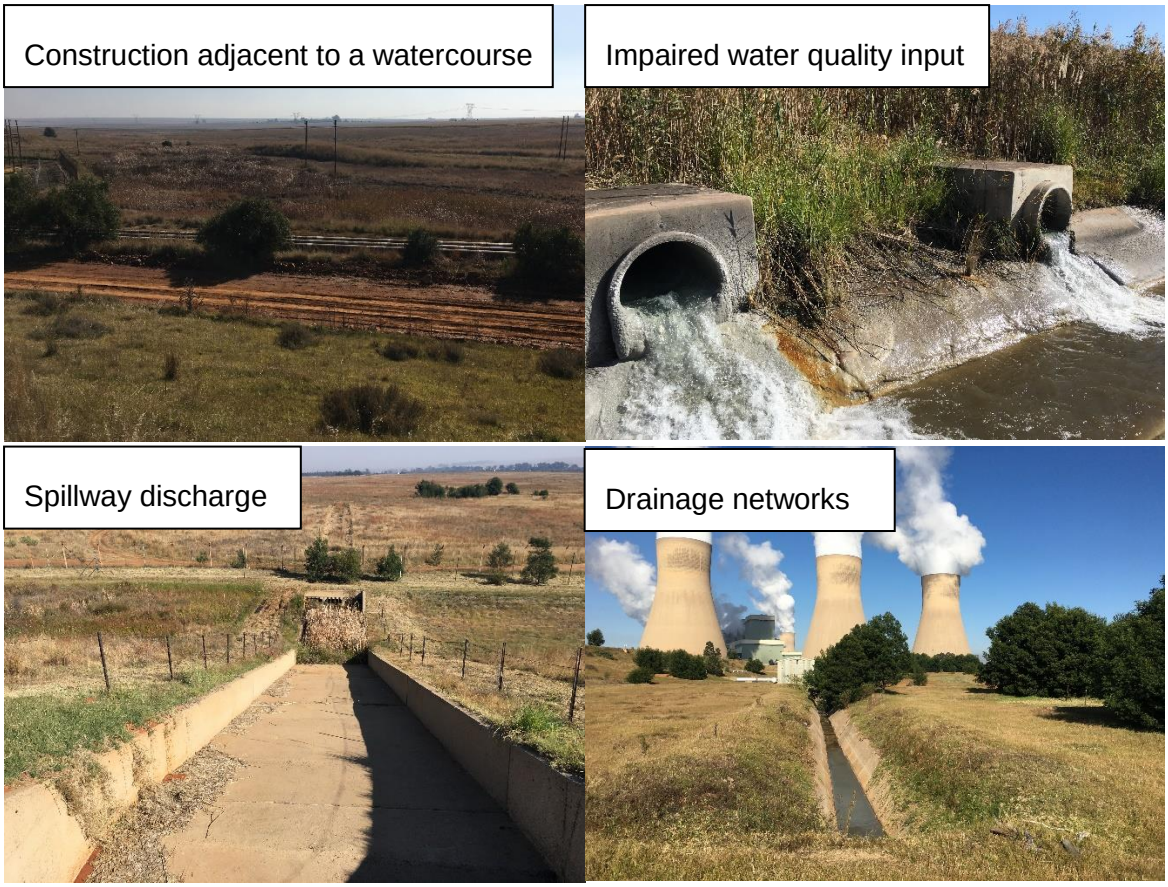



**Figure 7: Photographic evidence of current general impacts observed on site**

## 7.2 Anticipated Impacts

The following list provides a framework for the anticipated major impacts associated with the proposed drains in particular.

1. Loss of wetland areas
    a. Project activities that can cause loss of wetland areas
        i. Vegetation stripping
        ii. Soil excavations
        iii. Digging of foundations
    b. Secondary impacts associated with the loss of wetlands
        i. Loss of ecosystem services
2. Altered hydrological regime
    a. Project aspects that can causes changes to surface hydrology
        i. Vegetation removal
        ii. Soil excavations
        iii. Intercepted surface and interflows by the drain
        iv. Increased interflow from seepage drains
    b. Secondary impacts associated with altered regime
        i. Loss of ecosystem services
        ii. Worsening of the ecological status of wetlands
3. Impaired water quality

a. Project activities that can impact on the local water quality
    i. Clearing of vegetation
    ii. Earth moving (removal and storage of topsoil and overburden)
    iii. Pollution of water resources due to spills and leaks
    iv. Chemical (organic/inorganic) spills
    v. Erosion
    vi. Impaired water quality seepage
b. Secondary impacts associated with impaired water quality
    i. Contaminated soil profile and loss of soil fertility

4. Erosion and sedimentation of water resources
    a. Project activities that can cause increased erosion and sedimentation
        i. Vegetation removal
        ii. Soil excavations and stockpiles
        iii. Erosion
    b. Secondary impacts associated with erosion and sedimentation
        i. Loss of ecosystem services

## 7.3 Impact Assessment

Direct impacts to the watercourses are a key consideration for the risk assessment, these are for the areas that will be excavated to accommodate the seepage drain. Indirect risks that have also be considered for the project, and which are considered to be secondary risks includes aspects such as impaired water quality seepage and altered hydrology.

Dams can typically benefit from the construction of a seepage drain in the foundation (Stephens,2010), which will reduce seepage and improve stability. However, for this project the focus will be to reduce seepage of the dams.

The drain should typically be excavated to a depth that will minimize all possible seepage from the dams (this is unknown at this stage of the project). The drain should be excavated to solid rock, if feasible (Stephens, 2010). In the event that the underlying rock is fissured it can be cleaned or filled with varying mixes i.e. concrete, slush grouting, etc.

According to Stephen (2010) material is then placed in the drain in layers to a maximum 50-75mm thick and to a minimum width of 1m for small dams (i.e. hand laid cores) and layers 75-150mm thick and 2-3m wide for larger dams (i.e. material laid by scoop or scraper and compacted by machinery). These layers should be well compacted, which can be achieved manually or by machines, or a combination of both.

Findings from the DWS aspect and impact register/risk assessment are provided in Table 3, with risks calculated for the High level dam, Ash dam and Low level dam in Table 4, Table 5 and Table 6 respectively.

**Table 3: Aspects assessed for the proposed project**

| Activity | Impact | Aspect |
|---|---|---|
| Construction and operation of Seepage Interception Drains | Loss of wetland areas<br>Loss of seepage / interflow<br>Altered hydrological regime<br>Impaired water quality inputs<br>Decrease in water integrity<br>Loss of ecological services | Removal of vegetation<br>Stripping and stockpiling of top soil<br>Excavation of drain<br>Stockpiling of sub-soil<br>Geotechnical sites<br>Storm water management<br>Contaminated seepage water input<br>Drainage patterns change due to drain<br>Clearing & shaping of drain<br>Cleaning of drain area<br>Mixing & pouring of fill<br>Temporary access routes<br>Temporary working areas<br>Layering of drain fill material<br>Compaction of fill material<br>Additional Associated Infrastructure<br>Operation of equipment and machinery<br>Vehicle activity<br>Domestic and industrial waste<br>Storage of chemicals, mixes and fuel<br>Spills and leaks |

**Table 4: DWS Risk Impact Matrix for the High level dam**

| Aspect | Flow Regime | Water Quality | Habitat | Biota | Severity | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Sig. | Without Mitigation | With Mitigation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | | | | | | | |
| Removal of vegetation | **2** | **2** | **1** | **1** | 1.5 | **2** | **2** | 5.5 | 2 | 2 | **1** | 2 | 7 | 38.5 | **Low** | **Low** |
| Stripping and stockpiling of top soil | 1 | 2 | 1 | 1 | 1.25 | 2 | 2 | 5.25 | 2 | 2 | 1 | 2 | 7 | 36.75 | **Low** | **Low** |
| Excavation of drain | 3 | 3 | 2 | 1 | 2.25 | 2 | 2 | 6.25 | 3 | 4 | 1 | 4 | 12 | 75 | **Moderate*** | **Low** |
| Stockpiling of sub-soil | **1** | **2** | **2** | **1** | 1.5 | **2** | **2** | 5.5 | 2 | 2 | 1 | 2 | 7 | 38.5 | **Low** | **Low** |
| Geotechnical sites | 1 | 2 | 1 | 1 | 1.25 | 1 | 1 | 3.25 | 1 | 1 | 1 | 2 | 5 | 16.25 | **Low** | **Low** |
| Storm water management | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 6 | 3 | 2 | 1 | 3 | 9 | 54 | **Low** | **Low** |
| Contaminated seepage water input | 1 | 3 | 2 | 2 | 2 | 3 | 3 | 8 | 3 | 2 | 1 | 4 | 10 | 80 | **Moderate*** | **Low** |
| Drainage patterns change due to drain | 3 | 2 | 2 | 1 | 2 | 3 | 3 | 8 | 3 | 3 | 1 | 4 | 11 | 88 | **Moderate** | **Low** |
| Clearing & shaping of drain | 1 | 3 | 2 | 1 | 1.75 | 1 | 3 | 5.75 | 2 | 2 | 1 | 3 | 8 | 46 | **Low** | **Low** |
| Cleaning of drain area | 1 | 2 | 1 | 1 | 1.25 | 1 | 3 | 5.25 | 2 | 1 | 1 | 2 | 6 | 31.5 | **Low** | **Low** |
| Mixing & pouring of fill | 1 | 3 | 1 | 1 | 1.5 | 1 | 2 | 4.5 | 2 | 1 | 1 | 2 | 6 | 27 | **Low** | **Low** |
| Temporary access routes | 1 | 2 | 2 | 1 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 2 | 8 | 44 | **Low** | **Low** |
| Temporary working areas | **1** | **2** | **2** | **1** | 1.5 | **1** | **3** | 5.5 | 3 | 2 | 1 | 3 | 9 | 49.5 | **Low** | **Low** |
| Layering of drain fill material | 1 | 2 | 1 | 1 | 1.25 | 1 | 2 | 4.25 | 2 | 2 | 1 | 3 | 8 | 34 | **Low** | **Low** |
| Compaction of fill material | 2 | 2 | 1 | 1 | 1.5 | 1 | 2 | 4.5 | 2 | 1 | 1 | 3 | 7 | 31.5 | **Low** | **Low** |
| Additional Associated Infrastructure | 1 | 1 | 2 | 1 | 1.25 | 1 | 3 | 5.25 | 3 | 2 | 1 | 2 | 8 | 42 | **Low** | **Low** |
| Operation of equipment and machinery | 1 | 2 | 1 | 2 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 2 | 8 | 44 | **Low** | **Low** |
| Vehicle activity | 1 | 2 | 1 | 2 | 1.5 | 2 | 3 | 6.5 | 3 | 2 | 1 | 2 | 8 | 52 | **Low** | **Low** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic and industrial waste | 1 | 2 | 1 | 1 | 1.25 | 1 | 3 | 5.25 | 3 | 2 | 1 | 3 | 9 | 47.25 | **Low** | **Low** |
| Storage of chemicals, mixes and fuel | 1 | 3 | 1 | 1 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 3 | 9 | 49.5 | **Low** | **Low** |
| Spills and leaks | 1 | 3 | 1 | 1 | 1.5 | 2 | 3 | 6.5 | 3 | 2 | 1 | 3 | 9 | 58.5 | **Moderate*** | **Low** |
| **Operational Phase** | | | | | | | | | | | | | | | | |
| Drainage patterns change due to drain | 2 | 2 | 2 | 1 | 1.75 | 3 | 5 | 9.75 | 3 | 2 | 1 | 3 | 9 | 87.75 | **Moderate*** | **Low** |
| Loss of dam seepage | 2 | 2 | 1 | 1 | 1.5 | 2 | 5 | 8.5 | 2 | 2 | 1 | 2 | 7 | 59.5 | **Moderate*** | **Low** |
| Contaminated seepage water input | 1 | 3 | 1 | 2 | 1.75 | 3 | 5 | 9.75 | 4 | 2 | 1 | 3 | 10 | 97.5 | **Moderate** | **Low** |

( * ) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

**Table 5: DWS Risk Impact Matrix for the Ash dam**

| Aspect | Flow Regime | Water Quality | Habitat | Biota | Severity | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Sig. | Without Mitigation | With Mitigation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | | | | | | | |
| Removal of vegetation | **2** | **3** | **2** | **2** | 2.25 | **2** | **2** | 6.25 | 2 | 2 | **1** | 2 | 7 | 43.75 | **Low** | **Low** |
| Stripping and stockpiling of top soil | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 6 | 2 | 2 | 1 | 2 | 7 | 42 | **Low** | **Low** |
| Excavation of drain | 3 | 3 | 2 | 2 | 2.5 | 2 | 2 | 6.5 | 3 | 4 | 1 | 4 | 12 | 78 | **Moderate*** | **Low** |
| Stockpiling of sub-soil | **2** | **2** | **2** | **1** | 1.75 | **2** | **2** | 5.75 | 2 | 2 | 1 | 2 | 7 | 40.25 | **Low** | **Low** |
| Geotechnical sites | 2 | 2 | 2 | 1 | 1.75 | 1 | 1 | 3.75 | 1 | 1 | 1 | 2 | 5 | 18.75 | **Low** | **Low** |
| Storm water management | 3 | 3 | 2 | 1 | 2.25 | 2 | 2 | 6.25 | 3 | 2 | 1 | 3 | 9 | 56.25 | **Moderate** | **Low** |
| Contaminated seepage water input | 2 | 3 | 2 | 2 | 2.25 | 3 | 3 | 8.25 | 3 | 2 | 1 | 4 | 10 | 82.5 | **Moderate** | **Low** |
| Drainage patterns change due to drain | 3 | 2 | 2 | 2 | 2.25 | 3 | 3 | 8.25 | 3 | 3 | 1 | 4 | 11 | 90.75 | **Moderate** | **Low** |
| Clearing & shaping of drain | 3 | 3 | 2 | 1 | 2.25 | 1 | 3 | 6.25 | 2 | 2 | 1 | 3 | 8 | 50 | **Low** | **Low** |
| Cleaning of drain area | 2 | 2 | 1 | 1 | 1.5 | 1 | 3 | 5.5 | 2 | 1 | 1 | 2 | 6 | 33 | **Low** | **Low** |
| Mixing & pouring of fill | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 5 | 2 | 1 | 1 | 2 | 6 | 30 | **Low** | **Low** |
| Temporary access routes | 1 | 2 | 2 | 1 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 2 | 8 | 44 | **Low** | **Low** |
| Temporary working areas | **2** | **2** | **2** | **2** | 2 | **1** | **3** | 6 | 3 | 2 | 1 | 3 | 9 | 54 | **Low** | **Low** |
| Layering of drain fill material | 2 | 2 | 1 | 1 | 1.5 | 1 | 2 | 4.5 | 2 | 2 | 1 | 3 | 8 | 36 | **Low** | **Low** |
| Compaction of fill material | 2 | 2 | 1 | 2 | 1.75 | 1 | 2 | 4.75 | 2 | 1 | 1 | 3 | 7 | 33.25 | **Low** | **Low** |
| Additional Associated Infrastructure | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 6 | 3 | 2 | 1 | 2 | 8 | 48 | **Low** | **Low** |
| Operation of equipment and machinery | 1 | 3 | 2 | 2 | 2 | 1 | 3 | 6 | 3 | 2 | 1 | 2 | 8 | 48 | **Low** | **Low** |
| Vehicle activity | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 7 | 3 | 2 | 1 | 2 | 8 | 56 | **Moderate*** | **Low** |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic and industrial waste | 1 | 2 | 1 | 2 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 3 | 9 | 49.5 | **Low** | **Low** |
| Storage of chemicals, mixes and fuel | 1 | 3 | 1 | 1 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 3 | 9 | 49.5 | **Low** | **Low** |
| Spills and leaks | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 7 | 3 | 2 | 1 | 3 | 9 | 63 | **Moderate*** | **Low** |
| **Operational Phase** | | | | | | | | | | | | | | | | |
| Drainage patterns change due to drain | 3 | 2 | 2 | 2 | 2.25 | 3 | 5 | 10.25 | 3 | 2 | 1 | 3 | 9 | 92.25 | **Moderate** | **Low** |
| Loss of dam seepage | 2 | 2 | 1 | 1 | 1.5 | 2 | 5 | 8.5 | 2 | 2 | 1 | 2 | 7 | 59.5 | **Moderate*** | **Low** |
| Contaminated seepage water input | 1 | 3 | 1 | 2 | 1.75 | 3 | 5 | 9.75 | 4 | 2 | 1 | 3 | 10 | 97.5 | **Moderate** | **Low** |

( * ) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

**Table 6: DWS Risk Impact Matrix for the Low level dam**

| Aspect | Flow Regime | Water Quality | Habitat | Biota | Severity | Spatial scale | Duration | Consequence | Frequency of activity | Frequency of impact | Legal Issues | Detection | Likelihood | Sig. | Without Mitigation | With Mitigation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Construction Phase** | | | | | | | | | | | | | | | | |
| Removal of vegetation | **4** | **3** | **4** | **3** | 3.5 | **2** | **2** | 7.5 | 2 | 2 | **5** | 2 | 11 | 82.5 | **Moderate** | **Moderate** |
| Stripping and stockpiling of top soil | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 7 | 2 | 2 | 5 | 2 | 11 | 77 | **Moderate** | **Moderate** |
| Excavation of drain | 4 | 3 | 4 | 3 | 3.5 | 2 | 2 | 7.5 | 3 | 4 | 5 | 4 | 16 | 120 | **Moderate** | **Moderate** |
| Stockpiling of sub-soil | **2** | **2** | **2** | **2** | 2 | **2** | **2** | 6 | 2 | 2 | 1 | 2 | 7 | 42 | **Low** | **Low** |
| Geotechnical sites | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 4 | 1 | 1 | 5 | 2 | 9 | 36 | **Low** | **Low** |
| Storm water management | 3 | 3 | 3 | 2 | 2.75 | 2 | 2 | 6.75 | 3 | 2 | 5 | 3 | 13 | 87.75 | **Moderate** | **Moderate** |
| Contaminated seepage water input | 2 | 3 | 2 | 2 | 2.25 | 3 | 3 | 8.25 | 3 | 2 | 1 | 4 | 10 | 82.5 | **Moderate** | **Moderate** |
| Drainage patterns change due to drain | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 9 | 3 | 3 | 5 | 4 | 15 | 135 | **Moderate** | **Moderate** |
| Clearing & shaping of drain | 3 | 3 | 3 | 2 | 2.75 | 2 | 3 | 7.75 | 2 | 2 | 5 | 3 | 12 | 93 | **Moderate** | **Moderate** |
| Cleaning of drain area | 2 | 3 | 2 | 2 | 2.25 | 2 | 3 | 7.25 | 2 | 1 | 5 | 2 | 10 | 72.5 | **Moderate*** | **Low** |
| Mixing & pouring of fill | 2 | 3 | 2 | 1 | 2 | 1 | 2 | 5 | 2 | 1 | 5 | 2 | 10 | 50 | **Low** | **Low** |
| Temporary access routes | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 8 | 3 | 2 | 5 | 2 | 12 | 96 | **Moderate** | **Moderate** |
| Temporary working areas | **3** | **3** | **3** | **3** | 3 | **2** | **3** | 8 | 3 | 2 | 5 | 3 | 13 | 104 | **Moderate** | **Moderate** |
| Layering of drain fill material | 3 | 2 | 1 | 1 | 1.75 | 1 | 2 | 4.75 | 2 | 2 | 5 | 3 | 12 | 57 | **Moderate*** | **Low** |
| Compaction of fill material | 2 | 2 | 1 | 1 | 1.5 | 1 | 2 | 4.5 | 2 | 1 | 5 | 3 | 11 | 49.5 | **Low** | **Low** |
| Additional Associated Infrastructure | 2 | 1 | 2 | 1 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 2 | 8 | 44 | **Low** | **Low** |
| Operation of equipment and machinery | 2 | 3 | 1 | 3 | 2.25 | 1 | 3 | 6.25 | 3 | 2 | 1 | 2 | 8 | 50 | **Low** | **Low** |
| Vehicle activity | 1 | 3 | 1 | 3 | 2 | 2 | 3 | 7 | 3 | 2 | 1 | 2 | 8 | 56 | **Moderate*** | **Low** |



| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Domestic and industrial waste | 1 | 2 | 1 | 2 | 1.5 | 1 | 3 | 5.5 | 3 | 2 | 1 | 3 | 9 | 49.5 | **Low** | **Low** |
| Storage of chemicals, mixes and fuel | 1 | 3 | 1 | 2 | 1.75 | 1 | 3 | 5.75 | 3 | 2 | 1 | 3 | 9 | 51.75 | **Low** | **Low** |
| Spills and leaks | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 7 | 3 | 2 | 1 | 3 | 9 | 63 | **Moderate*** | **Low** |
| **Operational Phase** | | | | | | | | | | | | | | | | |
| Drainage patterns change due to drain | 4 | 3 | 2 | 3 | 3 | 3 | 5 | 11 | 3 | 2 | 5 | 3 | 13 | 143 | **Moderate** | **Moderate** |
| Loss of dam seepage | 2 | 2 | 2 | 2 | 2 | 2 | 5 | 9 | 2 | 2 | 1 | 2 | 7 | 63 | **Moderate*** | **Low** |
| Contaminated seepage water input | 1 | 3 | 1 | 2 | 1.75 | 3 | 5 | 9.75 | 4 | 2 | 1 | 3 | 10 | 97.5 | **Moderate** | **Low** |

( * ) denotes - In accordance with General Notice 509 “Risk is determined after considering all listed control / mitigation measures. Borderline Low / Moderate risk scores can be manually adapted downwards up to a maximum of 25 points (from a score of 80) subject to listing of additional mitigation measures detailed below.”

A number of moderate risks (prior to mitigation) were identified for the **High level dam** (Table 7). The proposed drain will not be constructed within a wetland, but adjacent (up-slope) to a channelled valley bottom wetland. Moderate risks were identified for aspects such as excavation of the drain, contamination by seepage, altered drainage patters and impaired water quality. Owing to the fact that there will be no direct impact to a wetland area for the proposed drain, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

**Table 7: Moderate risks (without mitigation) identified for the High level dam**

| Aspect | Without Mitigation | With Mitigation | Mitigation Measures |
|---|---|---|---|
| Excavation of drain | **Moderate** | **Low** | • Demarcate working and access areas.<br>• Avoid wetland areas.<br>• Minimize drain footprint area. |
| Contaminated seepage water input | **Moderate** | **Low** | • Containment of water ingress, & pumping to dam.<br>• Separation of clean and dirty water<br>• Monitor groundwater quality.<br>• Inspect the drains for level of affect. |
| Drainage patterns change due to drain | **Moderate** | **Low** | • Minimize drain footprint area.<br>• Construction during the dry season.<br>• Create temporary storm water channels around working area. Separate clean / dirty water.<br>• Wetland areas must be made No Go areas.<br>• Backfill of the drains must be concurrent (minor lag) with excavation, to limit the extent of the drain.<br>• Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.<br>• Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil. |
| Spills and leaks | **Moderate** | **Low** | • Site induction to include the reporting and cleaning of spills and leaks and general good “housekeeping”.<br>• All chemicals and toxicants during construction must be stored in bunded areas.<br>• All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.<br>• Maintenance and fuelling of vehicles and machinery must be off-site in designated working or fuelling areas.<br>• Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. |
| Loss of dam seepage | **Moderate** | **Low** | This is the aim of the project |

A number of moderate risks (prior to mitigation) were identified for the **Ash dam** (Table 8). The proposed drain is predominantly aligned with an existing gravel access road, lined by *Eucalyptus* trees. The majority of the area proposed for the drain is considered to be considerably disturbed or altered, with only a small portion of the unchanneled valley bottom wetland area being constructed within. Approximately 3ha of the wetland (measuring 54.2ha) will be lost, reflecting a 5.5% wetland loss of this HGM unit.

Moderate risks were identified for aspects such as excavation of the drain, storm water management, contamination by seepage, altered drainage patters, vehicle activity and impaired water quality.

Owing to the fact that only 5.5% of the wetland HGM unit will be lost in order to intercept dam seepage, with the likely area to be lost already in a modified state and partially sustained by storm water input, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

**Table 8: Moderate risks (without mitigation) identified for the Ash dam**

| Aspect | Without Mitigation | With Mitigation | Mitigation Measures |
|---|---|---|---|
| Excavation of drain | **Moderate** | **Low** | • Demarcate working and access areas.<br>• Avoid wetland areas (where possible).<br>• Minimize drain footprint area. |
| Storm water management | **Moderate** | **Low** | • Create temporary storm water channels around working area. Separate clean / dirty water.<br>• Storm water channels and preferential flow paths should be filled with aggregate and/or logs (branches included) to dissipate and slow flows limiting erosion. |
| Contaminated seepage water input | **Moderate** | **Low** | • Containment of water ingress, & pumping to dam.<br>• Separation of clean and dirty water<br>• Monitor groundwater quality.<br>• Inspect the drains for level of affect. |
| Drainage patterns change due to drain | **Moderate** | **Low** | • Minimize drain footprint area.<br>• Construction during the dry season.<br>• Create temporary storm water channels around working area. Separate clean / dirty water.<br>• Wetland areas must be made No Go areas.<br>• Backfill of the drains must be concurrent (minor lag) with excavation, to limit the extent of the drain.<br>• Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.<br>• Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil. |
| Vehicle activity | **Moderate** | **Low** | • Demarcate working and access areas.<br>• Avoid wetland areas.<br>• Construct from existing access routes or disturbed areas.<br>• Create only temporary access routes and working areas.<br>• Vehicles should be inspected regularly for faults and possible leaks, these should be serviced off-site.<br>• Maintenance and fuelling of vehicles must be off-site in designated working or fuelling areas.<br>• Vehicles should be cleaned regularly off-site in designated wash bays. |
| Spills and leaks | **Moderate** | **Low** | • Site induction to include the reporting and cleaning of spills and leaks and general good “housekeeping”.<br>• All chemicals and toxicants during construction must be stored in bunded areas.<br>• All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.<br>• Maintenance and fuelling of vehicles and machinery must be off-site in designated working or fuelling areas. |

| | | | |
|---|---|---|---|
| | | | • Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. |
| Loss of dam seepage | **Moderate** | **Low** | This is the aim of the project |

A number of moderate risks (prior to mitigation) were identified for the **Low level dam** (Table 9). The proposed drain is approximately 8.6ha, with 6ha (70%) of the drain to be constructed in a channelled valley bottom wetland. The most notable (and ecological damning) risk posed by the drain is that drain will intercept / obstruct the movement of water across the system. The loss of wetland area is unavoidable for this drain, and the hydrology of the system will be altered due to the construction of the drain in the system.

A number of Moderate risks (without mitigation) were identified for this drain, with the largest risks stemming from the expect loss of wetland area, and the resulting loss of services and decreased integrity of the system. This wetland unit, although a modified system, presently functions as a well-established wetland system that offers all of the goods and services of a natural wetland of its kind (EnviRoss, 2017).

Owing to the fact that approximately 70% of the drain will be constructed in a moderately modified and well-functioning wetland system, the risks associated with a number of aspects remain Moderate despite the recommended mitigation measures.

**Table 9: Moderate risks (without mitigation) identified for the Low level dam**

| Aspect | Without Mitigation | With Mitigation | |
|---|---|---|---|
| Removal of vegetation | **Moderate** | **Moderate** | • Stripping areas can be demarcated to avoid unnecessary removals (survey pegs).<br>• Keep stripping areas to a minimum footprint area.<br>• Vegetation should be stripped / removed in a phased manner.<br>• Where possible, store vegetation for re-planting and rehab efforts. Impacted areas can be re-vegetated using sods from removed vegetation.<br>• Sloped areas must be re-vegetated, either using removed vegetation or with a grass seed mix consisting of natural endemic species.<br>• Mulch can be used to encourage re-vegetation efforts for re-growth. |
| Stripping and stockpiling of top soil | **Moderate** | **Moderate** | • Removed soils, top soil and subsoil must be stockpiled next to the excavation area separately.<br>• Soil stockpiles should be low and relatively flat to reduce wind and water erosion potential.<br>• Soil stockpiles should be prioritised for backfill and rehabilitation efforts to limit standing time.<br>• Areas with minimal disturbance and negligible signs of compaction can be ripped (to re-vegetate naturally). |
| Excavation of drain | **Moderate** | **Moderate** | • Demarcate working and access areas.<br>• Avoid wetland areas (where possible).<br>• Minimize drain footprint area. |
| Storm water management | **Moderate** | **Moderate** | • Create temporary storm water channels around working area. Separate clean / dirty water.<br>• Storm water channels and preferential flow paths should be filled with aggregate and/or logs |

| | | | |
|---|---|---|---|
| | | | (branches included) to dissipate and slow flows limiting erosion. |
| Contaminated seepage water input | **Moderate** | **Moderate** | • Containment of water ingress, & pumping to dam.<br>• Separation of clean and dirty water<br>• Monitor groundwater quality.<br>• Inspect the drains for level of affect. |
| Drainage patterns change due to drain | **Moderate** | **Moderate** | • Minimize drain footprint area.<br>• Construction during the dry season.<br>• Create temporary storm water channels around working area. Separate clean / dirty water.<br>• Wetland areas must be made No Go areas (where possible).<br>• Backfill of the drains must be concurrent (minor lag) with excavation, to limit the extent of the drain.<br>• Stockpiling should take place outside of the water resources. All stockpiles must be protected from erosion, stored on flat areas where run-off will be minimised, and be surrounded by bunds.<br>• Any exposed earth should be rehabilitated promptly by planting suitable vegetation (vigorous indigenous grasses) to protect the exposed soil.<br>• Create surface and sub-surface flow paths down the wetland, around the drain area. These may include swales and perforated piping. |
| Clearing & shaping of drain | **Moderate** | **Moderate** | • Only “local” soils must be used for the shaping, soils should not be imported from elsewhere.<br>• Restrict activities within the drain area.<br>• Removed material must be moved off-site, avoid the wetland areas.<br>• Conduct clearing and shaping in the dry season.<br>• Contain dirty water, and use this for shaping. Do not discharge dirty water into the wetland. |
| Cleaning of drain area | **Moderate** | **Low** | • Silt traps should be set (downslope) within the wetlands during construction phase.<br>• Signs of excess sediment within the system should be removed manually.<br>• Limit the use of heavy machinery and equipment to clean the drain. |
| Temporary access routes | **Moderate** | **Moderate** | • Make use of existing routes or avoid wetland areas.<br>• Rehabilitation of compacted areas post construction.<br>• Ripping should be done to a maximum depth of 300 mm in two directions at right angles.<br>• Ripping should be conducted during the drier period<br>• After construction, compacted top soil should be ripped and vegetation re-planted or seeds dispersed |
| Temporary working areas | **Moderate** | **Moderate** | • Make use of already disturbed areas or avoid wetland areas.<br>• Rehabilitation of compacted areas post construction.<br>• Ripping should be done to a maximum depth of 300 mm in two directions at right angles.<br>• Ripping should be conducted during the drier period<br>• After construction, compacted top soil should be ripped and vegetation re-planted or seeds dispersed |
| Layering of drain fill material | **Moderate** | **Low** | • Ripping should be done to a maximum depth of 300 mm in two directions at right angles.<br>• Ripping should be conducted during the drier period. |

| | | | |
|---|---|---|---|
| | | | • After construction, compacted top soil should be ripped and vegetation re-planted or seeds dispersed |
| Vehicle activity | **Moderate** | **Low** | • Demarcate working and access areas.<br>• Avoid wetland areas.<br>• Construct from existing access routes or disturbed areas.<br>• Create only temporary access routes and working areas.<br>• Vehicles should be inspected regularly for faults and possible leaks, these should be serviced off-site.<br>• Maintenance and fuelling of vehicles must be off-site in designated working or fuelling areas.<br>• Vehicles should be cleaned regularly off-site in designated wash bays. |
| Spills and leaks | **Moderate** | **Low** | • Site induction to include the reporting and cleaning of spills and leaks and general good "housekeeping".<br>• All chemicals and toxicants during construction must be stored in bunded areas.<br>• All machinery and equipment should be inspected regularly for faults and possible leaks, these should be serviced off-site.<br>• Maintenance and fuelling of vehicles and machinery must be off-site in designated working or fuelling areas.<br>• Have action plans on site, and training for contactors and employees in the event of spills, leaks and other impacts to the aquatic systems. |
| Loss of dam seepage | **Moderate** | **Low** | This is the aim of the project |

## 7.4 General mitigation measures to be implemented for the project.

- Prevent uncontrolled access of vehicles through the wetlands that can cause a significant adverse impact on the hydrology and functioning of the systems;
- Laydown yards, camps and storage areas must be beyond the water resource areas and associated buffers where applicable;
- As much material must be pre-fabricated and then transported to site to avoid the risks of contamination associated with mixing, pouring and the storage of chemicals and compounds on site;
- All contractors and employees should undergo induction which is to include a component of environmental awareness. The induction is to include aspects such as the need to avoid littering, the reporting and cleaning of spills and leaks and general good "housekeeping";
- Adequate sanitary facilities and ablutions must be provided for all personnel throughout the project area. Use of these facilities must be enforced (these facilities must be kept clean so that they are a desired alternative to the surrounding vegetation);
- No dumping of construction material on-site may take place;
- All waste generated on-site during construction must be adequately managed. Separation and recycling of different waste materials should be supported; and
- Temporary and permanent erosion control methods may include silt fences, flotation silt curtains, retention basins, detention ponds, interceptor ditches, seeding and sodding, riprap of exposed embankments, erosion mats, and mulching.

# 8 CONCLUSIONS

The Biodiversity Company was commissioned to conduct a wetland assessment as part of the BA and WULA process for the proposed Seepage Interception Drains for the Duvha Power Station. A single dry season survey was conducted in early June 2017.

A baseline wetland assessment was completed by EnviRoss CC which has been considered to supplement the requirements of this study.

The baseline study identified and delineated seven (7) HGM units for the area. Only four (4) HGM units were considered for this study, these would be either directly or indirectly impact on by the proposed drains. All the wetlands within the project area are Moderately modified (Class C). The ecological functioning of the wetlands was viewed as a moderate to high ecological service level.

The construction of seepage interception drains is proposed for four (4) dams. The drain proposed for the raw water dam will not have a direct impact on the delineated wetland areas, and the risks posed by the drain for this dam are expected to be low. In addition to this, there is no preferential flow path that stems from the raw water dam to a wetland area. As a result of this, no risk assessment was conducted for the raw water dam.

Direct impacts to the watercourses are a key consideration for the risk assessment, these are for the areas that will be excavated to accommodate the seepage drains. Indirect risks that have also be considered for the project, and which are considered to be secondary risks includes aspects such as impaired water quality seepage and altered hydrology.

A number of moderate risks (prior to mitigation) were identified for the **High level dam**. The proposed drain will not be constructed within a wetland, but adjacent (up-slope) to a channelled valley bottom wetland. Owing to the fact that there will be no direct impact to a wetland area for the proposed drain, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

A number of moderate risks (prior to mitigation) were identified for the **Ash dam**. The proposed drain is predominantly aligned with an existing gravel access road, lined by *Eucalyptus* trees. The majority of the area proposed for the drain is considered to be considerably disturbed or altered, with only a small portion of the unchanneled valley bottom wetland area being constructed within. Approximately 3ha of the wetland (measuring 54.2ha) will be lost, reflecting a 5.5% wetland loss of this HGM unit.

Owing to the fact that only 5.5% of the wetland HGM unit will be lost in order to intercept dam seepage, with the likely area to be lost already in a modified state and partially sustained by storm water input, and also taking into account the prescribed mitigation measures, all Moderate risks were re-allocated a Low risk.

A number of moderate risks (prior to mitigation) were identified for the **Low level dam**. The proposed drain is approximately 8.6ha, with 6ha (70%) of the drain to be constructed in a channelled valley bottom wetland. The most notable (and ecological damning) risk posed by the drain is that drain will intercept / obstruct the movement of water across the system. The loss of wetland area is unavoidable for this drain, and the hydrology of the system will be altered due to the construction of the drain in the system.

Owing to the fact that approximately 70% of the drain will be constructed in a moderately modified and well-functioning wetland system, the risks associated with a number of aspects remain Moderate despite the recommended mitigation measures.

The baseline study determined that this wetland unit functions as a well-established wetland system that offers all of the goods and services of a natural wetland of its kind.

# 9 REFERENCES

Department of Water Affairs and Forestry (DWS). (2005). A practical field procedure for identification and delineation of wetlands and riparian areas. Pretoria: Department of Water Affairs and Forestry.

EnviRoss CC. 2017. Eskom Generation, Duvha Power Station. Wetland surveys. Report author: Dr M Ross (Pr Sci Nat); Dr T Ross. Report Ref: Duvha_Wet201606. Date: Feb 2017

Stephens, T. 2010. Manual on small earth dams A guide to siting, design and construction. FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS Rome, 2010

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

# DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

Riparian Habitat and Wetland Delineation Impact Assessment for the Proposed Seepage Interception Drains at Duvha Power Station

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

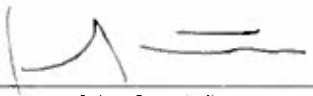
## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | The Biodiversity Company | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | | Percentage Procurement recognition | |
| Specialist name: | Andrew Husted | | | |
| Specialist Qualifications: | MSc Aquatic Health | | | |
| Professional affiliation/registration: | SACNASP (Pr Sci Nat) – 400213/11 | | | |
| Physical address: | 777 Peridot Street, Jukskei Park | | | |
| Postal address: | As above | | | |
| Postal code: | 2153 | Cell: | 0813191225 | |
| Telephone: | | Fax: | 0865271965 | |
| E-mail: | andrew@thebiodiversitycompany.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, __Andrew Husted_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

The Biodiversity Company

Name of Company:

28 May 2019

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, ANDREW HUSTED, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

The Biodiversity Company

Name of Company

29 May 2019

Date

Signature of the Commissioner of Oaths

2019-05-29

Date

SOUTH AFRICAN POLICE SERVICE
CLIENT SERVICE CENTRE
2019 -05- 29
DOUGLASDALE
SOUTH AFRICAN POLICE SERVICE

**Appendix D3 – Heritage Impact Assessment**

# *HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED SEEPAGE INTERCEPTION DRAINS AT DUVHA POWER STATION, EMALAHLENI MUNICIPALITY, MPUMALANGA PROVINCE*

Phase 1 – Heritage Impact Assessment

**Issue Date -** 31 May 2019

**Revision No. -** ver 0.2

**Project No**. - 240 HIA

PGS Heritage (Pty) Ltd
PO Box 32542 Totiusdal 0134, T +27 12 332 5305 F: +27 86 675 8077
Reg No 2003/008940/07

***Declaration of Independence***

*The report has been compiled by PGS Heritage (Pty) Ltd, an appointed Heritage Specialist for Nemai Consulting for the proposed Seepage Interception Drains at Duvha Power Station. The views stipulated in this report are purely objective and no other interests are displayed during the decision-making processes discussed in the Heritage Impact Assessment Process.*

*I, Wouter Fourie, declare that –*

*General declaration:*

- *I act as the independent archaeological specialist in this application*
- *I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant*
- *I declare that there are no circumstances that may compromise my objectivity in performing such work;*
- *I have expertise in conducting archaeological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;*
- *I will comply with the Act, Regulations and all other applicable legislation;*
- *I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;*
- *I have no, and will not engage in, conflicting interests in the undertaking of the activity;*
- *I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;*
- *I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;*
- *I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not*
- *All the particulars furnished by me in this form are true and correct;*
- *I will perform all other obligations as expected of an archaeological specialist in terms of the Act and the constitutions of my affiliated professional bodies; and*
- *I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.*

*Disclosure of Vested Interest*

- *I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;*

**HERITAGE CONSULTANT -** PGS Heritage (Pty) Ltd

**PRINCIPAL HERITAGE PRACTITIONER –** Wouter Fourie

**SIGNATURE -** _____

**CONTACT PERSON -** Jennifer Kitto
Tel - +27 (0) 12 332 5305
Email - jennifer@pgsheritage.co.za

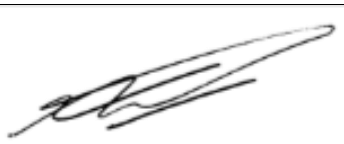
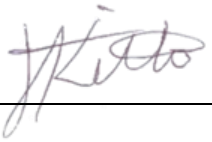
**SIGNATURE -** _____

**ACKNOWLEDGEMENT OF RECEIPT**

**CLIENT -** Nemai Consulting

**CONTACT PERSON -** Samantha Gerber
Tel - +27 (0) 11 781 1730
Fax - +27 (0) 11 781 1731
Email - samanthag@nemai.co.za

**SIGNATURE -** _____

| | | | |
|---|---|---|---|
| **Date -** | 31 May 2019 | | |
| **Document Title -** | **Heritage Impact Assessment for the Proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province** | | |
| **Control** | **Name** | **Signature** | **Designation** |
| **Project Sponsor** | Wouter Fourie |  | Heritage Specialists/ Principal Investigator |
| **Author** | Jennifer Kitto |  | Heritage Specialist |
| **Reviewed** | Samantha Gerber | | Environmental Consultant |

**EXECUTIVE SUMMARY**

PGS Heritage (Pty) Ltd (PGS) was appointed by Nemai Consulting to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Assessment Report (BA) for the proposed development of Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province.

No heritage sites were identified inside the study area. However, two heritage sites were identified just outside the boundary of one of the study areas. These include the remains of a demolished farmstead, most likely of recent to modern date (**DUV 001** of Low heritage significance), and a burial ground, consisting of 11 graves, (**DUV 002** of High heritage significance).

The identified burial ground is rated as a having High/Medium heritage significance as well as being Generally Protected A (GP.A). Mitigation measures and permits are therefore required before it may be affected or moved/destroyed, thus this site is considered as a "no go" area until further mitigation is implemented.

A preliminary investigation based on the SAHRIS palaeosensitivity map identified the presence of geological deposits of both Low and Very High palaeontological sensitivity underlying the location of the four proposed drains. Therefore, a detailed desktop assessment by a professional palaeontologist would be required before construction. This will confirm the initial sensitivity assessment and recommend specific mitigation measures to be undertaken before construction. A finds management protocol may need to be developed for the construction activities.

Provided that the recommended mitigation measures are followed, it is considered that the proposed development will have a LOW impact on heritage resources and therefore the development can proceed.

***Extent of mitigation***

Mitigation will be required for **DUV 002** (burial grounds)

- Demarcate the site as a "no go" area, with a 30-meter buffer and a fence.
- It is also recommended that the Environmental Control Officer (ECO) monitor construction at this location.

- If the graves will be disturbed in any way during construction or operation, and a buffer is not possible, a grave relocation process will need to take place.

Mitigation may be required for the geological formations rated as Very High Sensitivity for palaeontology which underlie a portion of the study area. This would be confirmed by the required desktop Palaeontological Impact Assessment study to be undertaken before construction commencdes.

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This report has been compiled taking into account the National Environmental Management Act (Act No. 107 of 1998)(NEMA) Appendix 6 requirements for specialist reports as indicated in the table below.

| NEMA Regulations (2014, amended 2017) - Appendix 6 | Relevant section in report |
|---|---|
| Details of the specialist who prepared the report | Page 2 of Report – Contact details and company |
| The expertise of that person to compile a specialist report including a curriculum vitae | Section 1.2 – refer to Appendix B |
| A declaration that the person is independent in a form as may be specified by the competent authority | Page 2 of the report |
| An indication of the scope of, and the purpose for which, the report was prepared | Section 1.1 |
| The date and season of the site investigation and the relevance of the season to the outcome of the assessment | Section 6 |
| A description of the methodology adopted in preparing the report or carrying out the specialised process | Section 3 |
| The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure | Section 4.2, 5 and 6.1 |
| An identification of any areas to be avoided, including buffers | Section 7 |
| A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section – Figure 15, 16, 17 and 18 |
| A description of any assumptions made and any uncertainties or gaps in knowledge; | Section 1.3 |
| A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment | Section 6 |
| Any mitigation measures for inclusion in the EMPr | Section 6 |
| Any conditions for inclusion in the environmental authorisation | Section 7 and 9 |
| Any monitoring requirements for inclusion in the EMPr or environmental authorisation | Section 9 |
| A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and | Section 10 |
| If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan | |
| A description of any consultation process that was undertaken during the course of carrying out the study | Not applicable. A public consultation process was handled as part of the EIA and EMP process. |
| A summary and copies if any comments that were received during any consultation process | Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised. |
| Any other information requested by the competent authority. | Not applicable. |

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**List of Appendices**

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# 1 INTRODUCTION

PGS Heritage (Pty) Ltd (PGS) was appointed by Nemai Consulting (Pty) Ltd to undertake a Heritage Impact Assessment (HIA) that forms part of the Basic Assessment Report (BAR) for the development of the Proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province.

No heritage sites[1] were identified inside the study area. However, two heritage sites were identified just outside the boundary of one of the study areas (Ash Dam servitude). These include the remains of a demolished farmstead, most likely of recent to modern date (DUV001 of Low heritage significance), and a burial ground, consisting of 11 visible graves, (DUV002 of High heritage significance).

## 1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area and as a result help determine if the proposed layout is viable. The HIA aims to inform the BAR in the development of a comprehensive Environmental Management Programme (EMPr) to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop the heritage resources within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

## 1.2 Specialist Qualifications

This HIA was compiled by PGS.

The staff at PGS has a combined experience of nearly 80 years in the heritage consulting industry. PGS and its staff have extensive experience in managing HIA processes and will only undertake heritage assessment work where they have the relevant expertise and experience to undertake that work competently.

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[1] *Heritage site as used in this report refers to a place/locality where a heritage resource occurs and not a declared heritage site as contemplated by s2 of the NHRA: "s2(xviii) heritage site" means a place declared to be a national heritage site by SAHRA or a place declared to be a provincial heritage site by a provincial heritage resources authority.*

Jennifer Kitto, co-author, has 19 years' experience in the heritage sector, a large part of which involved working for a government department responsible for administering the National Heritage Resources Act, No 25 of 1999. She is therefore well-versed in the legislative requirements of heritage management. She holds a BA in Archaeology and Social Anthropology and a BA (Hons) in Social Anthropology.

Mr. Wouter Fourie, the Project Coordinator, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited as a Principal Investigator; he is further an Accredited Professional Heritage Practitioner with the Association of Professional Heritage Practitioners (APHP).

Refer to **Appendix B** for CV's.

### 1.3 Assumptions and Limitations

Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the development area. Various factors account for this, including the subterranean nature of some archaeological sites. As such, should any heritage features and/or objects not included in the present inventory, be located or observed, a heritage specialist must immediately be contacted.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question, which also applies to graves and burial grounds. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

It should be noted that access to certain areas of the study area (specifically the Ash Dam servitude area) was hampered by dense vegetation, viz. stands of black wattle and blue gum trees.

### 1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation -

i. National Environmental Management Act (NEMA) Act 107 of 1998
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. GNR 982 of the 2014 EIA Regulations, as amended in 2017 (Government Gazette 38282) promulgated under the NEMA:
    a. Basic Assessment Report (BAR) – Regulations 19 and 23
    b. Environmental Scoping Report (ESR) – Regulation 21
    c. Environmental Impacts Report (EIR) – Regulation 23
    d. Environmental Management Programme (EMPr) – Regulations 19 and 23
ii. NHRA:
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. MPRDA Regulations of 2014:
    a. Environmental reports to be compiled for application of mining right – Regulation 48
    b. Contents of scoping report– Regulation 49
    c. Contents of environmental impact assessment report – Regulation 50
    d. Environmental management programme – Regulations 51
    e. Environmental management plan – Regulation 52
iv. The Regulations relating to the Management of Human Remains (GNR 363 of 2013 in Government Gazette 36473) promulgated under the National Health Act (Act No. 61 of 2003)
    a. Exhumation and Reburial of Human Remains - Regulations 26, 27 and 28

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority, and that an HIA will be required if a development triggers any of the development types listed in s38 of the NHRA. Section 34-36 further stipulates the protections afforded to structures older than 60 years, archaeological, palaeontological, meteorites, graves and burial grounds, as well as the process to be followed if these resources need to be disturbed.

NEMA states that an integrated EMP should, (23 -2 (b)) "…identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage". In addition, the NEMA (No 107 of 1998) and the GNR 982 (Government Gazette 38282, 14 December

2014) state that, “the objective of an environmental impact assessment process is to, … identify the location of the development footprint within the preferred site … focussing on the geographical, physical, biological, social, economic, cultural and heritage aspects of the environment” (GNR 982, Appendix 3(2)(c), emphasis added). In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive legally compatible HIA report is compiled.

### 1.5 Terminology and Abbreviations

*Archaeological resources*

This includes -

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;

ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;

iii. wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;

iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

*Cultural significance*

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

*Development*

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including -

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;

ii. carrying out any works on or over or under a place;

iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;

iv. constructing or putting up for display signs or boards;

v. any change to the natural or existing condition or topography of land; and

vi. any removal or destruction of trees, or removal of vegetation or topsoil.

*Earlier Stone Age*

The archaeology of the Stone Age, between 400 000 and 2 500 000 years ago.

*Fossil*

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

*Heritage*

That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999.

*Heritage resources*

This means any place or object of cultural significance.

*Holocene*

The most recent geological time period which commenced 10 000 years ago.

*Later Stone Age*

The archaeology of the last 30 000 years, associated with fully modern people.

*Late Iron Age (Early Farming Communities)*

The archaeology of the last 1000 years up to the 1800s, associated with people who carried out iron working and farming activities such as herding and agriculture.

*Middle Stone Age*

The archaeology of the Stone Age between 30 000-300 000 years ago, associated with early modern humans.

*Palaeontology*

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

| ***Abbreviations*** | ***Description*** |
|---|---|
| **AIA** | Archaeological Impact Assessment |
| **ASAPA** | Association of Southern African Professional Archaeologists |
| **CRM** | Cultural Resource Management |
| **DEA** | Department of Environmental Affairs |
| **EIA practitioner** | Environmental Impact Assessment Practitioner |
| **EIA** | Environmental Impact Assessment |
| **ESA** | Earlier Stone Age |
| **GPS** | Global Positioning System |
| **HIA** | Heritage Impact Assessment |
| **I&AP** | Interested & Affected Party |
| **LSA** | Later Stone Age |
| **LIA** | Late Iron Age |
| **MSA** | Middle Stone Age |
| **MIA** | Middle Iron Age |
| **NEMA** | National Environmental Management Act |

| | |
|---|---|
| **NHRA** | National Heritage Resources Act |
| **PIA** | Palaeontological Impact Assessment |
| **PHRA** | Provincial Heritage Resources Authority |
| **ROD** | Record of Decision |
| **SADC** | Southern African Development Community |
| **SAHRA** | South African Heritage Resources Agency |

Refer to **Appendix A** for further discussions on heritage management and legislative frameworks.

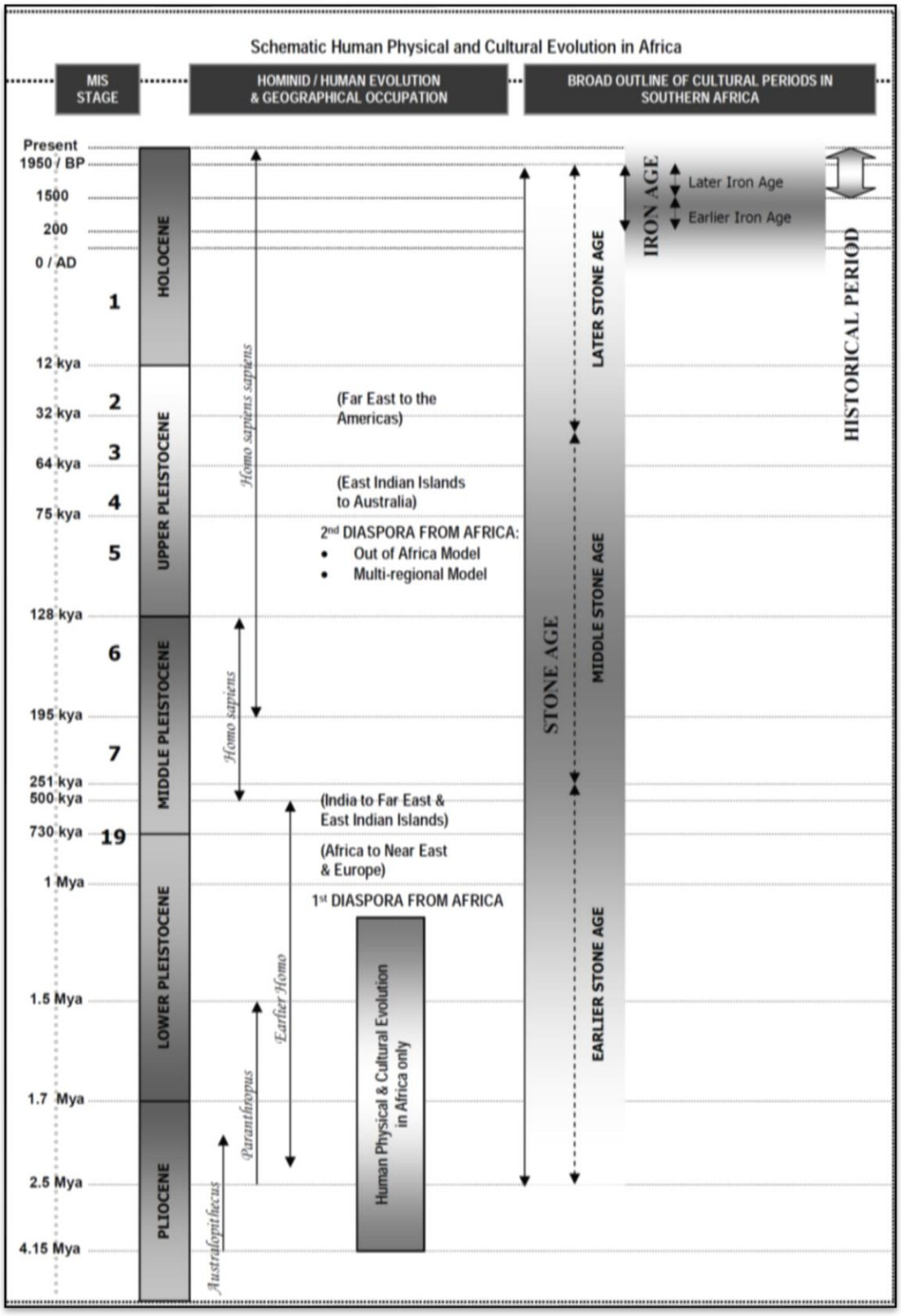


*Figure 1: Human and Cultural Timeline in Africa (Morris, 2008).*

# 2 TECHNICAL DETAILS OF THE PROJECT

## 2.1 Project Description

Duvha Power Station is a coal-fired power plant operated by Eskom Holdings SOC (Ltd) in Witbank, Mpumalanga Province. Nemai Consulting has been appointed as the independent Environmental Assessment Practitioner (EAP) to conduct the Environmental Authorisation (EA) and Water Use License (WUL) for the Duvha seepage interception drains, located in the Duvha Power Station.

Duvha Power Station has been in operation for a period of 36 years. Duvha produces wet ash that gets pumped to the ash dam which is located 1.7km east of the Witbank Dam. The settled water is then decanted to the low-level ash water return dam (LLAWRD) from where it gets pumped back to the station to produce more wet ash slurry. The Power Station ash dam is experiencing seepage water which is polluting the ground water towards the Witbank dam and mitigation measures have to be taken to prevent the continuous ground water seepage. A multi-disciplinary concept design to prevent seepage water is to be carried out to support the BAR and Water Use Licence Application (WULA) Processes as the drain would be within 500m of wetlands. Construction of the seepage interception drains at the various dams is necessary as the Department of Environmental Affairs (DEA) instructed Eskom to mitigate and prevent the ground water pollution.

In order to limit groundwater seepage from the existing large Ash Dam, as well as the high-level ash water return dam (HLAWRD), low-level ash water return dam LLAWRD and the raw water dam, it is proposed to construct cut-off interceptor drains along sections of the perimeter of each of these dams and to convey the intercepted water to designated discharge points (**Figure 2**, **Figure 3** and **Figure 4**).

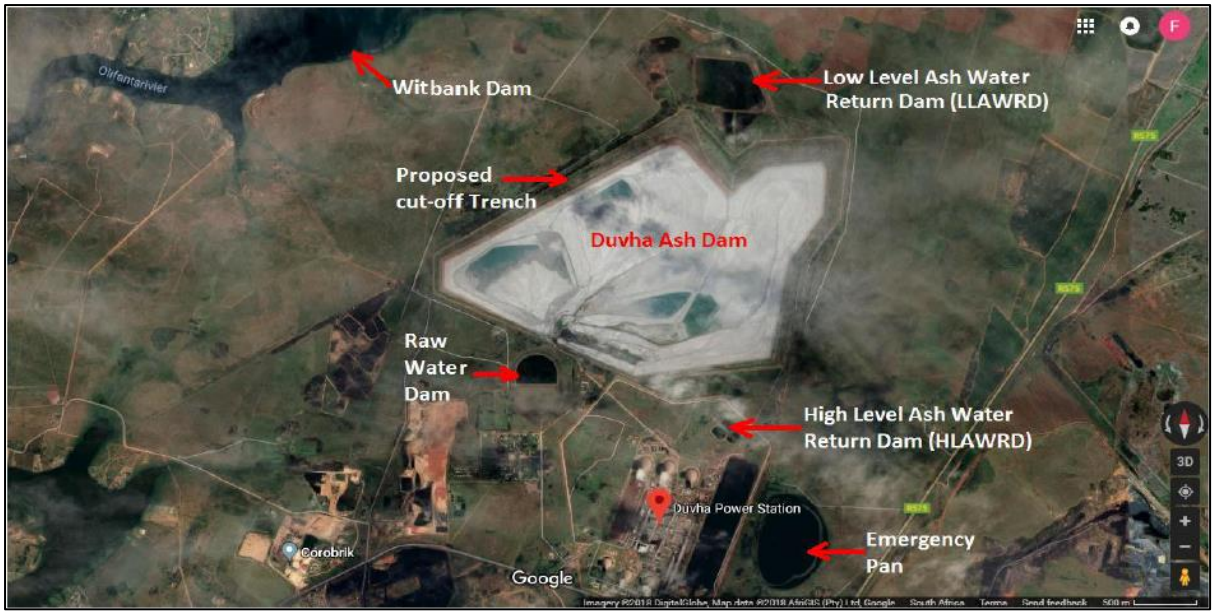


*Figure 2: Duvha Power Station (Site Layout), showing the location of the affected return water dams in relation to the Ash Dam (Map provided by Eskom, 2019)*


*Figure 3: Google Earth image showing the proposed servitude footprint areas for the seepage interception drains (yellow, green, blue and pink polygons) (Map provided by Nemai Consulting, 2017).*

**Duvha Seepage Interceptor Drain Design**

The design and construction of the Seepage Interception Drain will require the following design assumptions:

- Length of trench L = 2400m
- Length of Channel to daylight = 2000m
- Depth of trench D = 8.0m
- Manning pipe coefficient roughness n = 0.018

*Design Approach*

Four possible options were evaluated:

- Option 1 - Provision of an HDPE Class C Liner on top of Duvha's Ash Dam;
- Option 2 - Open Cut-off Trench;
- Option 3 - Closed Subsoil Cut-off Drain; and
- Option 4 - Do nothing

The closed subsoil cut-off drain is deemed the best option as Option 1 is unacceptable from a station availability point of view and Option 3 is therefore used for the Concept Design.

The design approach is to excavate an open trench down to bedrock and place a drain pipe on the bedrock with an HDPE cut-off curtain on the downstream side to intercept and drain the water. The trench will be backfilled with an open channel on the final surface to drain the stormwater. Two HDPE subsoil drainpipes just above the bedrock will be used, an upper slotted drain pipe and a larger lower unslotted pipe to lead the water away. The pipes will be led into manholes spaced at 200m intervals where the upper pipe's flow will fall by gravity into the lower pipe of the next segment (**Figure 4**).

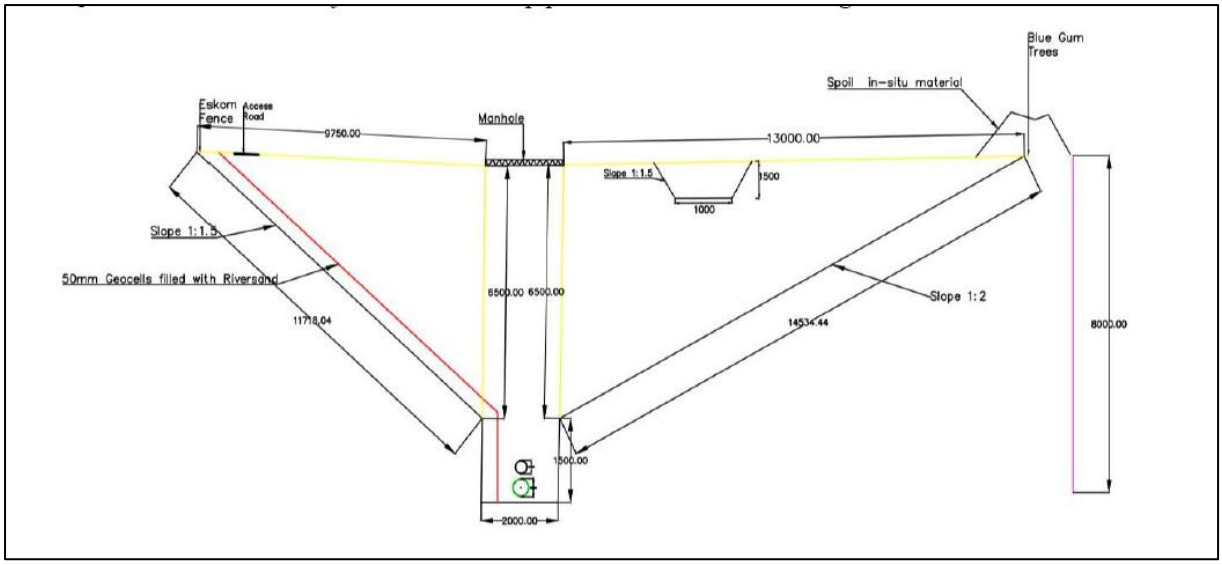


*Figure 4: Conceptual design of seepage interceptor drain (from Eskom Concept Design Report, 2019)*

## 2.2 Site Description

The Duvha Power Station is located roughly 13 km south-east of Witbank, between the R544 and the R575 roads. The proposed seepage drains will be constructed in the servitude areas around the ash dam and the three associated return water dams located around the Duvha Power Station. The study area therefore consists of the servitude areas around each of the affected dams: the Ash Dam (yellow polygon), the LLWRD (green polygon), the HLWRD (pink polygon) and the Raw Water Dam (blue polygon) (**Figure 3**). The servitude area for all four dams, as well as the area between the dams, has been disturbed previously by the construction of the dams and related infrastructure such as pipelines roads and ditches/drainage channels.

The general area surrounding the Duvha Power Station consists of the following: slightly to moderately undulating plains of degraded grassland (Moist Sandy Highveld Grassland), with wetlands, pans and rivers. The Witbank Dam is located 1,7km north-west of the study area. The surrounding land use includes mines and quarries and commercial cultivated land, interspersed with a few small villages associated with these mines and well-developed road and rail infrastructure (**Figure 5** to **Figure 11**).

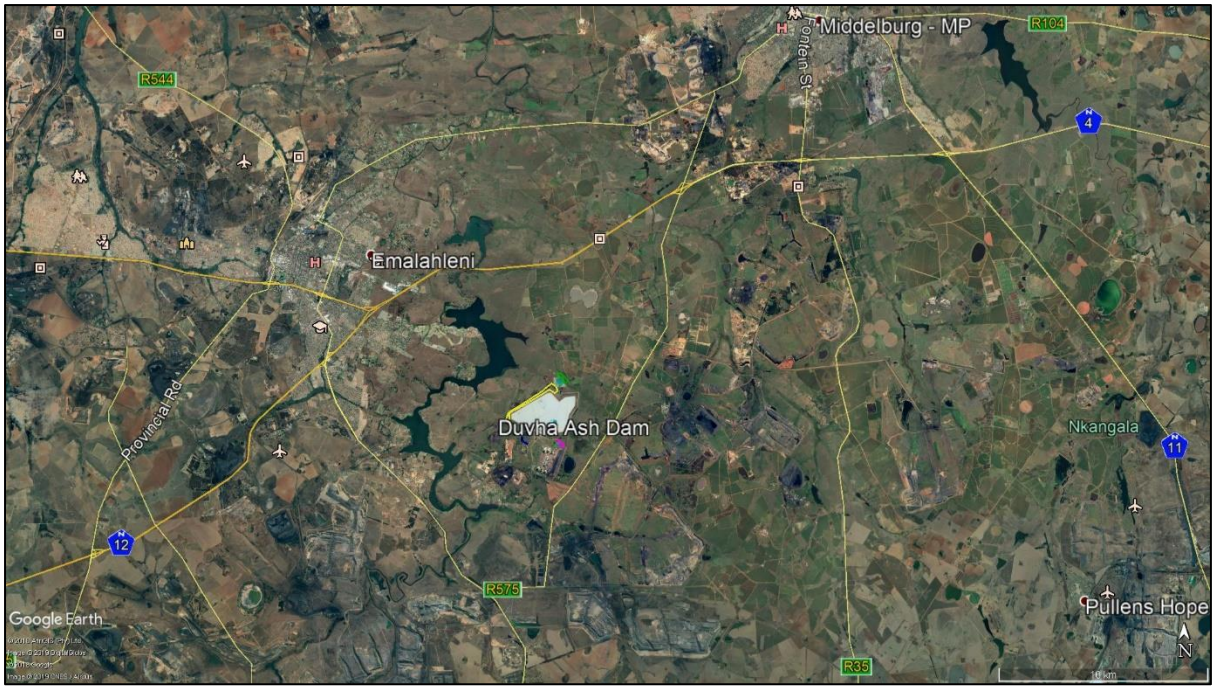


*Figure 5: Regional Location of Duvha Ash Dam*


*Figure 6: View of Ash Dam from outside the servitude north-western boundary*


*Figure 7: View of vlei at south-west end of the Ash Dam servitude*


*Figure 8: View of road and ditch in servitude of Ash Dam*


*Figure 9: View of road and pipeline running along Low-level Water Return Dam servitude*


*Figure 10: View from top of Raw Water Dam, inside the servitude area, towards the road*


*Figure 11: View of High-level Water Return Dam servitude, showing pipeline and ditch*

## 3 ASSESSMENT METHODOLOGY

The section below outlines the assessment methodologies utilised in the study.

### 3.1 Methodology for Assessing Heritage Site Significance

The applicable maps, tables and figures are included, as stipulated in NHRA and NEMA. The HIA process consists of three steps:

Step I – Literature Review - The background information to the field survey relies greatly on the Heritage Background Research.

Step II – Physical Survey - A physical survey was conducted predominantly by vehicle and on foot through the four study areas by an experienced team of two staff, which aimed at locating and documenting sites falling within and adjacent to the proposed development footprint.

Step III – The final step involved the recording and documentation of relevant archaeological resources, the assessment of resources in terms of the HIA criteria and report writing, as well as mapping and constructive recommendations.

The significance of the identified heritage sites is based on four main criteria -

- Site integrity (i.e. primary vs. secondary context),
- Amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m$^2$
    - Medium - 10-50/50m$^2$

- High - >50/50m$^2$
- Uniqueness; and
- Potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows -

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development activity position;
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site.

Impacts on these sites by the development will be evaluated as follows –

*Site Significance*

Site significance classification standards prescribed by the SAHRA (2006) and approved by the ASAPA for the Southern African Development Community (SADC) region, were used for the purpose of this report.

*Table 1: Site significance classification standards as prescribed by SAHRA.*

| FIELD RATING | GRADE | SIGNIFICANCE | RECOMMENDED MITIGATION |
|---|---|---|---|
| National Significance (NS) | Grade 1 | | Conservation; National Site nomination |
| Provincial Significance (PS) | Grade 2 | | Conservation; Provincial Site nomination |
| Local Significance (LS) | Grade 3A | High Significance | Conservation; Mitigation not advised |
| Local Significance (LS) | Grade 3B | High Significance | Mitigation (Part of site should be retained) |
| Generally Protected A (GP.A) | | High / Medium Significance | Mitigation before destruction |
| Generally Protected B (GP.B) | | Medium Significance | Recording before destruction |
| Generally Protected C (GP.A) | | Low Significance | Destruction |

### 3.2 Methodology for Impact Assessment

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology was used to describe impacts for each of the above-mentioned assessment criteria. A summarised explanation of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the above-mentioned criteria is given in **Table 2**.

*Table 2: Impact Assessment Criteria*

| CRITERIA | CATEGORIES | EXPLANATION |
|---|---|---|
| Overall nature | **Negative** | Negative impact on affected biophysical or human environment. |
| | **Positive** | Benefit to the affected biophysical or human environment. |
| Type | **Direct** | Are caused by the action and occur at the same time and place. |
| | **Indirect or Secondary** | Are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. May include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems. |
| | **Cumulative** | Is the impact on the environment, which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. |
| Spatial Extent over which impact may be experienced | **Site** | Immediate area of activity incorporating a 50m zone which extends from the edge of the affected area. |
| | **Local** | Area up to and/or within 10km of the 'Site' as defined above. |
| | **Regional** | Entire community, drainage basin, landscape etc. |
| | **National** | South Africa. |
| Duration of impact | **Short-term** | Impact would last for the duration of activities such as land clearing, land preparation, fertilising, weeding, pruning and thinning. Quickly reversible. |
| | **Medium-term** | Impact would after the project activity such as harvesting. Reversible over time. |
| | **Long-term** | Impact would continue beyond harvesting/ extraction of the trees. |
| | **Permanent** | Impact would continue beyond decommissioning. |
| Severity | **Low, Medium, High Negative** | Based on separately described categories examining whether the impact is destructive or benign, whether it destroys the impacted environment, alters its functioning or slightly alters the environment itself. |
| | **Low, Medium, High Positive** | |
| Reversibility | **Completely Reversible** | The impact can be completely reversed with the implementation of correct mitigation and rehabilitation measures. |
| | **Partly Reversible** | The impact can be partly reversed providing mitigation measures are implemented and rehabilitation measures are undertaken |

| | | |
|---|---|---|
| Irreplaceable Loss | **Irreversible** | The impact cannot be reversed, regardless of the mitigation or rehabilitation measures. |
| | **Resource will not be lost** | The resource will not be lost or destroyed provided mitigation and rehabilitation measures are implemented. |
| | **Resource may be partly destroyed** | Partial loss or destruction of the resource will occur even though all management and mitigation measures are implemented. |
| | **Resource cannot be replaced** | The resource cannot be replaced no matter which management or mitigation measures are implemented. |
| Probability of occurrence | **Unlikely** | <40% probability. |
| | **Possible** | 40% probability. |
| | **Probable** | >70% probability. |
| | **Definite** | >90% probability. |
| Mitigation Potential<br><br>[i.e. the ability to manage or mitigate an impact given the necessary resources and feasibility of application.] | **High or Completely Mitigable** | Relatively easy and cheap to manage. Specialist expertise or equipment is generally not required.<br>The nature of the impact is understood and may be mitigated through the implementation of a management plan or through 'good housekeeping'. Regular monitoring needs to be undertaken to ensure that any negative consequences remain within acceptable limits.<br>The significance of the impact after mitigation is likely to be low or negligible. |
| | **Moderate or Partially Mitigable** | Management of this impact requires a higher level of expertise and resources to maintain impacts within acceptable levels. Such mitigation can be tied up in the design of the Project.<br>The significance of the impacts after mitigation is likely to be low to moderate.<br>May not be possible to mitigate the impact entirely, with a residual impact(s) resulting. |
| | **Low or Unmitigable** | Will not be possible to mitigate this impact entirely regardless of the expertise and resources applied.<br>The potential to manage the impact may be beyond the scope of the Project.<br>Management of this impact is not likely to result in a measurable change in the level of significance. |
| Impact Significance | **Negligible** | - |
| | **Low** | Largely of HIGH mitigation potential, after considering the other criteria. |
| | **Moderate** | Largely of MODERATE or partial mitigation potential after considering the other criteria. |
| | **Substantial** | Largely of LOW mitigation potential after considering the other criteria. |

## 4 ARCHIVAL AND DESKTOP RESEARCH FINDINGS

### 4.1 Archival findings

The aim of the archival background research is to identify possible heritage resources that could be encountered during fieldwork, as summarised in **Table 3**.

*Table 3: Summary of History of the study area*

| DATE | DESCRIPTION |
|---|---|
| **2.5 million to 250 000 years ago** | The **Earlier Stone Age** is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and this comprises more refined and better made stone artefacts, such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago (Fourie, 2008).<br>No information with regard to ESA sites from the surrounding area could be found. However, it seems likely for such sites to exist here. |
| **250 000 to 40 000 years ago** | The **Middle Stone Age** is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique.<br>Middle Stone Age sites may occur along rivers and streams but none have been identified in the study area and their occurrence is difficult to predict. (De Jong, 2010). No information with regard to MSA sites from the surrounding area could be found. However, it seems likely for such sites to exist here. |
| **40 000 years ago – AD 400** | The **Later Stone Age** is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. Late Stone Age (LSA) people had even more advanced technology than the MSA people and therefore succeeded in occupying even more diverse habitats. Some sites are known to occur in the general region. These vary from sealed (i.e. cave) sites, located to the north and south of the study area, to open sites in the Magaliesberg. Also, for the first time we get evidence of people's activities derived from material other than stone tools. Ostrich eggshell beads, ground bone arrowheads, small bored stones and wood fragments with incised markings are traditionally linked with the LSA. (Van Schalkwyk a, 2006)<br><br>There appears to be a gap in the Mpumalanga LSA record between 9 000 BP and 5 000 BP. This may have to do with the general lack of Stone Age research in the province, but it also encompasses a period of rapid warming and major climate fluctuation, which may have forced people to seek out more protected and viable environments in this area.<br><br>The Mpumalanga Stone Age record becomes visible again in the mid-Holocene at the farm Honingklip (HKLP) near Badplaas in the Carolina District. Here two LSA sites were found on opposite sides of a bend in the Nhlazatshe |

| DATE | DESCRIPTION |
|---|---|
| | River, about 1km west of its confluence with the Teespruit. The HKLP sites are in the foothills of the Drakensberg, where the climate is warmer than the Highveld but cooler than the Lowveld (Delius (ed), 2006).<br><br>No information with regard to LSA sites from the surrounding area could be found. However, it seems likely for such sites to exist here. |
| **AD400-AD1100** | **Early Iron Age**<br><br>Early in the first millennium AD, there seems to be a significant change in the archaeological record of the greater part of eastern and southern Africa lying between the equator and Natal. This change is marked by the appearance of a characteristic ceramic style that belongs to a single stylistic tradition. These Early Iron Age people practised a mixed farming economy and had the technology to work metals like iron and copper.<br><br>The expansion of early farmers, who, among other things, cultivated crops, raised livestock, mined ore and smelted metals, occurred in this area between AD 400 and AD 1100. Dates from Early Iron Age sites indicate that by the beginning of the 5th century AD Bantu-speaking farmers had migrated down the eastern lowlands and settled in the Mpumalanga Lowveld. Subsequently, farmers continued to move into and between the Lowveld and Highveld of Mpumalanga until the 12th century. These Early Iron Age sites tend to be found in similar locations. Sites were found within 100m of water, either on a riverbank or at the confluence of streams. The close proximity to streams meant that the sites were often located on alluvial fans. The nutrient rich alluvial soils would have been favoured for agriculture. The availability of floodplains and naturally wetter soils would have been important for the practice of dryland farming. This may have been particularly so during the Early Iron Age, when climate reconstruction for the interior of South Africa suggests decreased rainfall between AD 900 and AD 1100 and again after AD 1450 (Delius, 2006). |
| **AD 1500-AD 1700** | While there is some evidence that the Early Iron Age continued into the 15th century in the Lowveld, on the escarpment it had ended by AD1100. The Highveld, particularly around Lydenburg, Badfontein, Sekhukhuneland, Roossenekal, and Steelpoort, became active again from the 15th century onwards. This later phase, termed the Late Iron Age (LIA), was accompanied by extensive stonewalled settlements (Delius, 2006). |
| **AD 1700 – AD 1840** | The Buispoort facies of the Moloko branch of the Urewe Ceramic Tradition is the first association of the study area's surroundings with the Iron Age. It is most likely dated to between AD 1700 and AD 1840. The key features on the decorated ceramics include rim notching, broadly incised chevrons and white bands, all with red ochre (Huffman, 2007). |
| **AD 1821 – AD 1823** | After leaving present-day KwaZulu-Natal the Khumalo Ndebele (more commonly known as the Matabele) of Mzilikazi migrated through the general vicinity of the study area under discussion before reaching the central reaches of the Vaal River in the vicinity of Heidelberg in 1823 (www.mk.org.za). |

| DATE | DESCRIPTION |
|---|---|
| | Two different settlement types have been associated with the Khumalo Ndebele. The first of these is known as Type B walling and was found at Nqabeni in the Babanango area of KwaZulu-Natal. These walls stood in the open without any military or defensive considerations and comprised an inner circle of linked cattle enclosures (Huffman, 2007). The second settlement type associated with the Khumalo Ndebele is known as Doornspruit, and comprises a layout which from the air has the appearance of a 'beaded necklace'. This layout comprises long scalloped walls (which mark the back of the residential area) which closely surround a complex core which in turn comprises a number of stone circles. The structures from the centre of the settlement can be interpreted as kitchen areas and enclosures for keeping small stock.<br><br>It is important to note that the Doornspruit settlement type is associated with the later settlements of the Khumalo Ndebele in areas such as the Magaliesberg Mountains and Marico and represent a settlement under the influence of the Sotho with whom the Khumalo Ndebele intermarried. The Type B settlement is associated with the early Khumalo Ndebele settlements and conforms more to the typical Zulu form of settlement. As the Khumalo Ndebele passed through the general vicinity of the study areas shortly after leaving Kwazulu-Natal, one can assume that their settlements here would have conformed more to the Type B than the Doornspruit type of settlement. It must be stressed however that no published information could be found which indicates the presence of Type B sites in the general vicinity of the study area.<br><br>No iron age sites objects or features have been identified in the study area (Van Schalkwyk, 2006). |
| **1836** | The first Voortrekker parties crossed over the Vaal River (Bergh, 1999). |
| **1850s – 1860s** | This period saw the early establishment of farms by white farmers in the general vicinity of the study area. This said, the archival study has shown that all the farms within the study area were formally inspected by the government of the Zuid-Afrikaansche Republiek during February 1868. Of course, this does not necessarily mean that before this date no farms had already been settled and farmed on, simply that during February 1868 the farms were officially proclaimed and registered with government. The permanent settlement of white farmers in the general vicinity of the study area would have resulted in the proclamation of individual farms and the establishment of permanent farmsteads. Features that can typically be associated with early farming history of the area include farm dwellings, sheds, rectangular stone kraals, canals, farm labourer accommodation and cemeteries.<br><br>Although it is possible that a few heritage sites associated with the very first establishment of white farmers from the study area and surroundings would likely still exist, this would be few in number due to their age as well as the destruction of farmsteads by the British forces during the South African War in accordance with the so-called 'scorched earth' policy. The other sites often associated with these early farms are graves and cemeteries for both white farmers and black farm labourers. These sites are often all that remains of the farmstead of the mid to late 19th century. |

| DATE | DESCRIPTION |
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| | |
| **1872 - 1894** | By 1872, the study area now fell within the district of Middelburg (Bergh, 1999). During this same year the general surroundings of the study area was visited by a geologist from Eastern Europe Woolf Harris. He visited the general vicinity of the study area in 1872 and identified coal in the Van Dyksdrift area. He is believed to have started the Maggie's Mine the following year (Falconer, 1990).<br>During this period, a number of small coal mining operations were started in the general vicinity, but as no railway line connected this area with the coal markets further to the west, it proved a difficult commercial undertaking. By 1889 there were four coal mines in the Witbank area, namely Brugspruit Adit, Maggie's Mine, Steenkoolspruit and Douglas (Falconer, 1990). |
| **20 October 1894** | On this day the railway line between Pretoria and Delagoa Bay (present-day Maputo) was completed near Balmoral located roughly 32km north-west of the study area.<br>This event was very significant for the study area and surroundings as the completion of the line meant that the vast deposits of coal known to have existed in this area since the mid-19th century could now be commercially mined (Bulpin, 1989) and easily transported to the Witwatersrand gold mines and the populated centres of Pretoria and Johannesburg where they were most required. |
| **1899 - 1902** | The Second South African War (1899-1902) took place during this time. Although no evidence for battles or skirmishes within the study areas during the South African War could be found. However, the Middelburg and the Balmoral Boer refugee camps were established in the general vicinity of the Witbank area. |
| | Middelburg concentration camp was the largest camp in the Transvaal system, reaching over 7,000 inmates at one point, and the reports of Dr Kendal Franks and the Ladies Committee suggest that it was very badly run. Dr Franks was critical of the layout of the camp and complained that the administration was 'lax', while the Ladies Committee thought it 'one of the most unsatisfactory we have seen'.1 An intake of over 3,000 in May 1901 brought in desperately impoverished and debilitated people, which precipitated disease.<br><br>By the time the first report was submitted in May 1901, there were already over 7,000 inmates in Middelburg camp, with more than 3,000 arriving in that month alone. Many Boers were from the poorest and most fever-stricken districts of the Transvaal, and commonly known amongst their fellow countrymen as "Mapochers"'. The new arrivals were often so destitute that some families had only one blanket amongst them, hundreds of children were without shoes and some girls had only one garment. In addition, many were ill with malaria. Apart from the Boer women and children, men who had voluntarily surrendered and had taken the oath of neutrality, were also |

| DATE | DESCRIPTION |
|---|---|
| | drafted into Middelburg camp from Cape Town and Ladysmith. Not surprisingly, tents and provisions ran out, as did cooking utensils and bedding. During September and October 1901 Middelburg camp was gradually reduced in size and the camp itself was concentrated and moved to a new site on the banks of the Oliphants River. After the end of the war, repatriation was a slow and methodical process but, by December 1902 there were still 600 people in camp. One reason for the delays was the fact that Middelburg was used as a depot for families returning from Natal. The camp was finally closed in January 1903 (http://www2.lib.uct.ac.za/mss/bccd/Histories/Middelburg/). |
| **1880s-1914** | **Witbank**<br><br>Originally the early residents of Witbank area were mainly stock farmers as there was no market for agricultural produce. Crops were restricted to the needs of the local families. Early travellers in the area, such as Thomas Baines, as far back as 1872 mentioned the coal used by local residents as fuel. Evidence has also been found that at first the African people, and later the Voortrekkers, mined coal from the outcrop, especially in the riverbeds, and transported it by ox-wagon to the Witwatersrand.<br><br>Actual systematic mining at Witbank only started in 1896 when Samuel Stanford, together with the Neumann Group, established the company Witbank Colliery Limited, and sank the first shaft on the farm Witbank. Earlier the farm was generally known as Swartbosch although the official name was Leraatsfontein. It was given the name Witbank because it was not so cumbersome and because of the large quartz rock which, in the words of Thomas Baines," loomed like a wagon tent in the distance." The town Witbank was laid out in 1903 by Witbank Colliery Limited and in the same year Samuel Stanford erected the first wood and iron building, consisting of a shop and hotel. Witbank Colliery Limited controlled the town until 9 April 1906 when a health committee was appointed. On 13 May 1910 a village council was elected and on the 8 November 1914 the town was granted municipal status. The mining of coal did not initially result in a population increase. But with the advent of the railway line between Pretoria and Lourenco Marques (now Maputo) the mining industry was firmly placed on an economic basis, and thereafter the population increased considerably<br>http://global.britannica.com/EBchecked/topic/646020/Witbank ). |
| **1975-1984** | During the seventies the demand for electricity in South Africa increased at an average of nine percent per year. In response to this demand, ESKOM had to virtually double its generating capacity. Against this background, construction of Duvha power station started in November 1975 on a farm called Speekfontein just outside Witbank. Duvha was one of South Africa's largest fossil fired power stations, and was often referred to as the "flagship" of the ESKOM fleet. The combined generating capacity of the six units is 3 600 MW, enough power to supply a city three times the size of Johannesburg with electricity. The availability of coal and water makes this area ideally suited for the establishment of power stations. When Duvha was completed the smoke-stacks were the tallest freestanding concrete structures in the Southern Hemisphere each 300 metres tall (July 1992). Unit 1 went into commercial |

| DATE | DESCRIPTION |
|---|---|
| | service on 18 August 1980, Unit 2 on 1 October 1980, Unit 3 on 16 September 1981, Unit 4 on 1 July 1982, Unit 5 on 31 March 1983 and Unit 6 on 22 February 1984 (http://www.eskom.co.za/sites/heritage/Pages/Duvha.aspx). |

## 4.2 Cartographic findings

Topographical maps obtained from the Directorate: Surveys and Mapping in Cape Town were used to compile a historic layering of the study area. Overlays of the maps were made on Google Earth.

### *4.2.1 First Edition Sheet 1:50 000 2529CD 1954 Middelburg (Transvaal)*

This map sheet was based on aerial photography carried out in 1948, was surveyed in 1954 and drawn in 1958 by the Trigonometrical Survey Office. The sheet was printed in 1959 by the Government Printer of South Africa. This map indicates an absence of heritage features in the immediate vicinity of most of the four proposed drain servitude areas. However, a couple of African homesteads (huts) are depicted just on the edges of the Ash Dam drain servitude and the Low-level Dam servitude. A 'native' compound is also depicted in the area where the Ash Dam is now located (**Figure 12**).

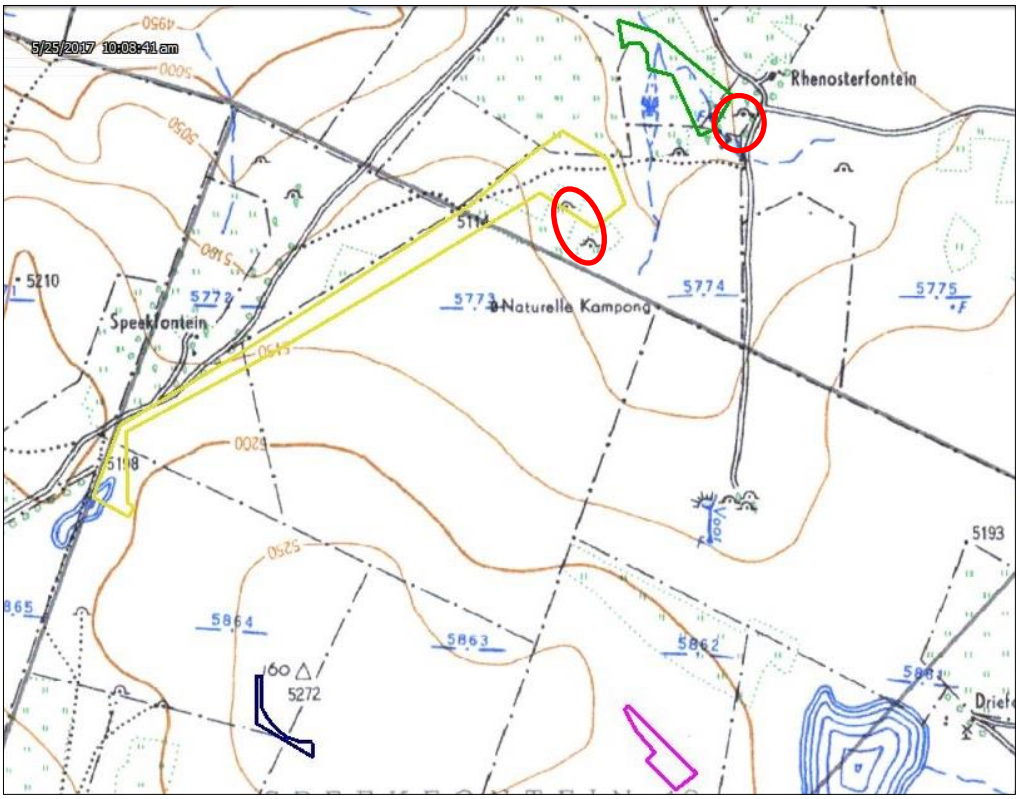


*Figure 12: View of an enlarged section of the First Edition 2529 CD-Sheet showing the four drain servitude areas (coloured polygons).*

### *4.2.2 Second Edition Sheet 1:50 000 2529CD Middelburg (Transvaal) 1974*

This map sheet was printed by the Government Printer and published by the Chief Directorate: Surveys and Land Information in 1974. This map (**Figure 13**) indicates that the area covered by the four drain servitude areas depicts several buildings in the immediate vicinity of the servitude area for the Ash dam (yellow polygon). No heritage sites are indicated in the servitude areas for the three other dams (green, pink and blue polygons). The buildings indicated will be at least 45 years old. Some structures are also depicted just outside the servitude areas.

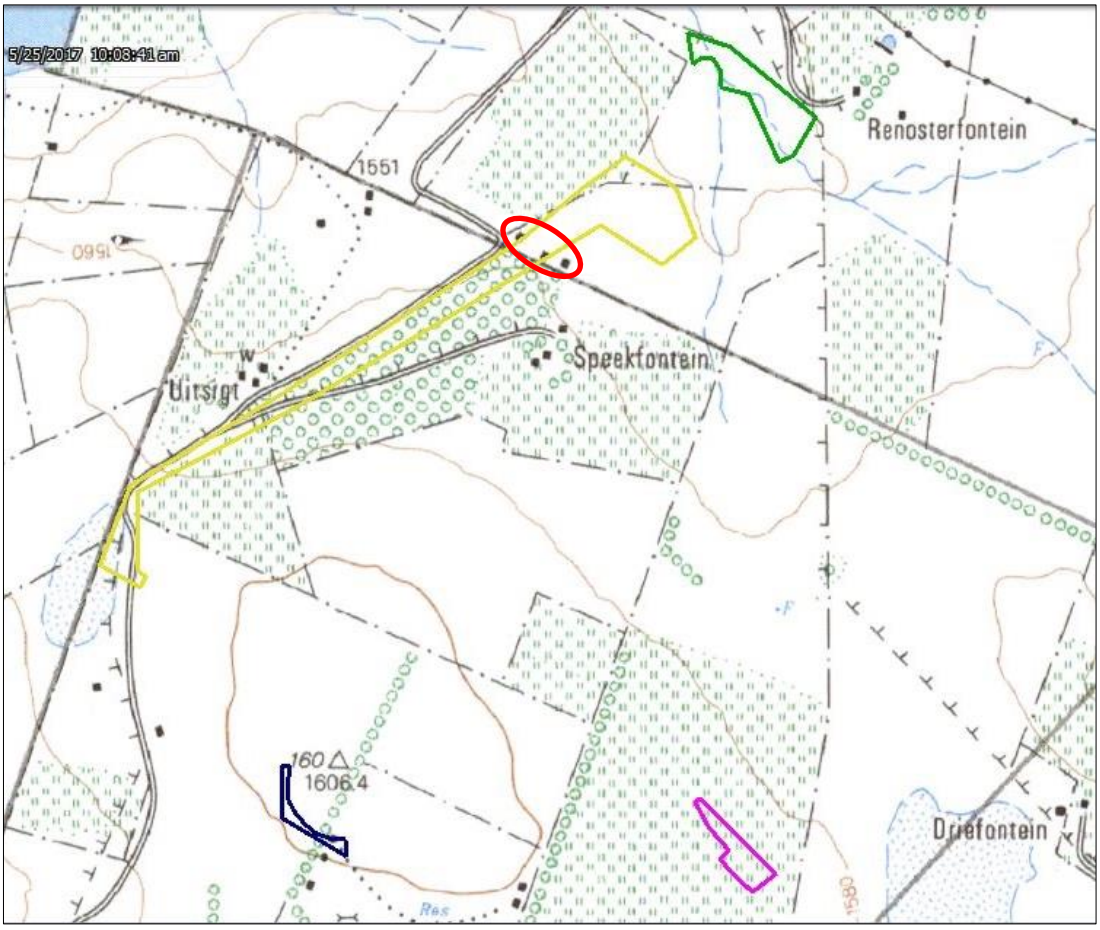


*Figure 13: View of an enlarged section of the Second Edition 1:50 000 2529CD Sheet showing the presence of several buildings (red circle) in the immediate vicinity of the servitude area for the Ash Dam (yellow polygon). Some structures are depicted just outside the servitude areas.*

### *4.2.3 Third Edition Sheet 1:50 000 2529CD Middelburg (Transvaal) 1996*

This map sheet was published by the Chief Directorate: Surveys and Land Information and printed by CTP Book printers in 1998.

This map (**Figure 14**) depicts most of the structures and features comprising the existing Duvha Power Station, including the Ash Dam and the water return dams, as well as various structures associated with the power station. Therefore, they were constructed before 1996.

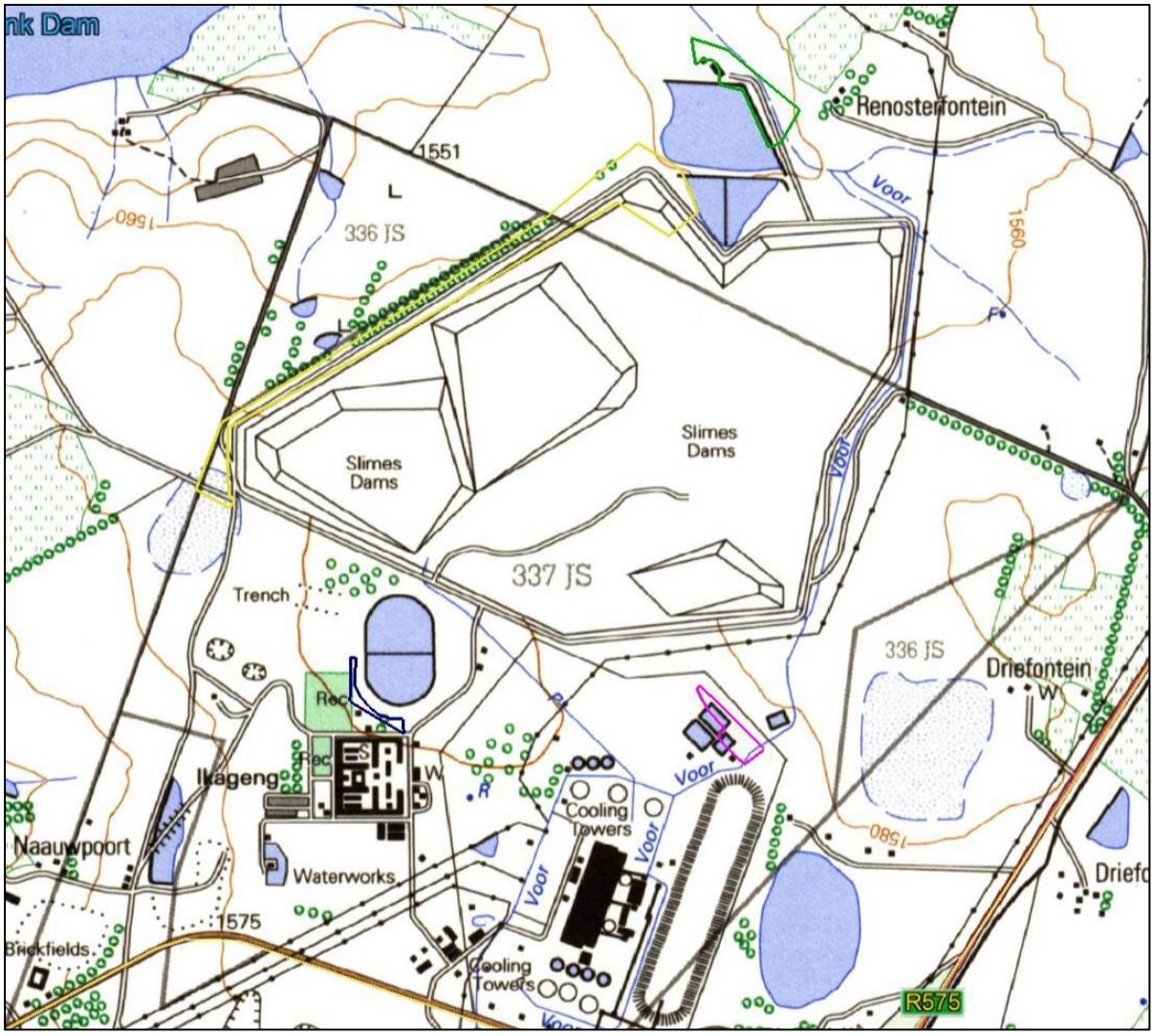


*Figure 14: View of an enlarged section of the Third Edition 1:50 000 2529CD Sheet overlaid on Google Earth. Most of the structures and features comprising the Duvha Power Station, including the Ash Dam and the water return dams, are depicted; i.e. they were constructed before 1996.*

### 4.3 Previous Archaeological and Heritage Research Studies Undertaken within the Study Area

A search of the SA Heritage Resources Information System (SAHRIS) database identified a number of HIA reports for the study area and general surrounding region. These reports confirm that a variety of heritage resources from different archaeological and historical periods have been identified previously

within the study area and surrounding region. The details of the heritage resources identified in the different reports are provided below, in ascending order:

- **Phase 1 Archaeological Survey of the Impunzi Division of Duiker Mining – Witbank/Ogies Area. Matakoma and CRM Africa in association. (2000)**

  The Impunzi Division was developing a new EMP of which the archaeological assessment was one component. Twenty-three sites of cultural and archaeological significance were identified. Seven of these sites were located outside of any development area and included two Middle Stone Age, one Late Stone Age, two Late Iron Age sites, and an historic homestead, while 16 were burial grounds which contained approximately 380 graves in total.

- **Eskom Transmission Line - Duvha (Witbank) To Janus (Mecklenburg): Cultural Heritage Scoping Report. For Environmental Impact Management Services by National Cultural History Museum (van Schalkwyk, 2003)**

  The report states that the assessment was not a final evaluation of either of the two proposed routes, but only an evaluation, based on existing information and a short field visit, to determine which of the two routes would be the preferred option. Therefore, the report only identified the types of heritage resources to be expected to occur in the general vicinity of the two routes. Stone tools are found over most of the two routes, especially on the escarpment and down on the lower laying areas. Iron Age sites also occur over the whole of the route. These sites date to the Early and Late Iron Age. A few stone walled sites are known in the northern section of the proposed development.

- **A Heritage Impact Assessment (HIA) Study for the EMP amendment for the Douglas Colliery in the Mpumalanga Province of South Africa. Prepared for Pulles Howard and De Lange. (Pistorius, 2004)**

  The study was commissioned to identify heritage resources in the mining area of the Douglas Colliery due to the proposed expansion of mining activities. A total of 23 heritage sites were identified: one historical house, six historical graveyards, nine remains dating from the relatively recent past and seven closed mine shafts.

- **A Report on a Cultural Resources Survey on the Farms Kleinkopje 15 IS and Steenkoolspruit 18 IS, Douglas Collieries, Emalahleni District Mpumalanga Province. (Pelser & Vollenhoven, 2008)**

  Archaetnos cc was requested by DMO Projects, BHP Billiton Energy Coal SA to conduct a cultural resources survey in the area known as Douglas Collieries as part of the Douglas Mine Optimization Project. The areas that were investigated included a number of grave sites that were previously identified and where graves were relocated from, as well as areas not previously surveyed. Mining operations are being extended and this survey functioned as a measure to ensure that no further graves or other cultural heritage sites that could exist in the area would be negatively impacted by the developments.

  The fieldwork undertaken revealed these included a possible grave, two farm labourer sites and a Late Iron Age (LIA) stone walled settlement.

- **Heritage Impact Report: ATCOM East Expansion of the Impunzi Colliery, on Portions of the Farms Steenkoolspruit 18 IS, Van Dyksdrift 19 IS and Kromfontein 30 IS, Emalahleni, Mpumalanga Province. For Jones and Wagener Consulting Engineers. (Fourie, 2012)**

  PGS Heritage & Grave Relocation Consultants (PGS) was appointed by Jones and Wagener Consulting Engineers to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the ATCOM East expansion of the Impunzi Colliery, on portions of the farms Steenkoolspruit 18 IS, Van Dyksdrift 19 IS and Kromfontein 30 IS, Emalahleni, Mpumalanga Province.

  The field work identified a total of 33 heritage structures and 11 cemeteries, of which two of the cemeteries were already part of a grave relocation process, at the time of writing the report.

- **Proposed Construction of Ash Disposal Facility for Kusile Power Station, Mpumalanga and Gauteng Provinces – Heritage Impact Assessment (Fourie, 2013)**

  PGS Heritage was appointed by Zitholele Consulting to undertake a Heritage Impact Assessment (HIA) that forms part of the Environmental Impact Assessment (EIA) for the proposed Ash Disposal Facility associated with the Kusile Power Station, which is located between the N4 and N12 highways, just before Witbank, in the Nkangala District Municipality, Mpumalanga.

The field work for the survey identified a total of 2 heritage structures and 4 cemeteries on Site A and 6 heritage structures and 5 cemeteries on Site B.

- **Cultural Heritage Impact Assessment for the Proposed Development of the Bravo 5 By-Pass Power Line, Duvha Power Station, Mpumalanga Province. (Van Schalkwyk, 2016)**

This survey was for the proposed construction of a 400 kV by-pass line, Bravo 5, approximately 10km in length, on the Bravo-Vulcan (Witbank) line to bypass Duvha Power Station. This development was largely to take place inside the existing Duvha Power Station property. No sites, features or objects of cultural significance were identified in the development area.

## 5 PALAEONTOLOGY

A basic palaeontological sensitivity for the study area was determined using the palaeosensitivity map on the SAHRIS database (South African Heritage Resources Information System) (http://www.sahra.org.za/sahris/map/palaeo). As can be seen in **Figure 15** and **Figure 16**, most of the area affected by the proposed seepage interception drain footprints (Ash Dam - yellow polygon and the Low-level Water Return Dam - green polygon) occurs in geology where the palaeontological sensitivity is assessed as being of Low (coloured blue). However, the two southern interception drain footprints (Raw Water Dam - blue polygon and High-level Water Return dam - pink polygon) are located in an area where the palaeontological sensitivity is assessed as being Very High (coloured red). Although the area has been previously disturbed by the construction of the power station, including the dams, at least a desktop palaeontological impact assessment study (PIA) will be required for the study area before construction can commence.

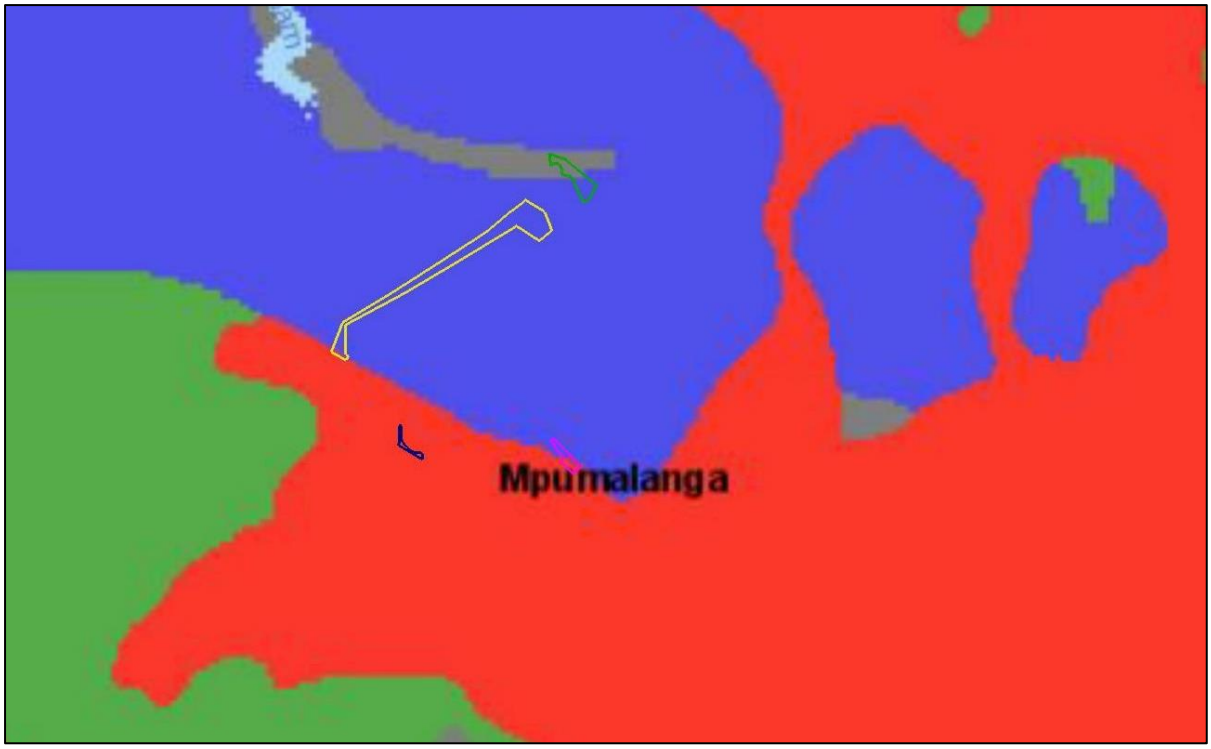


*Figure 15: Overlay of the individual drainage footprints on the palaeosensitivity map from the SAHRIS database. Most of the area is coloured blue, which is rated as Low sensitivity, but the two southern dams (HLWRD and Raw Water Dam) are located over an area coloured red, which is rated as Very High sensitivity.*

| Colour | Sensitivity | Required Action |
|---|---|---|
| RED | VERY HIGH | field assessment and protocol for finds is required |
| ORANGE/YELLOW | HIGH | desktop study is required and based on the outcome of the desktop study, a field assessment is likely |
| GREEN | MODERATE | desktop study is required |
| BLUE | LOW | no palaeontological studies are required however a protocol for finds is required |
| GREY | INSIGNIFICANT/ZERO | no palaeontological studies are required |
| WHITE/CLEAR | UNKNOWN | these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map. |

*Figure 16: SAHRIS palaeosensitivity ratings table*

## 6 FIELD WORK FINDINGS

Due to the nature of cultural remains, with the majority of artefacts occurring below the surface, a controlled-exclusive surface survey was conducted over a period of one day, on foot and by vehicle, by a heritage specialist and field assistant from PGS. The fieldwork was conducted on the 25th May 2017.

The track logs (in blue) for the survey are indicated on the map below. The study area comprises the proposed drain servitude areas around the four dams, as indicated in **Figure 17**.


*Figure 17: General Map indicating track logs and heritage sites identified from the fieldwork undertaken*


*Figure 18: Track log and heritage sites for Ash Dam servitude*

*Figure 19: Track log for Low-level Water Return Dam servitude*

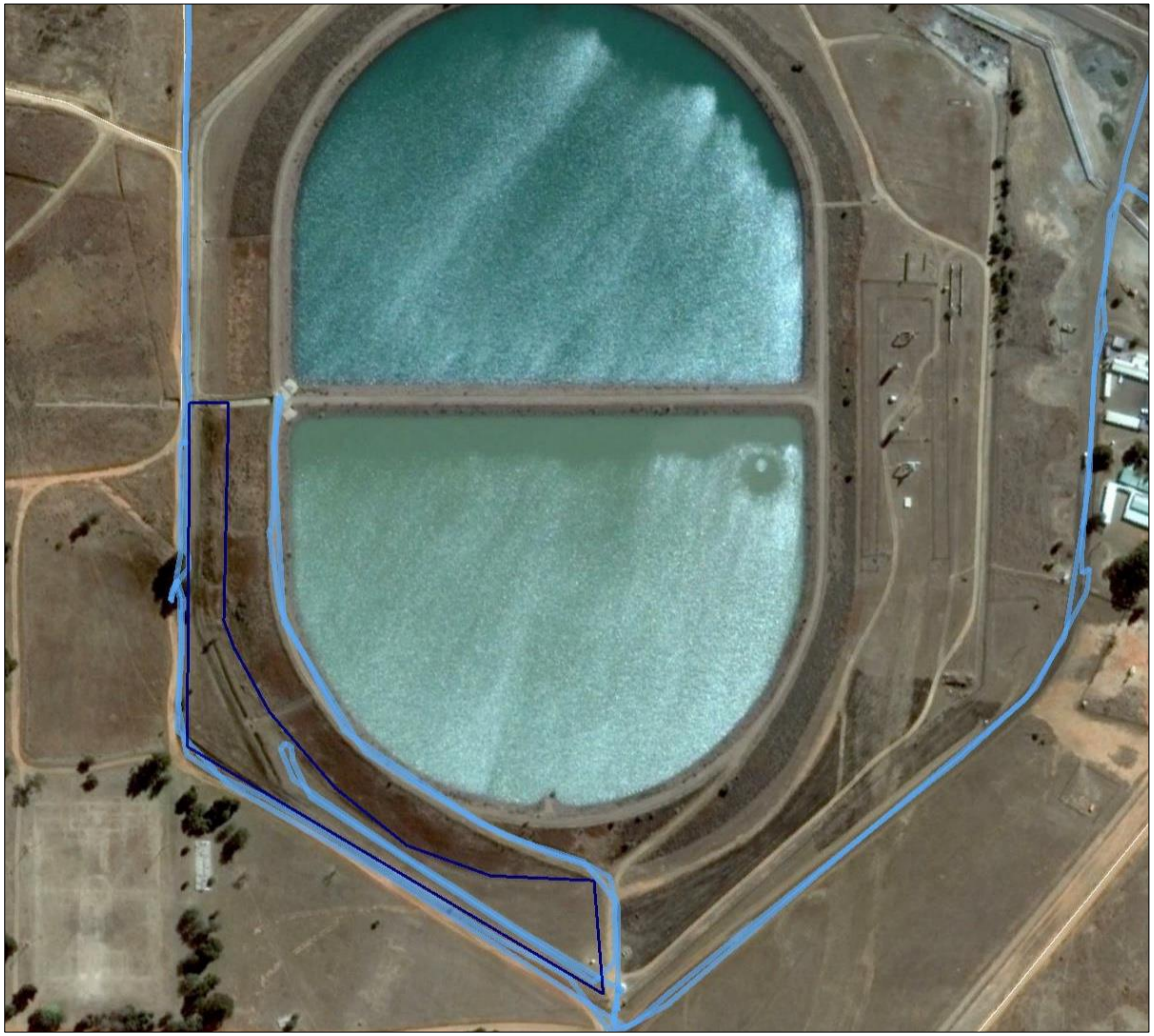

*Figure 20: Track log for Raw Water dam servitude*

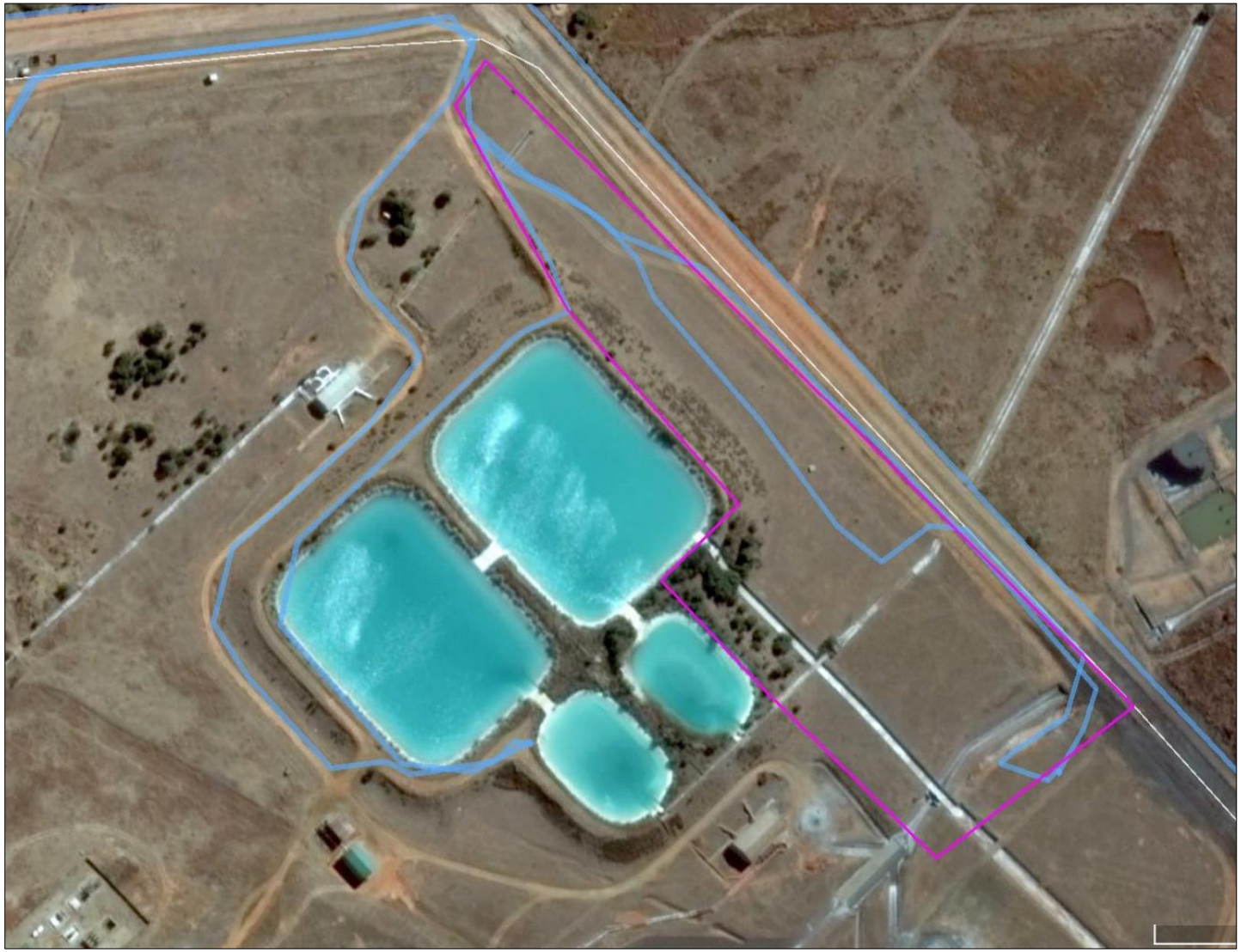

*Figure 21: Tracklog for High-level Water Return dam servitude*

## 6.1 Heritage Findings

No heritage sites were identified within the four drain servitudes comprising the proposed development area. However, two heritage sites were identified just outside the boundary of the drain servitude for the Ash Dam.

## 6.2 Sites Identified

### *6.2.1 DUV 001*

*GPS Coordinates:* -25.935692°; 29.326526°

*Site Description*

The demolished remains of four separate buildings occur at this location. The buildings seem to have been constructed of modern materials. The boundary wall is stone and cement. The foundation is modern brick. The estimated extent is approximately 75m in diameter. The site is located just outside the north-west boundary of the Ash Dam drain servitude area, approximately 100m away.


*Figure 22: View of DUV001, showing the foundation of one of the buildings*


*Figure 23: DUV001, showing boundary wall and remains of structure outside the wall*

*Figure 24: General view of DUV001, showing the dense vegetation growing over the site*

*Site Significance:*

The identified site **DUV 001** is deemed to be of **Low heritage significance** and is rated as **Generally Protected C (GP.C)**. The building remains are situated in the location where three structures marked W (winkel) are depicted on the 1974 topographic map sheet. Therefore remains are likely to be 45 years old or younger. No mitigation measures or permits are therefore required before the site can be affected, moved or destroyed.

*6.2.2 DUV 002:*

*GPS Coordinates:* -25.931079°; 29.336059°

*Site Description:*

A small formal fenced burial ground is located here. It consists of approximately 11 visible graves, some of which have inscribed headstones. The area where the graves are located is heavily overgrown with thick long grass and it was difficult to determine exactly how many graves are present. The graves are oriented east to west. Several graves have headstones with inscriptions that contain names and dates for the 1970s-1980s. Names include Mandla Geelbooi Masilela (d.1989), Dereke Wessel (d. 1980), Konny Amos Skhosana (d. 1974), and George (d. 1976). The burial ground is located just outside the boundary of the Ash Dam drain servitude area, approximately 13m away.


*Figure 25: View of DUV002, burial ground, looking towards the Ash Dam drain servitude*


*Figure 26: DUV002, View looking north-west*


*Figure 27: Masilela headstone, dated 1989*

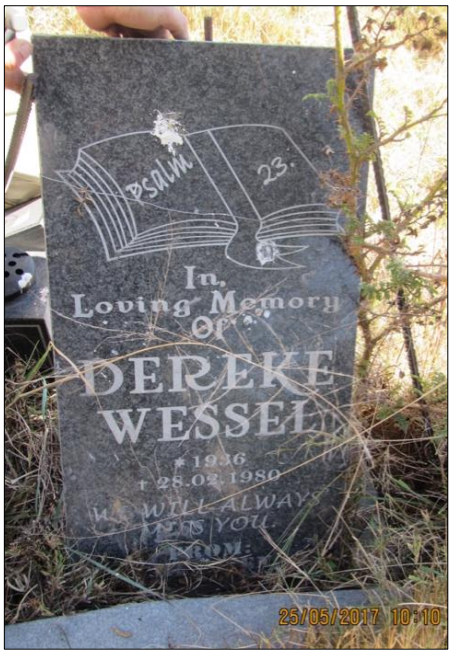


*Figure 28: Wessel headstone, dated 1980*


*Figure 29: Skhosana headstone, dated 1974*


*Figure 30: George headstone, dated 1976*

*Site Significance:*

The identified site DUV 002 is deemed to be of ***High heritage significance*** and is rated as **Generally Protected A (GP.A)**. Mitigation measures and permits are therefore required before the site may be affected, moved or destroyed.

Please refer to Section 9.1 and 9.3 for the required mitigation measures.

# 7 OVERALL IMPACT EVALUATION

The study has identified that the proposed project activities could have an indirect impact on the two identified heritage resources located just outside the boundary of the servitude for the Ash Dam seepage interception drain; however all the envisaged impacts on heritage resources, can be mitigated. The study has identified that the proposed project activities could have a High to Medium impact on the heritage resource site DUV002 (burial ground). The study has also identified a possible direct impact on underlying geology identified on the SAHRIS sensitivity map as being of Very High palaeontological sensitivity. This will need to be confirmed by at least a desktop PIA study before construction can commence.

## 7.1 Status Quo and "No go" Areas

### *7.1.1 Status Quo*

No heritage sites were identified inside the study area. However, two heritage sites were identified just outside the boundary of the Ash Dam seepage interception drain servitude area. These include the remains of several demolished buildings, most likely of recent to modern date (DUV001 of Low heritage significance), and a burial ground, consisting of 11 visible graves, (DUV002 of High heritage significance).

### *7.1.2 "No go" Areas*

The burial ground (DUV002) rated as having **High heritage Significance** as well as being **Generally Protected A (GP.A)** and is deemed as a "no-go area" without the implementation of mitigation. Mitigation measures and permits are required before this site may be affected or moved/destroyed; thus, this site is considered a "no go" area until further mitigation is implemented.

### 7.2 Project Impact (Unmitigated)

During the construction phase, impacts may occur to heritage resources as identified for the project. These impacts could occur as a result of construction activities such as topsoil stripping, excavations and vegetation clearing.

The combined weighted project impact to the Heritage resources (prior to mitigation) will possibly be of a moderate to high negative significance. The impact will be permanent and is in all likelihood going to happen. The impact risk class is thus **moderate to high**.

However, the implementation of the recommended mitigation measures will minimise the impacts and reduce the overall impacts to **low**.

### 7.3 Cumulative Impact

The baseline impacts are considered to be moderate for Heritage resources, and additional project impacts (if no mitigation measures are implemented) will increase the significance of the existing baseline impacts, where the cumulative unmitigated impact will probably be of a moderate to high significance. The impact is going to happen and will be short term in nature, therefore the impact risk class will be Moderate to High. However, with the implementation of the recommended management and mitigation measures this risk class can be minimized to a Low rating.

## 8 SUMMARY IMPACT ASSESSMENT TABLE

| POTENTIAL IMPACTS (in order of impact as described in Impact Matrix) | ASPECT (refer to Impact Matrix) | Nature | Type | Extent | Duration | Severity | Reversibility | Irreplaceable Loss | Probability | MITIGATION POTENTIAL | IMPACT SIGNIFICANCE | | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Without Mitigation | With Mitigation | |
| **CONSTRUCTION PHASE** | | | | | | | | | | | | | |
| Impact on historical structures | Heritage Resources | **Negative** | Indirect | Site | Permanent | **Low** | Irreversible | Resource cannot be replaced | Unlikely | High | **Low** | **Low** | No mitigation required |
| Impact on burial grounds | Heritage Resource | **Negative** | Indirect | Local | Permanent | **High negative** | Irreversible | Resource cannot be replaced | Possible | Moderate or Partially Mitigatable | **High** | **Low** | Refer to Sections 9.1 and 9.3 |

| POTENTIAL IMPACTS (in order of impact as described in Impact Matrix) | ASPECT (refer to Impact Matrix) | Nature | Type | Extent | Duration | Severity | Reversibility | Irreplaceable Loss | Probability | MITIGATION POTENTIAL | IMPACT SIGNIFICANCE | | MITIGATION MEASURES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | Without Mitigation | With Mitigation | |
| Impact on palaeontology **(based on SAHRIS palaeosensitivity map at least a desktop PIA study is required to assess the impact)** | | | | | | | | | | | **Requires PIA** | **Requires PIA** | **NB: A desktop PIA by a professional palaeontologist is required prior to construction to confirm the SAHRIS palaeosensitivity ratings** |

**Note: these ratings are based on the SAHRIS palaeosensitivity map and will require confirmation by a professional palaeontologist undertaking at least a desktop PIA study.**

## 9 HERITAGE MANAGEMENT GUIDELINES

### 9.1 Identified Heritage Resources

*9.1.1 DUV 001 (building remains):*

- no mitigation measures required

*9.1.2 DUV 002 (burial ground):*

- Demarcate the site as a "no go" area, with a 30m buffer and a fence.
- It is also recommended that the ECO monitor construction at this location.
- If the graves will be disturbed in any way during construction or operation, and a buffer is not possible, a grave relocation process will need to take place.

### 9.2 General Management Guidelines

1. The National Heritage Resources Act (Act 25 of 1999) states that, any person who intends to undertake a development categorised as-
   (a) the construction of a road, wall, transmission line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
   (b) the construction of a bridge or similar structure exceeding 50m in length;
   (c) any development or other activity which will change the character of a site-
      (i) exceeding 5 000 $m^2$ in extent; or
      (ii) involving three or more existing erven or subdivisions thereof; or
      (iii) involving three or more erven or divisions thereof which have been consolidated within the past five years; or
      (iv) the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;
   (d) the re-zoning of a site exceeding 10 000 $m^2$ in extent; or
   (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

**In the event that an area previously not included in this or any previous archaeological or cultural resources survey is to be disturbed, the SAHRA needs to be contacted. An enquiry must be lodged with them into the necessity for a further Heritage Impact Assessment.**

2. In the event that a further heritage assessment is required, it is advisable to utilise a qualified heritage practitioner, preferably registered with the Cultural Resources Management Section (CRM) of the Association of Southern African Professional Archaeologists (ASAPA).

This survey and evaluation must include:

(a) The identification and mapping of all heritage resources in the area affected;

(b) An assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6 (2) or prescribed under section 7 of the National Heritage Resources Act;

(c) An assessment of the impact of the development on such heritage resources;

(d) An evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;

(e) The results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;

(f) If heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and

(g) Plans for mitigation of any adverse effects during and after the completion of the proposed development.

3. It is advisable that an information section on cultural resources be included in the SHEQ training given to contractors involved in surface earthmoving activities. These sections must include basic information on:

   a. Heritage;
   b. Graves;
   c. Archaeological finds; and
   d. Historical Structures.

   This module must be tailor made to include all possible finds that could be expected in that area of construction.

   Possible finds include:

   a. Open air Stone Age scatters, disturbed during vegetation clearing. This will include stone tools.
   b. Palaeontological deposits such as bone, and teeth in fluvial riverbank deposits.

4. In the event that a possible find is discovered during construction, all activities must be halted in the area of the discovery and a qualified archaeologist contacted.
5. The archaeologist needs to evaluate the finds on site and make recommendations towards possible mitigation measures.
6. If mitigation is necessary, an application for a rescue permit must be lodged with SAHRA.
7. After mitigation, an application must be lodged with SAHRA for a destruction permit. This application must be supported by the mitigation report generated during the rescue excavation. Only after the permit is issued may such a site be destroyed.
8. If during the initial survey sites of cultural significance are discovered, it will be necessary to develop a management plan for the preservation, documentation or destruction of such a site. Such a program must include an archaeological/palaeontological monitoring programme, timeframe and agreed upon schedule of actions between the company and the archaeologist.

9. In the event that human remains are uncovered, or previously unknown graves are discovered, a qualified archaeologist needs to be contacted and an evaluation of the finds made.
10. If the remains are to be exhumed and relocated, the relocation procedures as accepted by SAHRA need to be followed. This includes an extensive social consultation process.

*Table 4: Roles and responsibilities of archaeological and heritage management when heritage resources are discovered during construction*

| ROLE | RESPONSIBILITY | IMPLEMENTATION |
|---|---|---|
| A responsible specialist needs to be allocated and should attend all relevant meetings, especially when changes in design are discussed, and liaise with SAHRA. | The client | Archaeologist and a competent archaeology support team |
| If chance finds and/or graves or burial grounds are identified during construction or operational phases, a specialist must be contacted in due course for evaluation. | The client | Archaeologist and a competent archaeology support team |
| Comply with defined national and local cultural heritage regulations on management plans for identified sites. | The client | Environmental Consultancy and the Archaeologist |
| Consult the managers, local communities and other key stakeholders on mitigation of archaeological sites, when discovered. | The client | Environmental Consultancy and the Archaeologist |
| Implement additional programs, as appropriate, to promote the safeguarding of our cultural heritage. (i.e. integrate the archaeological components into the employee induction course). | The client | Environmental Consultancy and the Archaeologist |
| If required, conservation or relocation of burial grounds and/or graves according to the applicable regulations and legislation. | The client | Archaeologist, and/or competent authority for relocation services |
| Ensure that recommendations made in the Heritage Report are adhered to. | The client | The client |
| Provision of services and activities related to the management and monitoring of significant archaeological sites (when discovered). The client with the specialist | The client | Environmental Consultancy and the Archaeologist |

| | | |
|---|---|---|
| needs to agree on the scope and activities to be performed | | |
| When a specialist/archaeologist has been appointed for mitigation work on discovered heritage resources, comprehensive feedback reports should be submitted to relevant authorities during each phase of development. | Client and Archaeologist | Archaeologist |

### 9.3 All phases of the project

*9.3.1 Archaeology*

The project will encompass a range of activities during the construction phase, including ground clearance and establishment of construction camps area.

It is possible that cultural material will be exposed during operations and may be recoverable, but this is the high-cost front of the operation, and so any delays should be minimised. Development surrounding infrastructure and construction of facilities results in significant disturbance, but construction trenches do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this phase of the project and these must be catered for. Temporary infrastructure is often changed or added to during the subsequent history of the project. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface, but still need to be catered for.

During the construction phase, it is important to recognise any significant material being unearthed, and to make the correct judgment on which actions should be taken. In the event that possible heritage resources are identified a qualified archaeologist/palaeontologist must be contacted to evaluate the finds and make recommendations on the mitigation required.

In addition, feedback reports can be submitted by the archaeologist to the client and SAHRA to ensure effective monitoring. This archaeological monitoring and feedback strategy should be incorporated into the EMPr of the project. Should an archaeological/palaeontological site or cultural material be discovered during construction (or operation), such as graves or burial grounds, the project manager needs to be able to call on a qualified expert to make a decision on what is required and if it is necessary to carry out emergency recovery. SAHRA would need to be informed and may give advice on procedure. The developers therefore should have some sort of contingency plan so that operations could move elsewhere temporarily while the material and data are recovered. The project thus needs

to have an archaeologist/palaeontologist available to do such work. This provision can be made in an archaeological monitoring programme.

In the case where archaeological material is identified during construction the following measures must be taken:

- Upon the accidental discovery of archaeological material, a buffer of at least 30 meters should be implemented.
- If archaeological material is accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the material, permits must be applied for from SAHRA under Section 35 of the NHRA.

*9.3.2 Graves*

In the case where a grave is identified during construction, the following measures must be taken:

- Upon the accidental discovery of graves, a buffer of at least 50 meters should be implemented.
- If graves are accidentally discovered during construction, activities must cease in the area and a qualified archaeologist be contacted to evaluate the find. To remove the remains a permit must be applied for from SAHRA (Section 36 of the NHRA) and other relevant authorities (National Health Act and its regulations). The local South African Police Services must immediately be notified of the find.
- Where it is recommended that the graves be relocated, a full grave relocation process that includes comprehensive social consultation must be followed.

The grave relocation process must include:

i. A detailed social consultation process, that will trace the next-of-kin and obtain their consent for the relocation of the graves, that will be at least 60 days in length;
ii. Site notices indicating the intent of the relocation;
iii. Newspaper notices indicating the intent of the relocation;
iv. A permit from the local authority;
v. A permit from the Provincial Department of Health;
vi. A permit from the South African Heritage Resources Agency, if the graves are older than 60 years or unidentified and thus presumed older than 60 years;
vii. An exhumation process that keeps the dignity of the remains intact;

viii. The whole process must be done by a reputable company that is well versed in relocations;

ix. The exhumation process must be conducted in such a manner as to safeguard the legal rights of the families as well as that of the development company.

### *9.3.3 Palaeontology*

A preliminary investigation based on the SAHRIS palaeosensitivity map identified the presence of geological deposits of both Low and Very High palaeontological sensitivity underlying the location of the four proposed drain servitude areas.

Due to the Very High palaeontological sensitivity identified by SAHRIS, a detailed desktop assessment by a professional palaeontologist would be required before construction commences. This will confirm the initial sensitivity assessment and recommend specific mitigation measures to be undertaken before construction. A finds management protocol may need to be developed for the construction activities.

## 10 CONCLUSIONS AND RECOMMENDATIONS

PGS was appointed by Nemai Consulting to undertake an HIA that forms part of the BAR for the proposed development of the Proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province.

No heritage sites were identified inside the four seepage interception drain servitude areas. However, two heritage sites were identified just outside the boundary of the Ash Dam drain servitude area. These include the remains of several demolished buildings, most likely of recent to modern date (DUV001 of Low heritage significance), and a burial ground, consisting of 11 visible graves, (DUV002 of High heritage significance).

The study has identified that the proposed project activities could have an indirect impact on the identified heritage resources located just outside the Ash Dam interception drain servitude area, however all the envisaged impacts on heritage resources can be mitigated. The study has identified that the proposed project activities will have a High to Medium impact on heritage resources.

As noted above, due to the Very High palaeontological sensitivity identified by SAHRIS, a detailed desktop assessment by a professional palaeontologist would be required before construction

commences. This will confirm the initial sensitivity assessment and recommend specific mitigation measures to be undertaken before construction. A finds management protocol may need to be developed for the construction activities.

***Extent of mitigation***

Mitigation will only be required for DUV 002 (burial ground):

- Demarcate the site as a "no go" area, with a 30m buffer and a fence.
- It is also recommended that the ECO monitor construction at this location.
- If the graves will be disturbed in any way during construction or operation, and a buffer is not possible, a grave relocation process will need to take place.

A detailed desktop assessment by a professional palaeontologist will recommend specific mitigation measures to be undertaken for palaeontological resources likely to be affected, before construction commences. A finds management protocol may need to be developed for the construction activities.

## 11 PREPARERS

Jennifer Kitto – Heritage Specialist
Wouter Fourie – Senior Heritage Specialist

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Appendix A

**LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA**

## 1 General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and paleontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In the NHRA, permits are required to damage, destroy, alter, or disturb them. People who already possess material are required to register it. The management of heritage resources is integrated with environmental resources and this means that before development takes place heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves, which are older than 60 years and are not in a formal burial ground (such as ancestral graves in rural areas), are protected. The legislation protects the interests of communities that have an interest in the graves - they should be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle are to be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resource authority and if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the construction company's cost. Thus, the construction company will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that -
An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- objects recovered from the soil or waters of South Africa, including archaeological and paleontological objects, meteorites and rare geological specimens;

- visual art objects;
- military objects;
- numismatic objects;
- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and pre-historic cultural remains, including graves and human remains.

## 2 Graves and burial grounds

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are under the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinterment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are under the jurisdiction of the South African Heritage Resource Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal burial ground administrated by a local authority.

Graves in the category located inside a formal burial ground administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years, over and above SAHRA authorisation.

If the grave is not situated inside a formal burial ground but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the burial ground authority must be adhered to.

Appendix B

**CURRICULUM VITAE OF TEAM**

**WOUTER FOURIE**

**Professional Heritage Specialist and Professional Archaeologist and Director PGS Heritage**

**Summary of Experience**

Specialised expertise in Archaeological Mitigation and excavations, Cultural Resource Management and Heritage Impact Assessment Management, Archaeology, Anthropology, Applicable survey methods, Fieldwork and project management, Geographic Information Systems, including *inter alia* -

- Involvement in various grave relocation projects (some of which relocated up to 1000 graves) and grave "rescue" excavations in the various provinces of South Africa
- Involvement with various Heritage Impact Assessments, within South Africa, including -
    - Archaeological Walkdowns for various projects
    - Phase 2 Heritage Impact Assessments and EMPs for various projects
    - Heritage Impact Assessments for various projects
- Iron Age Mitigation Work for various projects, including archaeological excavations and monitoring
- Involvement with various Heritage Impact Assessments, outside South Africa, including -
    - Archaeological Studies in Democratic Republic of Congo
    - Heritage Impact Assessments in Mozambique, Botswana and DRC
    - Grave Relocation project in DRC

**Key Qualifications**

BA [Hons] (Cum laude) - Archaeology and Geography - 1997

BA - Archaeology, Geography and Anthropology – 1996

MPhil – Conservation of the Built Environment - Current

Professional Archaeologist - Association of Southern African Professional Archaeologists (ASAPA) - Professional Member

Accredited Professional Heritage Specialist – Association of Professional Heritage Practitioners (APHP)

CRM Accreditation (ASAPA) -

Principal Investigator - Grave Relocations

Field Director – Iron Age

Field Supervisor – Colonial Period and Stone Age

Accredited with Amafa KZN

**Key Work Experience**

2003- current - Director – PGS Heritage (Pty) Ltd

2007 – 2008 - Project Manager – Matakoma-ARM, Heritage Contracts Unit, University of the Witwatersrand

2005-2007 - Director – Matakoma Heritage Consultants (Pty) Ltd

2000-2004 – CEO – Matakoma Consultants

1998-2000 - Environmental Coordinator – Randfontein Estates Limited. Randfontein, Gauteng

1997-1998 - Environmental Officer – Department of Minerals and Energy. Johannesburg, Gauteng

Worked on various heritage projects in the SADC region including, Botswana, Mozambique and the Democratic Republic of the Congo

**JENNIFER KITTO**

**Professional Heritage Specialist**

**Summary of Experience**

Public participation with regards to Heritage Impact Assessments, Cultural Resource Management and Heritage Impact Assessment Management, Historical and Archival Research, Applicable survey methods, Fieldwork and Project Management; whilst working, inter alia, on the following projects:

•Heritage Assessment Projects

- HIA Report, Dolos-Giraffe Substation, Hopefield-Bultfontein,
- HIA Report, Jagtlust Mine Extension, North-West Province
- HIA Report, Kolomela, Northern Cape
- HIA Report, Decontamination of AEL Detonator Campus, Modderfontein Factory, Modderfontein, City of Johannesburg Metropolitan Municipality, Gauteng
- HIA Report, Old Rand Leases Hostel redevelopment, Fleurhof Ext 10, Roodepoort, City of Johannesburg Metropolitan Municipality, Gauteng
- HIA Report, Watershed Substation, North-West Province
- HIA Report, Solid Waste Landfill Facility, Rhodes Village, Eastern Cape
- HIA Report, Rossouw
- Phase 2 mitigation report, Cass Farmstead, Optimum Colliery, Mpumalanga
- HIA Report, Kusile Ash Disposal Facility, Witbank, Mpumalanga
- Report on Rand Steam Laundries Background History, City of Johannesburg Metropolitan Municipality, Gauteng
- New Cemetery, Barkly East, Senqu Municipality, Eastern Cape (desktop/archival research for HIA report)
- Lady Slipper Country Estates, Nelson Mandela Metro Municipality, Eastern Cape (desktop/archival research for HIA report)
- Exxaro Resources Paardeplaats Project, Belfast, Mpumalanga (field survey and archival research for HIA report)
- Copperleaf Mixed Use Development, Farm Knoppieslaagte 385/Knopjeslaagte 140, Centurion, Gauteng (field survey and archival research for HIA report)
- Isundu-Mbewu Transmission Line Project, Pietermaritzburg, Kwazulu Natal (Initial Heritage Scan (survey) for Corridor 3 Alternative 1)

**Key Qualifications**

BA [Hons] – Social Anthropology- 1994/1995

BA - Archaeology and Anthropology – 1993

Technical Member- Association of Southern African Professional Archaeologists (ASAPA) -

**Key Work Experience**

2011 -2017: PGS Heritage (Pty) Ltd

2008-2011: SAHRA Burial Grounds and Graves Unit

1998 –2007: SAHRA Provincial Office: Gauteng

environmental affairs

Department:
Environmental Affairs
**REPUBLIC OF SOUTH AFRICA**

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

**Heritage Impact Assessment for the Proposed Ash Dam Seepage Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

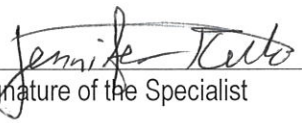
## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | PGS Heritage (Pty) Ltd | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | Level 5 | Percentage Procurement recognition | 80% |
| Specialist name: | Jennifer Kitto | | | |
| Specialist Qualifications: | BA (Archaeology), BA Hons (Anthropology) | | | |
| Professional affiliation/registration: | Association of Southern African Professional Archaeologists (ASAPA) | | | |
| Physical address: | 906 Bergarend Street, Waverley, Pretoria | | | |
| Postal address: | PO Box 32542, Totiusdal, Tshwane | | | |
| Postal code: | 0134 | Cell: | 076-560-4114 | |
| Telephone: | (012) 332-5305 | Fax: | 086-675-8077 | |
| E-mail: | jennifer@pgsheritage.co.za | | | |

## 2. DECLARATION BY THE SPECIALIST

I, ____Jennifer Kitto_____, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.



Signature of the Specialist

PGS Heritage (Pty) Ltd

Name of Company:

31 May 2019

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, JENNIFER KITTO, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

PGS Heritage (Pty) Ltd

Name of Company

31/05/2019

Date

LT OLIFANT
71883 2-2
CST

Signature of the Commissioner of Oaths

2019-05-31

Date

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CLIENT SERVICE CENTRE
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**Appendix D4 – Desktop Palaeontological Study**

# PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED SEEPAGE INTERCEPTION DRAINS AT DUVHA POWER STATION, EMALAHLENI MUNICIPALITY, MPUMALANGA PROVINCE

**Compiled for:**

**NEMAI CONSULTING (PTY) LTD**

PO BOX 1673, Sunninghill

2157

**18 September 2019**

**Prepared by:**

**BANZAI ENVIRONMENTAL (PTY) LTD**

**Declaration of Independence**

General declaration:

- I, Elize Butler, declare that –
- I act as the independent Palaeontologist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting palaeontological impact assessments, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in section 38 of the NHRA when preparing the application and any report relating to the application;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- All the particulars furnished by me in this form are true and correct;
- I will perform all other obligations as expected from a heritage practitioner in terms of the Act and the constitutions of my affiliated professional bodies; and
- I realise that a false declaration is an offence in terms of regulation 71 of the Regulations and is punishable in terms of section 24F of the NEMA.

**Disclosure of Vested Interest**

I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Regulations;

**PALAEONTOLOGICAL CONSULTANT:** Banzai Environmental (Pty) Ltd

**CONTACT PERSON:** Elize Butler

Tel: +27 844478759

Email: elizebutler002@gmail.com

SIGNATURE: 

The Palaeontological Impact Assessment report has been compiled taking into account the National Environmental Management Act (NEMA) Appendix 6 requirements for specialist reports as indicated in the table below.

*Table 1: NEMA Requirements*

| **NEMA Regs (2014) - Appendix 6** | **Relevant section in report** |
|---|---|
| 1. (1) A specialist report prepared in terms of these Regulations must contain-<br>a) details of-<br>i. the specialist who prepared the report; and<br>ii. the expertise of that specialist to compile a specialist report including a curriculum vitae; | Page ii of Report – Contact details and company and Appendix 1 |
| b) a declaration that the specialist is independent in a form as may be specified by the competent authority; | Page ii-iii |
| c) an indication of the scope of, and the purpose for which, the report was prepared; | Section 4 – Objective |
| (cA) an indication of the quality and age of base data used for the specialist report; | Section 5 – Geological and Palaeontological history |
| (cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change; | Section 9 – Impacts |
| d) the date, duration and season of the site investigation and the relevance of the season to the outcome of the assessment; | N/A-Desktop study |
| e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used; | Section 7 – Methodology |
| f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives; | Section 1 and Section 5 |
| g) an identification of any areas to be avoided, including buffers; | N/A |
| h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers; | Section 5 |
| i) a description of any assumptions made and any uncertainties or gaps in knowledge; | Section 7.1. – Assumptions and Limitation |

| | |
|---|---|
| j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment or activities; | Section 10 |
| k) any mitigation measures for inclusion in the EMPr; | Section 10 |
| l) any conditions for inclusion in the environmental authorisation; | N/A |
| m) any monitoring requirements for inclusion in the EMPr or environmental authorisation; | Section 10 |
| n) a reasoned opinion-<br>i. as to whether the proposed activity, activities or portions thereof should be authorised;<br>(iA) regarding the acceptability of the proposed activity or activities; and<br>ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; | Saction 1 and Section 10 |
| o) a description of any consultation process that was undertaken during the course of preparing the specialist report; | Not applicable. |
| p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and | Not applicable. To date not comments regarding heritage resources that require input from a specialist have been raised. |
| q) any other information requested by the competent authority. | Not applicable. |
| 2) Where a government notice *gazetted* by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply. | Refer to Section 2 and Section 3 compliance with SAHRA guidelines |

**EXECUTIVE SUMMARY**

Nemai Consulting (Pty) Ltd has appointed Banzai Environmental to undertake the Palaeontological Desktop Impact Assessment (DIA) assessing the palaeontological impact of the Proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province. The National Heritage Resources Act (No 25 of 1999, section 38) (NHRA), states that a Palaeontological Impact Assessment (PIA) is key to detect the presence of fossil material within the planned development footprint. This DIA is thus necessary to evaluate the effect of the construction on the palaeontological resources.

The proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province is primarily underlain by the metamorphic sediments of the Selons River Formation (Rooiberg Group) and a small area in the south is located in the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the metamorphic sediments of Selons River Formation is zero while the Vryheid Formation has a Very High Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website).

However, the southern portion of the development (2 camp sites, high level ash water return dam (HLAWRD), raw water dam as well as the most southern tip of the cut-off trench) falls in the Vryheid Formation which has a Very High Palaeontological Sensitivity. **But**, this area of the development footprint is very small and disturbed due to the agricultural and previous construction activities in the area. It is therefore considered that the construction and operation of the development may be authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. This Chance Find Protocol must also be included in the Environmental Management Programme Reports (EMPr). These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert South African Heritage Resources Agency (SAHRA) so that appropriate mitigation (*e.g.* documented and collection) can be undertaken by a 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 should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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## 1 INTRODUCTION

The coal-fired power plant, Duvha Power Station, is a operated by Eskom Holdings SOC (Ltd) in Witbank, Mpumalanga Province. Nemai Consulting (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioner (EAP) to obtain the Environmental Authorisation (EA) and Water Use License (WUL) for the Duvha seepage interception drains, located in the Duvha Power Station.

Duvha Power Station has been operational for the past 36 years. The Duvha power plant generates wet ash that is pumped to the ash dam (situated approximately 1.7 km east of the Witbank Dam). Settled water is firstly transferred to the low-level ash water return dam (LLAWRD) from where it is returned to the station to generate more wet ash slurry. Currently, the Power Station ash dam is experiencing seepage water that pollutes the groundwater towards the Witbank dam and mitigation measures must be undertaken to prevent the continuous groundwater seepage. A multi-disciplinary concept design to avoid seepage water is compulsory to support the Basic Assessment Report (BAR) and Water Use Licence Application (WULA) Processes as the traverse wetlands and fall within 500m of wetlands. Building of the seepage interception drains at the dams is required as Eskom was instructed by the Department of Water and Sanitation (now the Department of Human Settlements, Water and Sanitation (DHSWS)) to mitigate and prevent groundwater pollution.

To limit groundwater seepage from the existing large Ash Dam, high-level ash water return dam (HLAWRD), LLAWRD and the raw water dam, it is recommended to build cut-off interceptor drains alongside perimeter sections of each of the dams thus conveying the intercepted water to selected discharge points (Figure 1-3).


*Figure 1: Site layout of the Duvha Power Station, indicating the location of the affected return water dams in relation to the Ash Dam (Map provided by Escom, 2019*

)


*Figure 2: Google Earth image indicating the proposed servitude footprint areas for the seepage interception drains (blue, green, pink and yellow polygons) (Map provided by Nemai Consulting).*

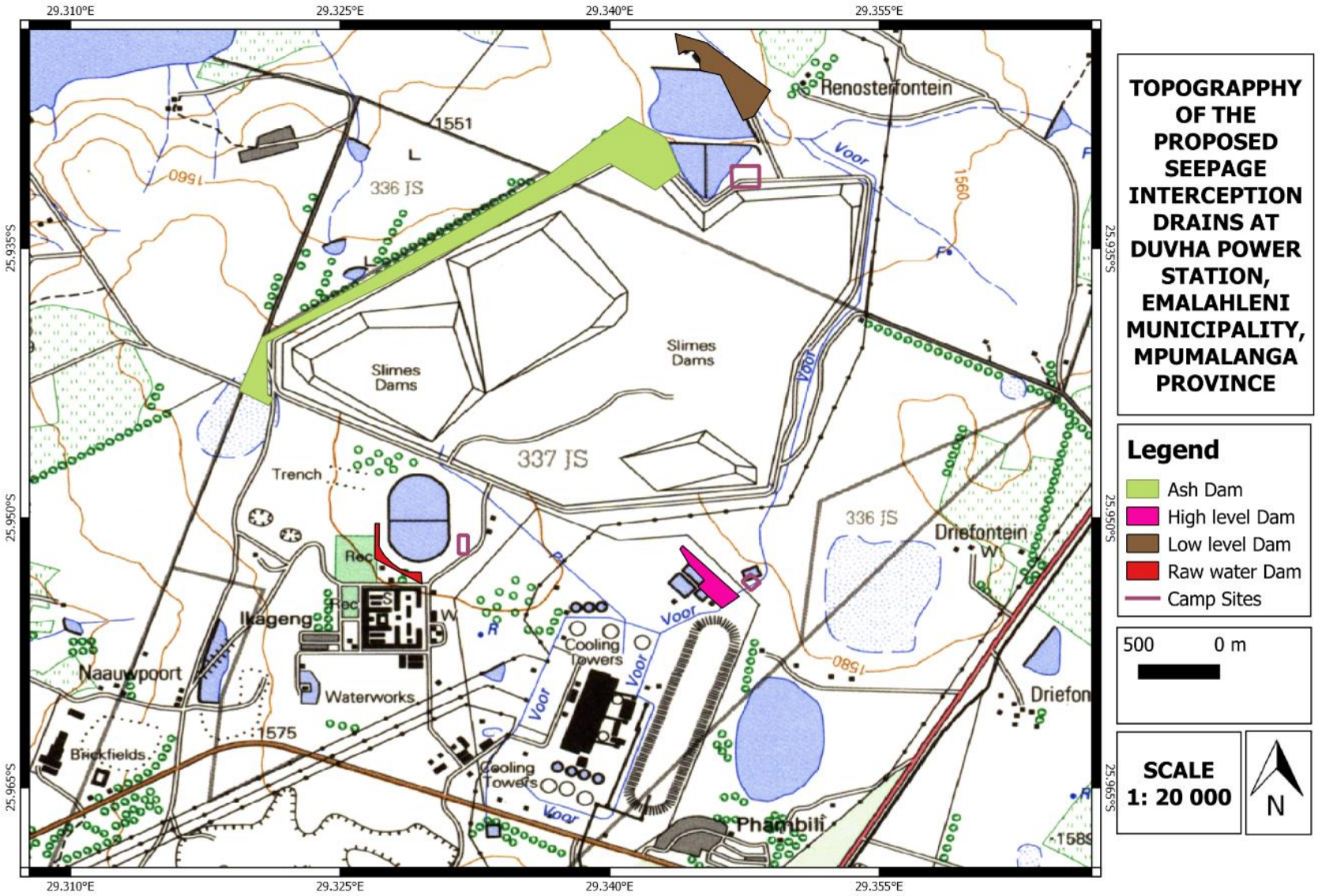


*Figure 3: Extract of the 1:50 000 2529 CD topographical map indicating the proposed Duvha Seepage Interception Drains. Map drawn by QGIS 2.18.28.*

**Duvha Seepage Interceptor Drain Design**

The design and construction of the Seepage Interception Drain will require the following design assumptions:

- Length of trench (Length) = 2400m
- Length of Channel to daylight = 2000m
- Depth of trench (Depth) = 8.0m
- Manning pipe coefficient roughness n = 0.018

**Design Approach**

Four possible options were evaluated:

- Option 1 – Provision of an HDPE Class C Liner on top of Duvha's Ash Dam;
- Option 2 – Open Cut-off Trench;
- Option 3 – Closed Subsoil Cut-off Drain; and
- Option 4 – Do nothing

The closed subsoil cut-off drain is deemed the best option as Option 1 is unacceptable from a station availability point of view and Option 3 is therefore used for the Concept Design. The design approach is to excavate an open trench down to bedrock and place a drain pipe on the bedrock with an HDPE cut-off curtain on the downstream side to intercept and drain the water. The trench will be backfilled with an open channel on the final surface to drain the stormwater. Two HDPE subsoil drainpipes just above the bedrock will be used, an upper slotted drain pipe and a larger lower unslotted pipe to lead the water away. The pipes will be led into manholes spaced at 200m intervals where the upper pipe's flow will fall by gravity into the lower pipe of the next segment[1].

## 2 QUALIFICATIONS AND EXPERIENCE OF THE AUTHOR

The author (Elize Butler) has an MSc in Palaeontology from the University of the Free State, Bloemfontein, South Africa. She has been working in Palaeontology for more than twenty-four years. She has extensive experience in locating, collecting and curating fossils, including exploration field trips in search of new localities in the Karoo Basin. She has been a member of the Palaeontological Society of South Africa for 13 years. She has been conducting PIAs since 2014.

## 3 LEGISLATION

### 3.1 NATIONAL HERITAGE RESOURCES ACT (25 OF 1999)

Cultural Heritage in South Africa, includes all heritage resources, is protected by the National Heritage Resources Act (Act 25 of 1999) (NHRA). Heritage resources as defined in Section 3 of the Act include **"all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens**".

[1]Information provided by PGS Consulting

Palaeontological heritage is unique and non-renewable and is protected by the NHRA. Palaeontological resources may not be unearthed, broken moved, or destroyed by any development without prior assessment and without a permit from the relevant heritage resources authority as per section 35 of the NHRA.

This DIA forms part of the Heritage Impact Assessment (HIA) and adhere to the conditions of the Act. According to **Section 38 (1)**, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint where:

- the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length;
- the construction of a bridge or similar structure exceeding 50 m in length;
- any development or other activity which will change the character of a site—
- (exceeding 5 000 $m^2$ in extent; or
- involving three or more existing erven or subdivisions thereof; or
- involving three or more erven or divisions thereof which have been consolidated within the past five years; or
- the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority
- the re-zoning of a site exceeding 10 000 $m^2$ in extent;
- or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

## 4 OBJECTIVE

The objective of a PIA is to determine the impact of the development on potential palaeontological material at the site.

According to the "SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports" the aims of the PIA are: 1) to **identify** the palaeontological status of the exposed as well as rock formations just below the surface in the development footprint 2) to estimate the **palaeontological importance** of the formations 3) to determine the **impact** on fossil heritage; and 4) to recommend how the developer ought to protect or mitigate damage to fossil heritage.

The terms of reference of a PIA are as follows:

**General Requirements:**

- Adherence to the content requirements for specialist reports in accordance with Appendix 6 of the EIA Regulations 2014, as amended;
- Adherence to all applicable best practice recommendations, appropriate legislation and authority requirements;

- Submit a comprehensive overview of all appropriate legislation, guidelines;
- Description of the proposed project and provide information regarding the developer and consultant who commissioned the study,
- Description and location of the proposed development and provide geological and topographical maps
- Provide Palaeontological and geological history of the affected area.
- Identification sensitive areas to be avoided (providing shapefiles/kmls) in the proposed dvelopment;
- Evaluation of the significance of the planned development during the Pre-construction, Construction, Operation, Decommissioning Phases and Cumulative impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative:
    - **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity.
    - **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity.
    - **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities.
- Fair assessment of alternatives (infrastructure alternatives have been provided):
- Recommend mitigation measures to minimise the impact of the proposed development; and
- Implications of specialist findings for the proposed development (such as permits, licenses etc).

## 5 GEOLOGICAL AND PALAEONTOLOGICAL HERITAGE

The proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province is primarily underlain by the metamorphic sediments of the Selons River Formation (Rooiberg Group) and a small area in the south is located in the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the metamorphic sediments of Selons River Formation is zero while the Vryheid Formation has a Very High Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website).

The southern portion of the development (2 camp sites, high level ash water return dam (HLAWRD), raw water dam as well as the most southern tip of the cut-off trench) falls in the Vryheid Formation which has a Very High Palaeontological Sensitivity and the Low level ash water return dam, most of the proposed cut-off trensh as well as the northern camp site falls in the Selons river Formation of the Rooiberg Group (Figure 4).

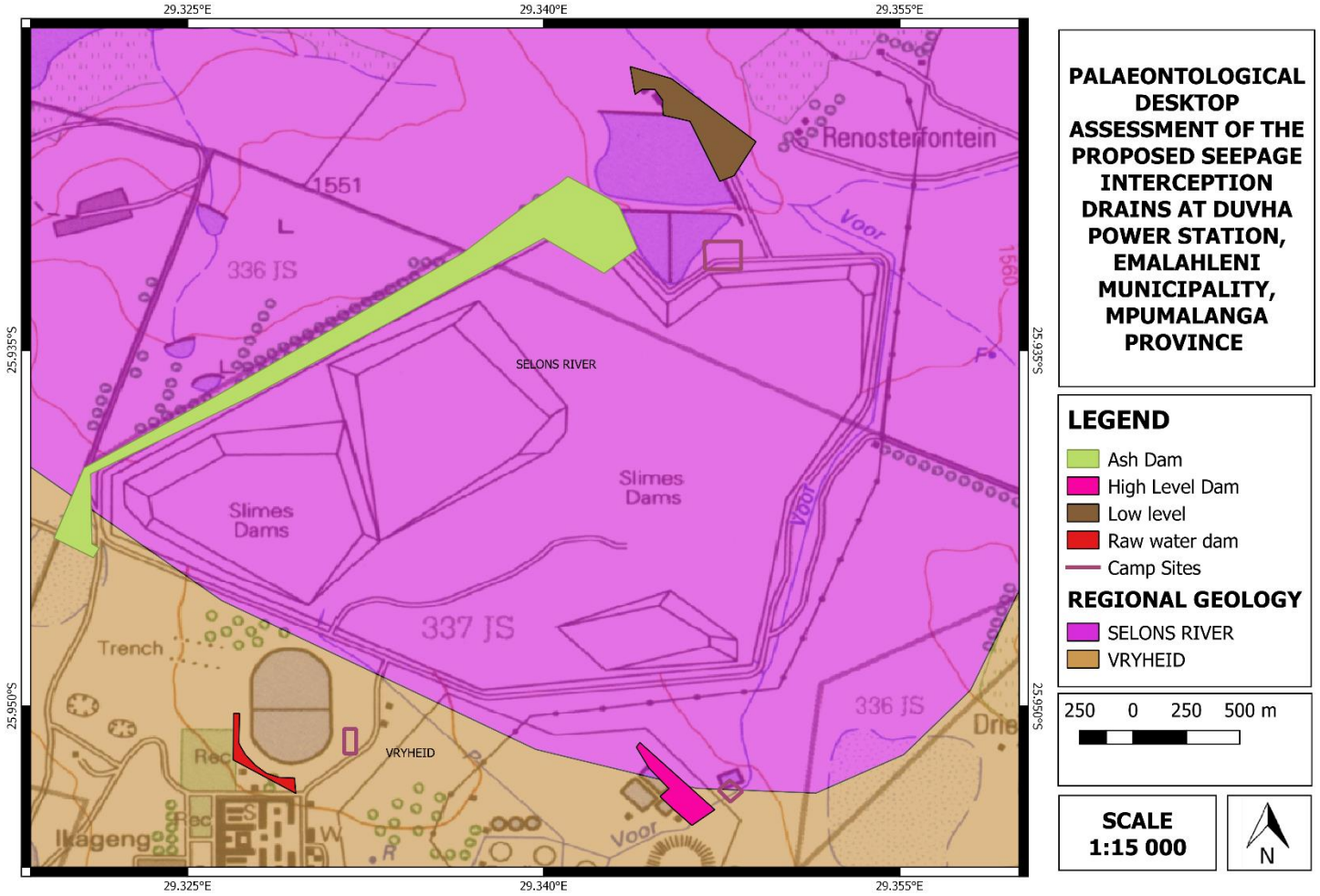


*Figure 4: Surface geology of the proposed Duvha Seepage Interception Drains is primarily underlain by the Selons River Formation and the Vryheid Formation, Ecca Group (Karoo Supergroup).: Map was drawn by QGIS 2.18.28*.

According to SACS (1980), the Rooiberg Group consisted of the Selons River Formation, which was divided in the Klipnek Member and the Doornkloof Member. Schweitzer *et al*. (1995) correlated the Doornkloof and Klipnek Members of the Selons River Formation (SACS, 1980) with the Schrikkloof and Kwaggasnek Formations respectively, thus rendering the Selons River Formation and its members redundant. The Kwaggasnek, Schrikkloof, Damwal and Dullstroom Formations are now known as the Rooiberg Group and comprises of volcanic units. Metamorphosed sediments of quartzites, sandstones, mudrocks and cherts are present which is mainly fluvial in origin.

As already mentioned, the Rooiberg Group comprises of volcanic units. The Rooiberg Group is known not to be fossiliferous.

**Ecca Group**

*Table 2: Ecca Group and Formations. (Modified from Johnson et al, 2006).*

<table>
<tr><th>Period</th><th>Supergroup</th><th>Group</th><th>Formation West of 24º E</th><th>Formation East of 24º E</th><th>Formation Free State / KwaZulu-Natal</th></tr>
<tr><td rowspan="8">Permian</td><td rowspan="8">Karoo Supergroup</td><td rowspan="8">Ecca Group</td><td>Waterford Formation</td><td>Waterford Formation</td><td rowspan="2">Volksrust Formation</td></tr>
<tr><td>Tierberg / Fort Brown Formation</td><td>Fort Brown Formation</td></tr>
<tr><td>Laingsburg / Rippon Formation</td><td>Rippon Formation</td><td>Vryheid Formation</td></tr>
<tr><td>Collingham Formation</td><td>Collingham Formation</td><td rowspan="3">Pietermaritzburg Formation</td></tr>
<tr><td>Whitehill Formation</td><td>Whitehill Formation</td></tr>
<tr><td>Prince Albert Formation</td><td>Prince Albert Formation</td></tr>
<tr><td colspan="2"></td><td>Mbizane Formation</td></tr>
</table>

The **Vryheid Formation** of the Ecca Group comprises mudrock, rhythmite, siltstone and fine- to coarse-grained sandstone (pebbly in places). The Formation contains up to five (mineable) coal seams. The different lithofacies are mainly arranged in upward-coarsening deltaic cycles (up to 80m thick in the southeast). Fining-upward fluvial cycles, of which up to six are present in the east, are typically sheet-

like in geometry, although some form valley-fill deposits. They comprise coarse-grained to pebbly, immature sandstones - with an abrupt upward transition into fine-grained sediments and coal seams.

The Vryheid Formation is known to contain a rich assemblage of Glossopteris flora which is the source vegetation for the Vryheid Formation. Gymnospermous glossopterids dominated the peat and non-peat accumulating of Permian wetlands after continental deglaciation took place (Falcon, 1986c, Greb *et al*., 2006).

Recent paleobotanical studies include that of Adenforff (2005), Bordy and Prefec (2008) and Prefec *et al.* (2008, 2009, 2010) and Prevec, (2011). Bamford (2011) described numerous plant fossils from this formation (e.g. *Azaniodendron fertile*, *Cyclodendron leslii, Sphenophyllum hammanskraalensis, Annularia sp., Raniganjia sp., Asterotheca spp., Liknopetalon enigmata, Hirsutum* sp., *Scutum* sp., *Ottokaria* sp., *Estcourtia* sp., *Arberia* sp., *Lidgetonnia* sp., *Noeggerathiopsis* sp., *Podocarpidites* sp as well as more than 20 Glossopteris species.

In the past, palynological studies have focused on the coal bearing successions of the Vryheid Formation and include articles by Aitken (1993, 1994, 1998), and Millsteed (1994, 1999), while recent studies were conducted by Götz and Ruckwied, 2014).

Bamford (2011) is of the opinion that only a small amount of data have been published on these potentially fossiliferous deposits and that most likely good material are present around coal mines and in other areas the exposures are poor and of little interest. When plant fossils do occur, they are usually abundant. According to Bamford it is not feasible to preserve all the sites but in the interests of science these sites ought to be well documented, researched and the collected fossils must be housed in an accredited institution.

To date, no fossil vertebrates have been collected from the Vryheid formation. The occurrence of fossil insects are rare, while palynomorphs are diverse. Non-marine bivalves and fish scales have also been reported from this formation. Trace fossils are abundantly found but the diversity is low. The mesosaurid reptile, *Mesosaurus* has been found in the southern parts of the basin but may also be present in other areas of the Vryheid formation. Regardless of the rare and irregular occurrence of fossils in this biozone, a single fossil may be of scientific importance as many fossil taxa are known from a single fossil.

## 6 GEOGRAPHICAL LOCATION OF THE SITE

The Duvha Power Station is situated approximately 13km south-east of Witbank, between the R544 and the R575 roads. The planned seepage drains will be built in the servitude areas around the ash dam and accompanying return water dams and the raw water dam within the Duvha Power Station boundary. The development area for all four dams, and the area between the dams, has been previously disturbed by the construction of the dams and associated infrastructure.

The surrounding area consists of slightly to moderately undulating plains of degraded grassland (Moist Sandy Highveld Grassland), with wetlands, pans and rivers. The Witbank Dam is approximately 1,7km north-west of the development area. The surrounding land use comprises mines, quarries and commercial cultivated land, scattered with small villages associated with the mines and well-developed road and rail infrastructure.

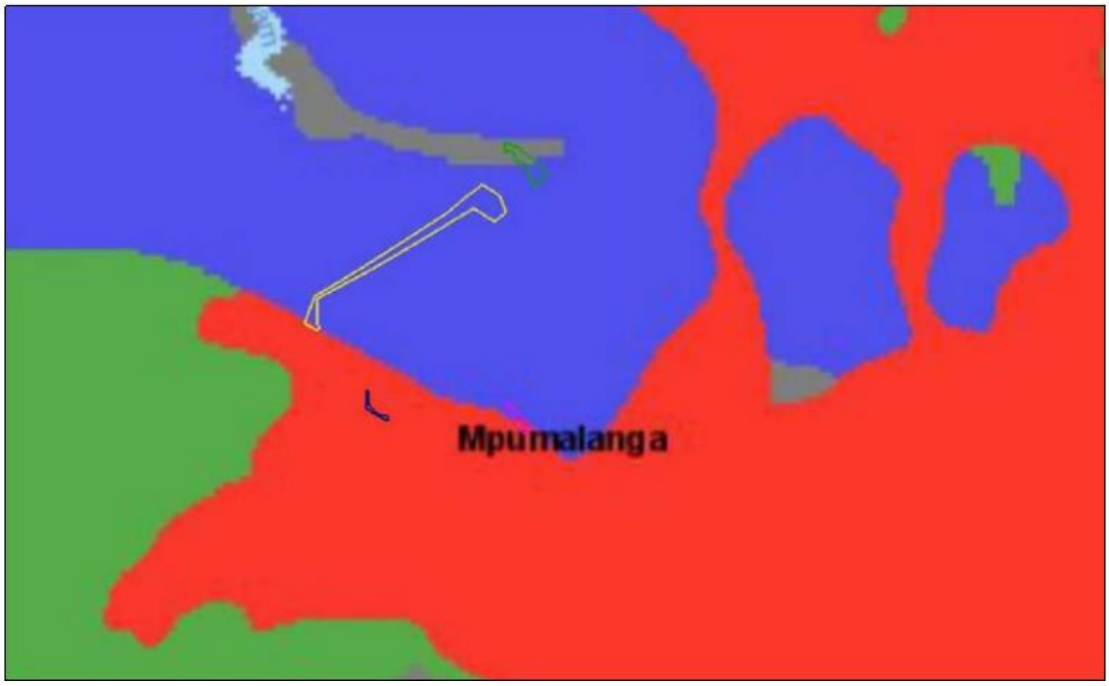


*Figure 5: Extract of the 1 in 250 000 SAHRIS PalaeoMap map (Council of Geosciences) indicating the location of the proposed development.*

*Table 3: Explanation of PalaeoMap*

| Colour | Sensitivity | Required Action |
|---|---|---|
| RED | VERY HIGH | field assessment and protocol for finds is required |
| ORANGE/YELLOW | HIGH | desktop study is required and based on the outcome of the desktop study, a field assessment is likely |
| GREEN | MODERATE | desktop study is required |
| BLUE | LOW | no palaeontological studies are required however a protocol for finds is required |
| GREY | INSIGNIFICANT/ZERO | no palaeontological studies are required |
| WHITE/CLEAR | UNKNOWN | these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map. |

According to the SAHRIS palaeosensitivity map (Figure 5), there is very little chance of finding fossils in this blue and grey area but a very high chance of finding fossils in the red area (Raw water dam and HLWRD).

## 7 METHODS

A desktop study was assembled to evaluate the possible risk to palaeontological heritage (this includes fossils as well as trace fossils) in the proposed development area. In compiling the desktop report, aerial photos, Google Earth 2018, topographical and geological maps and other reports from the same area as well as the author's experience were used to assess the proposed development footprint. No consultations were undertaken for this Impact Assessment.

### 7.1 Assumptions and limitations

The accuracy of Desktop Palaeontological Assessment is reduced by several factors which may include the following: the databases of institutions are not always up to date and relevant locality and geological information were not accurately documented in the past. Various remote areas of South Africa have not been assessed by palaeontologists and data is based on aerial photographs alone. Geological maps concentre on the geology of an area and the sheet explanations were never intended to focus on palaeontological heritage.

Similar Assemblage Zones, but in different areas is used to provide information on the presence of fossil heritage in an unmapped area. Desktop studies of similar geological formations and Assemblage Zones generally **assume** that exposed fossil heritage is present within the development area. The accuracy of the Palaeontological Impact Assessment is thus improved considerably by conducting a field-assessment.

## 8 ADDITIONAL INFORMATION CONSULTED

In compiling this report the following sources were consulted:

- The Palaeosensitivity Map from the SAHRIS website.
- A Google Earth map with polygons of the proposed development was obtained from Nemai Consulting (Pty) Ltd.
- 2529 CD Topographical Map.
- Palaeontological Impact Assesssments in close proximity to the development area found on the internet are included in the reference list and include: Bamford, 2011; 2018 and Butler 2017a, 2017b, 2018.
- The HIA of the development area by PGS Heritage:
    - Kitto, J. 2019. Heritage Impact Assessment for the proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province.

## 9 IMPACT ASSESSMENT METHODOLOGY

Impact assessment must take account of the nature, scale and duration of impacts on the environment whether such impacts are positive or negative. Each impact is also assessed according to the following project phases:

- Construction;

- Operation; and
- Decommissioning.

Where necessary, the proposal for mitigation or optimisation of an impact should be detailed. A brief discussion of the impact and the rationale behind the assessment of its significance should also be included. The rating system is applied to the potential impacts on the receiving environment and includes an objective evaluation of the mitigation of the impact. In assessing the significance of each impact the following criteria is used:

*Table 4:* The rating system

Relevant impacts to the proposed development is indicated in yellow

| | | |
|---|---|---|
| **NATURE** | | |
| Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.<br>The Nature of the Impact is the possible descruction of fossil heritage | | |
| **GEOGRAPHICAL EXTENT** | | |
| This is defined as the area over which the impact will be experienced. | | |
| 1 | Site | The impact will only affect the site. |
| 2 | Local/district | Will affect the local area or district. |
| 3 | Province/region | Will affect the entire province or region. |
| 4 | International and National | Will affect the entire country. |
| **PROBABILITY** | | |
| This describes the chance of occurrence of an impact. | | |
| 1 | Unlikely | The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence). |
| 2 | Possible | The impact may occur (Between a 25% to 50% chance of occurrence). |
| 3 | Probable | The impact will likely occur (Between a 50% to 75% chance of occurrence). |
| 4 | Definite | Impact will certainly occur (Greater than a 75% chance of occurrence). |
| **DURATION** | | |
| This describes the duration of the impacts. Duration indicates the lifetime of the impact as a result of the proposed activity. | | |
| 1 | Short term | The impact will either disappear with mitigation or will be mitigated through natural processes in a span shorter than the construction phase (0 – 1 years), or the impact will last for the period of a relatively short construction |

| | | |
|---|---|---|
| | | period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years). |
| 2 | Medium term | The impact will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years). |
| 3 | Long term | The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 30 years). |
| 4 | Permanent | The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered indefinite. |
| **INTENSITY/ MAGNITUDE** | | |
| Describes the severity of an impact. | | |
| 1 | Low | Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible. |
| 2 | Medium | Impact alters the quality, use and integrity of the system/component but system/component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity). |
| 3 | High | Impact affects the continued viability of the system/ component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation. |
| 4 | Very high | Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired. Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation. |
| **REVERSIBILITY** | | |
| This describes the degree to which an impact can be successfully reversed upon completion of the proposed activity. | | |
| 1 | Completely reversible | The impact is reversible with implementation of minor mitigation measures. |

| | | |
|---|---|---|
| 2 | Partly reversible | The impact is partly reversible but more intense mitigation measures are required. |
| 3 | Barely reversible | The impact is unlikely to be reversed even with intense mitigation measures. |
| 4 | Irreversible | The impact is irreversible and no mitigation measures exist. |
| **IRREPLACEABLE LOSS OF RESOURCES** | | |
| This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity. | | |
| 1 | No loss of resource | The impact will not result in the loss of any resources. |
| 2 | Marginal loss of resource | The impact will result in marginal loss of resources. |
| 3 | Significant loss of resources | The impact will result in significant loss of resources. |
| 4 | Complete loss of resources | The impact is result in a complete loss of all resources. |
| **CUMULATIVE EFFECT** | | |
| This describes the cumulative effect of the impacts. A cumulative impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question. | | |
| 1 | Negligible cumulative impact | The impact would result in negligible to no cumulative effects. |
| 2 | Low cumulative impact | The impact would result in insignificant cumulative effects. |
| 3 | Medium cumulative impact | The impact would result in minor cumulative effects. |
| 4 | High cumulative impact | The impact would result in significant cumulative effects |
| **SIGNIFICANCE** | | |
| Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The calculation of the significance of an impact uses the following formula:<br>(**Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.**<br>The summation of the different criteria will produce a non-weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating. | | |
| Points | Impact significance rating | Description |
| 6 to 28 | Negative low impact | The anticipated impact will have negligible negative effects and will require little to no mitigation. |
| 6 to 28 | Positive low impact | The anticipated impact will have minor positive effects. |
| 29 to 50 | Negative medium impact | The anticipated impact will have moderate negative effects and will require moderate mitigation measures. |

| | | |
|---|---|---|
| 29 to 50 | Positive medium impact | The anticipated impact will have moderate positive effects. |
| 51 to 73 | Negative high impact | The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact. |
| 51 to 73 | Positive high impact | The anticipated impact will have significant positive effects. |
| 74 to 96 | Negative very high impact | The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws". |
| 74 to 96 | Positive very high impact | The anticipated impact will have highly significant positive |

### 9.1 SUMMARY OF IMPACT TABLES

Only the site of the Seepage Interception Drains at Duvha Power Station will be affected by the proposed development. The expected duration of the impact on fossil heritage is assessed as potentially permanent to long term. According to the SAHRIS PalaeoMap there is a possibility that the impact will most likely happen as the sensitivity is very high. But, this area of the development footprint is very small and disturbed due to the agricultural and previous construction activities in the area and thus the magnitude of the impact occurring is medium due to the very small area affected and disturbance of the land. Without mitigation there will be a irriversable and irreplacable loss of fossil Heritage. The significance of the impact will be a negative medium impact.

## 10 FINDINGS AND RECOMMENDATIONS

The proposed Seepage Interception Drains at Duvha Power Station, Emalahleni Municipality, Mpumalanga Province is primarily underlain by the metamorphic sediments of the Selons River Formation (Rooiberg Group) and a small area in the south is located in the Vryheid Formation of the Ecca Group (Karoo Supergroup). According to the PalaeoMap of South African Heritage Resources Information System (SAHRIS), the Palaeontological Sensitivity of the metamorphic sediments of Selons River Formation is zero while the Vryheid Formation has a Very High Palaeontological Sensitivity (Almond and Pether 2008, SAHRIS website).

However, the southern portion of the development (2 camp sites, high level ash water return dam (HLAWRD), raw water dam as well as the most southern tip of the cut-off trench) falls in the Vryheid Formation which has a Very High Palaeontological Sensitivity. **But**, this area of the development **footprint is very small** and **disturbed due** to the agricultural and previous construction activities in the area. It is therefore considered that the construction and operation of the development may be

authorised as the whole extent of the development footprint is not considered sensitive in terms of palaeontological resources.

In the event that fossil remains are discovered during any phase of construction, either on the surface or exposed by fresh excavations, the **Chance Find Protocol** must be implemented by the Environmental Control Officer (ECO) in charge of these developments. This Chance Find Protocol must also be included in the Environmental Management Programme Reports (EMPr). These discoveries ought to be secured (preferably *in situ*) and the ECO ought to alert South African Heritage Resources Agency (SAHRA) so that appropriate mitigation (*e.g.* documented and collection) can be undertaken by a 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 should meet the minimum standards for palaeontological impact studies developed by SAHRA.

## 11 CHANCE FINDS PROTOCOL

The following procedure will only be followed in the event that fossils are uncovered during any stage of excavation.

### 11.1 LEGISLATION

Cultural Heritage in South Africa (includes all heritage resources) is protected by NHRA. According to Section 3 of the Act, all Heritage resources include “all objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects and material, meteorites and rare geological specimens”.

Palaeontological heritage is unique and non-renewable and is protected by the NHRA and are the property of the State. It is thus the responsibility of the State to manage and conserve fossils on behalf of the residents of South Africa. Palaeontological resources may not be broken or destroyed, excavated or moved by any development without prior assessment and without a permit from the applicable heritage resources authority as per section 35 of the NHRA.

### 11.2 BACKGROUND

A fossil is the naturally preserved remains (or traces) of plants or animals embedded in rock. These plants and animals lived in the geologic past. Fossils are extremely rare and irreplaceable. By studying fossils, it is possible to determine the environmental conditions that existed in a specific geographical area millions of years ago.

### 11.3 INTRODUCTION

This informational document is intended for workmen and foremen on construction sites. It describes the actions to be taken when mining or construction activities accidentally uncovers fossil material.

It is the responsibility of the ECO of the project to train the workmen and foremen in the procedure to follow when a fossil is accidentally uncovered. In the absence of the ECO, a member of the staff must be appointed to be responsible for the proper implementation of the chance find protocol as not to compromise the conservation of fossil material.

### 11.4 CHANCE FIND PROCEDURE

- If a chance find is made, the person responsible for the find must immediately **stop working** and all work must cease in the immediate vicinity of the find.
- The person who made the find must immediately **report** the find to his/her direct supervisor which in turn must report the find to his/her manager and the ECO or site manager. The ECO must report the find to the relevant Heritage Agency (South African Heritage Research Agency, SAHRA). (Contact details: SAHRA, 111 Harrington Street, Cape Town. PO Box 4637, Cape Town 8000, South Africa. Tel: 021 462 4502. Fax: +27 (0)21 462 4509. Web: www.sahra.org.za). The information to the Heritage Agency must include photographs of the find, from various angles, as well as the GPS co-ordinates.
- A preliminary report must be submitted to the Heritage Agency within **24 hours** of the find and must include the following: 1) date of the find; 2) a description of the discovery and a 3) description of the fossil and its context (depth and position of the fossil), GPS co-ordinates.
- Photographs (the more the better) of the discovery must be of high quality, in focus, accompanied by a scale. It is also important to have photographs of the vertical section (side) where the fossil was found.

Upon receipt of the preliminary report, the Heritage Agency will inform the ECO (site manager) whether a rescue excavation or rescue collection by a palaeontologist is necessary.

- The site must be secured to protect it from any further damage. **No attempt** should be made to remove material from their environment. The exposed finds must be stabilized and covered by a plastic sheet or sand bags. The Heritage agency will also be able to advise on the most suitable method of protection of the find.
- In the event that the fossil cannot be stabilized the fossil may be collected with extreme care by the ECO (site manager). Fossils finds must be stored in tissue paper and in an appropriate box while due care must be taken to remove all fossil material from the rescue site.
- Once Heritage Agency has issued the written authorization, the developer may continue with the development.

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**Appendix: 1: CV**

**ELIZE BUTLER**

**PROFESSION:** Palaeontologist

**YEARS' EXPERIENCE**: 25 years in Palaeontology

**EDUCATION:**

B.Sc Botany and Zoology, 1988
University of the Orange Free State

B.Sc (Hons) Zoology, 1991
University of the Orange Free State

Management Course, 1991
University of the Orange Free State

M. Sc. *Cum laude* (Zoology), 2009
University of the Free State

**Dissertation title:** The postcranial skeleton of the Early Triassic non-mammalian Cynodont *Galesaurus planiceps*: implications for biology and lifestyle

Registered as a PhD fellow at the Zoology Department of the UFS
2013 to current

**Dissertation title:** A new gorgonopsian from the uppermost D*aptocephalus Assemblage Zone*, in the Karoo Basin of South Africa

**MEMBERSHIP**

Palaeontological Society of South Africa (PSSA) 2006-currently

**EMPLOYMENT HISTORY**

| | |
|---|---|
| Part time Laboratory assistant | Department of Zoology & Entomology University of the Free State Zoology 1989-1992 |
| Part time laboratory assistant | Department of Virology University of the Free State Zoology 1992 |
| Research Assistant | National Museum, Bloemfontein 1993 – 1997 |
| Principal Research Assistant and Collection Manager | National Museum, Bloemfontein 1998–currently |

**TECHNICAL REPORTS**

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**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a 132KV powerline from the Tweespruit distribution substation (in the Mantsopa local municipality) to the Driedorp rural substation (within the Naledi local municipality), Free State province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed development of the new coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of a Photovoltaic Solar Power station near Collett substation, Middelberg, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment for the proposed township establishment of 2000 residential sites with supporting amenities on a portion of farm 826 in Botshabelo West, Mangaung Metro, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed prospecting right project without bulk sampling, in the Koa Valley, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed Aroams prospecting right project, without bulk sampling, near Aggeneys, Northern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvior aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** PIA site visit and report of the proposed Galla Hills Quarry on the remainder of the farm Roode Krantz 203, in the Lukhanji Municipality, division of Queenstown, Eastern Cape Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of Tina Falls Hydropower and associated power lines near Cumbu, Mthlontlo Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of the Mangaung Gariep Water Augmentation Project. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed Belvoir aggregate quarry II on portion 7 of the farm Maidenhead 169, Enoch Mgijima Municipality, division of Queenstown, Eastern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed construction of the Melkspruit-Rouxville 132KV Power line. Bloemfontein.

**Butler, E. 2017** Palaeontological Desktop Assessment of the proposed development of a railway siding on a portion of portion 41 of the farm Rustfontein 109 is, Govan Mbeki local municipality, Gert Sibande district municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed consolidation of the proposed Ilima Colliery in the Albert Luthuli local municipality, Gert Sibande District Municipality, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed extension of the Kareerand Tailings Storage Facility, associated borrow pits as well as a storm water drainage channel in the Vaal River near Stilfontein, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed construction of a filling station and associated facilities on the Erf 6279, district municipality of John Taolo Gaetsewe District, Ga-Segonyana Local Municipality Northern Cape. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed of the Lephalale Coal and Power Project, Lephalale, Limpopo Province, Republic of South Africa. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Overvaal Trust PV Facility, Buffelspoort, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed development of the H2 Energy Power Station and associated infrastructure on Portions 21; 22 And 23 of the farm Hartebeestspruit in the Thembisile Hani Local Municipality, Nkangala District near Kwamhlanga, Mpumalanga Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the Sandriver Canal and Klippan Pump station in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed upgrade of the 132kv and 11kv power line into a dual circuit above ground power line feeding into the Urania substation in Welkom, Free State Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2017.** Palaeontological Impact Assessment of the proposed diamonds alluvial & diamonds general prospecting right application near Christiana on the remaining extent of portion 1 of the farm Kaffraria 314, registration division HO, North West Province. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Hartebeesfontein, near Panbult, Mpumalanga. Bloemfontein.

**Butler, E. 2017.** Palaeontological Desktop Assessment for the proposed development of Wastewater Treatment Works on Rustplaas near Piet Retief, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment for the Proposed Landfill Site in Luckhoff, Letsemeng Local Municipality, Xhariep District, Free State. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed development of the new Mutsho coal-fired power plant and associated infrastructure near Makhado, Limpopo Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the authorisation and amendment processes for Manangu mine near Delmas, Victor Khanye local municipality, Mpumalanga. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Mashishing township establishment in Mashishing (Lydenburg), Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the Proposed Mlonzi Estate Development near Lusikisiki, Ngquza Hill Local Municipality, Eastern Cape. Bloemfontein.

**Butler, E. 2018.** Palaeontological Phase 1 Assessment of the proposed Swaziland-Mozambique border patrol road and Mozambique barrier structure. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed electricity expansion project and Sekgame Switching Station at the Sishen Mine, Northern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed construction of the Zonnebloem Switching Station (132/22kV) and two loop-in loop-out power lines (132kV) in the Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment for the proposed re-alignment and de-commisioning of the Firham-Platrand 88kv Powerline, near Standerton, Lekwa Local Municipality, Mpumalanga province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological field Assessment of the proposed Villa Rosa development In the Buffalo City Metropolitan Municipality, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed Mookodi – Mahikeng 400kV line, North West Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Desktop Assessment for the proposed Thornhill Housing Project, Ndlambe Municipality, Port Alfred, Eastern Cape Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed housing development on portion 237 of farm Hartebeestpoort 328. Bloemfontein.

**Butler, E. 2018.** Palaeontological desktop assessment of the proposed New Age Chicken layer facility located on holding 75 Endicott near Springs in Gauteng. Bloemfontein.

**Butler, E. 2018** Palaeontological Desktop Assessment for the development of the proposed Leslie 1 Mining Project near Leandra, Mpumalanga Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological field assessment of the proposed development of the Wildealskloof mixed use development near Bloemfontein, Free State Province. Bloemfontein.

**Butler, E. 2018.** Palaeontological Field Assessment of the proposed Megamor Extension, East London. Bloemfontein.

**Butler, E. 2018.** Palaeontological Impact Assessment of the proposed diamonds Alluvial & Diamonds General Prospecting Right Application near Christiana on the Remaining Extent of Portion 1 of the Farm Kaffraria 314, Registration Division HO, North West Province. Bloemfontein

**E. Butler.** 2019. Palaeontological Desktop Assessment of the proposed Westrand Strengthening Project Phase II.

**E. Butler**. 2019. Palaeontological Field Assessment for the proposed Sirius 3 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**E. Butler.** 2019. Palaeontological Field Assessment for the proposed Sirius 4 Photovoltaic Solar Energy Facility near Upington, Northern Cape Province

**E. Butler**. 2019. Palaeontological Field Assessement for Heuningspruit PV 1 Solar Energy Facility near Koppies, Ngwathe Local Municipality, Free State Province.

**E. Butler**. 2019. Palaeontological Field Assessment for the Moeding Solar Grid Connection, North West Province.

**E. Butler.** 2019. Recommended Exemption from further Palaeontological studies for the Proposed Agricultural Development on Farms 1763, 2372 And 2363, Kakamas South Settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019.** Recommended Exemption from further Palaeontological studies: of Proposed Agricultural Development, Plot 1178, Kakamas South Settlement, Kai! Garib Municipality

**E. Butler. 2019.** Palaeontological Desktop Assessment for the Proposed Waste Rock Dump Project at Tshipi Borwa Mine, near Hotazel, Northern Cape Province:

**E. Butler. 2019**. Palaeontological Exemption Letter for the proposed DMS Upgrade Project at the Sishen Mine, Gamagara Local Municipality, Northern Cape Province

**E. Butler. 2019.** Palaeontological Desktop Assessment of the proposed Integrated Environmental Authorisation process for the proposed Der Brochen Amendment project, near Groblershoop, Limpopo

E. **Butler. 2019.** Palaeontological Desktop Assessment of the proposed updated Environmental Management Programme (EMPr) for the Assmang (Pty) Ltd Black Rock Mining Operations, Hotazel, Northern Cape

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed Kriel Power Station Lime Plant Upgrade, Mpumalanga Province

**E. Butler.** 2019. Palaeontological Impact Assessment for the proposed Kangala Extension Project Near Delmas, Mpumalanga Province.

**E. Butler. 2019**. Palaeontological Desktop Assessment for the proposed construction of an iron/steel smelter at the Botshabelo Industrial area within the Mangaung Metropolitan Municipality, Free State Province.

**E. Butler. 2019**. Recommended Exemption from further Palaeontological studies for the proposed agricultural development on farms 1763, 2372 and 2363, Kakamas South settlement, Kai! Garib Municipality, Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019.** Recommended Exemption from further Palaeontological Studies for Proposed formalisation of Gamakor and Noodkamp low cost Housing Development, Keimoes, Gordonia Rd, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019**. Recommended Exemption from further Palaeontological Studies for proposed formalisation of Blaauwskop Low Cost Housing Development, Kenhardt Road, Kai !Garib Local Municipality, ZF Mgcawu District Municipality, Northern Cape Province.

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed mining permit application for the removal of diamonds alluvial and diamonds kimberlite near Windsorton on a certain portion of Farm Zoelen's Laagte 158, Registration Division: Barkly Wes, Northern Cape Province

**E. Butler. 2019**. Palaeontological Desktop Assessment of the proposed Vedanta Housing Development, Pella Mission 39, Khâi-Ma Local Municipality, Namakwa District Municipality, Northern Cape.

environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

| | (For official use only) |
|---|---|
| File Reference Number: | |
| NEAS Reference Number: | DEA/EIA/ |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

**PROJECT TITLE**

**PALAEONTOLOGICAL DESKTOP ASSESSMENT OF THE PROPOSED SEEPAGE INTERCEPTION DRAINS AT DUVHA POWER STATION, EMALAHLENI MUNICIPALITY, MPUMALANGA PROVINCE**

**Kindly note the following:**

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

**Departmental Details**

**Postal address:**
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

**Physical address**:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

## 1. SPECIALIST INFORMATION

| | | | | |
|---|---|---|---|---|
| Specialist Company Name: | Banzai Environmental Pty Ltd | | | |
| B-BBEE | Contribution level (indicate 1 to 8 or non-compliant) | Level 4 | Percentage Procurement recognition | Less than 51% |
| Specialist name: | Elize Butler | | | |
| Specialist Qualifications: | MSc | | | |
| Professional affiliation/registration: | PSSA | | | |
| Physical address: | 14 Eddie de Beer street, Dan Pienaar, Bloemfontein | | | |
| Postal address: | 14 Eddie de Beer street, Dan Pienaar, Bloemfontein | | | |
| Postal code: | 9301 | Cell: | | |
| Telephone: | 084 4478 759 | Fax: | | |
| E-mail: | Elizebutler002@gmail.com | | | |

## 2. DECLARATION BY THE SPECIALIST

I, Elize Butler, declare that –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

Banzai Environmental Pty Ltd

Name of Company:

25/09/2019.

Date

## 3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Elize Butler, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

Banzai Environmental

Name of Company

25-09-2019

Date

25/09/2019 CST

DT MAKHELE

Signature of the Commissioner of Oaths

2019.09.25

Date

SUID-AFRIKAANSE POLISIEDIENS
COMMUNITY SERVICE CENTRE
2019 -09- 25
BAYSWATER
SOUTH AFRICAN POLICE SERVICE