8 IMPACT IDENTIFICATION

8.1 Introduction

As required in section 31(2) of the NEMA Regulations, 2010, this section includes a description of the manner in which the biophysical, social, economic and cultural aspects of the environment may be affected by the proposed activity as well as a description of the environmental issues that were identified during the impact assessment process.

8.2 Topography

8.2.1 Potential Impacts

Due to the fact that the natural topography of the site is already disturbed by agriculture, two potential impacts are considered to be significant in terms of this project. The first impact considers the potential change of drainage patterns due to construction related earthworks and newly introduced stormwater patterns. Without mitigation the impact is considered to be of medium significance, however, with the implementation of mitigation measures, specifically regarding stormwater control, the impact significance reduces to low.

The second impact is related to the planning phase of the project in terms of the design of the facility which will need to take the existing topography into account with regards to allowing for effective stormwater and seepage collection systems.

It is anticipated that the deviation of the power lines and the pipeline will not result in any significant changes to the natural topography and therefore no impacts are expected.

8.2.2 Recommended Mitigation and Management Measures

The following mitigation and management measures are considered applicable:

- The contractor must ensure that adequate measures are put into place to control surface water flows across and around the site during earthworks.
- The quantity of contaminated stormwater entering cleared areas will be minimised by appropriate site design and by installation of control structures and drains which direct such flows away from cleared areas and slopes to stable (vegetated) areas or effective treatment installations.
- Areas susceptible to erosion must be protected by installing the necessary temporary and/or permanent drainage works as soon as possible. Areas susceptible to erosion must also be rehabilitated (re-vegetated) as quickly as possible.
- Any erosion channels developed during the construction period or during the vegetation establishment period shall be backfilled and compacted, and the areas restored/rehabilitated to a proper condition.

- Anti-erosion compounds shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. The application rate shall conform to the manufacturer's recommendations. The material used shall be of such quality that grass seeds may germinate and not prohibit growth.
- These erosion control measures, including stormwater drainage systems, will be installed before construction commences.
- Installed erosion control measures will be appropriate to site conditions to handle a one-in-two-year storm event for temporary structures, and a one-in-fifty year storm event for permanent structures which provide ongoing sediment control after a site has been rehabilitated.
- Contingency plans will be in place for extreme storm events.
- Blocking of stormwater drainage systems must be prevented and storm water must be managed to prevent soil erosion.
- All cleared areas will be promptly rehabilitated and in accordance with specific instructions from the Construction Manager.
- Soil must be exposed for the minimum time possible once cleared of invasive vegetation. The timing of clearing and grubbing must be co-ordinated as much as possible to avoid prolonged exposure of soils to wind and water erosion.

More detailed mitigation and management measures can be found in the Environmental Management Programme included in **Appendix E**.

8.3 Climate and Air Quality

The Air Quality Report is included in **Appendix O**.

8.3.1 Potential Impacts

- ***Process Description and Source Identification***

The main pollutant of concern associated with operations is particulate matter. Particulates are divided into different particle size categories with Total Suspended Particulates (TSP) associated with nuisance impacts and the finer fractions of PM_{10} (particulates with a diameter less than 10 µm) and $PM_{2.5}$ (diameter less than 2.5 µm) linked with potential health impacts. PM_{10} is primarily associated with mechanically generated dust whereas $PM_{2.5}$ is associated with combustion sources. Gaseous pollutants (such as sulphur dioxide, oxides of nitrogen, carbon monoxide, etc.) derive from vehicle exhausts and other combustions sources such as vehicles. These are however insignificant in relation to the particulate emissions and are not discussed in detail.

Table 8.1 provides a list of all sources of air pollution associated with the proposed project. The subsequent sections provide a generic description of the parameters influencing dust generation from the various aspects identified.

Table 8.1: Activities and aspects identified for the construction, operational and closure phases of the proposed wet ash disposal facility expansion project

Pollutant(s)	Aspect	Activity
Construction Phase		
Particulates	Construction of proposed wet ash disposal facility site	Clearing of groundcover
		Levelling of area
		Wind erosion from topsoil storage piles
		Tipping of topsoil to storage pile
	Vehicle activity on-site	Vehicle and construction equipment activity during construction operations
Gases and particles	Vehicle and construction equipment activity	Tailpipe emissions from vehicles and construction equipment such as graders, scrapers and dozers
Operational Phase		
Particles	Wind erosion	Exposed wet ash disposal facility
	Vehicle activity on-site	Vehicle activity at the wet ash disposal facility
Gases and particles	Vehicle activity	Tailpipe emissions from vehicle activity at the wet ash disposal facility
Closure and Rehabilitation Phase		
Particles	Rehabilitation of disturbed areas	Topsoil recovered from stockpiles
		Tipping of topsoil onto wet ash disposal facility
	Wind erosion	Exposed cleared areas and exposed topsoil during rehabilitation
	Vehicle activity on unpaved roads and on-site	Truck activity at site during rehabilitation
Gases and particles	Vehicle activity	Tailpipe emissions from trucks and equipment used for rehabilitation

- *Construction Phase*
  The construction phase normally comprises a series of different operations including land clearing, topsoil removal, road grading, material loading and hauling, stockpiling, compaction, (etc.). Each of these operations has their own duration and potential for dust generation. It is anticipated that the extent of dust emissions would vary substantially from day to day depending on the level of activity, the specific operations, and the prevailing meteorological conditions.

- *Operation Phase*
  Wind erosion is a complex process, including three different phases of particle entrainment, transport and deposition. It is primarily influenced by atmospheric conditions (e.g. wind, precipitation and temperature), soil properties (e.g. soil texture, composition and aggregation), land-surface characteristics (e.g. topography, moisture, aerodynamic roughness length, vegetation and nonerodible elements) and land-use practice (e.g. farming, grazing and mining) (Shao, 2008).

  Windblown dust generates from natural and anthropogenic sources. For wind erosion to occur, the wind speed needs to exceed a certain threshold, called the threshold velocity. This relates to gravity and the inter-particle cohesion that resists

removal. Surface properties such as soil texture, soil moisture and vegetation cover influence the removal potential. Conversely, the friction velocity or wind shear at the surface, is related to atmospheric flow conditions and surface aerodynamic properties. Thus, for particles to become airborne, the wind shear at the surface must exceed the gravitational and cohesive forces acting upon them, called the threshold friction velocity (Shao, 2008).

Estimating the amount of windblown particles to be generated from the proposed wet ash disposal facility is not a trivial task and requires detailed information on the particle size distribution, moisture content, silt content and bulk density. Dust will only be generated under conditions of high wind speeds (US.EPA, 1995).

- *Closure Phase*
  It is assumed that all ashing activities will have ceased during the Closure Phase. The potential for impacts during the closure phase will depend on the extent of rehabilitation efforts on the wet ash disposal facility. The closure phase will mainly include materials handling activities, wind erosion and to a lesser extent vehicle and equipment movement on site.

- ***Qualitative Evaluation***

  - *Construction Phase*
    It is not anticipated that the various construction activities will result in higher off-site impacts than the operational phase activities. The temporary nature of the construction activities, and the likelihood that these activities will be localised and for small areas at a time, will reduce the potential for significant off-site impacts.

    According to the Australian Environmental Protection Agency on recommended separation distances from various activities, a buffer zone of 300 m from the nearest sensitive receptor is required when extractive industries occur without blasting and a distance of 500 m when blasting will take place (AEPA, 2007).

  - *Operational Phase*
    The current air quality at the proposed site is not known. However, ambient air quality measurements of PM_{10} at the closest DEA monitoring site indicate elevated ambient air quality levels. The wet ash disposal facility operations will give rise to dust generation. These operations are low level release sources meaning that the dust gets generated at heights of between 0.5 m and 1 m from the wet ash disposal facility surface.

    Wind erosion, will occur during strong wind conditions when wind speeds exceed the critical threshold required to lift and suspend the ash particles. This threshold is determined by the parameters that resist removal such as the particle size distribution of the bed material, moisture content and vegetation. A typical wind speed threshold is given as 5.4 m/s for storage piles (US.EPA, 1995). Wind data for

the proposed wet ash disposal facility site (2007 – 2009) indicate an average wind speed of 3.4 m/s and a maximum of 14 m/s. The percentage when wind speeds exceed the 5.4 m/s threshold is 11.3%.

To provide an indication of the potential distance and significance of impacts from these activities, the US.EPA screening model (TScreen) is used. This model represents a quick method to calculate and "flag" the "worst-case" concentration that might occur. Screening models require very little input and have a built-in set of meteorological conditions based on stability classes. It is a quick screening tool to identify possible sources that might require more detailed modelling. **It is important to note that these models do not use actual meteorological data, but rather set stability classes that will produce the highest impacts. The impacts are therefore not related to the actual wind directions or speeds.** More sophisticated Gaussian plume and puff models such as the US.EPA regulatory AERMOD and CALPUFF models use actual meteorological conditions. For the purpose of this study, a screening model is sufficient as the focus of this study is merely to provide an indication of the potential significance of the operations on the surrounding environment.

Figure 8.1 provides a graphic representation of the possible highest daily PM10 ground level concentrations at set distances from the proposed wet ash disposal facility. This is with no mitigation in place. The concentrations are irrespective of actual wind speed and direction and reflect the worst-case scenario. The National Ambient Air Quality Standards (NAAQS) for PM_{10} over a day are 120 µg/m³ at present and 75 µg/m³ from beginning 2015, with four exceedances of these limits allowed over a one year period. The screening model is not sophisticated enough to indicate the number of exceedances but it provides an indication of the distance at which the limit is exceeded. With no mitigation in place, the 2015 limit of 75 µg/m³ is exceeded further than 3 km due to windblown dust from the wet ash disposal facility.

According to the Australian National Pollution Inventory (NPI) wind erosion can be reduced by 50% through water sprays and up to 30% by installing wind breaks. With water sprays enduring 50% reduction from wind erosion, windblown dust will be below the NAAQS limit of 75 µg/m³ at a distance of ~2km from the source.

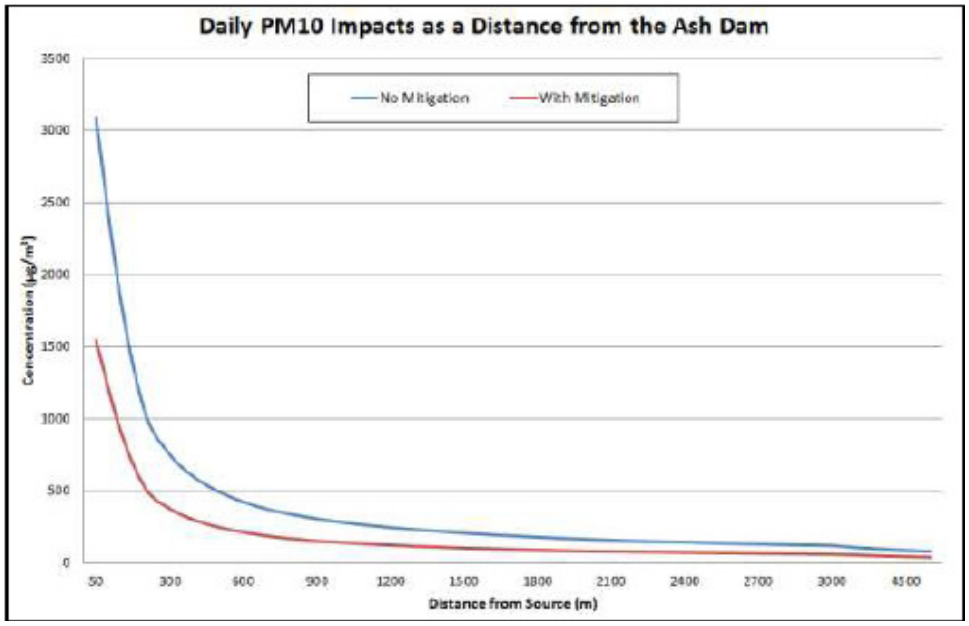

Figure 8.1: Estimated highest daily PM_{10} ground level concentrations at set distances from the emission source.

- *Closure Phase*
  The significance of the closure phase is likely to be linked to impacts from windblown dust. Windblown dust is likely to only impact off-site under conditions of high wind speed with no mitigation in place. If rehabilitation as indicated takes place i.e. vegetation cover, the impacts should be limited to be within the site boundary. As vegetation cover increases, the potential for wind erosion will decrease.

- ***Conclusion***

There is a probability for unacceptably high ground level PM_{10} concentrations from the proposed wet ash disposal facility operations at the farm nearest to the wet ash disposal facility (800 m to the south). This will be mainly due to the windblown dust incidences from the wet ash disposal facility. PM_{10} concentrations are likely to exceed the NAAQS 2015 limit of 75 µg/m³ for more than 3 km from the source. Impacts from the wet ash disposal facility may be high but with water sprays in place, these impacts will reduce significantly. The potential for impacts at the sensitive receptors will also depend on the wind direction and speed which could not be accounted for in this assessment.

In conclusion, if unmitigated, the windblown dust from the wet ash disposal facility may result in significant PM_{10} ground level concentrations. As the background ambient PM_{10} ground level concentrations may also be elevated in the area (based on measured PM_{10} concentrations at Hendrina) it is recommended that the wet ash disposal facility be mitigated in order to minimise the impacts from this source on the surrounding environment.

8.3.2 Recommended Mitigation and Management Measures

Fugitive dust can easily be mitigated. It is recommended that the dust management measures as stipulated in **Table 8.2** be applied to ensure the proposed activities have an insignificant impact on the surrounding environment and human health. It is also recommended that single dust fallout buckets be installed downwind of the tailings dam in order to monitor the impacts from this source.

Based on the qualitative evaluation of the proposed operations, management objectives are considered as summarised in **Table 8.2**.

Table 8.2: Air Quality Management Plan (Construction, Operational and Closure Phases)

Aspect	Impact	Management Action / Objective	Responsible Person
Construction Phase			
Land clearing activities such as dozing and scraping of vegetation and topsoil	PM_{10} concentrations and dust fallout	• Water spays at area to be cleared • Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles • Ensure travel distance between clearing area and topsoil piles to be at a minimum	Environmental Manager Contractor(s)
Wind erosion from exposed areas at wet ash disposal facility	PM_{10} concentrations and dust fallout	• Ensure exposed areas remain moist though regular water spraying • Dust fallout bucket to be placed to the east and to the west of the wet ash disposal facility with monthly dust fallout rates not exceeding 1200 $mg/m^2/day$[(a)]	Environmental Manager Contractor(s)
Operational Phase			
Wind erosion	PM_{10} concentrations and dust fallout	• Ensure water sprays at and around the wet ash disposal facility • Dust fallout bucket to be placed to the west and to the southeast (dominant wind direction) of the wet ash disposal facility with monthly dust fallout rates not exceeding 1200 $mg/m^2/day$[(a)]	Environmental Manager
Closure Phase			
Wind erosion from exposed areas	PM_{10} concentrations and dust fallout	• Cover wet ash disposal facility with previously collected topsoil • Apply water sprays to ensure the material remains moist • Ensure vegetation cover on the wet ash disposal facility	Contractor(s) Environmental Manager

[(a)] South African Dust Fall limit of 1200 $mg/m^2/day$ for heavy commercial and industrial sites not to be exceeded for two sequential months and not more than three exceedances in a year

More detailed mitigation and management measures can be found in the Environmental Management Programme included in **Appendix E**.

8.4 Soil and Agricultural Potential

The Agricultural Report is included in **Appendix J.**

8.4.1 Potential Impacts

- **Soil Analysis Results**

Samples of topsoil and subsoil were collected at three localities (S1 to S3). These points are marked on the soil map. The analysis results are shown in **Table 8.3**.

Table 8.3: Soil analysis results

Sample site		**S1**		**S2**		**S3**	
Co-ordinates (Lat/Long)		26° 02' 19.0" 29° 35' 08.0"		26° 02' 50.3" 29° 35' 16.5"		26° 02' 41.1" 29° 35' 32.9"	
Soil Form		Avalon		Avalon		Bainsvlei	
Horizon		A1	B1	A1	B1	A1	B1
Depth (mm)		0-300	300-700	0-300	300-700	0-300	300-700
Sa	**%**	88	80	86	82	70	66
Si		2	2	2	4	6	8
Cl		10	18	12	14	24	26
Na	**cmol kg^{-1}**	0.141	0.147	0.129	0.120	0.125	0.130
K		0.159	0.104	0.310	0.207	0.760	0.291
Ca		3.237	2.232	2.786	1.528	5.347	4.731
Mg		1.238	1.211	1.082	0.652	2.041	1.410
CEC		13.313	13.171	12.928	10.230	13.825	19.630
P (ppm)		9.69	1.23	36.73	5.98	6.82	0.79
pH (H_2O)		7.54	7.12	6.54	6.00	6.57	6.62
Org C (%)		0.79	0.49	0.75	0.60	1.63	1.32

The soil analysis results show the light texture of the yellow-brown (**Av**) soils, with the red (**Bv**) soils being slightly higher in clay. The soils are not highly leached (eutrophic), with pH levels being neutral to slightly acidic. S1 and S2 were cultivated sites, where the lower organic carbon levels and higher residual P fertilization contrast with the uncultivated site S3.

However, in general, these are fertile, productive soils, and no abnormal or unexpected values were observed.

- **Agricultural Potential**

The general agricultural potential class of each map unit, and the main limiting factors, are given in **Table 8.4** below.

Table 8.4: Agricultural Potential

Agricultural Potential	Map unit	Limitations	Area (ha)
Moderate to high	Av, Bv	Few limitations. Moderately deep to deep, friable soils. Underlying plinthite may occur at shallow depth in places	*120.35*
Low to moderate	Wa, Gc	Restricted depth to underlying plinthite in many areas. Reduced natural fertility	*14.57*
Low	Tu	Occasional subsoil wetness and flood hazard	*17.91*
Very Low	Ka, Ex	Almost continuous subsoil wetness and flood hazard (Ka) Soil has been disturbed with topsoil removal (Ex)	*55.21*
			208.049

From **Table 8.4,** it can be seen that most of the survey area comprises soils with moderate to high agricultural potential (Bv and Av map units); the soils are deep and freely drained, with few limitations, and climatic conditions for rain-fed cultivation are generally good, with sufficient rainfall.

Both the Tu and the Ka unit comprise wetlands (the Tu unit is a temporary wetland, while the Ka unit is a permanent wetland), and these should, as far as possible be left undisturbed.

The Ex map unit comprises areas where excavations have occurred. In some instances, there has been replacement of topsoil, but there are also significant areas where the excavation has been left with very little topsoil, and in some cases with the ferricrete outcropping at the surface. Due to the uneven distribution of these areas, the increased compaction of the soils in places and the subsequent significant reduction in available soil depth, this map unit is difficult to describe or classify and has a very low potential for agriculture.

8.4.2 Recommended Mitigation and Management Measures

All recommended mitigation measures with regards to top soil management are included in the EMPr (**Appendix E**).

8.5 Geology

8.5.1 Potential Impacts

The construction and operation of the facilities and infrastructure associated with the wet ash disposal facility project is not anticipated to impact the underlying geology of the area due to the fact that it entails the establishment of mainly surface infrastructure. However, the following potential impacts on the geological features of the study area have been identified, specifically with regards to surface geological features:

- Impacts associated with construction related earth works
- Impacts associated with the pollution of geological features in case of spillage / leakage of hydrocarbon and other hazardous material from storage facilities

Due to the existing disturbed nature of the study area, both these impacts are considered to have a medium significance without the implementation of mitigation measures

8.5.2 Recommended Mitigation and Management Measures

All recommended mitigation measures with regards to geology are included in the EMPr (**Appendix E**).

8.6 Biodiversity

The Biodiversity Report has been included in **Appendix K**.

8.6.1 Potential Impacts

Results of the floristic and faunal investigations were interpreted holistically in order to assess the potential impact on the ecological environment. The impact assessment is aimed at presenting a description of the nature, extent significance and potential mitigation of identified impacts on the biological environment.

- **Identification of Impacts**

No impacts were identified that could lead to a beneficial impact on the ecological environment of the study area since the proposed development is largely destructive as it involves the alteration of natural habitat or further degradation of habitat that is currently in a sub-climax status.

Impacts resulting from the proposed development on ecological attributes of the study area are largely restricted to the physical impacts on biota or the habitat in which they occur. Direct impacts include any impacts on populations of individual species of concern, including protected species, and on overall species richness. This includes impacts on genetic variability, population dynamics, overall species existence or health and on

habitats important for species of concern. In addition, impacts on sensitive or protected habitat are included in this category, but only on a local scale. These impacts are mostly measurable and easy to assess, as the effects thereof are immediately visible and can be determined to an acceptable level of certainty.

In contrast, indirect impacts are not immediately evident and can consequently not be measured immediately. In addition, the extent of the effect is frequently large scale, mostly regional. A measure of estimation is therefore necessary in order to evaluate the importance of these impacts. Lastly, impacts of a cumulative nature places direct and indirect impacts of these projects into a regional and national context, particularly in view of similar or resultant developments and activities.

The following impacts are relevant to any type of development in a natural environment:

- Direct impacts on threatened flora species;
- Direct impacts on threatened fauna species;
- Loss or degradation of natural/ pristine habitat;
- Direct impacts on common fauna & interactions with structures & personnel;
- Loss, or disruption of ecological connectivity;
- Faunal interactions with structures, servitudes and personnel;
- Loss/ degradation of surrounding habitat, species;
- Impacts on SA's conservation obligations & targets; and
- Increase in local and regional fragmentation/ isolation of habitat.

The following development alternatives are considered in the assessment:

- Proposed Wet Ash Disposal Facility:
  - Alternative 1 – Site E;
  - Alternative 2 – No-Go Option;
- Proposed Distribution Lines:
  - Alternative Corridor 2;
  - Alternative Corridor 3;
  - Alternative Corridor 4 –
- Proposed Pipelines:
  - Alternative Route 1;
  - Alternative Route 2; and
  - Alternative 3.

Not all of the impacts are likely to occur; an assessment of the likelihood that respective impacts would occur is addressed in the following section. Based on this likelihood, the relevant impact is therefore omitted or included in the assessment section. Furthermore, not all impacts are likely to occur in all aspects of the proposed development. Impacts will therefore be included in a case-by-case scenario.

- **Nature of Impacts**

  - *Direct Impacts on Threatened Flora Species*

    This is a direct impact since it results in the physical damage or destruction of Red Data species or areas that are suitable for these species, representing a significant impact on the biodiversity of a region. Threatened plant species, in most cases, do not contribute significantly to the biodiversity of an area in terms of sheer numbers, as there are generally few of them, but a high ecological value is placed on the presence of such species in an area as they represent an indication of pristine habitat conditions. Conversely, the presence of pristine habitat conditions can frequently be accepted as an indication of the potential presence of species of conservation importance, particularly in moist habitat conditions.

    Red Data species are particularly sensitive to changes in their environment, having adapted to a narrow range of specific habitat requirements. Changes in habitat conditions resulting from human activities is one of the greatest reasons for these species having a threatened status. Surface transformation/ degradation activities within habitat types that are occupied by flora species of conservation importance will ultimately result in significant impacts on these species and their population dynamics. Effects of this type of impact are usually permanent and recovery or mitigation is generally not perceived as possible.

    One of the greatest limitations in terms of mitigating or preventing this particular impact, is that extremely little information is generally available in terms of the presence, distribution patterns, population dynamics and habitat requirements of Red Data flora species. To allow for an accurate assessment, it is usually necessary to assess the presence/ distribution, habitats requirements, etc. associated with these species in detail and over prolonged periods; something that is generally not possible during EIA investigation such as this. However, by applying ecosystem conservation principles to this impact assessment and subsequent planning and development phases, potential impacts will be limited to some extent.

    The likelihood of Red Data flora species occurring within the study area is regarded low and available data did not indicate the known presence of Red Data plants in the region. Furthermore, habitat types present in the study area is in a sub-optimum condition. The extremely low likelihood that this impact might occur therefore results in this impact being omitted from the assessment.

  - *Direct Impacts on Threatened Fauna Species*

    Threatened animals also contribute significantly to the ecological diversity of a region since their presence usually provides an indication of a relatively pristine environment. Also regarded as a direct and significant impact on the biodiversity of a region, impacts

resulting from developments such as this are less likely to affect these animals directly since they are generally mobile and will ultimately be able to migrate from impacts that result from the proposed development. Significantly, however, decreasing suitable habitat that is available to them represents an indirect, but significant impact on the status of these animals. Aspects of these animals that will also be affected include migration patterns and suitable habitat for breeding and foraging purposes. Since these requirements are frequently stricter than most generalist species, impacts on their habitat are likely to be more significant than for most other fauna species.

The presence of Red Data fauna species on this property is regarded unlikely for several reasons, mostly including the absence of habitat that would be suitable for the requirements of Red Data fauna species, as well as the lack of knowledge of any Red Data species occurring in the region.

The likelihood of Red Data fauna species occurring within the study area is regarded low. Furthermore, habitat types present in the study area is in a sub-optimum condition. The extremely low likelihood that this impact might occur therefore results in this impact being omitted from the assessment.

- *Loss or Degradation of Sensitive/ Natural Habitat*

The loss or degradation of natural habitat or habitat that are regarded sensitive as a result of restricted presence in the larger region (atypical habitat) represents a potential loss of habitat and biodiversity on a local and regional scale. Sensitive habitat types might include mountains, ridges, koppies, wetlands, rivers, streams and localised habitat types of significant physiognomic variation and unique species composition. These areas represent centres of atypical habitat and contain biological attributes that are not frequently encountered in the greater surrounds. A high conservation value is generally ascribed to floristic communities and faunal assemblages that occupy these areas as they contribute significantly to the biodiversity of a region.

While wetland habitat are regarded as sensitive, the assessment thereof is omitted from this report as it will be addressed in more detail in the wetland ecology report.

No terrestrial habitat of a highly sensitive (pristine) nature is present on the study area. However, moderately natural grassland habitat does occur and is utilised by some animal species. Although this impact is regarded of relative low significance, it is still included in the assessment.

- *Direct Impacts on Common Fauna & Interactions with Structures & Personnel*

Although a relatively low diversity of animals has been established on this property, this impact is still likely to occur. Additionally, activities that are known to transpire from human–animal conflicts are likely to affect animals that do utilise the surrounding

areas. These activities might include poaching, snaring, killing by accidental contact, capturing, effects of domesticated cats and dogs, roadkills, etc. While the tolerance levels of common animal species is generally of such a nature that surrounding areas will suffice in habitat requirements of species forced to move from areas of impact, some species are not able to relocate, such as ground living and small species.

It should be noted that animals generally avoid contact with human structures, but do grow accustomed to structures after a period. An aspect that is of concern is the presence of vehicles on access and infrastructure roads, leading to road kills, particularly amongst nocturnal animals that might occur in the study area.

The presence of personnel within the development area during construction and operational phases will inevitably result in some contact with animals. While most of the larger animal species are likely to move away from humans, encounters with snakes remain likely. Similarly, the presence of humans within areas of natural habitat could potentially result in killing of animals by means of snaring, poaching, poisoning, trapping, etc. In addition, the presence of domestic dogs and cats is generally associated with humans. These animals are frequently accountable for killing natural fauna. It is also regarded moderately likely that animals might be attracted to the artificial water sources.

The proposed development will ultimately result in some human-animal interactions. It is unlikely that their conservation status will be affected, but any impact on animals is considered significant. This evaluation is therefore included in the assessment.

- *Loss or Disruption of Ecological Connectivity*

The region is characterised by highly transformed and fragmented grassland habitat types that are unlikely to be occupied by a high diversity of animal species. Evidence of this investigation has confirmed this and it can therefore be assumed that the animals that utilises these habitat types migrate extensively across the region for various reasons. Foraging, available water, food sources, breeding patterns and seasonal climate changes include some of the more obvious explanations for migration of animals.

While most of the larger mammal species (ungulates) are restricted in their movement by fences, small and medium sized animals, that include predators, burrowing species, small mammals, invertebrate species, reptiles, amphibians, etc. utilises all available natural habitat as either corridors or habitat. The loss of an area as large, as this property, will affect the migration pattern of some species that are present in the immediate region. While larger animals are able to avoid unsuitable habitat, smaller animals might not be able to cross or avoid these areas. Of note is also the effect of disruption of migration patterns of particularly flightless animals.

The size of the proposed development implies that much of the natural habitat that is present on the study area will become unsuitable for a number of species that might utilise this area on a frequent or infrequent nature. This assessment is therefore included in the assessment.

- *Impacts on Surrounding Habitat/ Species & Ecosystem Functioning*

Surrounding areas and species present in the direct vicinity of the study area could potentially be affected by indirect impacts resulting from construction and operational activities. This indirect impact also includes adverse effects on any processes or factors that maintain ecosystem health and character, including the following:

- Disruption of nutrient-flow dynamics;
- Introduction of chemicals into the ground- and surface water through leaching;
- Impedance of movement of material or water;
- Habitat fragmentation;
- Changes to abiotic environmental conditions;
- Changes to disturbance regimes, e.g. increased or decreased incidence of fire;
- Changes to successional processes;
- Effects on pollinators; and
- Increased invasion by plants and animals not endemic to the area.

Changes to factors such as these may lead to a reduction in the resilience of ecological communities and ecosystems or loss or changes in ecosystem function. Furthermore, regional ecological processes, particularly aquatic processes that are dependent on the status and proper functioning of the drainage line, are regarded important. It is well known that the status of a catchment is largely determined by the status of the upper reaches of the rivers. Small drainage lines, such as the one on this property, might be insignificant on a regional scale, but the combined status of numerous such small drainage lines will determine the quality of larger rivers further downstream.

The nature of this impact dictates that potential impacts are likely to spread from the development area into bordering areas; it is therefore included in the assessment.

- *Impacts on SA's Conservation Obligations & Targets*

This impact is regarded a cumulative impact since it affects the status of conservation strategies and targets on a local as well as national level and is viewed in conjunction with other types of local and regional impacts that affect conservation areas. The importance of vegetation types is based on the conservation status ascribed to regional vegetation types and while any impact that results in irreversible transformation of natural habitat is regarded significant, no significant disruption of ecosystem functioning is assumed in least threatened vegetation types, which still have more than 80% of their original extent untransformed.

Although the loss of natural vegetation is expected to result in an insignificant impact on the conservation status of the regional vegetation types, it is still included in the assessment of cumulative impacts based on the Endangered status thereof

- *Increase in Local & Regional Fragmentation/ Isolation of Habitat*

Uninterrupted habitat is a precious commodity for biological attributes in modern times, particularly in areas that are characterised by moderate and high levels of transformation. The loss of natural habitat, even small areas, implies that biological attributes have permanently lost their ability of occupying that space, effectively meaning that a higher premium is placed on available food, water and habitat resources in the immediate surrounds. This, in some instances might mean that the viable population of plants or animals in a region will decrease proportionally with the loss of habitat, eventually decreasing beyond a viable population size.

The danger in this type of cumulative impact is that effects are not known or is not visible with immediate effect and normally when these effects become visible, they are beyond repair. Impacts on linear areas of natural habitat affect the migratory success of animals in particular.

The general region is characterised by extremely high levels of transformation and habitat fragmentation. Although impacts from the proposed development are unlikely to increase regional or local levels of fragmentation and habitat isolation significantly, this impact is still included in the assessment of cumulative impacts.

8.6.2 Recommended Mitigation and Management Measures

All recommended mitigation and management measures with regards to the general aspects of the proposed site are included in the EMPr (**Appendix E**).

8.7 Avifauna

The Avifauna Report has been included in **Appendix L.**

8.7.1 Potential Impacts

- ***Wet Ash Disposal Facility***

Alternative 1 - Site E:

This site was preferred from an avifaunal perspective. It is situated closest to the Power Station. It consists primarily of cultivated lands ("mielie fields"). It has many disturbed

areas such as roads and powerlines in close proximity. However, the following impacts are identified.

- *Construction phase*

  The greatest predicted Impact of wet ash disposal facilities on avifauna are the **destruction of habitat** and **disturbance** of birds by construction activities. During the construction phase, habitat destruction and alteration inevitably takes place. Habitat destruction is anticipated to be the most significant impact in this study area. Similarly, the above mentioned construction and maintenance activities impact on bird through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of lower significance than habitat destruction.

- *Operational phase*

  Leachate from ash disposal facilities can contain heavy metals (Theism and Marley, 1979) which could result in **contamination of surrounding water sources**, used by water birds in the study area. Correct placing of the new ash disposal facility, away from wetlands, dams and water bodies, will help to mitigate this impact although it might not be practical in all scenarios.

Alternative 2 – No-go:

The current status quo with respect to environmental impacts would be maintained by not implementing the proposed wet ash disposal facility. The current farming activities will continue and the land use will not change. Presence and abundance of bird species, as described in the Avifaunal Scoping Report, would remain the same. Purely in terms of impacts on avifauna, this option would have the least impacts. With respect to the country's power requirements, there is a risk of inadequacy of power supply, since, without the ash disposal facility, Hendrina power station would have to stop operations.

- ***Powerlines***

Because of its size and prominence, electrical infrastructure constitutes an important interface between wildlife and man. Negative interactions between wildlife and electricity structures take many forms, but two common problems in southern Africa are electrocution of birds (and other animals) and birds colliding with power lines (Ledger 1983; Verdoorn 1996; Kruger 1999; Van Rooyen 1999; Van Rooyen 2000). Other problems are electrical faults caused by bird excreta when roosting or breeding on electricity infrastructure, (Van Rooyen & Taylor 1999) and disturbance and habitat destruction during construction and maintenance activities. The following is a description of the predicted impacts for the various powerline corridor alternatives, during the associated phases of the project.

Alternative Corridor (All Alternatives):

- *Construction phase*

  Habitat destruction. During the construction phase of power lines some habitat destruction and alteration inevitably takes place. This happens with the construction or establishment of access roads, and the clearing of servitudes. Servitudes have to be cleared of excess vegetation at regular intervals in order to allow access to the line for maintenance, to prevent vegetation from intruding into the legally prescribed clearance gap between the ground and the conductors and to minimize the risk of fire under the line which can result in electrical flashovers. These activities have an impact on birds breeding, foraging and roosting in or in close proximity of the servitude through modification of habitat. Habitat destruction is anticipated to be of low to moderate significance in this study area.

  Disturbance. Similarly, the above mentioned construction and maintenance activities impact on birds through disturbance, particularly during bird breeding activities. Disturbance of birds is anticipated to be of low significance.

- *Operational phase*

  Electrocutions. Electrocution of birds on overhead lines is an important cause of unnatural mortality of raptors and storks. It has attracted plenty of attention in Europe, USA and South Africa (APLIC 1994; van Rooyen & Ledger 1999). Electrocution refers to the scenario where a bird is perched or attempts to perch on the electrical structure and causes an electrical short circuit by physically bridging the air gap between live components and/or live and earthed components (van Rooyen 2004). Electrocution is possible on 132kV lines, depending on the exact pole structure used. For this study, **it is assumed that a bird friendly structure will be used, and the detailed impact assessment below, is based on this assumption**. Therefore, the impact of electrocution is likely to be of low significance for the proposed power lines.

  Collisions. A bird collision occurs when a bird in mid-flight does not see the overhead cables until it is too late to take evasive action (Smallie et al, 2009). This results in the bird colliding with the cables, and usually dying through injuries related to the impact with the cable or the subsequent impact with the ground. Collisions are the biggest single threat posed by transmission lines to birds in southern Africa (van Rooyen 2004). Most heavily impacted upon are bustards, storks, cranes and various species of water birds. These species are mostly heavy-bodied birds with limited manoeuvrability, which makes it difficult for them to take the necessary evasive action to avoid colliding with power lines (van Rooyen 2004, Anderson 2001). Unfortunately, many of the collision sensitive species are considered threatened in southern Africa. The Red Data species vulnerable to power line collisions are generally long living, slow reproducing species under natural conditions. Some require very specific conditions for breeding, resulting in very few successful breeding attempts, or breeding might be restricted to

very small areas. These species have not evolved to cope with high adult mortality, with the results that consistent high adult mortality over an extensive period could have a serious effect on a population's ability to sustain itself in the long or even medium term. Many of the anthropogenic threats to these species are non-discriminatory as far as age is concerned (e.g. habitat destruction, disturbance and power lines) and therefore contribute to adult mortality, and it is not known what the cumulative effect of these impacts could be over the long term. Collision with the proposed lines of certain large flying bird species such as Greater Flamingo, Lesser Flamingo, White Stork and Southern Bald Ibis is a possibility.

Nesting of birds on pylons is in fact a positive impact on avifauna, but may impact negatively on the quality of electrical supply by causing electrical faults. In some cases the nest material may pose problems to the pylon's structural integrity through added weight, and there is an increased fire risk due to the fuel load of these massive nests.

Disturbance: Routine maintenance of pylons and power lines could result in disturbance of certain bird species during the operational life span of the power line. This is especially true for breeding birds in the vicinity, as well as those that may roost or nest on the structures.

- *De-commissioning phase*

  During this phase it is possible that there may be an impact of **disturbance** on avifauna, as detailed above.

<u>Alternative – No-go:</u>

- *Construction phase*

  N/A

- *Operational phase*

  The current status quo would be maintained by not re-routing the power line. The existing line would remain, with its current possible impacts of Collision and Electrocution, as discussed above.

- ***Pipelines***

<u>All Alternatives:</u>

- *Construction phase*

  The impacts of pipelines on avifauna are only expected during the construction phase in the form of **habitat destruction and disturbance**. Habitat destruction caused by

construction will have some impact on avifauna, but as discussed elsewhere the habitat in this landscape is relatively uniform and disturbed and so this impact is unlikely to be too significant. Furthermore, much of the area can be re-habilitated to its original state, once the pipelines have been laid underground. Disturbance of avifauna, especially breeding birds is likely to occur to some minor extent, but is not likely to be too significant.

Alternative – No-go:

The current status quo would be maintained by not constructing pipelines on new footprint. The current farming activities will continue and the land use will not change. Presence and abundance of bird species, as described in the Avifaunal Scoping Report, would remain the same.

8.7.2 Recommended Mitigation and Management Measures

All recommended mitigation and management measures can be found in the Environmental Management Programme included in **Appendix E**.

More detailed mitigation and management measures can be found in the Environmental Management Programme included in **Appendix E**.

Figure 8.2 below shows the proposed power-line deviation corridor alternatives, as well as sensitive zones (see red shaded areas), through which overhead power-line sections may require collision mitigation. For all line alternatives, this includes an area to the west of the wet ash disposal facility site, close to some wetlands, as well as a small section at the north east corner of the wet ash disposal facility site. It is likely that alternative 2 will require more mitigation, as it passes to the north of a natural seasonal pan, on farm land to the south of the wet ash disposal facility site. Alternatives 3 and 4 fall outside sensitive areas.

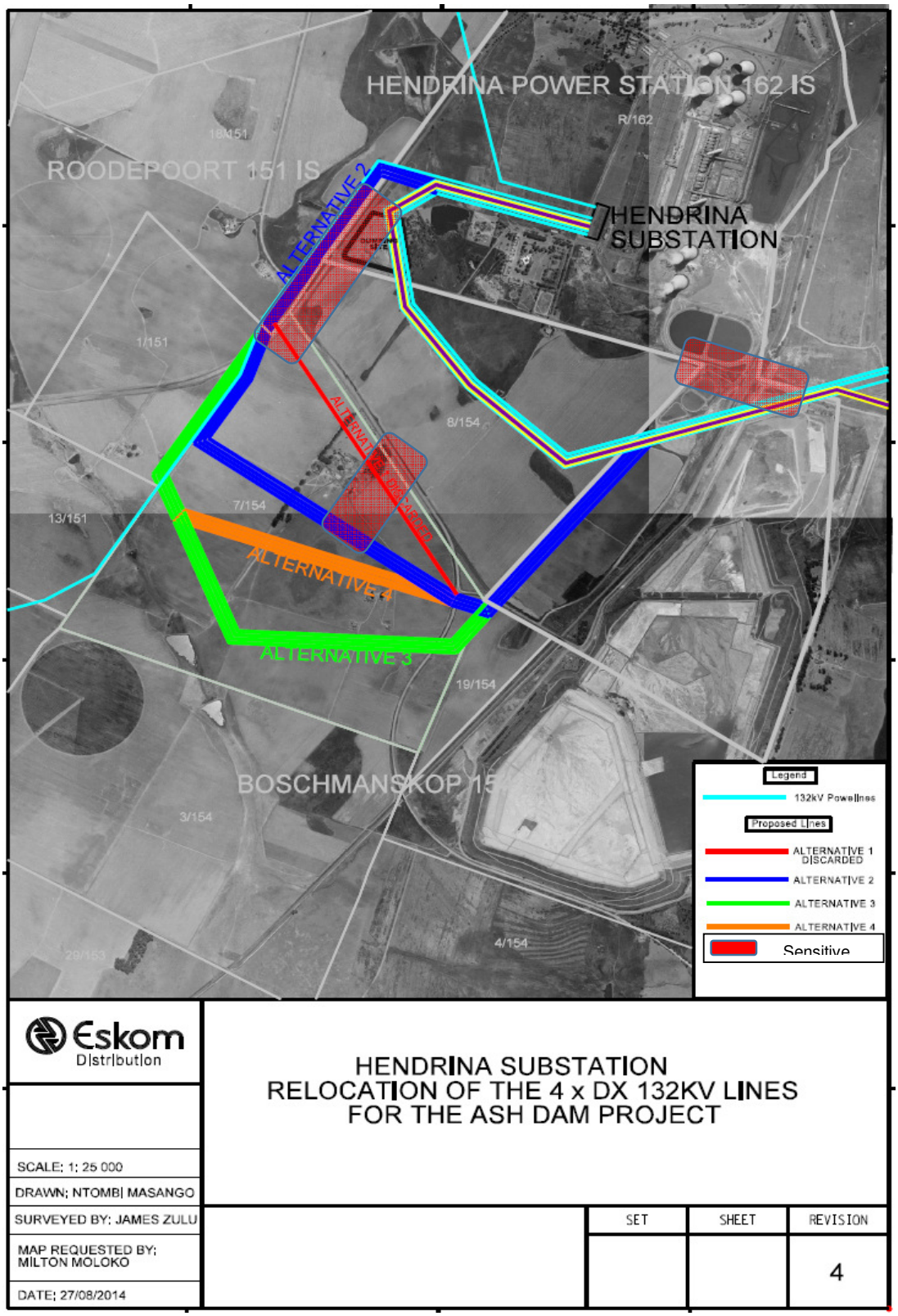

Figure 8.2: Map showing preferred wet ash disposal facility site E, existing HV electrical infrastructure, wetlands, proposed powerline deviation alternatives, as well as sensitive zones (see red shaded areas), through which overhead powerline sections may require collision mitigation.

8.8 Surface Water

The Surface Water / Aquatic Ecology Report is included in **Appendix M**.

8.8.1 Potential Impacts

The primary study area consists of approximately 34% wetland. Wetlands which will directly be affected by the proposed wet ash disposal facility are ecologically impaired to different degrees due to current land use activities. Implied wetlands mostly retain a water purification function and do not contribute notably to stream flow augmentation and flood attenuation. Although the EIS assessment reflected overall Moderate sensitivity, and the wetlands associated with the study area play a lesser role in moderating the quantity and quality of water of major rivers, they still provide potential habitat for species with conservation status and serve as a corridor along the Woes-Alleenspruit system.

Wetlands in the secondary study area are also ecologically impaired. The hydrological characteristics of the valley bottom systems have been greatly altered by additional water input and a number of impeding structures (roads and dams). Simultaneously, seep zones have been infringed on by agricultural activity, destroying habitat and disturbing hydromorphic soils. Most wetlands, in the secondary study area, are vulnerable to changes in hydrology and geomorphology in their respective catchments. However, Wetland 1 is more likely to be affected by the construction of the wet ash disposal facility as it receives most of the drainage of the primary study area.

Results from the aquatic biomonitoring reflected poor ecological conditions in the receiving environment, with mostly pollution tolerant species sampled. Low abundances and species richness were present at both monitoring sites for diatoms and aquatic macroinvertebrates. One monitoring site yielded a population of *B. neefi*. Results from biomonitoring provide snap shot view of baseline conditions which may be used as a platform for comparison of future monitoring effort.

- ***Wet Ash Disposal Facility***

  - ***Alternative 1 – Site E***

Construction Phase

Functional units 1, 6 and 7 (as referred to in the Surface water report) will be cleared of vegetation effectively eliminating remaining ecological integrity and functionality. Main concerns during the construction phase are erosion and sediment control.

Operation Phase

The loss of wetland functions will mostly be expressed during the operation phase. It is assumed that runoff generated by the footprint, and not diverted by the clean catchment

diversion channel, will be treated as polluted water and redirected to a pollution control facility. This will reduce the runoff received by HGM2. However this is not expected to impose a negative trajectory to this functional unit, mostly due to the dam already intercepting most of this runoff. The dam, however, will reduce in volume and this might have implications for current abstraction activities. The loss of other wetland functions, associated with HGM1, is not perceived as significant and should not contribute to ecological degradation of the downstream catchment.

Additional consideration should be given to the likelihood of surface water pollution due to runoff or malfunctioning of the pollution control system, in which case polluted water will accumulate in the dam downstream of HGM1. Biological receptors, assessed in Wetland 1, are not sensitive to changes in water quality as they already suggest chronic organic pollution. Thus, a lower severity is assigned to occasional alteration in surface water quality.

De-commissioning Phase

It is assumed that the wet ash disposal facility will be stabilised pre-decommissioning, with the aim of increasing surface roughness. Changes to the drainage system are also expected. The long term impacts of the decommissioned dam on surface water quality will rely on leachate and/or runoff quality, as well as the probability of surface water pollution.

Cumulative Impacts

The receiving catchment is in a transformed state due to mining, agriculture and residential development. Most of the East-Woes-Alleenspruit as well as the middle and lower parts of the Woes-Alleenspruit have been modified by mining activity. The upper reaches of the Woes-Alleenspruit is in a fair condition with mostly agricultural practices driving ecological change. The proposed development will pose a cumulative impact risk, particularly to the upper reaches of the receiving catchment. As mentioned earlier, no significant cumulative impact relating to aquatic biodiversity, flood attenuation or stream flow augmentation is expected. The hydrological contribution, of the area of influence to the downstream catchment is marginal.

- ***The No-go alternative***

A likely trajectory assessment for hydrology, geomorphology and vegetation ascertained, in most cases, a slight to substantial deterioration of most wetlands during the next five years. Factors most likely to contribute to this deterioration include:

- *Ongoing agricultural practices infringing on seasonal and temporary zones.*
- *Active wetland draining (particularly in HGM 1).*
- *A likely increase in alien woody component in the catchment and within some functional units.*

- *Current discharge at HGM 6, impose a risk of gully formation and subsequent draining of seeps.*
- *Impeding road and dam structures result in the loss of functional wetland habitat and alter natural hydrology.*
- *In-channel excavation occurring at the tar road crossing at HGM 2 further contributes to a negative trajectory in wetland health.*

It follows that even if the no-go alternative applies wetlands within the primary and secondary study area are likely to further degrade over the next 5 years. This notion supports recommendation for the construction of the wet ash disposal facility on alternative E, particularly when considering the ecological constraints and risks of other alternatives (refer to aquatic screening and scoping reports). Concurrently, the anticipated negative trajectory provides an opportunity for offsite mitigation with particular emphasis on Wetlands 1, 2, 8, 9 and 10.

- ***Power lines***

Existing power lines located on Alternative E will have to be moved to accommodate the wet ash disposal facility, and thus three alternative corridors have been identified as new dx-line routes (Figure 8.2). At the point where all three alternatives overlap they intersect Wetland 4 which is impacted by existing road infrastructure and power line corridors. All three proposed line corridor alternatives also cross through Wetland 1 and 2, and run parallel to 7.

Alternative corridor 1 was discarded as a possible alternative because of objections by the local farmers. The alignment of Alternative 2 is most accessible, requiring only minimal additional disturbance relating to the construction and maintenance phase. However, Alternative 2 will infringe on the northern section of Wetland 8, the largest pan system within the secondary study area. Wetland 8 (HGM 13 and 14) was in a Largely modified state with its immediate catchment mostly transformed. However, it is probable that Wetland 8 provides suitable habitat for wading birds (at least in seasonal intervals) and is thus a less preferred alternative (please refer to Section 5.2.2). Alternative 4 intersects Wetland 8 which, for the same reasons as Alternative 2, makes it a less preferred alternative (please refer to Section 5.2.4). Alternative 3 does not infringe upon any additional wetland habitats, beyond Wetland 4 and 5, making it the most preferred alternative. However, Alternative 3 is least accessible and runs parallel to Wetland 10 (HGM 17, 18, and 19), which was in a Moderately modified ecological state and was deemed capable of providing valuable EcoServices. Therefore, caution should be taken during construction so as not to further impair the remaining ecological integrity of Wetland 10 (please refer to Section 5.2.3). Additionally, alternative 3 also runs parallel to Wetland 9 and 11.

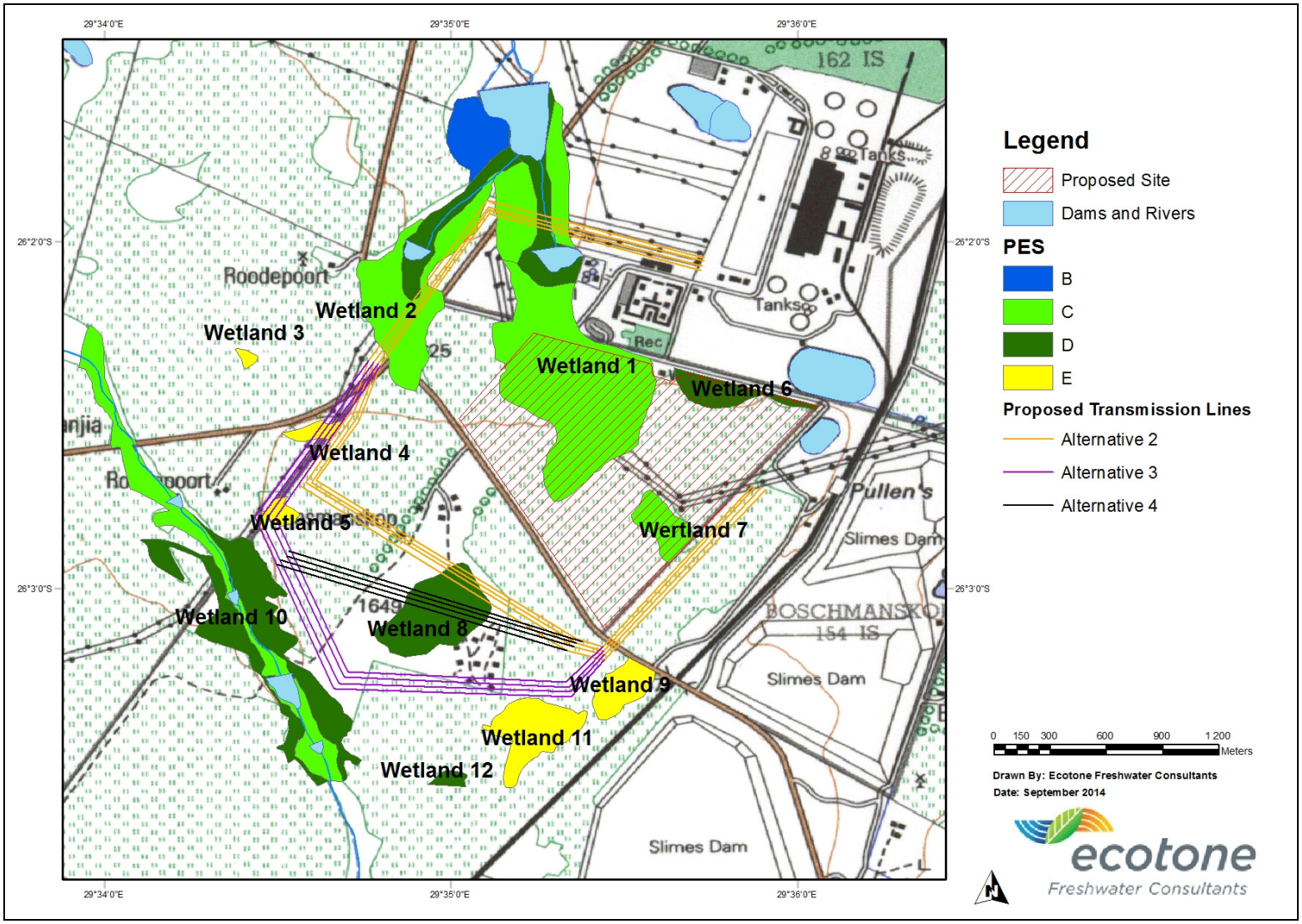

Figure 8.3: Map showing the Powerline alternatives (Nel *et al.,* 2004; Chief Directorate – Surveys and Mapping).

- ***Water supply Pipeline***

The proposed development will require moving an existing raw water pipeline from Alternative E to the proposed alignment shown in Figure 8 2. The pipeline is not expected to cross any wetlands, although it does come close to the boundary of Wetland 8. Environmental risk linked to aquatic ecology is thus not a concern. Even so, emphasis, during construction, should fall on soil conservation, erosion and sediment control, as these factors might negatively impact receiving drainage systems.

8.8.2 Recommended Mitigation and Management Measures

All recommended mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

- ***Alternative E***

During the construction and operational phase of the proposed wet ash disposal facility at Alternative E, general mitigation measures need to be stringently implemented and enforced in order to minimise the potential impacts. Listed below are mitigation measures concerning the construction of the proposed wet ash disposal facility:

- Construction activities need to comply with any condition set forth by applicable authorities.
- Clean water run-off channels must be constructed to divert clean water from above the construction site and divert the water around the work area (Clemens, 2010). This will be an important feature with regards to Wetland 1 (downstream of Alternative E) as it will help prevent run-off from become sediment-laden and entering receiving wetlands.
- Vegetation clearing needs to be limited to the construction limits as it will assist in limiting erosion and reducing the velocity of run-off. In addition, clearing should only take place immediately before construction activities commence. Vegetative cover is the most effective measure to stabilise top soil and to prevent erosion, sedimentation and associated water quality impacts.
- Wetlands connected to affected HGM units in the primary study area will require monitoring during the construction phase. The results of the monitoring should feed into an adaptive management system. Specific emphasis should be placed on retaining wetland function PES.

- ***Power supply lines***

During the construction of the proposed power supply lines, general (Section 6.1) and mitigation measures need to be stringently implemented and enforced in order to minimise the potential impacts. Listed below are mitigation measures concerning the construction of the proposed power supply lines:

- The placement and construction of the power line pylons should be avoided in wetlands.
- Clearing of vegetation needs to be limited to the construction limits.
- All excavated material during the construction of the pylons, should be deposited and stabilised in distinct piles within approved areas with suitable erosion control measures in place in order to minimise and reduce erosion and siltation.

In the event of any damage to the surrounding wetlands during the construction of the power line corridors, the advice of a suitably and qualified specialist will be required in order to facilitate suitable rehabilitation of the wetland in question.

- ***Water supply pipeline***

During the construction of the proposed pipeline, general (Section 6.1) mitigation measures are also applicable. Listed below are mitigation measures concerning the construction of the proposed pipeline:

- The construction of the pipeline servitude should not infringe on the wetland areas.
- Surface and storm water must be diverted away from excavation.
- Water accumulated within the trenches (rainfall events etc.) needs to be pumped out through a water bypass system in order to filter out sediment.

- ***Off-site Mitigation***

All reasonable and responsible actions have been considered to avoid impacts on wetland imposed by the proposed development. It thus follows, that the only mitigation for residual loss of wetland functions associated with the proposed development will be off-site mitigation. In light of the PES and EIS of HGM units identified in the primary study area and the environmental least cost associated with Alternative E, off-site mitigation is a feasible management action. It must however be noted that off-site mitigation is not an alternative/substitute to on-site mitigation measures and that it will not reduce the magnitude and severity of the impacts associated with the proposed wet ash disposal facility construction. Off-site mitigation should be implemented in combination with the above-mentioned mitigation measures. The impaired state of receiving wetlands in the secondary study area and the hectare equivalents provided in this report provide an opportunity and base for off-site mitigation. An additional wetland study will be required to provide a comprehensive off-site mitigation plan.

- ***Monitoring***

One of the main aims of this report was to establish baseline conditions of the receiving environment. The results of which thus provide a platform for future monitoring. It is recommended that constituents of this report be incorporated into a monitoring plan with quarterly intervals during construction and biannually during the operational phase of the

proposed development. It is pertinent for monitoring sites and methodology to be consistent as this provides credibility and continuity in information.

Results of each monitoring report should be compared with that of past assessments. Particular emphasis must be placed on spatial and temporal variation in faunal and floral community structures as well as the absence and presence of indicator species. In the case of invertebrates and fish, seasonal average of abundances, species richness and feeding group ratios should be provided along with a standard deviation. It is always a good idea to include raw data in the form of an appendix. A record of seasonal variation in biological responses will also aid in highlighting other drivers of ecological change (i.e. mining or discharge activity), and it will help to measure the rate of recovery in the system after an unforeseen spill event. From this, target thresholds for aquatic communities may be generated, which in turn will act as a measurable environmental performance indicator.

Changes measured in biological metrics must justify an immediate correction in the process inducing the change. Biomonitoring reports should inform an adaptive management process, which ideally, should address relevant components of the process as soon as possible (prior to the following biomonitoring assessment). After a number of monitoring surveys (approximately four), a template for expected community structures may be extrapolated from the data. From this, key species or ratios between species may be highlighted which, in turn, will act as a standard in itself. These key species and or ratios between species may be used for comparison and interpretation

More detailed mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

8.9 Groundwater

The Ground Water Report has been included in **Appendix N**.

8.9.1 Potential Impacts

- ***Wet Ash Disposal Facility***

o *Alternative 1 - Site E:*

Construction phase

The use of earth-moving plant also brings a risk of hydrocarbon spillages during the construction phase. This can be mitigated by careful storage and handling of hydrocarbons (e.g. diesel, lubricants, hydraulic fluids, etc), preferably in bunded areas.

A liner will be installed at the base of the proposed ash disposal facility. Such a liner, whilst presumably adding considerably to the cost of the ash disposal facility, should

greatly limit downward movement of leachate (in conjunction with an under drain system) when the ash disposal facility is operational. There is of course still a chance of contamination (e.g. by hydrocarbons) while the ash disposal facility is being constructed and before the liner system has been installed.

Operational phase

If any lining system is compromised, wet ash disposal facility operation (wet ash disposal by slurry) will lead to increased recharge to the groundwater in the vicinity of the site, and a rise in the water table. This also implies a possible change in groundwater flow direction. The quality of groundwater beneath the site is likely to deteriorate, since natural groundwater would be mixing with the poorer quality ash leachate. The under-drain and penstock system is designed to convey supernatant water away from the wet ash disposal facility to the return water dam, but a portion of the water will percolate downwards into the aquifer. A liner should be able to greatly reduce the downward movement of leachate into the aquifer.

De-commissioning phase

Decommissioning of the wet ash disposal facility will involve stopping the disposal of ash slurry and making changes to the drainage system (e.g. sealing or removing the penstocks). The wet ash disposal facility may also undergo some degree of shaping and re-vegetation, ideally with the addition of a layer of topsoil. The immediate effect will be to greatly reduce the volume of leachate available for percolation into the ground, but this is unlikely to cease altogether – natural precipitation falling onto the decommissioned wet ash disposal facility will most likely mean that some leachate will continue to percolate downwards, leading to a persistent water quality impact (albeit possibly a relatively mild impact). This however needs to be assessed within the framework of Environmental requirements at that time.

Cumulative impacts

The likely cumulative impacts of all three phases, even with the prescribed liner in place, (wet ash disposal facility construction, operation and decommissioning) are likely to be a long-term rise in water table in the vicinity of the site, accompanied by a deterioration in groundwater quality, if there are seepages into the groundwater. These impacts will most likely gradually reverse once the wet ash disposal facility is decommissioned, but are unlikely to completely disappear for many years.

- *Alternative 2 – No-Go:*

If the wet ash disposal facility is not constructed ("no-go" option) then there will be no additional impacts on groundwater at the site, provided no other activities are carried out at the site which could affect the groundwater.

- ***Power Line Corridors***

It will be necessary to re-route the existing electricity power lines, since these presently cross the proposed wet ash disposal facility site. The power lines will be routed around the wet ash disposal facility to the south. Apart from possible local pollution during construction or decommissioning of the power lines (e.g. by a diesel fuel spill) there is likely to be very little impact on groundwater by the lines during any of the phases. This applies to all possible power line corridors – all of them are located on the same geology (Vryheid Formation shales of the Karoo Supergroup) and on the same hydrogeological map classification (classified "D2"). Differences in elevation (and therefore presumably depth to water table) between the three proposed corridors are small. There is likely to be no impact of the "no-go" option (i.e. leaving the power lines as they are) on the local groundwater.

- ***Pipelines***

It will be necessary to re-route the existing water pipeline carrying water south from the main pipeline at Hendrina since the pipeline presently crosses the proposed wet ash disposal facility site. Eskom propose to route the pipeline round the wet ash disposal facility to the south, close to the wet ash disposal facility so as to minimize costs. Apart from possible local pollution during construction or decommissioning of the pipeline (e.g. by a diesel fuel spill) there is the possibility of a relatively small impact on groundwater during the construction and decommissioning phases (possible local dewatering of shallow perched groundwater during trench construction, and a slightly higher risk of groundwater pollution if contaminants enter the open pipeline trench. There is likely to be no impact of the "no-go" option (i.e. leaving the pipeline as it is currently)) on the local groundwater.

8.9.2 Recommended Mitigation and Management Measures

The following section refers to the wet ash disposal facility only and not to the pipeline or powerline diversions. The diversions are considered to have only a small potential impact on local groundwater, and normal "good housekeeping" measures such as preventing diesel spills from plant and forbidding the disposal of any waste material into holes dug for the pipeline or power lines is recommended.

- ***Construction Phase***

During the construction phase of the wet ash disposal facility the impacts of ash leachate are expected to be limited if at all present, mainly because the construction phase is not expected to last very long (weeks or months). It is expected to consist of clearing the site, the removal of any infrastructure at the site, the installation of under-drain systems and related pipework, the penstock installation, and the initial construction of the wet ash disposal facility walls. The construction phase may also include the installation of piezometers for groundwater monitoring. There is likely to be a lot of plant and equipment on the site at this time, with the possibility of spills and leaks of hydrocarbons and other

polluting fluids. Solid wastes left at the site can also give rise to polluting leachates following rain.

Recommended mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

- ***Operational Phase***

The operational phase has the potential to change both the quantity (water table level will rise) and quality of local groundwater (quality likely to deteriorate). The local groundwater flow direction may also be modified due to the local rise in the water table and the fact that the site is close to a water divide. Minimizing the volume of leachate percolating through the wet ash disposal facility and migrating downwards into the aquifer is the key to reducing all of these impacts. Mitigation measures therefore include:

Recommended mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

- ***Decommissioning Phase***

Decommissioning of the wet ash disposal facility will mean that ash slurry will no longer be disposed to the facility, and also that a degree of re-vegetation may be achieved. Whilst the liner system should prevent most percolation of leachate into local groundwater in the long term, some failures could occur that necessitate the following mitigation measures:

It is likely that minor changes to water table elevation and groundwater flow direction in the immediate vicinity of the site will persist after decommissioning has finished, since the overlying wet ash disposal facility (even if vegetated and managed) will alter the flow / recharge characteristics of the local area. These issues are expected to be relatively minor.

Recommended mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

8.10 Sites of Archaeological, Historical and Cultural Interest

The Heritage Report has been included in **Appendix P**.

8.10.1 Potential Impacts

Identified heritage sites

Based on the above sources and the field visit, the following heritage sites, features and objects were identified in the proposed development area:

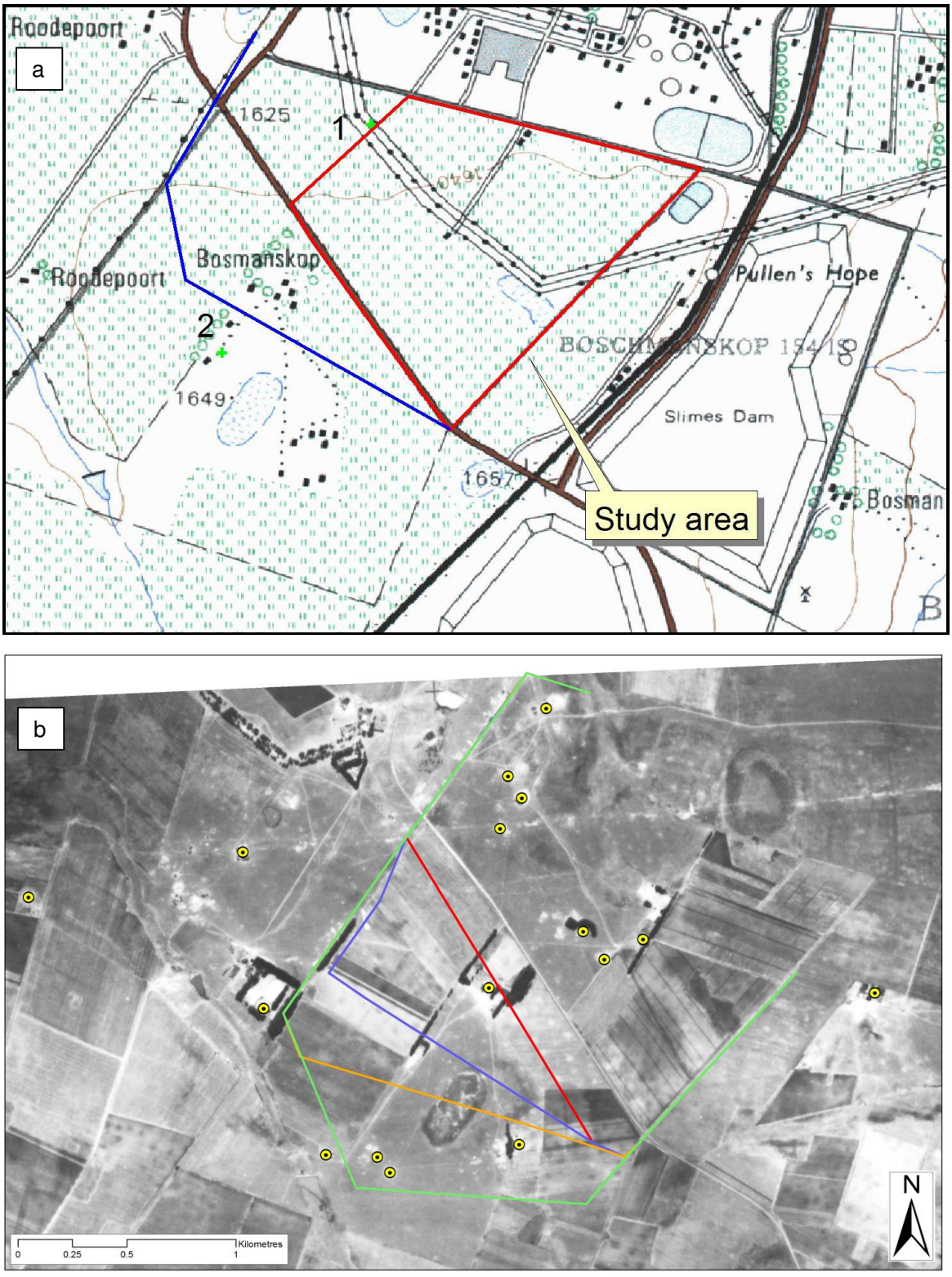

Figure 8.4: Layout of the study area showing the identified site and existing power lines (figure at the top), as well as the proposed corridors for the power line alternatives in relation to heritage features (figure b at the bottom).

- *Stone Age*

No sites, features or objects of cultural significance dating to the Stone Age were identified in the study area.

- *Iron Age*

  No sites, features or objects of cultural significance dating to the Iron Age were identified in the study area.

- *Historic period*

  - *Cemeteries*

Location	No. 1	S 26.03891	E 29.58714
Description			
Informal cemetery with probably 5 graves. Only one has a gravestone and most are only marked with stone cairns.			
Significance		High on a local level – Grade III	
Mitigation			
As these graves are located inside the area where the wet ash disposal facility is to be developed they will be impacted on. If it is impossible to retain them in place, they must be relocated after following correct procedure.			

Location	No. 2	S 26.04872	E 29.58071
Description			
Single grave of former land owner.			
Significance		High on a local level – Grade III	
Mitigation			
This site is located close to the alternative alignment 1 of the power line, but it would not be impacted on by the development of the line as this alternative has been discarded.			

Figure 8.5 The identified cemeteries.

The NHRA stipulates the assessment criteria and grading of archaeological sites. The following categories are distinguished in Section 7 of the Act:

- Grade I: Heritage resources with qualities so exceptional that they are of special national significance;
- Grade II: Heritage resources which, although forming part of the national estate, can be considered to have special qualities which make them significant within the context of a province or a region; and
- Grade III: Other heritage resources worthy of conservation on a local authority level.

The occurrence of sites with a Grade I significance will demand that the development activities be drastically altered in order to retain these sites in their original state. For Grade II and Grade III sites, the applicable mitigation measures would allow the development activities to continue.

Table 8.5 Heritage resources identified in the study area.

Resource ID	Resource Period	Type	Description
1641/Wf/001	Union of South Africa (1910 CE to 1961 CE)	Site	Historical werf dating from 1913 consists of a main farmhouse and associated buildings
1641/BGG/002	Democratic Republic of South Africa (1994 to present)	Burial / grave	Grave sitecontaining one grave of Petrus Christiaan van Wyk 1945/11/01 – 2010/09/11
1641/Ste/003	Apartheid Republic of South Africa (1961 to 1994)	Site	Farm workers house. It used to belong to the grandfather of the farm workers living on the property and is known as the ancestors house

Heritage resources identified within the project area consist of built structures and burial grounds and graves. These are presented in Table 5 4. The two notable structures identified include 1641/Wf/001 discussed above and 1641/Ste/003.

The structure 1641/Ste/003 is known as the "Groen Huis" (date not confirmed), which used to belong to the grandfather of the current farm labourers living on the farm. After his passing, the house became a place for the ancestors to the labourers, and is now considered a spiritual place. In respect of these beliefs, the landowner has retained the structure.

Based on current information regarding sites in the surrounding area, all sites known to occur in the study region are judged to have a **Grade III significance** and therefore would not prevent the proposed development for continuing after the implementation of the proposed mitigation measures and its acceptance by SAHRA.

Figure 8.6 The "Groen Huis"

8.10.2 Recommended Mitigation and Management Measures

- *Impacts during construction*

Issue	Impact on heritage sites and features
Potential impact	Discovery of previously unknown heritage sites or features during construction can halt work in the vicinity of the finds
EMPr	Management measures to be included in the EMPr for actions to be taken on uncovering unknown sites and features

- *Impacts during operation*

Issue	Impact on heritage sites and features
Potential impact	Discovery of previously unknown heritage sites or features during construction can halt work in the vicinity of the finds
EMPr	Management measures to be included in the EMPr for actions to be taken on uncovering unknown sites and features

- *Impacts during decommissioning*

Issue	Impact on heritage sites and features
Potential impact	Discovery of previously unknown heritage sites or features during construction can halt work in the vicinity of the finds
EMPr	Management measures to be included in the EMPr for actions to be taken on uncovering unknown sites and features

More detailed mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

8.11 Visual Aspects

The Visual Impact Assessment has been included in **Appendix Q.**

8.11.1 Potential Impacts

The combined results of the visual exposure, viewer incidence / perception and visual distance of the proposed wet ash disposal facility and associated infrastructure (including powerlines and pipelines) are displayed on **Figures 8.6 & 8.8**.

Here the weighted impact and the likely areas of impact have been indicated as a visual impact index. Values have been assigned for each potential visual impact per data category and merged in order to calculate the visual impact index.

An area with short distance, a potential visual exposure to the proposed wet ash disposal facility, a high viewer incidence, and a predominantly negative perception would therefore have a higher value (greater impact) on the index. This helps in focussing the attention to the critical areas of potential impact when evaluating the issues related to the visual impact.

Of relevance is that the visual character of the area in close proximity to the proposed site is influenced by the presence of the existing Hendrina Power Station, the mining areas and the numerous powerlines. This existing visual context will be taken into consideration during the assessment of the anticipated visual impacts which follows, affecting the probability of anticipated impacts.

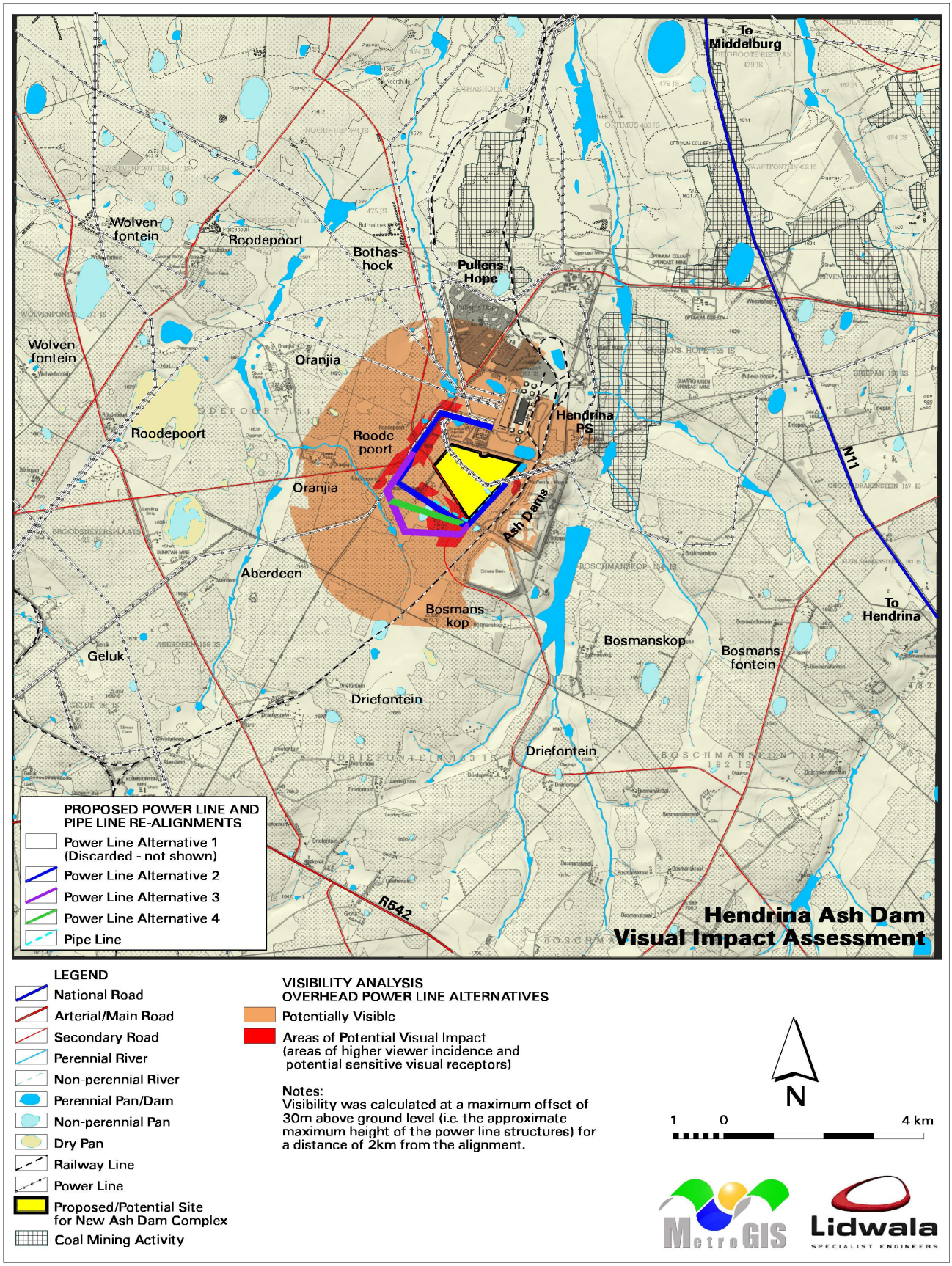

Figure 8.7 Visual impact of the disposal facility at site E and the surrounding infrastructure (power line corridors).

- **The Wet Ash Disposal Facility**

  - *Alternative 1- Site E*

Construction phase:

The anticipated nature of visual impacts is as follows:

- The clearing of vegetation and required earthworks to prepare the site for the proposed wet ash disposal facility could result in visual impact through the exposure of bare soil within an otherwise vegetated or cultivated environment.
- Spoil stockpiles and waste dumps could manifest as topographic intrusions (albeit temporary).
- Lay down areas and materials stockpiles may also be visible, and represent potential eyesores.
- In addition, there will be a noticeable increase in heavy vehicles utilising the roads to the development site during construction. These may cause, at the very least, a visual nuisance to other road users and land owners in the area.
- Dust from construction work could also result in potential visual impact.
- At the end of construction, the failure to properly rehabilitate and reinstate construction sites could result in the persistence of visual impacts as a result of cleared vegetation. Erosion could follow.

The anticipated magnitude of visual impacts is as follows:

- Visual impact related to the construction phase is expected to be moderate in close proximity to the proposed site and low within the greater region.

  Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

Operational phase

The anticipated nature of visual impacts is as follows:

- During operation, the proposed wet ash disposal facility will grow in increments of 2,5 – 3m per year until it reaches an estimated maximum height of 44m after about 16 years. The bulk of this wet ash disposal facility represents the primary visual impact, which will reach a maximum after approximately 16 years.
- Access roads will be required for operational and maintenance purposes. These roads have the potential of manifesting as landscape scarring, and thus a potential visual impact within the viewshed areas.
- The area immediately surrounding the proposed wet ash disposal facility has a relatively low incidence of receptors, so light trespass and glare from the security and after-hours operational lighting may have some significance for visual

receptors in close proximity. Existing light sources such as the power station and nearby mining activities reduce the probability of this impact occurring, however.

- Another potential lighting impact is that known as sky glow. Sky glow is the condition where the night sky is illuminated when light reflects off particles in the atmosphere such as moisture, dust or smog. The sky glow intensifies with the increase in the amount of light sources. Each new light source, especially upwardly directed lighting, contribute to the increase in sky glow.

The anticipated magnitude of visual impacts is as follows:

- Areas of **moderate** visual impact are expected within a 1km radius of the proposed wet ash disposal facility. Within this radius, sensitive visual receptors may experience potentially **high** visual impact along the secondary roads and within homesteads and settlements adjacent to the site. The latter include Bosmanskop and Roodepoort.
- The extent of potential visual impact decreases somewhat between the 1km and 2,5km radius, with a significant visually screened area in the south east beyond the existing wet ash disposal facilities. Visually exposed areas are likely to be exposed to **low** visual impact. Stretches of secondary roads in the north, north west, west and to a lesser extent to the south will be exposed to potentially **moderate** visual impact. In addition, the homestead / settlement of Oranjia may be exposed to moderate visual impact.
- Between 2,5km and 5km the extent of potential visual exposure is reduced, especially along the incised drainage lines in the west and east. The magnitude of impacts are also mostly reduced to **very low**. Sensitive visual receptors within this zone may be exposed to **low** visual impact. These include users of secondary roads in the north and west, and various settlements and homesteads, including Bothashoek, Oranjia, Aberdeen, Driefontein and Bosmanskop.
- Beyond the 5km radius, the magnitude of potential visual impacts is mostly **negligible**. The extent of visual exposure is also broken up by drainage lines and low lying areas in the north, and mountains in the south. Users of parts of the N11 and most secondary roads within the study area, as well as residents of Roodepoort and Bosmansfontein could be exposed to potentially **very low** visual impact.

De-commissioning phase

The anticipated nature of visual impacts is as follows:

- During decommissioning, the form of the wet ash disposal facility will be manipulated to tie in with the landform of the surrounding environment. Ultimately, this is a positive impact.
- The rehabilitation works for the proposed wet ash disposal facility will may be likened to construction to some extent, as it is anticipated that interim vegetation planted on the slopes during operation will be removed ahead of earthworks,

resulting the exposure of bare soil within an otherwise vegetated or cultivated environment.
- Earthworks could manifest as denuded earth and landscape scarring and dust could result in additional visual impact in the short term.
- Post decommissioning, the failure to properly rehabilitate and reinstate could result in the persistence of visual impacts as a result of cleared vegetation. Erosion could follow.

The anticipated magnitude of visual impacts is as follows:

- Visual impact related to the decommissioning phase is expected to be **moderate** in close proximity to the site and **low** within the region. Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

Cumulative impacts

The anticipated nature of visual impacts is as follows:

- The construction of the wet ash disposal facility and ancillary infrastructure will increase the cumulative visual impact of mining and industrial type infrastructure in close proximity thereto as well as within the region.

The anticipated magnitude of visual impacts is as follows:

- Cumulative visual impact within the region is expected to be **moderate** in close proximity to the proposed site and **low** within the region. Sensitive visual receptors include users of the national, arterial and secondary roads, residents of settlements and homesteads, and tourists visiting or passing through the area.

o *Alternative 2 – No-Go*

Construction phase:

As no construction will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

Operational phase:

As no activity will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

De-commissioning phase:

As no activity will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

Cumulative impacts:

As no activity will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

- **Power lines**

o *All Corridors*

Construction phase:

The anticipated nature of visual impacts is as follows:

- In addition, there will be a noticeable increase in heavy vehicles utilising the roads to the development site during construction. These may cause, at the very least, a visual nuisance to other road users and land owners in the area.
- Dust from construction work could also result in potential visual impact.
- At the end of construction, the failure to properly rehabilitate and reinstate construction sites could result in the persistence of visual impacts as a result of cleared vegetation. Erosion could follow.

The anticipated magnitude of visual impacts is as follows:

- Visual impact related to the construction phase is expected to be **low** in close proximity to the proposed site and **very low** within the region. Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

Operational phase:

The anticipated nature of visual impacts is as follows:

- In addition to the powerlines themselves, each line will require the maintenance of a cleared servitude along its alignment as well as an access road. In this respect, vegetation will need to be kept cleared or short.

The anticipated magnitude of visual impacts is as follows:

- The anticipated visual impact resulting from all alternatives for the new overhead powerlines is expected to be of **moderate** magnitude in close proximity to the

proposed site and **low** within the greater region. Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

De-commissioning phase:

It is not anticipated that the powerlines will be decommissioned or removed, so no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

Cumulative impacts:

The anticipated nature of visual impacts is as follows:

- The construction of the new power lines will increase the cumulative visual impact of industrial and electrical type infrastructure (especially powerlines) in close proximity thereto as well as within the region.

The anticipated magnitude of visual impacts is as follows:

- Cumulative visual impact in close proximity to the powerline and within the region is expected to be **low** in close proximity to the proposed site and **very low** within the region. Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

- *Alternative – No-Go*

Construction phase:

As no construction will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

Operational phase:

As no realignment of the existing powerlines will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

De-commissioning phase:

As no realignment of the existing powerlines will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

Cumulative impacts:

As no realignment of the existing powerlines will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

- **Pipelines**

  - *Alternative Route*

Construction phase:

The anticipated nature of visual impacts is as follows:

- The clearing of vegetation and required earthworks to prepare for the installation of the pipe line could result in visual impact through the exposure of bare soil within an otherwise vegetated or cultivated environment.
- In addition, there will be a noticeable increase in heavy vehicles utilising the roads to the development site during construction. These may cause, at the very least, a visual nuisance to other road users and land owners in the area.
- Dust from construction work could also result in potential visual impact.
- At the end of construction, the failure to properly rehabilitate and reinstate construction sites could result in the persistence of visual impacts as a result of cleared vegetation. Erosion could follow.

The anticipated magnitude of visual impacts is as follows:

- Visual impact related to the construction phase is expected to be **low** in close proximity to the proposed site and **very low** within the region. Sensitive visual receptors include users of secondary roads and residents of settlements and homesteads in close proximity.

Operational phase:

As the pipeline is laid underground, no visual impacts are anticipated. The visual environment will maintain its rehabilitated, post-construction status quo.

De-commissioning phase:

It is not anticipated that the pipeline will be decommissioned or removed, so no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

Cumulative impacts:

As the pipeline is laid underground, no cumulative visual impacts are anticipated. The visual environment will maintain its rehabilitated, post-construction status quo.

- *Alternative – No-Go*

Construction phase:

As no construction will take place, no visual impacts are anticipated. The visual environment will maintain its status quo.

Operational phase:

As no realignment of the existing pipe line will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

De-commissioning phase:

As no realignment of the existing pipe line will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

Cumulative impacts:

As no realignment of the existing pipe line will take place, no altered or additional visual impacts are anticipated. The visual environment will maintain its status quo.

Recommended Mitigation and Management Measures

The size of the proposed wet ash disposal facility (with an estimated maximum height of 44m) is not possible to mitigate. The following mitigation is, however possible:

- **Planning phase**

OBJECTIVE: The mitigation of visual impacts associated with the planning of the proposed wet ash disposal facility and associated infrastructure.

Project Component/s	The proposed wet ash disposal facility, powerlines and pipeline.	
Potential Impact	Primary visual impact due to the presence of the wet ash disposal facility and the powerlines as well as the visual impact of lighting at night.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 1 km of the site) as well as within the region.	
Mitigation: Target/Objective	Optimal planning of infrastructure to minimise visual impact.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Plan to retain / reinstate vegetation in all areas outside of the development footprint. Consolidate and concentrate on-site infrastructural requirements to maximise vegetated areas.	Eskom / design consultant	Planning phase.
Where possible, create vegetated buffer areas (with a minimum width of 4m) along the perimeter of the site, and especially between the site and sensitive visual receptors (i.e. users of roads and residents of homesteads and settlements in close proximity). This will increase the perceived distance between the receptor and the site, as the receptor no longer feels on the 'doorstep' of the facility. Consult an ecologist with respect to species types, mix and placement.	Eskom / design consultant	Planning phase.
Where appropriate (i.e. where there are sensitive visual receptors) consider supplementing planting in vegetated areas and buffers to increase VAC. Consult an ecologist with respect to species types, mix and placement.	Eskom / design consultant	Planning phase.
Make provision to incrementally rehabilitate the wet ash disposal facility for its entire lifespan, starting as soon as possible.	Eskom / design consultant	Planning phase.
Plan and design required lighting in terms of specification and placement, in order to minimise lighting impacts. Any of the following is recommended:	Eskom / design consultant	Planning phase.

○ Shielding the sources of light by physical barriers (walls, vegetation, or the structure itself); ○ Limiting mounting heights of fixtures, or using foot-lights or bollard lights; ○ Making use of minimum lumen or wattage in fixtures; ○ Making use of down-lighters or shielded fixtures; ○ Making use of Low Pressure Sodium lighting or other low impact lighting. ○ Making use of motion detectors on security lighting. This will allow the site to remain in relative darkness, until lighting is required for security or maintenance purposes.		
Performance Indicator	Reduced prominence of the wet ash disposal facility and powerlines and minimal of lighting at night to observers on or near the site (i.e. within 1 km) and within the region.	
Monitoring	Not applicable.	

- **Construction phase**

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the construction of the proposed wet ash disposal facility and associated infrastructure.

Project Component/s	Construction site	
Potential Impact	Visual impact of general construction activities, and the potential scarring of the landscape due to vegetation clearing and resulting erosion.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 1 km of the site) as well as within the region.	
Mitigation: Target/Objective	Minimal visual intrusion by construction activities and intact vegetation cover outside of immediate works areas.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Ensure that vegetation is not unnecessarily cleared or removed during the construction period.	Eskom / contractor	Construction phase.
Reduce the construction period through careful logistical planning and productive implementation of resources.	Eskom / contractor	Construction phase.
Plan the placement of lay-down areas and temporary construction equipment camps in order to minimise vegetation clearing (i.e. in already disturbed areas) wherever possible.	Eskom / contractor	Construction phase.
Restrict the activities and movement of construction workers and vehicles to the immediate construction site and	Eskom / contractor	Construction phase.

demarcated access roads.		
Ensure that rubble, litter, and disused construction materials are appropriately stored (if not removed daily) and then disposed regularly at licensed waste facilities.	Eskom / contractor	Construction phase.
Reduce and control construction dust through the use of approved dust suppression techniques as and when required (i.e. whenever dust becomes apparent).	Eskom / contractor	Construction phase.
Restrict construction activities to daylight hours in order to negate or reduce the visual impacts associated with lighting.	Eskom / contractor	Construction phase.
Rehabilitate all disturbed areas, construction areas, servitudes etc immediately after the completion of construction works. If necessary, an ecologist should be consulted to assist or give input into rehabilitation specifications.	Eskom / contractor	Construction phase.
Performance Indicator	Vegetation cover, where it occurs, is intact with no evidence of degradation or erosion.	
Monitoring	Monitoring of vegetation clearing during construction. Monitoring of rehabilitated areas quarterly for at least a year following the end of construction.	

- **Operational phase**

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the operation of the proposed wet ash disposal facility and associated infrastructure.

Project Component/s	The proposed wet ash disposal facility, powerlines and pipeline.	
Potential Impact	Visual impact of wet ash disposal facility itself and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 1km of the site) and within the region.	
Mitigation: Target/Objective	Well maintained and neat facility.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Maintain the general appearance of the facility as a whole, including the wet ash disposal facility, the internal roads, servitudes and any ancillary infrastructure.	Eskom / operator	Operational phase.
Maintain roads to forego erosion and to suppress dust. Implement remedial actions as a when required.	Eskom / operator	Operational phase.
Monitor rehabilitated areas, and implement	Eskom / operator	Operational phase.

remedial action as and when required.		
Performance Indicator	Well maintained and neat facility with intact vegetation on and in the vicinity of the facility.	
Monitoring	Monitoring of the entire site on an ongoing basis.	

- **Decommissioning phase**

OBJECTIVE: The mitigation and possible negation of visual impacts associated with the decommissioning of the proposed wet ash disposal facility and associated infrastructure.

Project Component/s	The proposed wet ash disposal facility, powerlines and pipeline.	
Potential Impact	Visual impact of residual visual scarring and vegetation rehabilitation failure.	
Activity/Risk Source	The viewing of the above mentioned by observers on or near the site (i.e. within 1km of the site) and within the region.	
Mitigation: Target/Objective	Rehabilitated wet ash disposal facility that blends in with the topography and vegetation of the surrounding environment.	
Mitigation: Action/control	**Responsibility**	**Timeframe**
Remove infrastructure not required for the post-decommissioning use of the site.	Eskom / operator	Decommissioning phase.
Reshape the landform of the wet ash disposal facility to resemble / mimic that of the surrounding topography. Full rehabilitate all areas using appropriate vegetation species. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Eskom / operator	Decommissioning phase.
Rehabilitate access roads and servitudes not required for the post-decommissioning use of the site. If necessary, an ecologist should be consulted to give input into rehabilitation specifications.	Eskom / operator	Decommissioning phase.
Monitor rehabilitated areas quarterly for at least a year following decommissioning, and implement remedial action as and when required.	Eskom / operator	Decommissioning phase.
Performance Indicator	Intact vegetation cover on the wet ash disposal facility and in all rehabilitated areas with no evidence of degradation or erosion.	
Monitoring	Monitoring of rehabilitated areas quarterly for at least a year following decommissioning.	

More detailed mitigation and management measures can be found in the Environmental Management Plan included in **Appendix E**.

8.12 Noise Impact

A professional noise opinion was undertaken by Mr Francois Malherbe of Francois Malherbe Acoustic Consultants. This study was undertaken to identify the existing major noise sources and noise sensitive areas in the environment of the proposed wet ash disposal facility extension; estimate the current ambient noise levels in the affected areas; carry out sample calculations in order to estimate the impact of noise emissions on ambient noise levels at the identified noise sensitive areas; and assess the noise impact in terms of the applicable regulations in Mpumalanga.

The major noise sources include a bulldozer, excavator, articulated truck and vibrating roller during construction; and a backhoe loader and vibrating compactor during operations.

The professional opinion of the specialist was that the noise impact caused by the noise emissions during the construction and operation of the proposed new wet ash disposal facility is of low significance.

The full opinion is included in **Appendix V**.

8.13 Social Environment

8.13.1 Potential Impacts

Social impact assessment (SIA) may be defined as:

> *"the process of assessing or estimating, in advance, the social consequences that are likely to follow from specific policy actions or project developments, particularly in the context of appropriate national, state or provincial environmental policy legislation. Social impacts include all social and cultural consequences to human populations of any public or private actions that alter the ways in which people live, work, play, relate to one another, organise to meet their needs, and generally cope as members of society"* (International Committee on Guidelines and Principles, 1994, p. 108).

In general terms a Social Impact Assessment (SIA) can be described as the systematic appraisal before the project is started of the impact on the day-to-day quality of life of persons and communities when the environment is affected by development and in this case the development is not positive, wet ash disposal facility is a waste dump. Seen from this viewpoint, "social impacts" include all the significant changes in the social environment that take place because of the actions of a development/project/wet ash disposal facility that would not otherwise have occurred. The crucial thing is that any SIA should identify *undesirable* and *irreversible* consequences.

Specific attention should normally be given to vulnerable groups in the affected population(s), such as the poor, the elderly, women, and the unemployed. In this case,

Hendrina wet ash disposal facility, no large communities are affected in a different way than they already are affected by the existing wet ash disposal facility growth over many years. The social fabric of the existing environment was built around Hendrina Power Station and Pullenshope was in previous years an Eskom town specifically built to accommodate Eskom employees.

In essence, this means that no measurable change or social impact is expected when Eskom simply continues its operations as normal and expand its wet ash disposal facility to accommodate another 20 to 30 years of generation capacity. This hypothesis was tested by interviewing community members as well as the farmer directly affected and possible impacts identified that might have a permanent impact.

In most cases, the assessment of social impacts is carried out **before** the impacts actually occur. The impacts are already present in this case and the social impact process must determine if anything substantial will change with the new extension of the wet ash disposal facility. This means that an SIA is normally anticipatory and not empirical. It attempts to assist the planning process of a proposed development or decision by identifying the likely impacts before they take place. Being anticipatory, however, also entails estimating the likely future impacts based on the existing empirical knowledge of the impacts of similar actions in the past. In this case the future on a macro scale was already experienced – wet ash disposal facility with its current impact over the years. On a micro level individuals will be impacted directly and long term impacts continued.

Lastly, it should be emphasised that no impact assessment – whether environmental or social – can supply wholly accurate results. This is due to the fact that the causes and effects of environmental and socio-economic changes are complex, and also because such an assessment deals with future uncertainties. An SIA is neither a technical nor an economical exercise; the focus rather falls on **concerns in and impacts on the social environment.** In addition, regardless of how good the data and the understanding of the affected environment are, an SIA (and an EIA, for that matter) always involves an element of subjective judgment. As a planning tool, the SIA can assist project management in understanding, implementing and managing a project in such a way that negative impacts are avoided or mitigated, and positive impacts are optimised. In addition some direct unavoidable impact on the farm land, extending the wet ash disposal facility on agricultural land, will most definitely occur and will have an impact on the individual farmer. This impact can therefore be dealt with when realising that this particular farm will most probably loose its viable economic size.

Possible social impacts expected on a **micro level**, as discussed as example in the previous paragraph, were identified. These were also indicated by community members during interviews.

- Potential health hazards emanating from exposure to dust from the existing and therefore future ash waste dump;

- Dust per se as a impact on the so-called quality of life, visual as well as nuisance levels;
- Commercial land value as well as viable economic unit decline resulting in un-economic unit due to the wet ash disposal facility being built on 124 ha of high productive agricultural land;
- The affected property as the only remaining alternative for the new proposed wet ash disposal facility

From the scoping exercise it became apparent that very few impacts were new or had to be added to those already experienced.

On a **macro level** the following were identified and being investigated in the case where the no-go option is chosen and the power station has to close as well as possible impacts in the case where the wet ash disposal facility is built and the power station remains in operation for another 20 to 30 years:

No-go option:

- Possible negative economic impact on the town of Pullenshope due to the power station closure, in terms of direct job losses at the power station as well as the indirect requirement for ancillary services provided by the surrounding areas. Although an impact will definitely be felt, it may not be as high as previously thought as the economic development of the town would continue due to the fact that the mining industry is growing in the area.
- Possible impact for the housing market in Pullenshope is seen to be similar to the above, the housing market will change from being predominantly Eskom to being more mining.
- Impact on health;
- Impact on all other services, water and sanitation;
- Impact on Eskom workers at the power station, retrenchments etc. In the event that the power station should close many employees will loose their jobs. .

Go –option:

- Adverse consequences for commercial farmers and farming in the affected environment, leading to a decline in farming practices and drop in land value in general;
- New coal mines opening around the power station;
- Infrastructure pressure;
- Possible economic growth of the area;
- Even though there will not be many new jobs created by some of the construction activities of a new wet ash disposal facility, there will still be an influx of workers that will come to find work.

8.13.2 Recommended Mitigation and Management Measures

- ***Construction Phase***

o *Social Interaction*

- All neighbours must be notified and advised of the timing of the intended construction activities.
- The Hendrina Power Station mist deal with community complaints as per their ISO 14001 commitments.
- Contractors must prevent and prohibit their employees from entering neighbouring land and homes.
- All construction activities must take place within the demarcated footprint.
- Movement of construction personnel on site, outside of the demarcated development areas, must be strictly prohibited.

o *Working Hours*

- Normal working hours (e.g. 6 am – 6pm) must be maintained as far as possible.
- Night-time activities should be limited as far as possible, and construction activities must be contained to reasonable hours during the day and early evening.

o *Employment – Local Preference*

- As far as possible, Eskom should encourage its contractors to give employment preference to residents of the Pullenshope, Hendrina and Middelburg Areas in accordance with approved agreements and procedures.

- ***Operational Phase***

o *Conduct of Employees*

The following restrictions or constraints will be placed on the operation and maintenance staff in general:

- No indiscriminate disposal of rubbish or rubble.
- No littering of the servitude and substation areas and the surrounding areas.
- No collection of firewood.
- No interference with any fauna or flora.
- No use of facilities other than ablution facilities provided.
- All Eskom safety, health and environmental procedures will be complied with.

- ***Social Closure Objectives***

The main objective of social closure is to ensure that issues will be addressed and managed so that the main objective and acceptable closure plan can be attained. The main objectives for social closure can be summarized as follows:

- Stakeholder engagement is undertaken and their views must be taken into account during closure planning;
- Permanent employees will be re-deployed and re-skilled to ensure minimum job losses;
- To stimulate the economy of the area by implementing viable projects that will enable some of the employees to be re-deployed within that sector, where possible;
- That rehabilitation work as well as other related work with regard to closure is not outsourced but that ex-employees with the level of experience and commitment can form part of this process ensuring job continuation after closure, where possible;
- That all Eskom owned houses are sold to individuals;
- That all employees are generally satisfied with re-deployment, re-skilling and alternative employment opportunities.

The relocation of the linear infrastructure such as the powerlines and pipeline will result in the need to establish new servitudes. The establishment of these new servitudes will restrict the use of the agricultural land that it will traverse. Such restrictions may alter or compromise how the existing land owner uses the land and will impact on the landowners ability to cultivate his crops and generate an income. Eskom will be required to enter into an agreement with the landowner on permissible uses of the land within the servitudes. Generally grazing and dry land agriculture are permissible within servitudes and thus there are unlikely to be significant impacts on the economic use of the land.