Lidwala Environmental & Planning Services

Eskom Holdings Limited

Environmental Impact Assessment for the Proposed Expansion of Ash Disposal Facilities at Hendrina Power Station, Mpumalanga Province

SCREENING REPORT

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Environmental Impact Assessment for the Proposed Expansion of Ash Disposal Facilities at Hendrina Power Station, Mpumalanga Province

Screening Report

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1.1 Why Extend The Hendrina Power Station Ash Dams?

Eskom's core business is the generation, transmission and distribution of electricity throughout South Africa. Electricity by its nature cannot be stored and must be used as it is generated. Therefore electricity is generated according to supply-demand requirements. The reliable provision of electricity by Eskom is critical to industrial development and poverty alleviation in the country.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users in South Africa, it has to continually expand its infrastructure of generation capacity and transmission and distribution powerlines. This expansion includes not only the building of new power stations but also expanding and upgrading existing power stations to extend their life.

The Hendrina Power Station, in the Mpumalanga Province currently uses a wet ashing system for the disposal of ash . Hendrina Power Station currently have five ash dams, of which two ash dams (Ash dam 3 and 5) are currently in operation, the other three dams (Ash dam 1, 2 & 4) are not in use due to either having reached their full capacity (Dams 1 and 4) or due to stability issues (Dam 2). At the current rate of disposal Dams 3 and 5 will reach full capacity within five years (from the end of 2010). The Hendrina Power Station is anticipated to ash approximately 64.2 million m3 until the end of its life span which is currently estimated to be 2035.

It is clear that the existing ashing facilities are not able to provide sufficient capacity for this amount of ash in order to ensure that the power station can operate for its full life span. Therefore, Hendrina Power Station propose to extend its ashing facilities and associated infrastructure with the following development specifications:

- Airspace of 43.3 million m3
- Ground footprint of 139 ha for the ash dam
- Ground footprint of approximately 70 ha for associated infrastructure such as Ash Water Return dams and Seepage dams

The need for this is extension will allow station to continue ashing in an environmentally responsible way for life of station, which is related to the high ash content in the coal and an urgent need to extend station life.

1.2 What Does The Hendrina Ash Dam Extension Project Entail?

The project includes the expansion of the Ash Dam facilities at the Hendrina Power Station in the Mpumalanga Province. The ash dam expansion will need to be big enough to dispose of 43.3 million m^3. The footprint of the proposed expansion is estimated to be in the order of 209 ha however the final shape and design of the footprint is still to be determined through conceptual engineering and design.

It is envisaged that the proposed power station will continue to utilise a wet ashing system, however this will be investigated during the EIA process. In addition to the expansion of the ash dams the project will also include the expansion of the relevant infrastructure associated with the ashing system, such as Ash water dams, pipelines, stormwater trenches, seepage water collection systems, pump stations, seepage dams etc.

2 SCREENING ANALYSIS METHODOLOGY

2.1 Introduction

A screening study was initiated upfront in the process in order to identify potential ideal/preferred areas within the study area that would be suitable for use as alternative sites for the proposed new ash dam. The study area was demarcated using an 8 km radius around the Hendrina Power Station. A further 5 km radius was also included in the study as this is anticipated to be the area within which no substantial additional costs would be incurred in terms of the construction and operation of the proposed new ash dam.

In order to ensure that sites were identified in the most objective manner possible, a sensitivity mapping exercise was undertaken for the study area. The purpose of such an exercise was to identify suitable areas within the study area that could accommodate the proposed new ash dam and associated infrastructure and to pro-actively identify sensitive areas (i.e. fatal flaws) that should ideally be avoided. The sites identified during this exercise will be evaluated during the scoping phase of the project

2.2 Sensitivity Mapping

The qualitative sensitivity mapping exercise divided the study area into three categories *viz.* lower, medium and higher sensitivity areas. A sensitivity map for the study area was requested from each of the following specialist fields:

Biophysical

- Groundwater
- Surface Water
- Fauna and Flora
- Avifauna

Social

- Social
- Heritage
- Visual

Table 2.1 provides a description of the various categories used in the sensitivity mapping.

Table 2.1 Description of the various categories used in the sensitivity mapping

Study Component	Category	Description
Biophysical Components		
Fauna and Flora	Higher Sensitivity	Areas of atypical habitat, conservation areas, riparian and wetland habitat, known presence of plant species of concern, not regarded suitable for proposed development, expected impacts likely to be unacceptable on a local or regional scale, adverse impact not possible to mitigate
	Medium Sensitivity	Associated with natural/ pristine regional habitat, moderate likelihood of harbouring species and habitat of concern, moderate suitability for proposed development. Even with careful site selection, expected impacts could be potentially significant, but possible to mitigate through site-specific mitigation measures and site selection
	Lower Sensitivity	Associated with transformed habitat, not likely to contain biodiversity attributes of sensitivity, considered suitable for proposed development, expected impacts regarded to be of low significance, possible to mitigate through generic mitigation measures. The status of specific areas is also influenced by the presence of nearby sites of sensitivity
Surface Water	Higher Sensitivity	100 m zone from the edge of the permanent wet zone for valley bottom and pan systems.
	Medium Sensitivity	100 m buffer zone from the edge of the temporary zones, or the edge of the riparian zones.
	Lower Sensitivity	Higher lying areas, reflecting terrestrial soils and no obligate, facultative hydrophilic vegetation
Ground Water[1]	Higher Sensitivity	Those areas within the 250 m surface water buffer zone.
	Medium Sensitivity	Areas falling within the area classified as D3, but still outside of all areas within the 250 m surface water buffer zone.
	Lower Sensitivity	Areas falling outside of the 250 m buffer around surface water features, and outside of the area classified as "D3" on the general hydrogeology map series (GRA1 data)

[1] Depth of groundwater across the site is not known with accuracy, but is almost certainly shallower closer to surface water features - hence the higher sensitivity assigned to a 250 m buffer zone adjacent to surface water features. Permeability (rate at which water can "penetrate" ground) is covered by the DWA hydrogeological classification - essentially the same across the site ("D2"), except for the small area classified as "D3" - which has higher borehole yields and likely higher permeability, and has therefore been classified as medium sensitivity rather than lower sensitivity. The 250 m buffer is a horizontal distance, not a depth.

Study Component	Category	Description
Avifauna	Higher Sensitivity	Wetlands, rivers and streams, farm dams, CWAC sites,
	Medium Sensitivity	Remaining cultivated lands and farm lands
	Lower Sensitivity	Built up areas, roads, mines, existing ash dams, railway lines and high voltage power lines
Social Components		
Social: Distance from proposed Ash Dam	Higher Sensitivity	500 – 1000 meters
	Medium Sensitivity	1000 – 1500 meters
	Lower Sensitivity	1500 meters or more
Social: Settlement Type	Higher Sensitivity	Residential
	Medium Sensitivity	Informal Community
	Lower Sensitivity	Single Housing
Social: Settlement Farms	Higher Sensitivity	Community
	Medium Sensitivity	Farm House
	Lower Sensitivity	No housing
Social: Health Risk – air quality	Higher Sensitivity	High risk within radius of 500 – 1000m
	Medium Sensitivity	Medium risk within radius of 1000 – 1500m
	Lower Sensitivity	Low risk within radius of more than 1500m
Social: Dust pollution (visibility/health/quality)	Higher Sensitivity	Above legal standard
	Medium Sensitivity	Within limits
	Lower Sensitivity	Below legal limits
Social: Visual Impact (quality of life)	Higher Sensitivity	Within 1000m
	Medium Sensitivity	Within 1500m
	Lower Sensitivity	Within 3000m
Social: Economic impact on agriculture	Higher Sensitivity	Private farmland
	Medium Sensitivity	Eskom land (but farmed)
	Lower Sensitivity	Denuded land
Heritage	Higher Sensitivity	Heritage resources with qualities so exceptional that they are of special national significance.
	Medium Sensitivity	Heritage resources which, although forming part of the national state, can be considered to have special qualities which make them significant within the context of a province or a region. Medium sensitivity areas also include areas where little work has been undertaken and therefore the presence of significant heritage resources is not known.

Study Component	Category	Description
	Lower Sensitivity	Other heritage resources worthy of conservation, and which prescribes heritage resources assessment criteria, consistent with the criteria set out in section 3(3) of the National Heritage Resources Act (Act No 25 of 1999), which must be used by a heritage resources authority or a local authority to assess the intrinsic, comparative and contextual significance of a heritage resource and the relative benefits and costs of its protection, so that the appropriate level of grading of the resource and the consequent responsibility for its management may be allocated in terms of section 8 of the said Act.
Visual	Higher Sensitivity	Restricted location for the proposed development with highest visual sensitivity – no positive criteria and one or more restrictions (negative criteria).
	Medium Sensitivity	Acceptable or suitable location for the proposed development with neutral visual sensitivity – no positive criteria, but no restrictions (negative criteria) either.
	Lower Sensitivity	Preferred or ideal location for the proposed development with lowest visual sensitivity – complies with the positive criteria with no restrictions (negative criteria)

2.3 GIS Layer Amalgamation and Sensitivity Indice Calculation

In order to calculate a combined sensitivity rating for the study area, all the GIS layers received from each specialist area of study (e.g. ground water, biosensitivity etc) were combined to form one integrated layer (**Figure 2.1**). During this integration, string arrays were built containing information on the layer name, the assigned sensitivity rating for each particular area and the adjustment factor for the particular layer (**Figure 2.2**).

Three results (**Figure 2.2**) were then calculated from the integrated layer (**Figure 2.1**) by unnesting and summarising the string array data using the following logics:

- **maximum sensitivity wins:**
  The maximum sensitivity rating found in the array became the sensitivity index.
- **sum of all sensitivity ratings:**
  The sensitivity index was the sum of each sensitivity rating found in the array.
- **sum of all adjusted sensitivity ratings:**
  Each sensitivity rating found in the array was adjusted by the assigned adjustment factor for each particular layer. The sensitivity index was then the sum of these.

The presented maps were then created by reclassifying each logic result into five classes, namely:

- low sensitivity (light green),
- low medium sensitivity (green)
- medium sensitivity (yellow)
- medium high (orange)
- high sensitivity (red).

Finally, the reclassified layer was clipped with the pre-determined no-go areas layer (to remove them from consideration) and further clipped with the 8km radius study area buffer to remove any extraneous features.

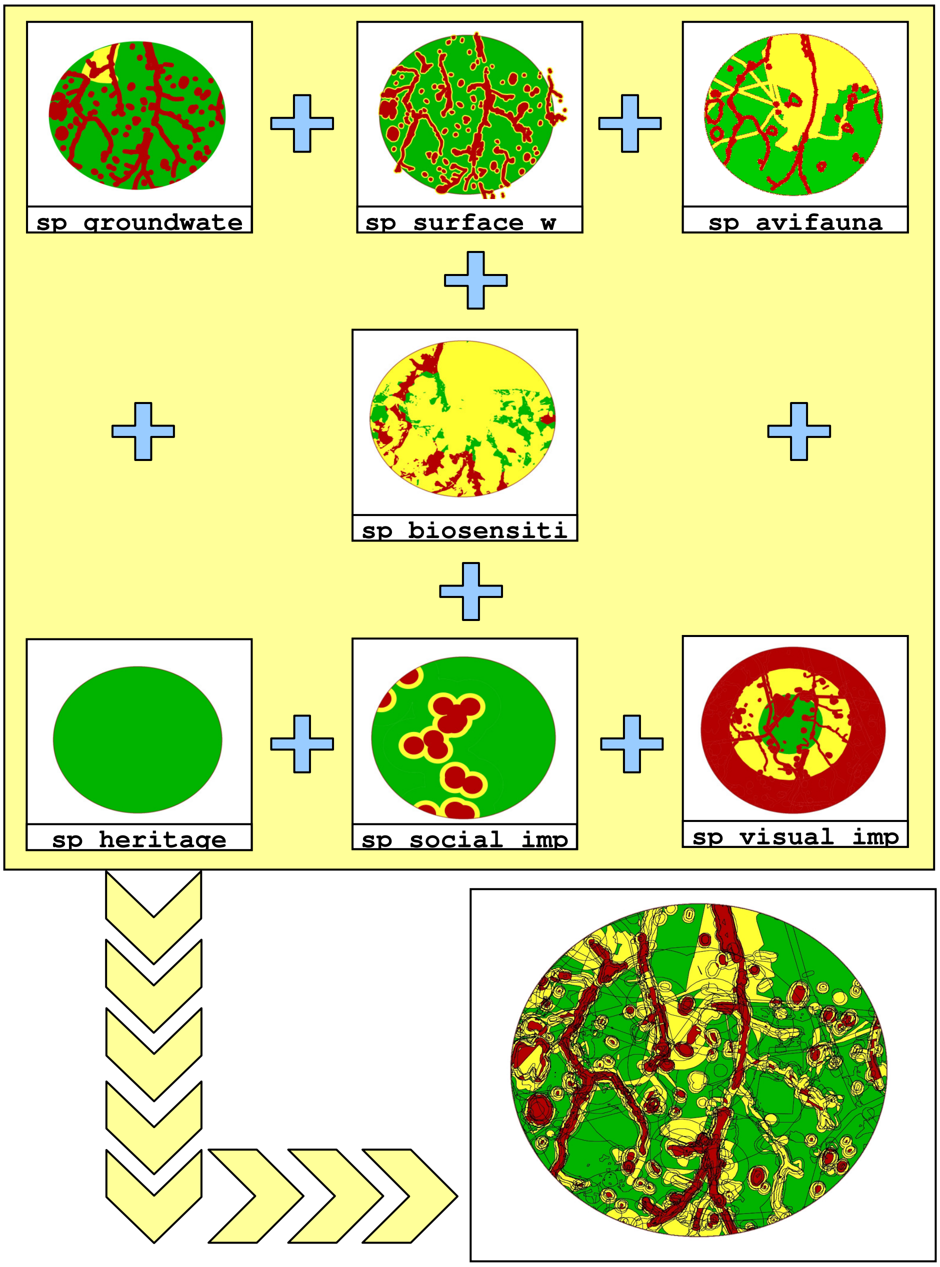
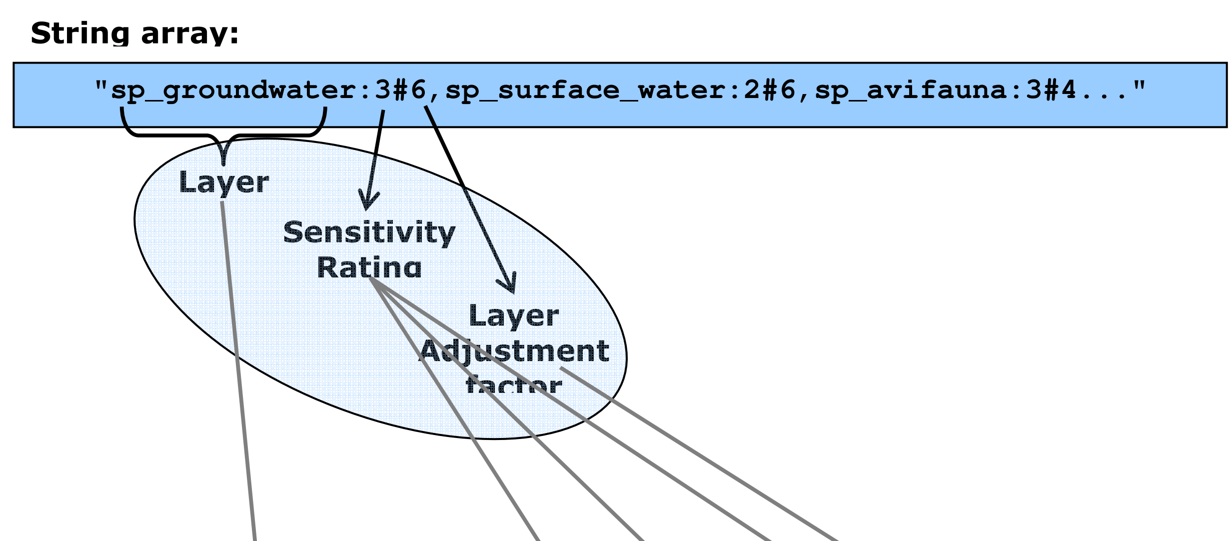


Figure 2.1: Layer integration



Layer	Max Wins	No Factor	With Adjustment Factor
sp_g roundwater	3	3 x 1 (3)	3 x 6 (18)
sp_s urface_water	2	2 x 1 (2)	2 x 6 (12)
sp_a vifauna	3	3 x 1 (3)	3 x 4 (12)
sp_b iosensitivity	1	1 x 1 (1)	1 x 4 (4)
sp_h eritage	2	2 x 1 (2)	2 x 2 (4)
sp_v isual_impact	1	1 x 1 (1)	1 x 2 (2)
sp_s ocial_impact	1	1 x 1 (1)	1 x 2 (2)
Sensitivity Rating	**3**	**13**	**54**

Figure 2.2: String array parts and resultant indice calculations: max wins; sensitivity rating as is and sensitivity with an applied factor.

2.4 Adjustment Factor / weighting factor Methodology

In order to give each component a weighting factor with which to adjust the layers, the following methodology was utilised.

In a weighted matrix each variable / component is given a different importance weighting. In order to ensure that consensus is obtained with regards to the weighting / adjustment factors input from the project team and all specialists was obtained. Each member of the Project team was asked to rank each variable according to their own understanding of its significance, utilising the following ratings:

- 1 - low significance
- 2 - medium significance
- 3 - high significance

Once all the input was received, the rating provided for each variable was added and then divided by the number of people that took part in the exercise in order to obtain an average rating. Three sets of ratings were collected, namely:

- Specialist and Lidwala Project Team ratings (**Table 2.2**)
- Client ratings (**Table 2.3**)
- Combined ratings (**Table 2.4**)

The final decision to utilise the combined rating as the final weighting factors for the sensitivity analysis was due to the fact that the client's ratings did not dilute the weighting factors, they actually made the weighting factors stricter.

Table 2.2: Specialist and Lidwala Project Team ratings

	Specialists and Lidwala Project Team												
Aspect	Social	Fauna and Flora	Surface Water	Ground water	Design	Geotech	Avifauna	Project Manager	GIS	Soil	Final Total	Number participants	Average Rating
Social	3	1	2	3	2	2	1	2	1	1	18	10	1.80
Fauna and flora	2	3	2	2	1	1	3	2	2	2	20	10	2.00
surface water	2	3	3	3	2	2	2	3	3	2	25	10	2.50
groundwater	2	3	3	2	2	2	2	3	3	2	24	10	2.40
heritage	1	2	2	1	1	1	1	1	1	1	12	10	1.20
visual	2	2	1	1	3	3	1	2	1	1	17	10	1.70
technical and cost	1	1	1	3	3	3	1	3	2	1	19	10	1.90
Avifauna	2	3	2	2	2	2	3	2	3	1	22	10	2.20

Table 2.3: Client ratings

	Eskom Team					
Aspect	Env	Civil	Mech	Final Total	Number participants	Average Rating
Social	2.5	1	2	5.5	3	1.83
Fauna and flora	2	3	1.75	6.75	3	2.25
surface water	2.5	3	2.25	7.75	3	2.58
groundwater	2.5	3	2.25	7.75	3	2.58
heritage	1	2	1.5	4.5	3	1.50
visual	1.5	1	1.25	3.75	3	1.25
technical and cost	2	2	2.75	6.75	3	2.25
Avifauna	1.5	2	1.75	5.25	3	1.75

Table 2.4: Combined ratings

	Specialists and Lidwala Project Team			Eskom Team			Final Combined Ratings		
Aspect	Final Total	Number participants	Average Rating	Final Total	Number participants	Average Rating	Final Total Combined	Number participants	Final Average Rating
Social	18	10	1.80	5.5	3	1.83	23.5	13	1.81
Fauna and flora	20	10	2.00	6.75	3	2.25	26.75	13	2.06
surface water	25	10	2.50	7.75	3	2.58	32.75	13	2.52
groundwater	24	10	2.40	7.75	3	2.58	31.75	13	2.44
heritage	12	10	1.20	4.5	3	1.50	16.5	13	1.27
visual	17	10	1.70	3.75	3	1.25	20.75	13	1.60
technical and cost	19	10	1.90	6.75	3	2.25	25.75	13	1.98
Avifauna	22	10	2.20	5.25	3	1.75	27.25	13	2.10

The final weighting factors for each aspect are therefore as follows:

- Social = 1.81
- Fauna and Flora = 2.06
- Surface Water = 2.52
- Ground Water = 2.44
- Heritage = 1.27
- Visual = 1.60
- Avifauna = 2.10
- Technical and Cost = 1.98

3 DESCRIPTION OF THE STUDY AREA

3.1 Biophysical Environment

3.1.1 Fauna and Flora (Ecology)

- ***Land Cover & Land Use of the Region***

Land cover categories are presented in **Figure 3.1**. For the purpose of this assessment, land cover are loosely categorised into classes that represent natural habitat and land use categories that contribute to habitat degradation and transformation on a local or regional scale. In terms of the importance for biodiversity the assumption is made that landscapes that exhibit high levels of transformation are normally occupied by plant communities and faunal assemblages that does not reflect the original or pristine status of an area or region. This is particularly important in the case of Red Data species as these plants and animals have extremely low tolerance levels to any disturbance, which is one of the main reasons for being threatened. Any significant changes to the status of habitat available to these species are therefore likely to result in severe impacts on these species and their conservation status.

The study area is located in a region that comprises extensive areas of transformed habitat that resulted from agriculture and mining. The high transformation factor of the region renders remaining habitat fragmented and isolated. Little natural grassland habitat remains in the area, the majority being around streams and rivers where ploughing is not possible or soils are poor in nutrients.

One of the shortfalls of the Environmental Potential Atlas database (ENPAT) is that it does not reflect the current status of natural habitat within the study area. At this stage of the process it is therefore assumed that all areas indicated to comprise of natural grassland are representative of the regional vegetation types and are in a good condition. While this assumption is unlikely to hold true for most of the study area, an assessment of the actual ecological status of grasslands within the study area is beyond the scope of this report.

- ***Ridges & Topography***

Varied topography is recognised as one of the most powerful influences contributing to the high biodiversity of southern Africa. Landscapes composed of spatially heterogeneous abiotic conditions provide a greater diversity of potential niches for plants and animals than do homogeneous landscapes. Richness and diversity of flora has been found to be significantly higher in sites with high geomorphological heterogeneity and it can reasonably be assumed that associated faunal communities will also be significantly more diverse in spatially heterogeneous environments.

The topography of the region falls into the categories of 'Moderately Undulating Plains and Pans' and the general altitude is approximately 1,600 meter above sea level. No extensive areas of significant slopes are present in the study area, but small localised areas of outcrops and ridges are present. No GIS analysis of available data was compiled for the purpose of this report.

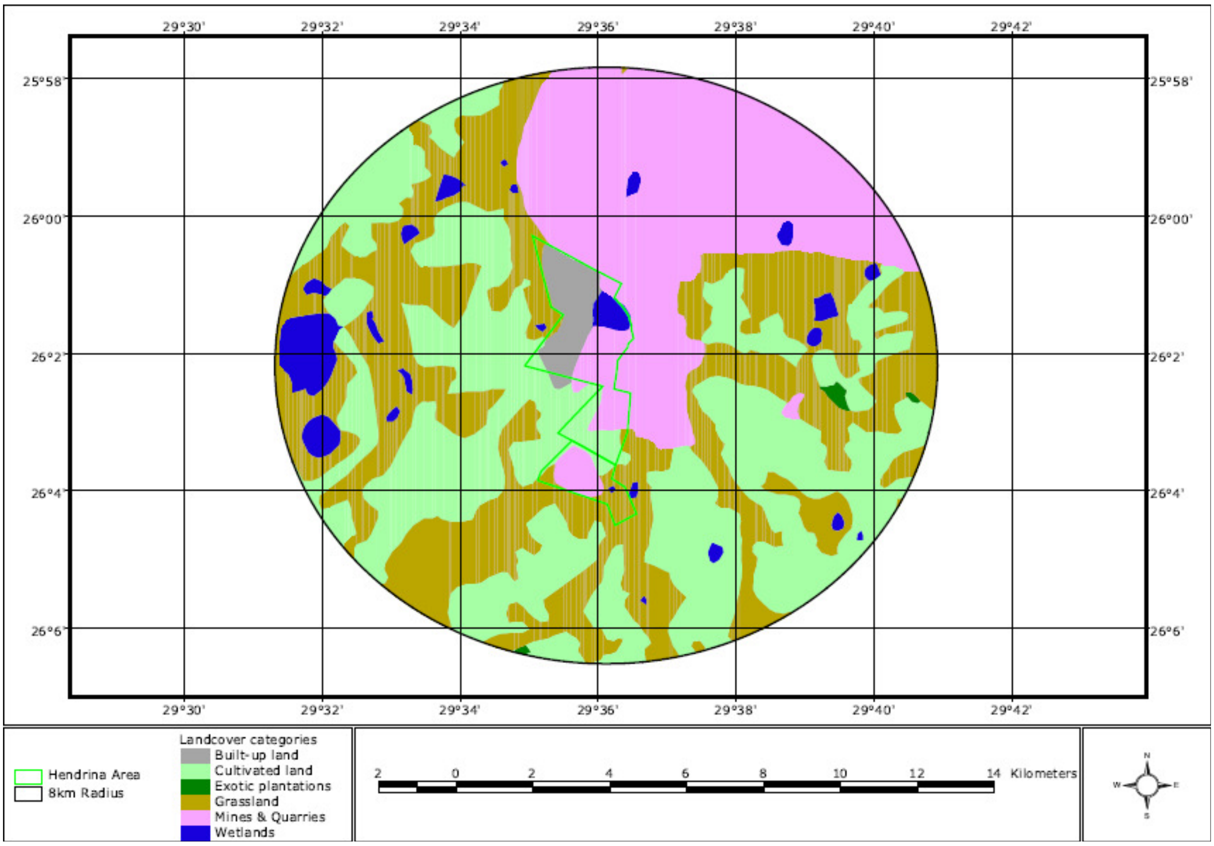


Figure 3.1: Land cover categories of the study area

- ***Regional Vegetation - VEGMAP***

The study area is situated within the Grassland Biome, specifically within the Eastern Highveld Grassland vegetation type (**Figure 3.2**). This vegetation type is regarded Endangered and only very small fractions are conserved in statutory reserves. Some 44% is transformed by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact than which is currently indicated by land cover data. The Endangered status of this vegetation type warrants a medium-high environmental sensitivity. Small portions of the Eastern Temperate Freshwater Wetlands vegetation type are located within the study area. Due to the Endangered status, a High biophysical sensitivity is ascribed to all areas of natural vegetation, irrespective of the current status.

- *Eastern Highveld Grassland*

  The vegetation is 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 (Acac*ia caffra, Celtis africana, Diospyros lycioides, Parinari capensis, Protea caffra, P.*

welwitchii and *Searsia magalismontana*). This vegetation type has been assigned an ecological status of Endangered.

- *Eastern Temperate Freshwater Wetlands*

This vegetation type occurs around water bodies with stagnant water (lakes, pans, periodically flooded vleis, and edges of calmly flowing rivers) and is embedded within the Grassland Biome. The landscape is generally flat, or shallow depressions filled with (temporary) water bodies supporting zoned systems of aquatic and hygrophilous vegetation of temporarily flooded grasslands and ephemeral herblands. The vleis from where flow of water is impeded by impermeable soils and/ or by erosion resistant features, such as dolerite intrusions. Many vleis and pans of this type of wetlands are inundated and/ or saturated only during the summer rainfall season and for some months after this into the middle of the dry winter season, but the may remain saturated all year round. Surface water inundation may be present at any point while the wetland is saturated and some plan species will be present only under inundated condition, or under permanently saturated conditions. The presence of standing water should not be taken as a sign of permanent wetness. A Vulnerable status is ascribed to this vegetation type. Due to the association with wetland habitat types, a High biophysical sensitivity is ascribed to all areas of natural vegetation.

It would appear as if not all the smaller pans within the study area are captured within the VEGMAP database. More detailed investigations will be conducted if required during the EIA phase.

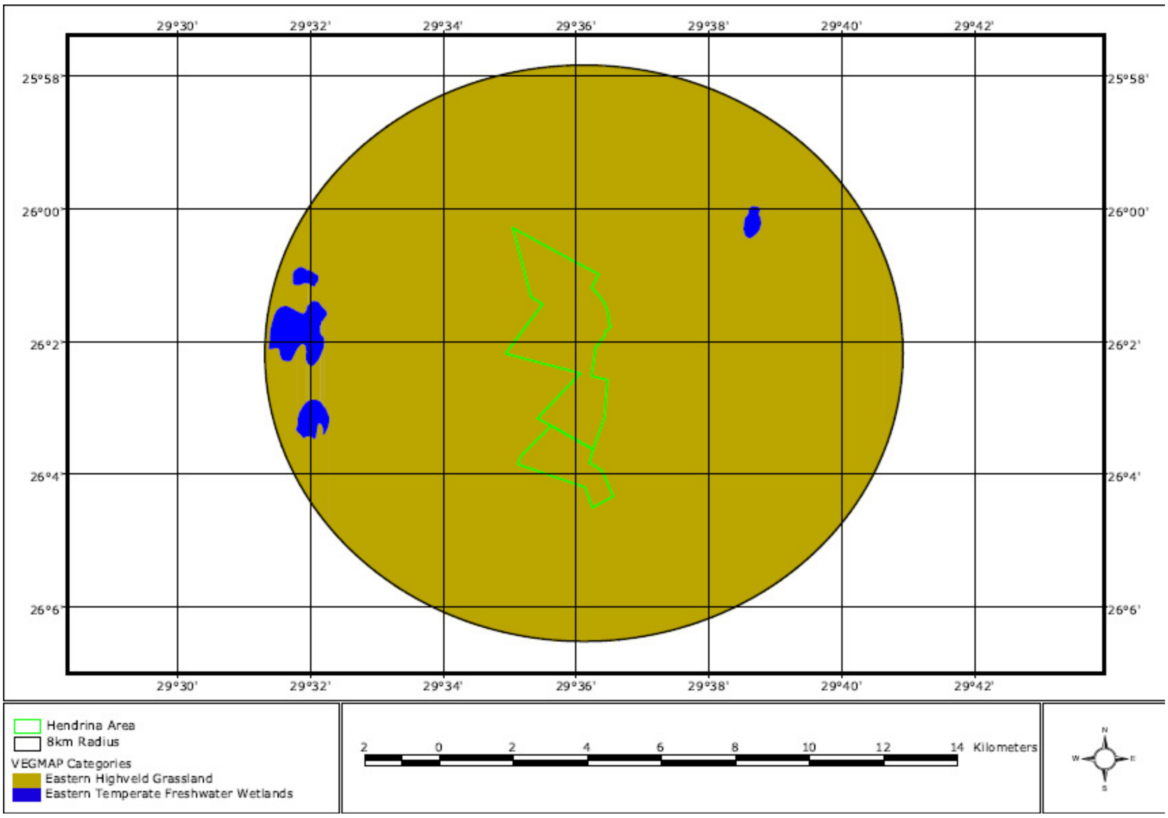


Figure 3.2: VEGMAP vegetation types of the region

- ***MBCP Categories***

Classification of the Terrestrial Biodiversity Classification categories (**Figure 3.3**) in the study area is as follows:

- Highly Significant areas - protection needed, very limited choice for meeting targets;
- Important and Necessary areas - protection needed, greater choice in meeting targets;
- Areas of Least Concern – natural areas with most choices, including for development;
- Areas with No Natural Habitat Remaining – transformed areas that make no contribution to meeting targets.

Extensive parts of the study area are regarded 'Areas with No Natural Habitat Remaining', mainly the result of agriculture and mining that decimated natural grassland habitat, or affected remaining areas of natural grassland habitat to the extent that it no longer supports natural ecological processes. Guidelines suggest restricting permissible land uses within each biodiversity conservation category are as follows:

- Highly Significant Areas - Land use types 1 to 3 permitted, type 4 and unavoidable developments, as above;
- Important and Necessary Areas - Land use types 1 to 3 recommended, types 4 and 5 allowed under restriction;
- Areas of Least Concern - All land uses permitted, although several require restrictions; and
- The Mpumalanga Biodiversity Conservation Plan (MBCP) also identifies the 35.8% of the Province that has 'No natural habitat remaining' and which has very little biodiversity value. The general mechanism of applying these guidelines therefore rely on reinforcing the use of EIA procedures and regulations by means of specialist biodiversity surveys by locally knowledgeable experts.

Restrictions in terms of mining activities (Land Use 15 - Surface mining, dumping, dredging), according to the MBCP, are illustrated in **Figure 3.4**. Areas that are classified as 'Restricted' are not automatically excluded according to the MBCP or that the application will automatically be denied, but rather that specialists studies clearly need to indicate that the proposed development will not adversely affect any sensitive floristic or faunal attributes that occur, or potentially could occur, within the study area. Specialist studies are furthermore required to show that the proposed development will not lead to cumulative impacts, regional degradation and habitat transformation and the loss of biodiversity on a local or regional scale.

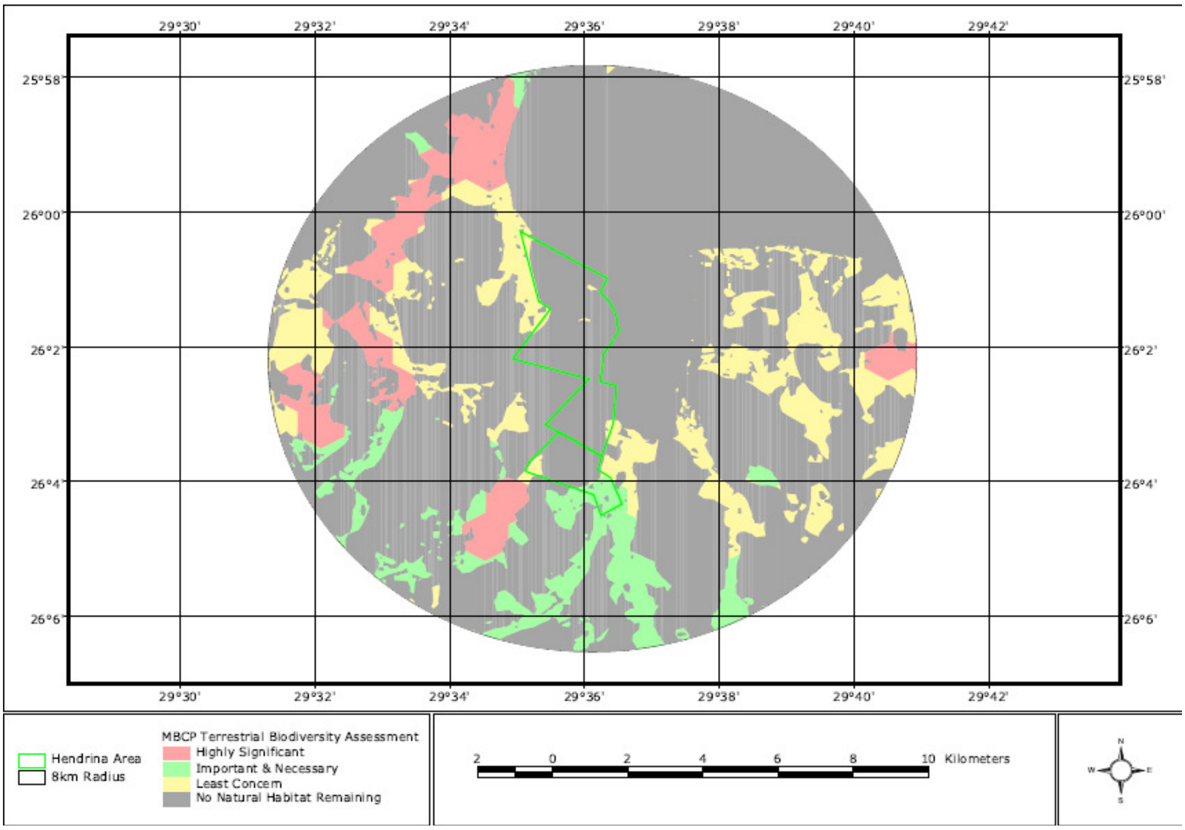


Figure 3.3: MBCP Biodiversity categories of the region

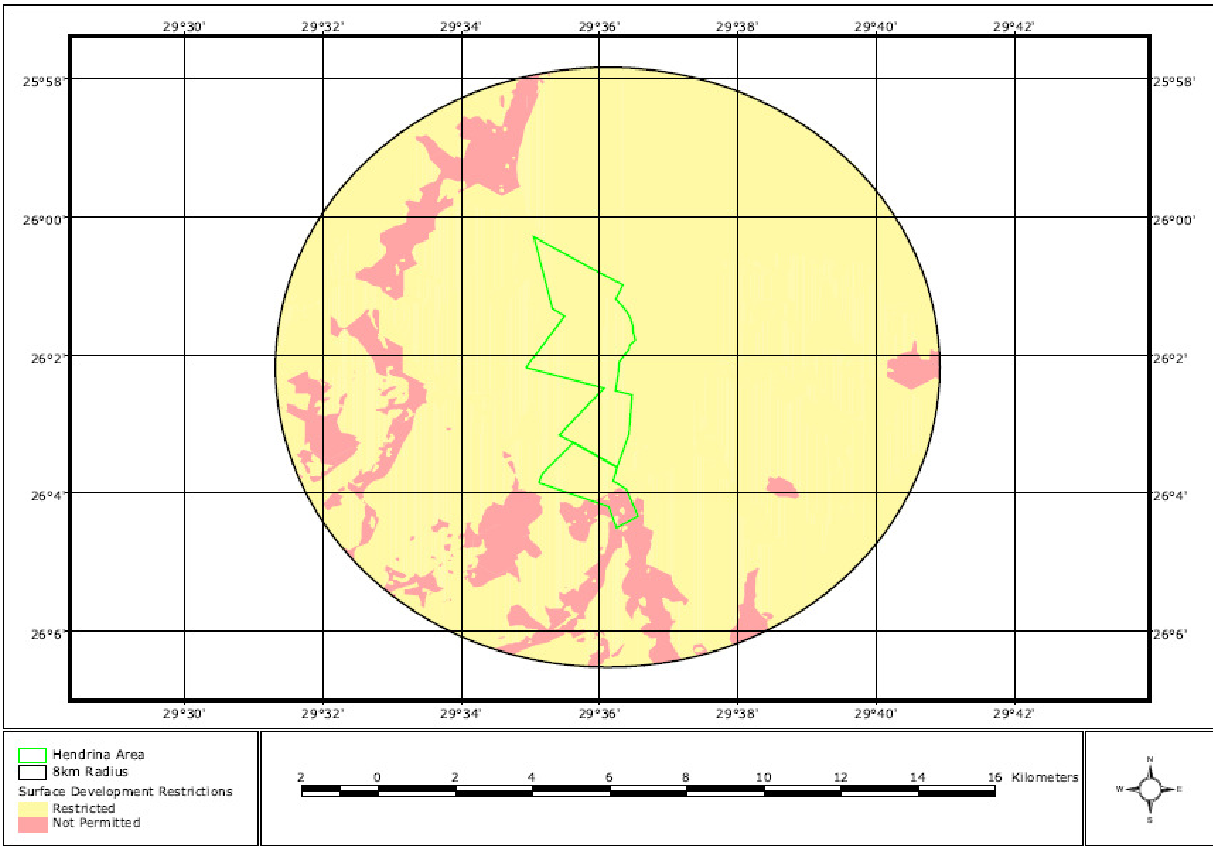


Figure 3.4: Restrictions in terms of Land Use 15 (surface mining, dumping, dredging)

- ***Surface Water***

The study area is situated within the Olifants River Catchment Area. Areas of surface water[2] that could potentially be affected by the proposed line variants include non-perennial rivers and streams, ranging in size from small drainage lines to rivers with relative wide streambeds, dams, and endorheic pans. Visual observations made during the site investigation revealed that the status of these rivers and streams is relatively degraded as a result of agricultural and mining activities in the region.

Areas of surface water generally contribute significantly towards the local and regional biodiversity of any area due to the atypical habitat that is available within ecotonal habitat types on the fringes of aquatic habitat types. These ecotones (areas or zones of transition between aquatic and terrestrial habitat types) are frequently occupied by species that occur in both the bordering habitat types. In addition, many flora and fauna species are specifically adapted to exploit the temporal or seasonal fluctuation in moisture levels in these areas and exhibits extremely narrow habitat variation tolerance levels. These areas therefore generally comprise high biodiversity in relatively small areas and are furthermore also traversed by terrestrial animals that utilise water sources on a frequent basis. However, due to the perennial nature of the rivers and streams in the study area, their contribution to biodiversity is not as significant as in cases where frequent flow patterns are noted in the western, wetter parts of the country.

Ecotonal interface areas form narrow bands around areas of surface water and they constitute extremely small portions when calculated on a purely mathematical basis. However, taking the high species richness into consideration these areas are extremely important on a local and regional scale. Rivers also represent important linear migration routes for a number of fauna species as well as a distribution method for plant seeds. All areas of surface water are therefore regarded important in terms of biodiversity attributes and a high biodiversity sensitivity is ascribed to these parts of the study area.

3.1.2 Avifauna

The study area falls within the 2629BA and 2529DC Quarter Degree Grid Squares (QDGS) and the South African Bird Atlas Project (SABAP) records 193 and 221 bird species of which 16 are Red Listed Species (Harrison *et al* 1997) and one species is protected internationally under the Bonn Convention on Migratory Species. In addition the study area includes 2 Coordinated Waterbird Count (CWAC) areas which are regarded as sites important for water birds either by virtue of the species present or the numbers in which they are represented.

[2] Please note that areas of surface water, as indicated on accompanying maps, were provided by the wetland ecological specialist. No detailed descriptions relating to the wetland habitat types within the study area will be presented in this report; the reader is referred to the wetland report that is compiled separately to this report. This report will only highlight the importance and contribution of wetlands in terms of regional biodiversity.

Data on the bird species that could occur in the study area and their abundance was obtained from the Southern African Bird Atlas Project (Harrison *et al*, 1997). These data provided an indication of the bird species that were recorded in the quarter degree squares within which this proposed project falls, i.e. 2629BA and 2529DC.

Table 3.1: Red Listed bird species recorded in the quarter degree squares (2629BA and 2529DC) within which the study area is located (Harrison et al, 1997). Report rates are percentages of the number of times a species was recorded by the number of times the square was counted. Conservation status is classified according to Barnes (2000).

Total Cards		66	64
Total Species		193	221
Total Breeding Species		44	27
Name	Conservation status	2629BA report rate	2529DC report rate
Botha's Lark	EN	2	-
Southern Bald Ibis	VU	5	14
African Marsh-Harrier	VU	2	-
Lesser Kestrel	VU	3	13
African Grass Owl	VU	2	2
Denham's Bustard	VU	-	2
White-bellied Korhaan	VU	-	2
Yellow-billed Stork	NT	3	-
Greater Flamingo	NT	27	36
Lesser Flamingo	NT	8	17
Secretarybird	NT	3	5
Black Harrier	NT	2	-
Pallid Harrier	NT	-	2
Blue Korhaan	NT	3	2
Black-winged Pratincole	NT	5	2
Black Stork	NT	-	5
White Stork	Bonn	11	14

EN=Endangered; VU=Vulnerable; NT=Near-threatened; Bonn=Protected Internationally under the Bonn Convention on Migratory Species.

The SABAP data lists 1 Endangered, 6 Vulnerable and 9 Near threatened species as occurring within the study area. In addition, one species, the White Stork is protected internationally under the Bonn Convention on Migratory Species.

Two CWAC sites occur in the study area. A potential CWAC site is any body of water, other than the oceans, which supports a significant number of birds. This definition includes natural pans, vleis, marshes, lakes, rivers, estuaries and lagoons as well as the whole gamut of manmade impoundments.

The two CWAC sites are Oranje Pan and Coetzeespruit Dam. Key IUCN Listed species recorded at the CWAC sites include the Greater Flamingo and African Marsh-Harrier.

3.1.3 Surface water

- ***Ecoregion Characteristics***

The study area is located in the western parts of Mpumalanga province and falls predominantly within the Eastern Highveld grassland with isolated patches consisting of Eastern Temperate Freshwater wetlands (**Table 3.2**). The desktop review indicated that surface water systems are located in quaternary catchment B12B. Landscape features for the Eastern grassland biome includes slightly to moderately undulating plains, some low hills and pan depressions, while the Temperate Freshwater wetlands are an expression of impermeable soils or erosion resistant geological features (**Table 3.2**). Mean Annual Precipitation (MAP) ranges between 600-800 mm per annum, frequently in the form of summer storms. The annual temperature in the study area is 14.7 °C for Eastern Highveld grassland and 14.9 °C for Eastern Temperate Freshwater wetlands. The Mean Annual Potential Evaporation rate (MAPE) exceeds the MAP in the area, thus a net loss in precipitation is experienced (**Table 3.2**).

Table 3.2: Environmental variables and geomorphologic description of the study area (Mucina and Rutherford, 2006)

Environmental Features	Bioregion	
	Eastern Highveld grassland	Eastern Temperate Freshwater wetland
Landscape features	Slightly to moderately undulating plains, including some low hills and pan depressions	Flat landscapes or shallow depressions filled with (temporary) water, supporting zones systems of hygrophilous vegetation
Geology and soils	Red and yellow sandy soils found on shales and sandstones	Peat soils, ranging from Champagne to Rensburg. Vleis form on impermeable soils or erosion resistant features e.g. dolerite intrusions
MAP	726 mm	704 mm
MAT	14.7 °C	14.9 °C
MFD	32 d	38 d
MAPE	1926 mm	1953 d
Status	E	LC
MAP: Mean Annual Precipitation; MAT: Mean Annual Temperature; MFD: Mean Frost Days; MAPE: Mean Annual Potential Evaporation; E: endangered; LC: Least Concerned		

- ***River Characterisation***

A characterisation of the rivers in the study area reveals that the receiving Klein-Olifants River is an order three river (**Table 3.3**). Six attributes were used to obtain the PES on desktop quaternary catchment level by the National Spatial Biodiversity Assessment (Nel *et al.*, 2004). These attributes predominantly allude to habitat integrity of instream and riparian habitat. With this in mind, the receiving Klein-Olifants River and the Woestalleen system fall in a D-category which relates to largely transformed state (Table 3). Biological communities also reflect fair to unacceptable health in these systems (RHP, 2001). The instream habitat associated with the ecoregion in the study area reflects more degradation than adjacent ecoregions (RHP, 2001).

Most of the surface water systems are perennial systems. Nel *et al.* (2004) lists a status of critically endangered for all the river signatures associated with the study area. The ascribed river status indicates a limited amount of intact river systems carrying the same heterogeneity signatures nationally. This implies a severe loss in aquatic ecological functioning and aquatic diversity in similar river signatures on a national scale (Nel *et al*., 2004).

Table 3.3: Desktop river characterisation of rivers and streams located in the study area (Nel *et al*., 2004) and DWAF (2000).

	Klein-Olifants River	**Woestalleen System**
River Order	3	1
Quaternary Catchment	B12B	B12B
Class	Perennial	Perennial
PES (NSBA)	**D**	**D**
PES (DWAF)	**C**	**C**
EIS (DWAF)	**Moderate**	**Moderate**
Conservation Status (NSBA)	Critically Endangered	Critically Endangered

- ***Drivers of Ecological Change***

The property falls within the Upper Olifants Sub-Area of the Olifants Water Management Area (WMA4). The Upper Olifants Sub-Area is the most urbanised of the 4 sub-areas in WMA4. The Upper Olifants covers an area of 11 464 km^2 with a mean annual runoff of 10 780 million m^3 (Midgley *et al.,* 1994). Surface runoff in this area is regulated by a number of large dams, namely Witbank, Bronkhorstspruit and the Middleburg dams (Basson *et al*., 1997). Majority of the urban population is located in Witbank and Middelburg areas, and it is projected that the population in these urban areas is expected to grow in the near future therefore increasing the water requirement in the Sub-Area (**Table 3.4**). Extensive coal mining activities are taking place in the sub-area, both for export to other provinces and for use in the six active coal fired power stations in the sub-area. Water quality in this sub-area is therefore under threat. Mining activities in the area impact on the natural hydrological system by increasing infiltration and recharge rates of the groundwater. Approximately 62 million m^3 is predicted to decant from mining activities (post closure) every year, creating a need for water quality management plans in this Sub-Area (DWAF, 2004).

Table 3.4: Reconciliation of water requirements and availability (million m³/a) for the year 2000 in the Olifants Water Management Area (DWAF, 2004b).

Sub-area	MAR	Local yield	Transfers in	Transfer out	Local requirement	Deficit
Upper Olifants	465	238	171	96	314	1
Middle Olifants	481	210	91	3	392	94
Steelpoort	396	61	0	0	95	34
Lower Olifants	698	100	1	0	104	63

3.1.4 Ground water

The study area is located on coal-bearing rocks of the Vryheid Formation, part of the lower Karoo Supergroup. These rocks are principally deltaic and fluvial siltstones and mudstones, with subordinate sandstones. The coal seams originated as peat swamps, or similar environments. Where the Dwyka Group is absent (suspected in the study area), the Vryheid Formation has been deposited directly onto rugged pre-Karoo topography, and the thickness of the Formation can be quite variable as a result. The Vryheid Formation is generally considered as a minor aquifer, with some abstractions of local importance. Relatively minor outcrops of the Rooiberg and Quaggasnek Formations which underlie the Vryheid Formation are found in the study area. The small outcrop of the Quaggasnek Formation in the NW of the study area appears to be the basis for the zone classified as "D3" on the general hydrogeology map series.

3.2 Social Environment

3.2.1 Socio-economic

The Hendrina Power Station is situated in the Mpumalanga Province and within the Steve Tshwete Local Municipality area of jurisdiction.

The closest towns include Hendrina and Middleburg with the small community of Pullen's Hope situated right next to the power station.

The town of Hendrina was proclaimed on 5 June 1916 and is approximately 20 km from the power station. Hendrina is the second largest town in the municipality (after Middleburg). The main business / commercial activities in Hendrina include the OTK co-operation and a large manufacturing company.

Pullen's Hope is situated directly adjacent to the power station and is considered to be the fourth largest settlement in the municipal area. The original stands were developed by Eskom to accommodate personnel employed at the Hendrina power station. The current ownership of the community is assumed to be municipal, however, this remains to be confirmed.

The socioeconomic analysis is specifically aimed at spatial related matters, i.e. demographics, employment and income and economic profile. The 2001 Census figures were used and comparisons were made with the Demarcation Board Data. The latter is based on the 1996 Census data which has been statistically manipulated to coincide with the newly demarcated study area.

- ***Demographics***

Table 3.5: Household Dwelling Type in Steve Tshwete Local Municipality

	2001	**%**	**1996**	**%**
Dwelling type				
Formal	26 776	73,9	24 762	74,3
Informal	5 863	16,2	5 171	15,5
Traditional	3 516	9,7	3 169	9,5
Other	74	0,2	241	0,7
Total	36 229	100	33 343	100

Source: 2001 Census data

The above mentioned table indicates that 73,9% of the 2001 population reside in formal dwellings. This is slightly less than the 1996 figure of 74,3%. The population residing informally has increased from 15,5% to 16,2%, whilst the traditional settlements increased slightly from 9,5% to 9,7%. Households increased from 33 343 in 1996 to 36 229 in 2001. This represents an increase of 8,65% over 5 years or 1,73% per annum.

Table 3.6: Population Groups in Steve Tshwete Local Municipality

	2001	**%**	**1996**	**%**
African	114 371	80,1	91 224	67,4
Coloured	3 547	2,5	3 530	2,6
Indian	1 313	0,9	1 900	1,4
White	23 541	16,5	37 747	27,9
Total	**142 772**	**100**	**135 412**	**100**

Source: 2001 Census data

Table 3.6 indicates that the African population increased from 67,4% to 80,1% of the total population in the study area. Housing subsidy projects that were initiated in the study area played a significant role, as well as the fact that expansion at the mines and major industries took place during the same time. A lack of job opportunities in the former homelands also resulted that entire households moved to the area where the breadwinners were employed. A large decrease also took place in terms of the White population from 27,9% in 1996 to 16,5% in 2001. Nevertheless, Steve Tshwete still hosts the largest percentage of White people within the Nkangala District. Skilled labour tends to move to the metropoles and larger cities as better and more jobs are available.

Table 3.7: Population Growth in Steve Tshwete Local Municipality

	2001	1996	% Growth	% Average Annual Growth
African	114 371	91 224	25,4	5,1
Coloured	3 547	3 530	0,5	0,1
Indian	1 313	1 900	31,0	6,2
White	23 541	37 747	38,0	7,6
Total	**142 772**	**135 412**	**5,4**	**1,08**

Source: 2001 Census data

The African population increased by 25,4% over 5 years or 5,1% on average annually. The Indian and White population decreased by 31% and 38% respectively over the 5 years or 6, 2% and 7,6% on average annually. Therefore, the need for housing in the lower income brackets, mainly subsidy linked housing has increased and will tend to increase over time.

- ***Population Estimates***

Population estimates for Steve Tshwete Municipality are reflected in **Table 3.8** and includes the total number of people.

Table 3.8: Population Estimates 2001

Area	Population	Households	Average Household Size
Middelburg	142 769	36 229	3,9

Source: 2001 Census data

Table 3.9: Number and Percentage by Gender

	Male	Female	Total	Male %	Female %	Total %
Steve Tshwete	70 596	72 184	142 772	49,4	50,6	**100**
Nkangala	491 225	529 363	1 020 590	48,1	51,9	**100**
Mpumalanga	1 497 325	1 625 985	3 122 985	47,9	52,1	**100**

Source: 2001 Census data

The study area has an advantage in terms of its male population compared to that of the Nkangala District and Mpumalanga. This can mainly be attributed to more job opportunities created by the mining and industrial sectors.

- ***Age and Gender Profile***

Table 3.10: Age Profile 2001 in Steve Tshwete Local Municipality

	Steve Tshwete/ Male	Steve Tshwete/ Female	Nkangala/ Male	Nkangala/ Female
0 – 4 years	6 866	6 894	53 561	54 533
5 – 14 years	14 102	14 423	115 276	117 363
15 – 34 years	26 589	27 969	181 762	196 895
35 – 64 years	21 159	20 004	124 132	132 381
65+ years	1 878	2 889	16 490	28 175
Total	**70 594**	**72 179**	**491 221**	**529 347**

Source: 2001 Census data

- ***Level of Education***

The level of education for the population in the study area is reflected in **Table 3.11** format with specific reference to number of people with primary, secondary and tertiary qualifications.

Table 3.11: Level of Education in Steve Tshwete Local Municipality

Persons	2001	%
None	15 769	27,8
Pre School	2 063	3,6
School	37 243	65,6
College	958	1,7
Technikon	319	0,6
University	226	0,4
Adult Education Centre	48	0,1
Other	132	0,2
Total	**56 758**	**100**

Source: 2001 Census data

- Only 3% of the population has a tertiary or higher qualification.
- 27,8% of the population have no qualification. It is noted that infants and children less than 5 years are excluded from this figure.
- Access to farm schools and the availability of schools for specially the rural population have been highlighted as part of the IDP prioritisation process. The high levels of illiteracy reflect the need for education facilities and after school learning.

- ***Population Growth Estimates***

It should be noted that population growth statistics should only be used as a guideline for future planning. These figures must be reviewed and adjusted on an ongoing basis with the availability of more relevant and specific data. Specific reference is made to the latest Census figures.

The population growth estimates are reflected for the time period 1996 to 2001 and the time period 2001 to 2006. However, the latest Census figures are disputed by Council. It was therefore suggested that the following assumptions are made for the short term as the next cycle in the Census data capturing will commence early in 2006. Any changes in the tendencies relating to population trends will then be captured.

The growth rates will be as follows for the period 2001 to 2006, namely:

- Middelburg: 3,3%
- Mhluzi: 0,0%
- Hendrina: 0,0%
- Kwazamokhule: 2,0%
- Middelburg NU: 2,3%

Table 3.12: Population Growth Rate 1996 – 2006 in Steve Tshwete Local Municipality

Area	Population Growth		Population 2001	Population Increase 2001 - 2006
	1991 - 1996	1996 - 2001		
Middelburg	1,1	3,3	42 296	49 750
Mhluzi	10,6	1,7	46 011	46 011
Hendrina	1,5	8,9	885	885
Kwazamokhule	17,9	2,0	12 843	14 180
Middelburg NU	12,0	2,3	40 737	45 642
Middelburg (MP 313)	0,7	1,1	142 772	156 468

Source: Census 2001

- The proposed population growth implies that an additional 13 696 people will reside in the study area. At a household size of approximately 3,94 people, this represents an additional 3 476 households.
- The increase in population and number of households has a significant influence on service delivery, provision of affordable housing, education, health facilities and infrastructure.
- The need for additional housing are outlined as part of the spatial analysis (refer to Chapter 2).
- A relatively high population growth rate is predicted for the urban areas with specific reference to Middelburg and Kwazamokhule. The current estimated backlog of 6 883 stands consist of 2 308 stands in Newtown accommodating 9 289 residents, whilst approximately 4 575 backyard families are residing in Mhluzi (Waste disposal survey: October 2000). In Middelburg an additional 1 500 units should be developed annually from 2001 to 2006 to address the expected growth. The bulk of the residential units will be required to accommodate the homeless, mainly relying on government housing subsidies.
- A backlog of approximately 350 stands is present in Kwazamokhule. The development of Kwazamokhule X7 consisting of 600 residential stands will, once servicing has taken place, address the backlog sufficiently.

- ***Employment and Income***

The analysis of employment and income levels in the study area are reflected as informal, formal and unemployed workforce, and average income per capita.

Table 3.13: Informal, Formal and Unemployed Workforce 2001 in Steve Tshwete Local Municipality

Area	1996	%	2001	%
Employed	47 423	80,4	41 678	64,6
Unemployment	11 574	19,6	22 798	35,4
Not economically active	-	-	31 619	-
Total labour force	**58 997**	**100**	**64 476**	**100**

Source: 2001 Census data

- The economic active population decreased by approximately 15,8% from 1996 to 2001.
- The total labour force increased by 9,3%.

- ***Income***

The per capita income for the study area is provided for 1996 and 2001.

Table 3.14: Individual Monthly Income in Steve Tshwete Local Municipality

Persons	1996	%	2001	%
None	91 608	64,2	54 806	53,7
R1 - R400	6 258	4,4	3 586	3,5
R401 - R800	13 100	9,2	17 642	17,3
R801 - R1600	9 897	6,9	6 257	6,1
R1 601 – R3 200	9 888	6,9	6 057	6,0
R3 201 - R6 400	6 723	4,7	9 666	9,5
R6 401 - R12 800	3 593	2,5	2 957	2,9
R12 801 - R25 600	1 177	0,8	624	0,6
R25 601 - R51 200	278	0,2	285	0,3
R51 201 - R102 400	135	0,1	93	0,1
R102 401 - R204 800	90	0,08	**-**	**-**
Over R204 801	25	0,02	**-**	**-**
Total	**142 772**	**100**	**101 973**	**100**

Source: 2001 Census data

Table 3.14 indicates that the percentage of people with no income increased from 53,7% to 64,2% as percentage of the total in the respective census. However, the increase over the 5 years is 67%, or 13,42% on average annually. People earning between R1 and R1 600 totals 29 255 compared to 27 485 during 1996. This represents an increase of 6,4% between 1996 and 2001, or 1,2% on average annually. In total 84% of the inhabitants of Steve Tshwete Local Municipality falls within the lower income bracket.

Table 3.15: Annual Household Income in Steve Tshwete Local Municipality

Household	1996	%	2001	%
None	5 578	15,1	1 691	7,1
R1 - R4 800	2 163	5,8	929	3,9
R4 801 - R9 600	5 068	13,7	3 122	13,1
R9 601 - R19 200	6 397	17,3	5 417	22,8
R19 201 - R38 400	6 705	18,1	4 740	19,9
R38 401 - R76 800	5 008	13,5	3 269	13,7
R76 801 - R153 600	3 604	9,7	2 947	12,4
R153 601 - R307 200	1 784	4,8	1 563	6,6
R307 201 - R614 400	479	1,3	113	0,5
R614 401 - R1 228 800	123	0,3	**-**	-
R1 228 801 - R2 457 600	95	0,3	**-**	**-**
Over R2 457 600	39	0,1	**-**	**-**
Total	**37 043**	**100**	**23 791**	**100**

Source: 2001 Census data

From the above mentioned **Table 3.15** it is clear that 51,8% of the households earn less than R19 200 per year. This reflects on monthly household income of less than R1 600. This figure has increased from 46,9% during 1996 to 51,8% during 2001. Therefore, it is clear that more low income households within the lower bracket of the Governments Housing Subsidy Scheme are moving to the study area. The pressure on limited financial resources will increase which will negatively impact on service delivery. If R3 200/month or R38 400 per annum is used as the cut off point for people qualifying for Government subsidies, the percentage increase to an alarming 69,9% of the total number of households, compared to 66,8% during 1996. Household with no annual income increase from 7,1% to 15,1% from 1996 to 2001.

- ***Employment and GGP Contribution to the Local Economy***

The Steve Tshwete Local Municipality is situated in the centre of the Nkangala District Municipality. The economic structure of the Steve Tshwete economy is presented graphically in **Figure 3.5**.

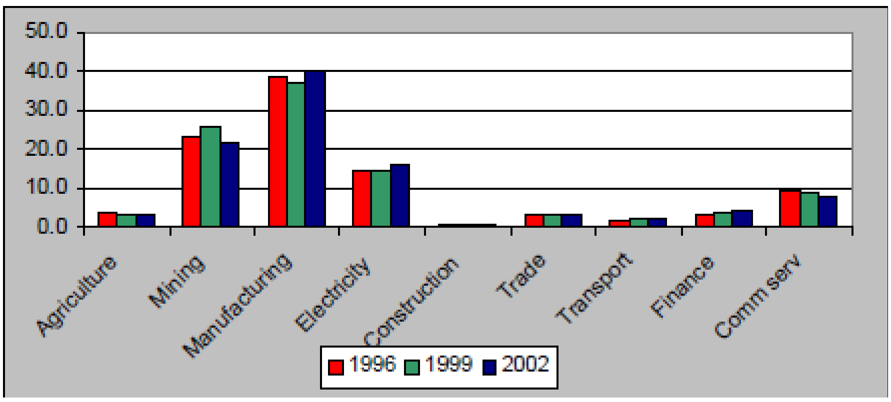


Figure 3.5: Middelburg GGP profile by sector, 1996 to 2002

Source: Global Insight Version, 1.50 (172), 2003

Manufacturing dominates the local economy. This is followed by the mining, electricity and community services sectors. As a result of growth in the remaining sectors, the relative importance of the manufacturing sector decreased during 1996 – 1999 but during 1999 – 2002 the relative contribution of the manufacturing sector increased to levels higher than in 1996. Conversely, the mining sectors proportional contribution increased during 1996 - 1999 and decreased to levels lower than in 1996.

The agriculture and community services sectors' proportional contribution decreased during the medium term (1996 - 2002) while the transport and finance sectors contribution increased during the same period.

The growth rates achieved by the various sectors are presented in **Table 3.16**.

Table 3.16: Growth rates 1996 - 2002

Sectors	1996 - 1999	1999 - 2002	1996 - 2002
Agriculture	0.2	3.4	1.6
Mining	7.5	2.0	2.6
Manufacturing	2.7	7.3	5.0
Electricity	2.9	7.8	5.3
Construction	6.9	2.1	2.3
Trade	3.8	4.1	3.9
Transport	12.6	9.0	10.8
Finance	12.4	7.0	9.7
Comm. services	0.3	0.6	0.4
Total	**4.1**	**4.2**	**4.2**

Source: Global Insight Version, 1.50 (172), 2003

Transport, finance, electricity and manufacturing recorded relatively high growth rates between 1996 and 2002, whereas mining and construction declined significantly recently (1999 - 2002).

The aggregate Steve Tshwete economy recorded a relatively high growth rate for all the periods under observation. This economy grew at the second highest growth rate when compared to the other local municipalities in the Nkangala District. The above economic analysis presents the following implications for Steve Tshwete:

- Middelburg constitutes one of Nkangala's two key industrial areas. Hence, the strong growth in the manufacturing sector should be stimulated and maintained. This implies that the growth should be stimulated in specific subsectors to facilitate a diversification of the manufacturing base.
- The agriculture sector should be included in the development initiatives in a manner that exploits the opportunities associated with the Maputo Corridor.
- The high growth of the transport sector indicates that opportunities exist for the establishment of transport related initiatives, as well as the formation of a transport hub that serves as a link between the remainder of Mpumalanga and Gauteng.

Apart from the above mentioned implications, various initiatives should be formulated and implemented to ensure that Steve Tshwete's sectoral advantages (agriculture, mining, manufacturing, and finance) are leveraged/exploited.

3.2.2 Visual

The study area for the visual assessment encompasses a geographical area of approximately 420km² (the extent of the maps displayed below).

There are no major towns in the immediate area. Middelburg lies 40 km to the north west, and Hendrina some 16km to the south east. A significant number of residences and homesteads occur throughout the study area, and in close proximity to the power station.

The N11 bypasses the site in the east and the R542 traverses a section of the study area in the south west. In addition, a number of secondary roads interconnect with the national and arterial roads, as well as with one another.

Mining activity is a prolific land use in the study area, which in combination with the existing power station results in areas of a decidedly industrial nature within an otherwise rural and agricultural setting.

The topography of the area is typical of the Mpumalanga Highveld, mainly a gently undulating plateau, varying between 1680m and 1600m amsl along the Woes-Alleen Spruit.

In addition to the spruit, a large number of dams and pans are present in the study area, although many of these have been disturbed to some extent by mining activity. The drainage lines which traverse the study area all flow north towards the Olifants River.

The ENPAT describes the terrain as *moderately undulating plains and pans* and the natural vegetation type as *Bankenveld.*

With its moderately dry subtropical climate, the study area receives between 621 and 752 mm of rainfall per annum.

No formally protected areas or conservation areas are located within the identified study area.