ESKOM HOLDINGS: GENERATION

Proposed Above Ground Bulk Storage Fuel Oil Tank: Grootvlei Power Station

Soil and Land Use Assessment

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Declaration

I, Kurt Barichievy, declare that I –

- act as an independent specialist consultant in the field of soil science for the **soil and land use assessment report for the proposed above ground bulk storage fuel oil tank at the Grootvlei Power Station, Mpumalanga Province**;
- do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2010;
- have and will not have any vested interest in the proposed activity proceeding;
- have no, and will not engage in, conflicting interests in the undertaking of the activity;
- undertake to disclose, to the competent authority, any material information that have or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the Environmental Impact Assessment Regulations, 2010; and
- will provide the competent authority with access to all information at our disposal regarding the application, whether such information is favourable to the applicant or not.

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Scientist
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ESKOM HOLDINGS: GENERATION

PROPOSED ABOVE GROUND BULK STORAGE OIL FUEL TANK – GROOTVLEI POWER STATION

SOIL AND LAND USE ASSESSMENT

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SOIL AND LAND USE ASSESSMENT

1 INTRODUCTION

Eskom Holdings (Generation) requested a baseline assessment of the soil and land use characteristics for the area affected by the proposed installation of an additional above ground bulk storage fuel oil tank, at the Grootvlei Power Station in Mpumalanga Province.The primary objective of this assessment is to provide specialist soil and land use input for the overarching Basic Assessment Report (BAR). In order to achieve this objective a study of the climate, soils, terrain, land capability, geology and current land use was carried out. This report serves to summarise such a study and present the relevant results as well as the predicted impacts of the proposed activities on the local land uses and associated soil resources.

The proposed development includes the installation of additional 500m^3 bulk storage oil fuel tank, adjacent to existing above ground fuel oil storage facilities. Two positional alternatives, 30 metres apart, have been also been tabled for this environmental application. It is hoped that this assessment, along with the other specialist studies, will inform the final positioning of the fuel oil storage tank and minimise the predicted potential impacts on the receiving environment.

1.1 Brief Description of the Site and Alternatives

The purpose of this section is to provide basic site information for later reference. Please note that a more detailed description of the site's characteristics is provided in **Sections 3 - 6** of this report. The project area is located within the boundaries of the Grootvlei Power Station, which is situated approximately 15 kilometres north west of the town of Balfour in the Mpumalanga Province of South Africa (**Figure 1**). The first of Grootvlei's six units were commissioned in 1969. In 1989 three units were mothballed and in 1990 the other three followed. Due to the power crisis being experienced in South Africa, Eskom decided to return the power station to service which has a total installed capacity of 1200MW (**Internet 1, 2011**).

The power station and associated infrastructure cover an area of approximately 5km^2. The broad development area has the following midpoint co-ordinates: 26^o 46' 05.05" S 28^o 29' 53.50" E. The two positional alternatives have already been completely transformed by anthropogenic activities. Both alternatives have been raised, levelled and gravelled. Surrounding developments include 6 existing bunded above ground fuel oil storage tanks, a coal storage area and a coal processing unit. The immediate area surrounding alternatives 1 and 2 is characterised by low environmental significance and sensitivities. Due to their close proximity and similar characteristics both alternatives will be subjected to exactly the same impacts and impact severity.

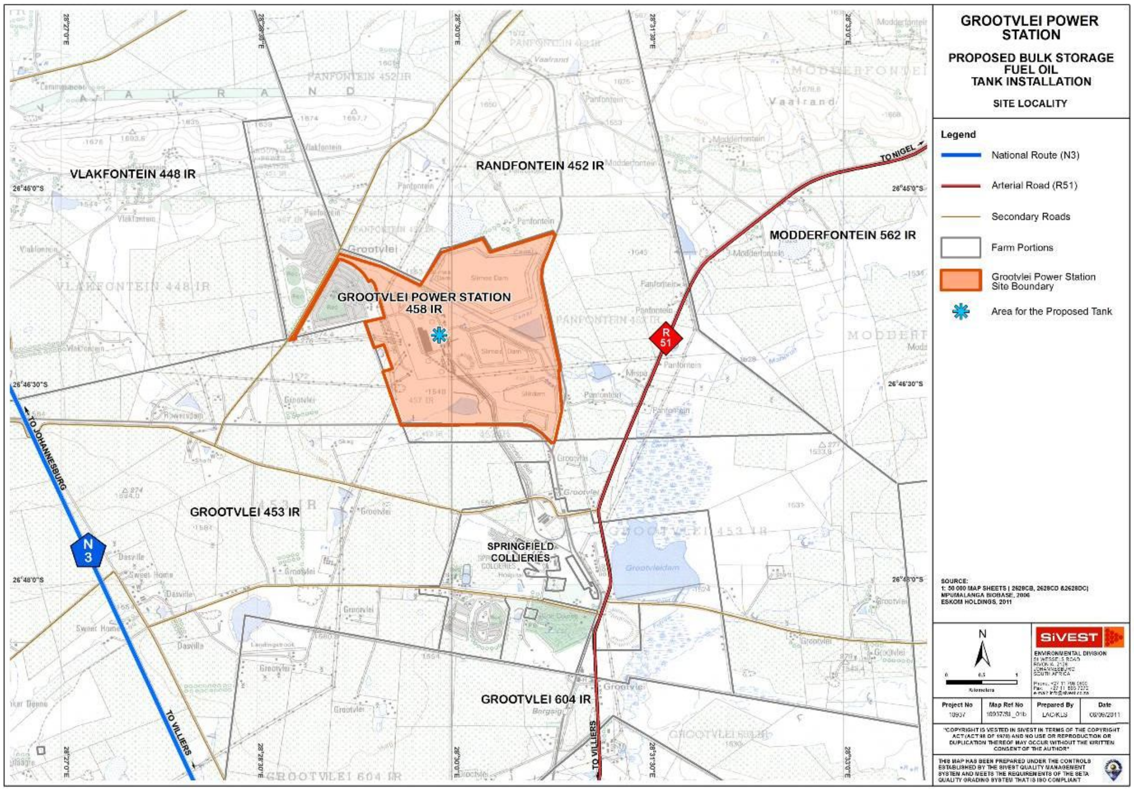

Figure 1: The locality map

Figure 2: Site overview (Google Earth, 2011, Image Date 2009)

1.2 Description of Proposed Activities and Technical Details

Grootvlei power station consists of 6 coal fired units rated at 200MW. These different drum boilers are fired with pulverised fuel (PF) via individual coal milling plants. The fuel oil is used to start up and shutdown of these boilers. The fuel oil plant supplies oil to the burners of all six boiler units via a common 4 inch supply duct. The used fuel oil returns to the fuel oil plant via a 5 inch circulation duct. Oil tankers deliver fuel oil on daily basis to the station. The fuel oil is predominantly supplied by Sasol from any of their two supply depots, namely Sasol refinery and Sasol depot.

The fuel oil in Grootvlei power station is stored in six storage tanks. Five tanks have a capacity of 97 m^3 and one with capacity of 75 m^3, so the total existing capacity at the Grootvlei Power Station is 560 m^3. Each tank is fitted with an outflow heater, located inside the take-off of each tank. Each tank is fitted with a drain line that features an isolating valve for draining sediment that accumulates at the bottom of the tanks.

Grootvlei Power Station is proposing to install an additional 7th bulk fuel oil storage tank with a capacity of 500 m^3. After the additional proposed tank has been installed the total capacity will be 1 060 m^3. Two positioning alternatives, Alternative 1 and 2, has been proposed (**Figure 2**). There is also a possibility that two different design alternatives will most likely be considered.

The 7th proposed tank will be installed on the open space adjacent to the existing 6 tanks, approximately 15 meters from the other nearest tank and a small building (**Figure 3**). The new proposed tank will be linked to the other six existing tanks and will therefore; similarly discharge to the same line as the other six existing tanks. As with all the existing tanks, the new proposed fuel storage tank will be bunded. Bunding is a liquid containment facility that prevents leaks and spillage from storage tanks and pipes. The proposed concrete bund will have a capacity to capture and store 110% of the tank's storage capacity.

Figure 3: Photo of an existing fuel storage tank at the Grootvlei Power Station

2 METHODOLOGY

The following methodology was followed in order to ascertain the *status quo* of soil and agricultural resources within the proposed development area. Further, outline the predicted impacts resulting from the proposed development and activities on the proposed development area.

2.1 Desktop Study

A detailed desktop assessment was undertaken for the proposed development area. The objective of this study is to broadly evaluate the soil and land use of the site and receiving environment by interrogating relevant climate, topographic, landuse and soil datasets. By utilising these data resources one is able to broadly assess the current soil and land use characteristics and provide a basis for a more detailed and spatially relevant assessment.

2.2 Field Verification, Soil Survey and Land Use Assessment

A detailed soil survey was conducted for both positional Alternatives, while a reconnaissance style soil survey was undertaken for the surrounding environment. At each sample point a hand auger was used to identify and describe the diagnostic horizons to form and family level according to "Soil Classification - A Taxonomic System for South Africa" as well as noting relevant soil characteristics such as depth and limiting layers. At each of these auger points the relevant soil and land use data was recorded and the location of the auger point was captured using a handheld GPS. Aerial photography and site visits were used to determine and delineate current land use for the potential sites as well as the surrounding environment. This assessment will illustrate the proximity of sensitive environmental features near the proposed development area.

2.5 Impact Assessment

The impact assessment utilises the findings of the soil survey and land use assessment in order to determine reference conditions of the soil and land use resources. Potential impacts, as a result of the proposed activities, are described in this section and any major impacts/fatal flaws will be identified for consideration by the pertinent authorities.

2.6 Mitigation Measures and Soil Management Plans

A soil management plan (SMP) was developed for the proposed development area. This management plan includes implementation plans for the mitigation measures, in order to reduce / ameliorate the predicted soil and land use impacts. This section also outlines the methods and procedures which will need to be followed to restore, minimise and rectify indiscriminate (emergency) impacts and damage during the project's life cycle.

3 DESKTOP SOIL AND LAND USE ASSESSMENT

The objective of the desktop assessment is to provide broad soil and land use characteristics for both positional alternatives and surrounding environment. It should be clearly noted that, since the spatial information used to drive this portion of the assessment is of a reconnaissance nature, only broad/large scale climate, land use and soil details are provided. More detailed and site specific information is provided in subsequent sections of this report (**Section 4**).

In order to ascertain the broad soil and land capability characteristics; relevant climate, topographic, landuse and soil datasets were sourced and interrogated. Existing large scale GIS data was sourced from National GIS Datasets as well as the Environmental Potential Atlas for South Africa (ENPAT) Database for the Mpumalanga Province of South Africa, compiled by the Department of Environmental Affairs and Tourism (**DEAT, 2001**). The main purpose of ENPAT is to proactively indicate potential conflicts between development plans and critical, endangered or sensitive environments. By combining the aforementioned data sources one is able to broadly assess the proposed development area and receiving environment, and its ability to accept change, in the form of development.

3.1 Climate

The climate of the study area can be classified as *highveld* with a summer rainfall regime (i.e. most of the rainfall is confined to the summer months. Mean Annual Precipitation (MAP) for the proposed development area is approximately 671 mm per year with 73% of this falling between November and March **(Table 1** and **Figure 4)**. Rainfall for this area usually takes the form of large summer thundershowers. The summer rainfall regime is generally adequate for dry land crop production. However adapted crops and some form of supplementary irrigation will be required to produce sustainable yields outside of this summer rainfall window.

Average daily temperatures range from 26 ^{o}C in summer to 16 ^{o}C in winter, while average night time temperatures range from 14 ^{o}C in summer to 0 ^{o}C in winter (**SaExplorer, 2011**). Frost is common during the winter months. In summary the climate for the study area is moderately to severely restrictive to agricultural production due to low temperatures, frost and / or moisture stress which limits the number of suitable crops which can be grown sustainably.

Table 1: Mean Annual Rainfall (Source: The South Africa Rain Atlas)

Rainfall (mm)	Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Mean	671	112.8	87.3	71.9	39.4	17.9	7.6	6.3	10.9	28.7	68.7	102.8	116.9

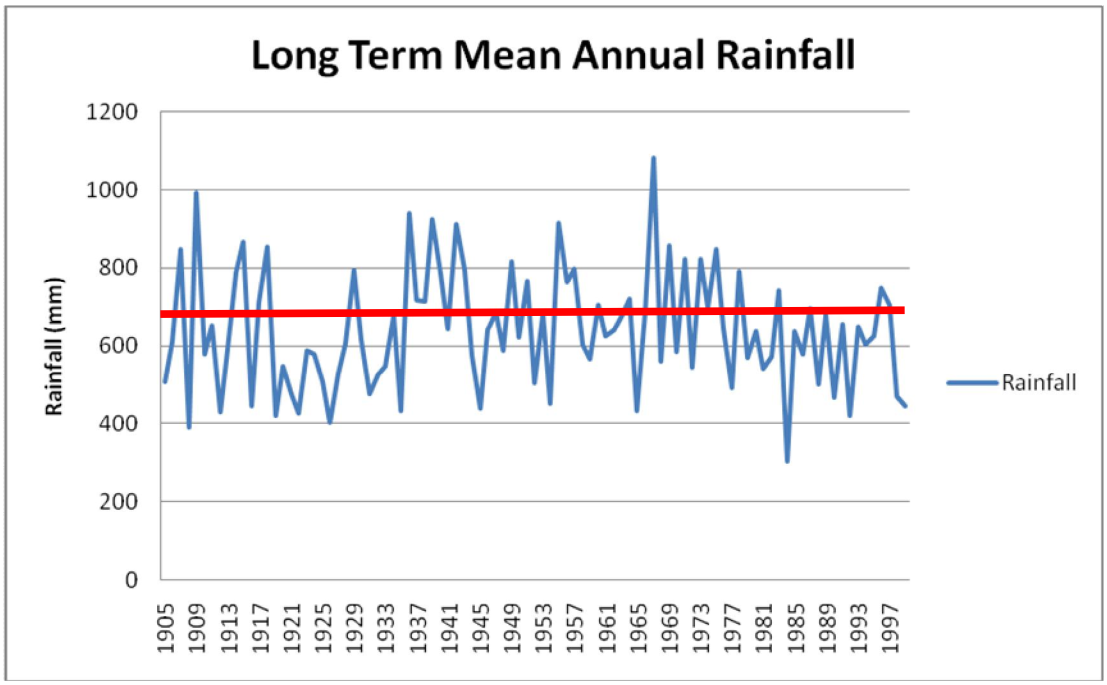

Figure 4: Long term annual rainfall (1905 – 1998) for the study area and long term average (indicated by the red line) (Source: The Daily Rainfall Extraction Utility, Lynch 2003)

3.2 Geology

According to the ENPAT database, for the Mpumalanga Province, the study area is completely underlain by Arenite (**Figure 5**), a sedimentary clastic rock. Arenite geological materials mainly form by erosion of other rocks or turbiditic re-deposition of sands. Arenites often appear as massive or bedded medium-grained rocks with a middling- to wide-spaced preferred foliation and often develop a pronounced cleavage (**Internet 2**, **2011**). There appears to be no Dolomitic areas near the proposed development area.

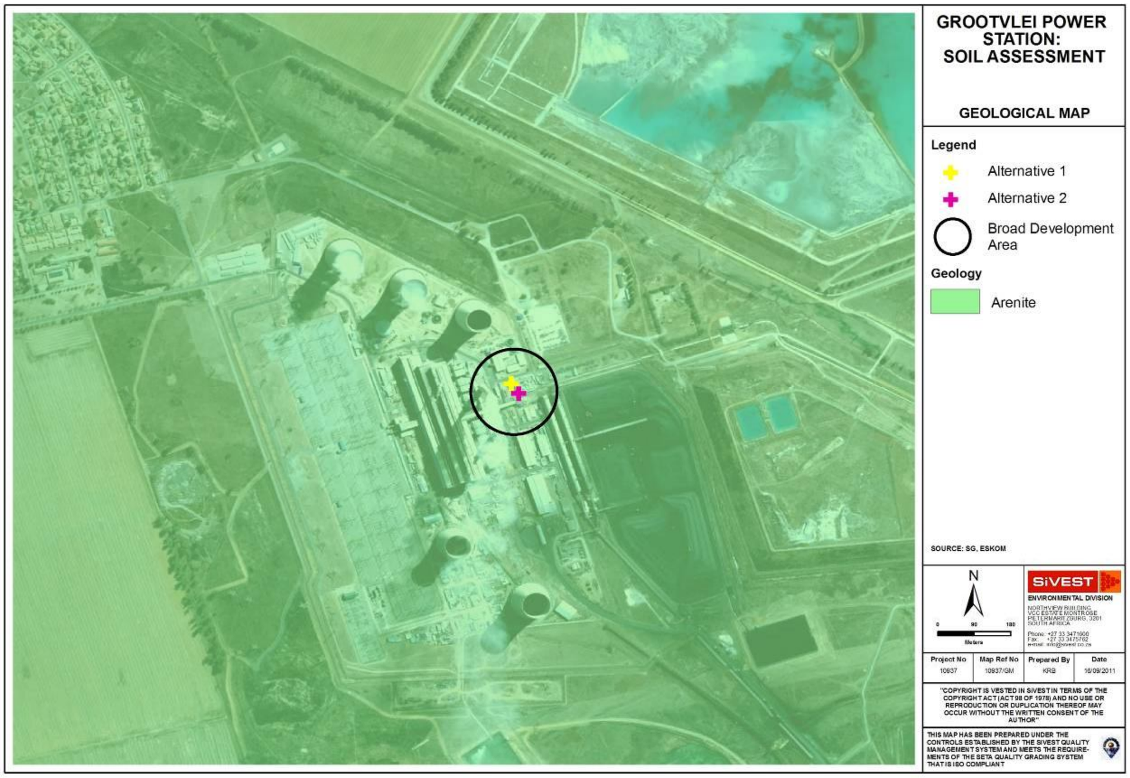

Figure 5: Geologic map

3.3 Terrain

The study area is characterised by flat and gently sloping topography with an average gradient of less than 10% (**Figure 6**). No significant earthworks are expected during site preparation as the platform, where the installation of the above ground fuel tank is proposed, has already been raised and completely levelled. The broad development area slopes gently from west to east. The topography of the proposed development area and surrounds is not a limiting factor for either general land use activities or the proposed development.

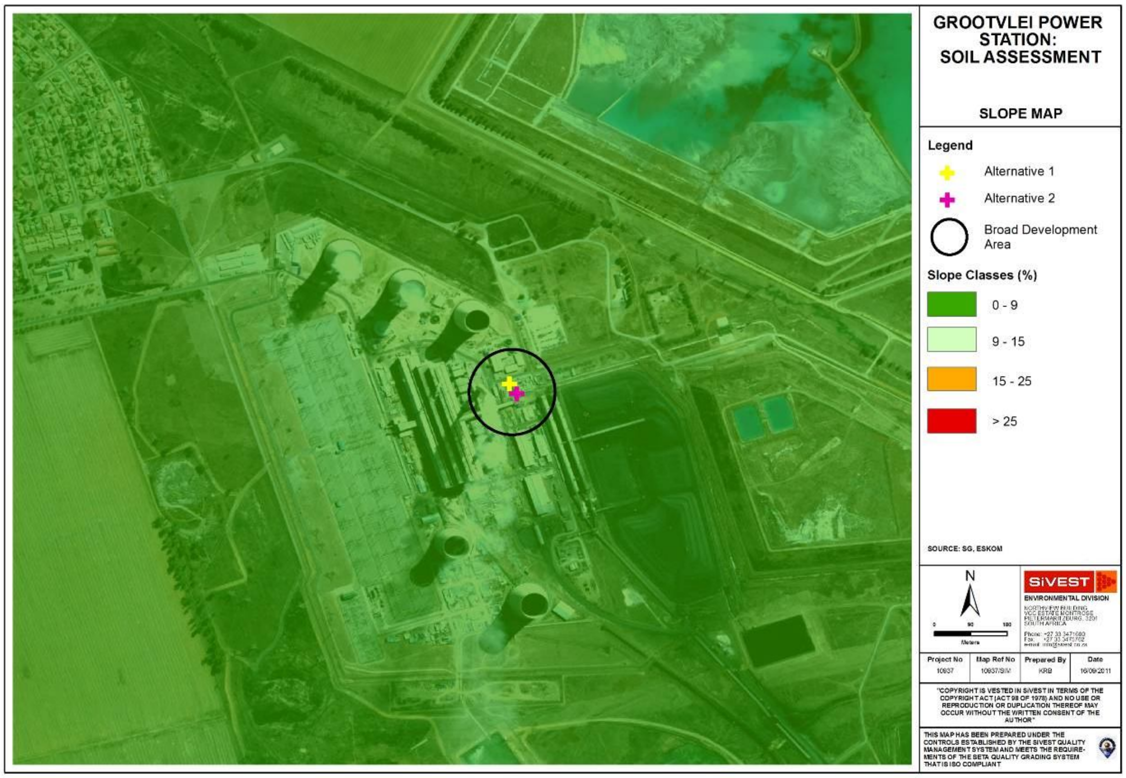

Figure 6: Slope map

3.4 Land Use

According to the ENPAT Database and 2010 land cover data set the study area consists of a mix of urban, peri-urban, natural, water bodies and agricultural land uses (**Figure 7**). However by overlaying this land use data sets onto the aerial photo it is clear that a number of these land use areas have misclassified. This is particularly true for the water bodies and urban classes with large portions of the power station being classified as a water body. In order to refine these desktop results a detailed land use assessment was completed for both Alternatives as well as the surrounding environment. The results of this detailed, site specific assessment are described in **Section 4.3**.

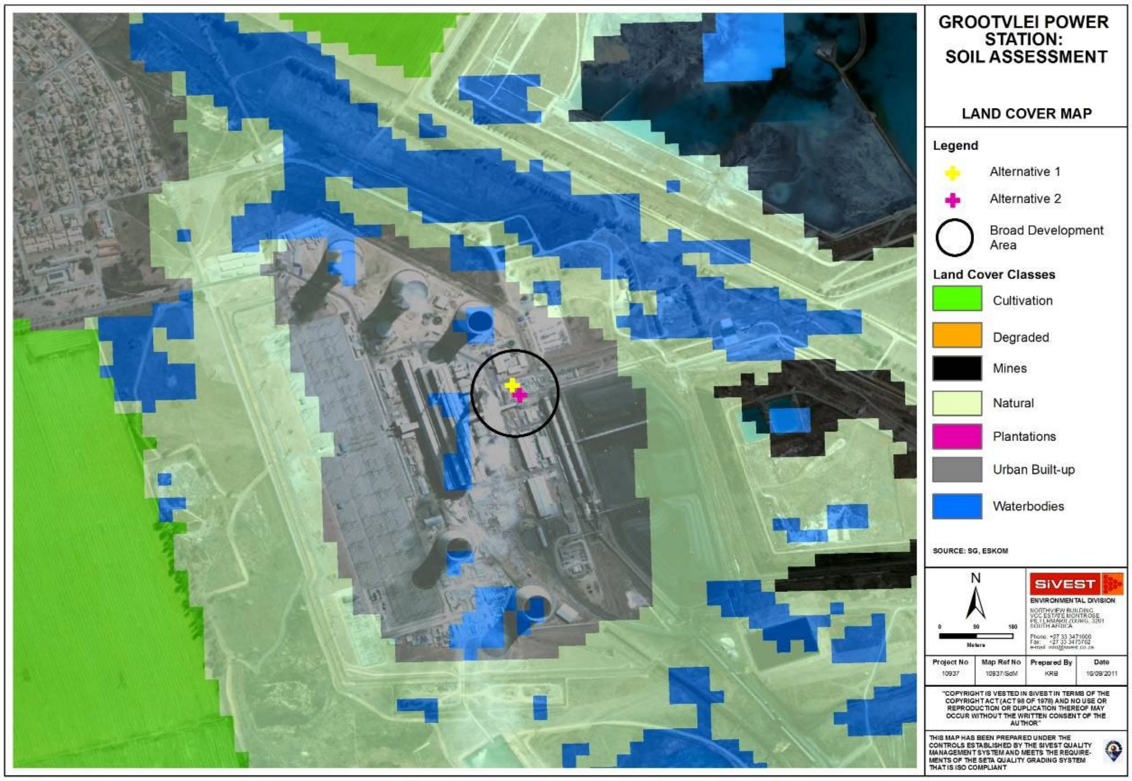

Figure 7: Land cover map (unverified)

3.5 Soil Characteristics

The majority of the site, including the broad development area and two positional alternatives, is dominated by soils within a plinthic catena (**Figure 8**). A catena is defined as a sequence of soils of similar age, derived from similar parent material but having different characteristics due to variation in topography and drainage (**Soil Classification Working Group, 1991**). Soils in a catena sequence will typically range from well drained (e.g. Hutton Soil Form) near the hilltop, grading via yellow soils on the mid-slopes to poorly drained grey soils in the valley bottoms. Typically a plinthic horizon is found in profiles of the yellow and grey members of this sequence (**Fey, 2010**). According to ENPAT dataset these soils will generally have a moderate clay content of between 15 and 35% and moderate depth ratings of between 0.45 – 0.75m (**Figures 9** and **10**).

The southeastern corner of the study area is dominated by is dominated by this mix of well structured undifferentiated soils which can include Vertic, Melanic and red structured soils with a clay content of over 35%. These soil profiles would tend to be greater than 0.75 m in depth.

Along with this desktop soil assessment a detailed soil survey was completed for both site alternatives. The results of this detailed, site specific soil assessment are shown in **Section 4.2**.

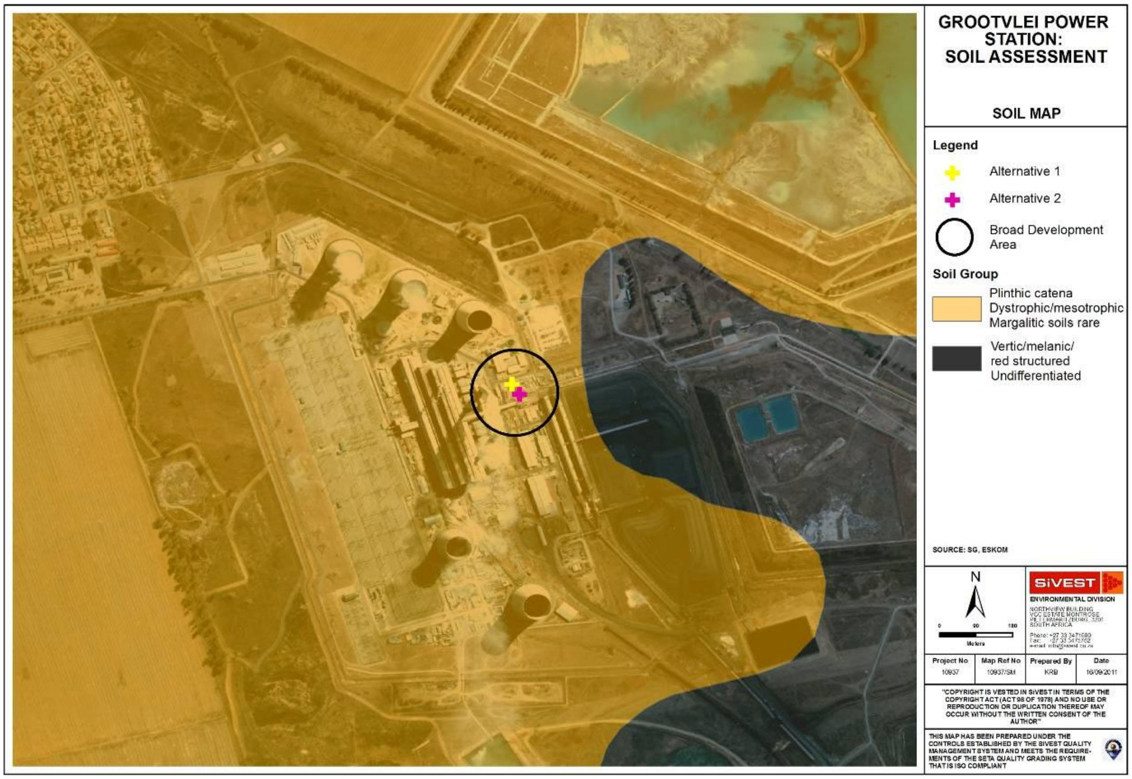

Figure 8: Broad soil type map

Figure 9: Soil clay content map

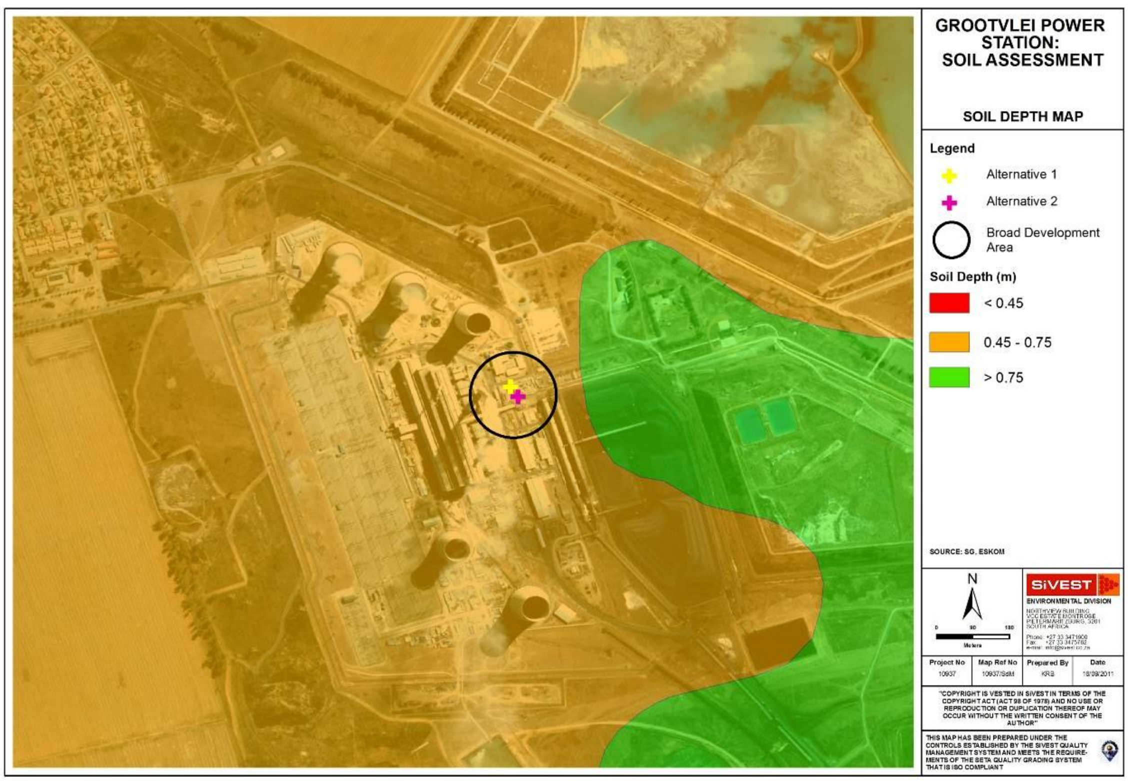

Figure 10: Soil depth map

4 FIELD VERIFICATION

A detailed soil survey and land use assessment was conducted for both positional alternatives, while a reconnaissance style soil survey was undertaken for the surrounding environment. At each sample point a hand auger was used to identify and describe the diagnostic horizons to form and family level according to "Soil Classification - A Taxonomic System for South Africa" and the following properties were noted:

- Estimation of 'A' horizon clay content,
- Permeability of upper B horizon,
- Effective rooting depth,
- Signs of wetness,
- Surface rockiness,
- Surface crusting,
- Vegetation cover, and
- Detailed description of the particular area such as slope.

4.1 Verified Site Characteristics: An Overview

The two positional alternatives have already been completely transformed by anthropogenic activities. Both alternatives site are located on the same development platform which has been raised, levelled and gravelled (**Figure 11** and **12**). It appears that material may have been imported to create the installation platforms. Surrounding developments include 6 existing, bunded above ground bulk storage fuel oil tanks, a coal storage area and a coal processing unit. The immediate area surrounding Alternatives 1 and 2 is characterised by low environmental significance and sensitivities. Due to their close proximity and similar characteristics both alternatives will be subjected to exactly the same impacts and impact severity. The broad development area slopes gently from west to east and during the site visit it was noted that the broad development currently has sufficient storm water infrastructure to accommodate the proposed development.

Figure 11: Current condition of positional Alternative 1

Figure 12: Current condition of positional Alternative 2

4.2 Soil Descriptions

This Section lists the **major soil forms** encountered during the soil survey along with a site-specific description of each soil form.

4.2.1 Oakleaf Form

Family: 1110 (Not bleached, Non-red, luvic)

Diagnostic Horizons and Materials:

A-Horizon: Orthic

B-Horizon: Neocutanic B

Site Specific Description:

The Oakleaf soil form falls within the Cumulic Soil Group and underlies the entire development platform. It appears that additional material may have been imported to create the installation platforms. The Orthic A-horizon overlies a brown Neocutanic B and due to presence of cutans and infillings was not uniform in colour (**Figure 13**). The Neocutanic B was moderately structured and exhibited luvic[1] characteristics (clay content increase with depth). The total depth of the profile was approximately 0.4 m and overlies weathering rock. It could not be determined if the underlying rock was imported during platform creation.

Land Use Capability:

In normal circumstances this soil form would be associated with good agricultural potential. However with an effective depth of only 0.4 m this potential is greatly reduced due to a shallow effective rooting depth. Furthermore the creation of the development platform and associated anthropogenic activities been modified the soil profile and compacted the soil. Soil compaction modifies the soil structure, alters its natural porosity and encourages surface sealing (crusting). The soil surface has also been sealed with gravel further reducing future land use capability.

[1] Clay content increases with soil depth

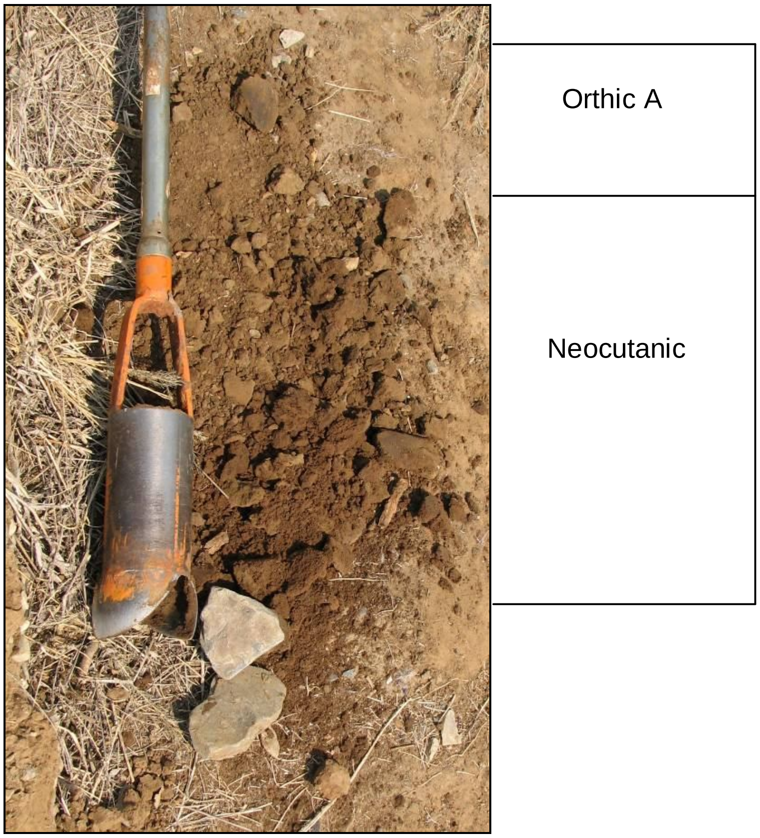

Figure 13: An example of a shallow Oakleaf Form encountered on the proposed development area

4.2.2 Glenrosa Form

Family: 1210 (B1 Hard, at least 70% volume has rock/weathering rock, no signs of wetness and is non-calcareous)

Diagnostic Horizons and Materials:

A-Horizon: Orthic

B-Horizon: Lithocutanic

Site Specific Description:

This soil form was identified near the two positional alternatives, on the closet portion of undisturbed land (i.e. not sealed by gravel, tar or cement). The shallow Orthic A horizon overlies a Lithocutanic B-horizon, which contains a high proportion (over 70%) of weathering rocks (**Figure 14**). The B-Horizon is generally limiting to plant roots but gaps between the weathering rock fragments can be opened by larger plant roots and thus the land use potential of this soil can be higher than expected. The Lithocutanic B merges into solid rock layers which are limiting to plant roots. Surface rocks were evident across the land surface where this soil form was found indicating rooting depth limitations.

Land Use Capability:

Without intensive land preparation this soil generally has moderately low agricultural potential due to the distinct lack of rooting depth and as such these soils are generally utilised for grazing land. These soils also exhibit high soil erosion hazard ratings thus soil conservation practices such as minimum tillage and trash blankets should be employed.

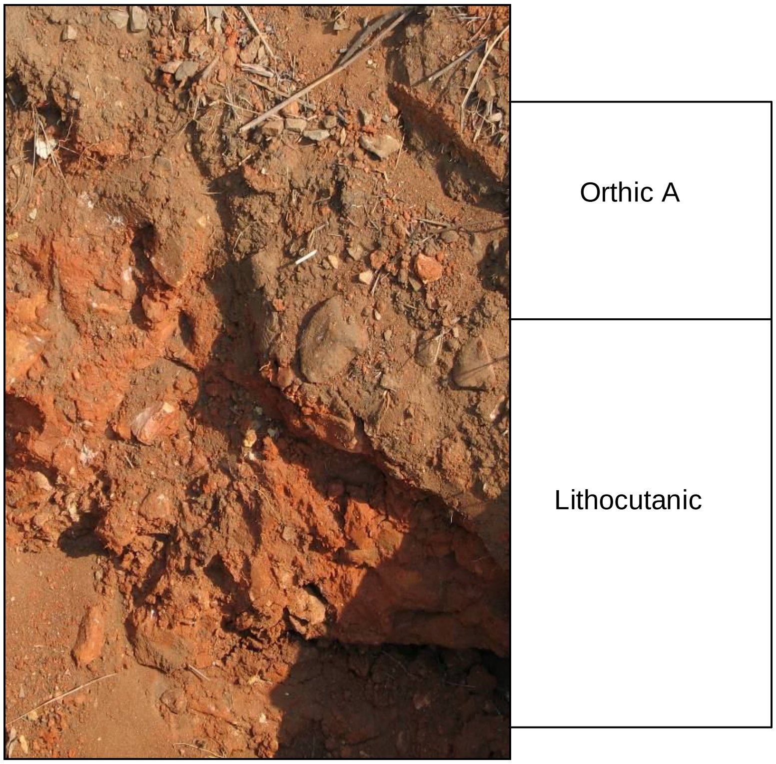

Figure 14: A shallow Glenrosa Soil Form encountered near the positional alternatives

4.3 Land Use Assessment

A detailed land use map was produced for study area. This was achieved by combining recent high resolution aerial photography with site visits and ground truthing. The resultant map (**Figure 15**) shows that the study area has been dramatically altered by anthropogenic activities, most notably the Grootvlei Power Station and associated infrastructure. The broad development area has been developed and can be classified as industrial. The surrounding land use areas are dominated by ash and tailing dams and vacant land. This vacant land is located within the bounds of the Grootvlei Power Station and act as a buffer between the station and neighbouring land uses. Agricultural land is found on the outskirts of the assessed area.

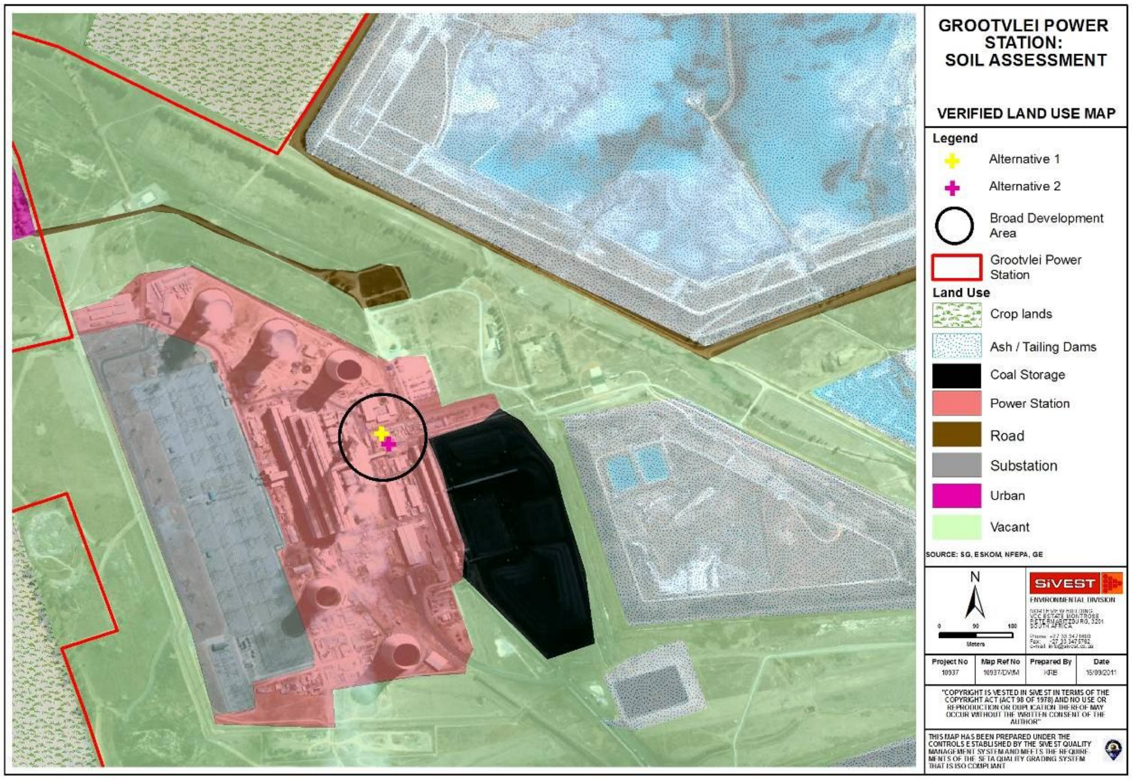

Figure 15: Verified land use map

4.4 Current Impacts on Soil and Land Resources

Both site alternatives and their associated soil and land resources are currently impacted upon by existing activities and developments. The source of these impacts includes the power station, ash and tailings dams, industrial processing infrastructure, the nearby Grootvlei community, agriculture, road creation and general infrastructure development.

The broad development area has already been completely transformed by industrial developments. These developments have lead to degradation of both soil and land resources Vegetation has been cleared and most of the land surface has been sealed by roads, storage areas and buildings. The natural topography and soil profile has been altered due to earth works and construction. In all likelihood the underlying soils have been contaminated to some degree by the hydrocarbon spills from vehicles and machinery as well as from the nearby ash and tailing storage facilities.

5 IMPACT ASSESSMENT

Soil is a natural resource, which is non-renewable in the short term and is expensive to either reclaim or improve following degradation (**van Lynden & Oldeman, 1997**). The ***International Soil Reference and Information Centre*** **(ISRIC)**, the producers of the World Map of Human-Induced Soil Degradation, recognises two categories of human-induced soil degradation processes.

The first category deals with soil degradation by displacement of soil material mainly through water and wind erosion. Soil erosion causes land degradation through a reduction in agricultural potential in many parts of South Africa. The major issues surrounding soil erosion are the loss of the top soil layer required for plant growth, reduction of soil nutrients, siltation of aquatic systems as well as the general land and ecosystem degradation.

The second category of soil degradation deals with in-situ soil physical and chemical and biological deterioration. In-situ soil degradation due to anthropogenic activities can be divided into various classes and subclasses:

- **Physical Degradation** (waterlogging, compaction, crusting, pore modification, etc.)
- **Chemical Degradation** (eutrophication, acidification, salinisation, heavy metal pollution, etc.)
- **Biological Degradation** (pathogen introduction, modification of microbial activity etc)

A single or combination of the aforementioned degradations leads to a decrease in soil quality/health which in turn influences land capability ratings.

The areas directly affected by the proposed developments/activities have low capability ratings and low sensitivities due to existing impacts (**Section 4.4**). The current soil resources in the broad development area have all been subject to physical, chemical and biological degradation. Owing to this the installation and operation of an additional above ground fuel storage tank, will have a very limited impact on soil and land use resources. The proposed development will not cause any additional loss of virgin soils nor will it impact on agriculturally or sensitive land use areas. Both positional alternatives are partly sealed by concrete and completely covered by gravel.

If typical mitigation measures are implemented then the installation and normal operation of an additional above ground fuel storage should not create new or additional impacts on local soil and land use resources. Thus this impact assessment will focus on the potential risk of contamination if the fuel storage tank were to leak or fail completely (i.e. an emergency situation). This potential impact is rated in the impact rating table below.

The determination of the effect of an environmental impact on an environmental parameter (in this instance, underlying soil and nearby land uses) is determined through a systematic analysis of the various components of the impact. This is undertaken using information that is available to the environmental practitioner through the process of the environmental impact assessment. The impact evaluation of predicted impacts was undertaken through an assessment of the significance of the impacts.

5.1 Determination of Significance of Impacts

Significance is determined through a synthesis of impact characteristics which include the context and the intensity of an impact. Context refers to the geographical scale (i.e. site, local, national or global) whereas Intensity is defined by the severity of the impact (e.g. the magnitude of deviation from background or baseline conditions, the size of the area affected, the duration of the impact and the overall probability of occurrence). Significance is calculated as per the example shown in **Table 2**.

Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. The total number of points scored for each impact indicates the level of significance of the impact.

5.2 Impact Rating System Methodology

Impact assessments must take account of the nature, scale and duration of effects on the environment whether such effects are positive (beneficial) or negative (detrimental).

5.2.1 Rating System Used To Classify Impacts

The rating system is applied to the potential impact on the receiving environment and includes an objective evaluation of the mitigation of the impact. Impacts have been consolidated into one rating. In assessing the significance of each issue, the following criteria (including an allocated point system) is used:

NATURE		
Include a brief description of the impact of environmental parameter being assessed in the context of the project. This criterion includes a brief written statement of the environmental aspect being impacted upon by a particular action or activity.		
GEOGRAPHICAL EXTENT		
This is defined as the area over which the impact will be expressed. Typically, the severity and significance of an impact have different scales and as such bracketing ranges are often required. This is often useful during the detailed assessment of a project in terms of further defining the determined.		
1	Site	The impact will only affect the site
2	Local/district	Will affect the local area or district
3	Province/region	Will affect the entire province or region
4	International and National	Will affect the entire country

PROBABILITY		
This describes the chance of occurrence of an impact		
1	Unlikely	The chance of the impact occurring is extremely low (Less than a 25% chance of occurrence).
2	Possible	The impact may occur (Between a 25% to 50% chance of occurrence).
3	Probable	The impact will likely occur (Between a 50% to 75% chance of occurrence).
4	Definite	Impact will certainly occur (Greater than a 75% chance of occurrence).
REVERSIBILITY		
This describes the degree to which an impact on an environmental parameter can be successfully reversed upon completion of the proposed activity.		
1	Completely reversible	The impact is reversible with implementation of minor mitigation measures
2	Partly reversible	The impact is partly reversible but more intense mitigation measures are required.
3	Barely reversible	The impact is unlikely to be reversed even with intense mitigation measures.
4	Irreversible	The impact is irreversible and no mitigation measures exist.
IRREPLACEABLE LOSS OF RESOURCES		
This describes the degree to which resources will be irreplaceably lost as a result of a proposed activity.		
1	No loss of resource.	The impact will not result in the loss of any resources.
2	Marginal loss of resource	The impact will result in marginal loss of resources.
3	Significant loss of resources	The impact will result in significant loss of resources.
4	Complete loss of resources	The impact is result in a complete loss of all resources.

DURATION		
This describes the duration of the impacts on the environmental parameter. Duration indicates the lifetime of the impact as a result of the proposed activity		
1	Short term	The impact and its effects will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 1 years), or the impact and its effects will last for the period of a relatively short construction period and a limited recovery time after construction, thereafter it will be entirely negated (0 – 2 years).
2	Medium term	The impact and its effects will continue or last for some time after the construction phase but will be mitigated by direct human action or by natural processes thereafter (2 – 10 years).
3	Long term	The impact and its effects will continue or last for the entire operational life of the development, but will be mitigated by direct human action or by natural processes thereafter (10 – 50 years).
4	Permanent	The only class of impact that will be non-transitory. Mitigation either by man or natural process will not occur in such a way or such a time span that the impact can be considered transient (Indefinite).
CUMULATIVE EFFECT		
This describes the cumulative effect of the impacts on the environmental parameter. A cumulative effect/impact is an effect which in itself may not be significant but may become significant if added to other existing or potential impacts emanating from other similar or diverse activities as a result of the project activity in question.		
1	Negligible Cumulative Impact	The impact would result in negligible to no cumulative effects
2	Low Cumulative Impact	The impact would result in insignificant cumulative effects
3	Medium Cumulative impact	The impact would result in minor cumulative effects
4	High Cumulative Impact	The impact would result in significant cumulative effects

INTENSITY / MAGNITUDE		
Describes the severity of an impact		
1	Low	Impact affects the quality, use and integrity of the system/component in a way that is barely perceptible.
2	Medium	Impact alters the quality, use and integrity of the system/component but system/ component still continues to function in a moderately modified way and maintains general integrity (some impact on integrity).
3	High	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component is severely impaired and may temporarily cease. High costs of rehabilitation and remediation.
4	Very high	Impact affects the continued viability of the system/component and the quality, use, integrity and functionality of the system or component permanently ceases and is irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.

SIGNIFICANCE
Significance is determined through a synthesis of impact characteristics. Significance is an indication of the importance of the impact in terms of both physical extent and time scale, and therefore indicates the level of mitigation required. This describes the significance of the impact on the environmental parameter. The calculation of the significance of an impact uses the following formula: **(Extent + probability + reversibility + irreplaceability + duration + cumulative effect) x magnitude/intensity.** The summation of the different criteria will produce a non weighted value. By multiplying this value with the magnitude/intensity, the resultant value acquires a weighted characteristic which can be measured and assigned a significance rating.

Points	Impact Significance Rating	Description
6 to 28	Negative Low impact	The anticipated impact will have negligible negative effects and will require little to no mitigation.
6 to 28	Positive Low impact	The anticipated impact will have minor positive effects.
29 to 50	Negative Medium impact	The anticipated impact will have moderate negative effects and will require moderate mitigation measures.
29 to 50	Positive Medium impact	The anticipated impact will have moderate positive effects.
51 to 73	Negative High impact	The anticipated impact will have significant effects and will require significant mitigation measures to achieve an acceptable level of impact.
51 to 73	Positive High impact	The anticipated impact will have significant positive effects.
74 to 96	Negative Very high impact	The anticipated impact will have highly significant effects and are unlikely to be able to be mitigated adequately. These impacts could be considered "fatal flaws".
74 to 96	Positive Very high impact	The anticipated impact will have highly significant positive effects.

5.2.2 Impact Summary

Once rated, the impacts are summarised and a comparison made between pre- and post mitigation phases. The rating of environmental issues associated with different parameters prior to and post mitigation of a proposed activity will be averaged. A comparison is then made to determine the effectiveness of the proposed mitigation measures and identify critical issues related to the environmental parameters.

5.2 Rating of Predicted Impacts: Contamination of soil and land use resources

From a soil and land use perspective the contamination of undisturbed soils and productive land uses as a result of the proposed activities, is the primary concern. This assessment has shown that areas directly affected by the proposed developments/activities have low capability ratings and low sensitivities. Field verification has also illustrated that the current soil resources, in the broad development area, have all been subject to physical, chemical and biological degradation. Owing to this the installation and operation of an additional above ground fuel storage tank will have a very limited impact on soil and land use resources. However contamination of more sensitive land uses and soils, without certain mitigation measures, could occur in the unlikely event of a major fuel leak or complete failure of storage tank (i.e. an emergency situation).

Note: The pre-mitigation rating of the contamination of nearby soil and land use resources impact is taken as worst case scenario i.e. the fuel tank is not bunded or lined.

Table 2: Impact rating table for the contamination of local soil and land use resources

IMPACT TABLE		
Environmental Parameter	*Soil and Land Use Resources*	
Issue/Impact/Environmental Effect/Nature	*Contamination of nearby soil and land use resources caused by a major fuel leak or complete failure of the proposed above ground fuel storage tank.*	
Extent	*District*	
Probability	*Very Unlikely*	
Reversibility	*Partly reversible*	
Irreplaceable loss of resources	*Without mitigation measures the impact will result in significant loss of resources.*	
Duration	*Medium Term*	
Cumulative effect	*High cumulative impacts*	
Intensity/magnitude	*High*	
Significance Rating	*This issue, without suitable mitigation, has the potential to have a significant impact on soil and land use resources in the district. Pre-mitigation significance rating is medium negative. With appropriate mitigation measures, this impact significance rating becomes negligible.*	
	Pre-mitigation impact rating	Post mitigation impact rating
Extent	2	1
Probability	1	1
Reversibility	3	1
Irreplaceable loss	2	1
Duration	2	1
Cumulative effect	3	1

Intensity/magnitude	3	1
Significance rating	-39 (**medium negative**)	-6 (**low negative**)
Mitigation measures	▪ Construct a complete sealed concrete bund around the proposed fuel oil tank. This bund must have a capacity of 110% of the fuel storage tank. ▪ Undertake regular checks and maintenance on the fuel oil storage tank and bund. ▪ Should contaminated water enter the bund, this would then need be removed from the site, and would be recycled off-site as part of the remediation process. Contaminated water should not be distributed onto soil and land surfaces and should be disposed of at an approved disposal site.	

6 MITIGATION MEASURES AND SOIL MANAGEMENT PLAN

6.1 Construction of the concrete bund

The primary mitigation measure for this project will be the concrete bund which will enclose the bottom of the above ground fuel oil tank. This bund must have a capacity of 110% of the fuel storage tank. This structure will capture any fuel leaks and will contain the fuel if the storage tank were to fail thus greatly reducing the risk of soil contamination. If fuel is captured in the structure it must be drained into a suitable storage vessel and be recycled or disposed of at an approved disposal site. Under no circumstance should fuel or contaminated water be released onto unprotected soil surfaces. Due to the current condition of both positional alternatives the need for earth works or further disruptions to the soil profile will be minimal.

6.2 Erosion

Additional clearing activities should not be necessary on or near the proposed development area. Nevertheless it is recommended that construction only be undertaken during agreed working times and permitted weather conditions. If heavy rains are expected activities should be put on hold to reduce the risk of erosion. If additional earthworks are required, any steep or large embankments that are expected to be exposed during the ‘rainy’ months should either be armoured with fascine like structures. If earth works are required then storm water control and wind screening should be undertaken to prevent soil loss from the site.

6.3 Soil and Land Use Contamination

Every precaution must be taken to ensure that any chemicals or hazardous substances do not further contaminate unprotected soil resources or productive land use areas.

For this purpose the persons undertaking construction must:

- Ensure that the mixing /decanting of all chemicals and hazardous materials should take place on a tray or impermeable surface.
- Waste generated from these should then be disposed of at a registered landfill site.
- Ensure all storage tanks are designed and managed in order to prevent pollution of drains, groundwater and soils.
- Construct separate storm water collection areas and interceptors at storage tanks, and other associated potential pollution activities.
- Ensure that use and storage of fuels and chemicals that could potentially leach into the ground be controlled. Adequate spillage containment measures shall be implemented, such as cut off drains, etc. Fuel and chemical storage containers shall be set on a concrete plinth. The containment capacity shall be equal to the full amount of material stored, plus 10%.
- Appoint appropriate contractors to remove any residue from spillages from site. Handling, storage and disposal of excess or containers of potentially hazardous materials shall be in accordance with the requirements of the above-mentioned Regulations and Acts.
- Ensure that used oils/lubricants are not disposed of on/near the site, and that contractors purchasing these materials understand the liability under which they must operate. The Environmental Control Officer will be responsible for reporting the storage/use of any other potentially harmful materials to the relevant authority.
- Ensure that potentially harmful materials are properly stored in a dry, secure environment, with concrete or sealed flooring. The Environmental Control Officer will ensure that materials storage facilities are cleaned/maintained on a regular basis, and that leaking containers are disposed of in a manner that allows no spillage onto the bare soil or surface water. The management of such storage facilities and means of securing them shall be agreed.

6.4 General & Hazardous Substances and Materials

Storage areas can be hazardous, unsightly and can cause environmental pollution if not designed and managed carefully. The selection of the site for the storage of materials needs to consider the prevailing winds, distance to water bodies and general on-site topography. These areas need to be demarcated and fenced if necessary.

Fire prevention facilities must be present at all storage facilities. It is important that the storage areas for hazardous chemicals are positioned away from sensitive areas and high risk areas (where applicable). The persons undertaking construction shall maintain storage of all potentially polluting materials, and shall undertake potentially polluting operations as far away as practically possible from drainage areas, and topsoil/subsoil stockpiles. The Contractor will ensure that additional supervisory time is spent to monitor such works. Such materials/operations include (but are not limited to):

- batching, storing of cement, concrete and mortar
- petrol, oil and chemical storage and transfer
- washing, ablution and toilet facilities
- plant storage

Hazardous materials to be stored on site are those that are potentially poisonous, flammable, carcinogenic or toxic. These materials include diesel, petroleum, oil, bituminous products; cement;

solvent based paints; lubricants; explosives; drilling fluids; pesticides and herbicides and Liquid Petroleum Gas (LPG). Material Safety Data Sheets (MSDS's) shall be readily available on site for chemicals and hazardous substances to be used on site. MSDS's should also include information on ecological impacts and measures to minimize negative environmental impacts during accidental releases or escapes.

Furthermore hazardous storage and refueling areas must be bunded with an approved impermeable liner to protect groundwater quality. A Method Statement is required for the filling of and dispensing from fuel storage tanks should such tanks be required. All necessary approvals with respect to fuel storage and dispensing (if required on site) shall be obtained from the appropriate authorities.

The persons undertaking construction should submit a Method Statement and plans for the storage of hazardous materials and emergency procedures. Should a spill occur within these bunded areas it must be cleaned up, removed and disposed safely from these areas as soon as possible after detection in order to minimize pollution risk and reduced bunding capacity. Materials collected in this area must be disposed of at a suitable waste site.

All imported materials (e.g. sand) must be stockpiled within the site boundary / Construction Zone. Sand and excavated material stockpiles should be protected against wind using temporary screens, and from water erosion using tarpaulins where necessary.

It is likely that most of the cement requirements are to be transported to site as "ready mix". To prevent spillage onto roads, "ready mix" trucks shall rinse off the delivery shoot into a suitable sump prior to leaving the Site. Cement / concrete shall not be mixed directly on the ground. Dagga boards, mixing trays and impermeable sumps shall be used at all mixing and supply points. Unused cement bags are to be stored so as not to be effected by rain or runoff events. Used cement bags shall be stored in weatherproof containers to prevent windblown cement dust and water contamination. Used cement bags shall be disposed of on a regular basis via the solid waste management system, and shall not be used for any other purpose.

All visible remains of excess concrete shall be physically removed on completion of the plaster or concrete pour section and disposed of. Washing the remains into the ground is not acceptable as groundwater contamination could occur. All excess aggregate shall also be removed. With respect to exposed aggregate finishes, the persons undertaking construction shall collect all contaminated water and store it in sumps for disposal at an approved waste site.

Hazardous chemical substances (as defined in the Regulations for Hazardous Chemical Substances) used during construction shall be stored in secondary containers. The relevant Material Safety Data Sheets (MSDS) shall be available on Site. Procedures detailed in the MSDS shall be followed in the event of an emergency situation.
No paint products may be disposed of on site.

All harmful materials are must properly stored in a dry, secure environment, with concrete or sealed flooring and a means of preventing unauthorised entry. The Environmental Control Officer shall further ensure that materials storage facilities are cleaned / maintained on a regular basis, and that leaking containers are disposed of in a manner that allows no spillage onto the bare soil. The management of such storage facilities and means of securing them shall be agreed.

All fuel and oil is to be stored within a demarcated area on site. Areas for storage of fuels and other flammable materials shall comply with standard fire safety regulations and may require the approval of the Local Municipal Fire Prevention Officer. Safety and fire prevention precautions must be strictly adhered to. Fuels and oils must be stored in tanks or drums with lids that remain firmly closed and shielded from the elements, and kept under lock and key.

All asbestos material shall be disposed of according to the Asbestos Regulations 2001, as per Government Notice. R: 155, dated 10 February 2002, promulgated under the Occupational Health and Safety Act, 1993 (Act No. 85 of 1993).

6.5 Land Rehabilitation

All rubble is to be removed from the site to an approved landfill site as per construction phase requirements. No remaining rubble is to be buried on site. The site is to be free of litter and surfaces are to be checked for waste products from activities such as concreting or asphalting and cleared.

7 PREFERRED SITE LOCATION

If the above mitigation measures (**Section 5.2** and **Section 6**) are correctly implemented then there is no reason why the proposed development cannot be accommodated on either of the identified site alternatives. This is due to the current condition of the proposed development area, the close proximity of the two positional alternatives as well as their similarities in terms of the impacts on the receiving environment.

8 CONCLUSION AND RECOMMENDATIONS

SiVEST were appointed by Eskom Holdings Generation to undertake a specialist soil and land use assessment for the area affected by the proposed above ground bulk storage fuel oil tank at the Grootvlei Power Station in the Mpumalanga Province.

The verified land use assessment indicates that the proposed development area and surrounding environment has been dramatically altered by anthropogenic activities, most notably the Grootvlei Power Station and associated infrastructure. Field verification also illustrated that the current soil resources, in the broad development area, have all been subject to physical, chemical and biological degradation. If typical mitigation measures are implemented then installation and normal operation of an additional above ground fuel storage should not create new or compounded existing impacts on local soil and land use resources. Owing to this, the installation and operation of an additional above ground fuel storage tank should have a very limited impact on soil and land use resources.

A number of mitigation measures have been stipulated in this report and include process to reduce the risk of erosion, land degradation and contamination. Recommended mitigation measures include a completely sealed concrete bund with the capacity to store 110% of the fuel storage tank it encloses. **If the all the proposed mitigation measures are correctly implemented then there is no reason why the proposed development cannot be accommodated on either of the identified site alternatives.** This is due to the current condition of the proposed development area, the close proximity of the two positional alternatives as well as their similarities in terms of the impacts on the receiving environment.

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