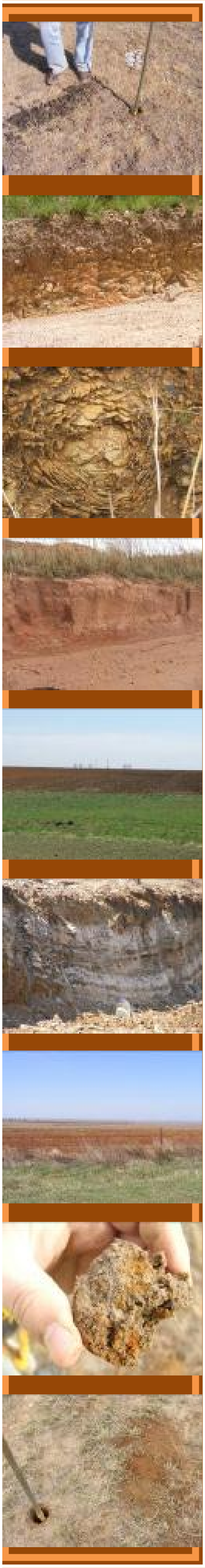

February 2010

SOIL AND AGRICULTURAL POTENTIAL

PROPOSED TUTUKA GENERAL WASTE DISPOSAL SITE: SOIL AND AGRICULTURAL POTENTIAL SPECIALIST STUDY

Proponent: **Eskom Holdings Limited**

Prepared by: **Zitholele Consulting**

FINAL SOIL AND AGRICULTURAL POTENTIAL REPORT

Project 12333

EXECUTIVE SUMMARY

The Tutuka Power Station is looking to either extend their current waste disposal site or to establish a new general waste disposal site. An EIA is currently underway for the proposed project and several specialist studies including soils are required. In this report the findings from the soil and agricultural assessment is detailed.

The study site has four main soil types, dark soils (Inhoek), shallow soils (Milkwood), clay soils (Willowbrook) and disturbed soils (Witbank). All of these have a relatively low agricultural potential due to the shallow soils, the high clay content and the disturbed nature of the soils. Therefore the agricultural potential is limited to grazing.

The current operations at the Tutuka Power Station include an existing waste disposal site that is currently impacting on the soil resources. In addition soil is sourced from the adjacent land to serve as cover material at the current site.

The proposed development will impact on the soil resources and hence the agricultural potential during construction by compacting and moving soil. In addition construction vehicles can spill lubricants and hydrocarbons that can also find their way into the soil system. Due to the nature of a waste disposal site construction and the high likelihood of the impact occurring this impact is rated as a **Moderate** impact.

During the operational phase there is a potential for surface water to come into contact with the domestic waste on the site and to either form leachate or contaminated runoff that can impact on the soils. In addition the soil under the waste site will be covered with an ever increasing amount of waste. This unmitigated scenario was rated as a **Moderate** impact. With the successful implementation of the mitigation measures this impact can be reduced to a lower scoring **Moderate** impact.

During the closure phase the impact will be the same as assessed during the construction phase with earth-moving equipment operating on site. Once the closure is completed and the rehabilitation taken effect the impact will remain a **Moderate** impact as the soil will remain covered by the waste body. There is still a potential for leachate generation, although the likelihood is lower than during operation.

The assessment of the soils and agricultural potential at the proposed Tutuka general waste disposal site has found that the proposed development has the potential to impact on the soils and their agricultural potential. However these impacts can be mitigated by the successful implementation of the mitigation measures proposed in this report. Although the mitigation measures will not eliminate the impact, it will ensure that the impact is limited to the footprint of the waste disposal site and the cover material source areas. It is therefore recommended that the development be approved conditional to the implementation of the abovementioned mitigation measures.

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

Eskom is currently operating the Tutuka Power Station as part of its electricity generation fleet. Throughout the operational life of the station, general waste, inclusive of garden waste and building rubble, is being generated. This waste is being disposed of in an authorised general waste disposal site within the Tutuka Power Station premises.

The current waste disposal site provides domestic waste disposal services to New Denmark Colliery, Thuthukani Township, Tutuka Power Station, selected contractors and some neighbouring farmers. This particular disposal site has reached its capacity, and as of the end of October 2008, the waste has been transported to a waste disposal site at Kriel town, which is approximately 200 km away from the power station. The associated transportation costs are high and therefore an alternative means of waste disposal needs to be put in place.

Two alternatives are available for the Tutuka Power Station waste disposal site. The first would be to extend the current waste disposal site and to apply for a permit amendment into a new Waste License. The second alternative is to establish a new waste disposal site within close proximity to the power station property and the current site. A site selection exercise in line with the Minimum Requirements for the Disposal of Waste by Landfill, Draft 3rd edition (Department of Water Affairs[1], 2005) was undertaken to identify the suitable alternatives.

After the site selection process a study area was identified that would provide sufficient space for any of the potential waste disposal site alternatives. The study area is illustrated in Figure 1-1 below.

[1] DWA previously referred to as the Department of Water Affairs and Forestry (DWAF).

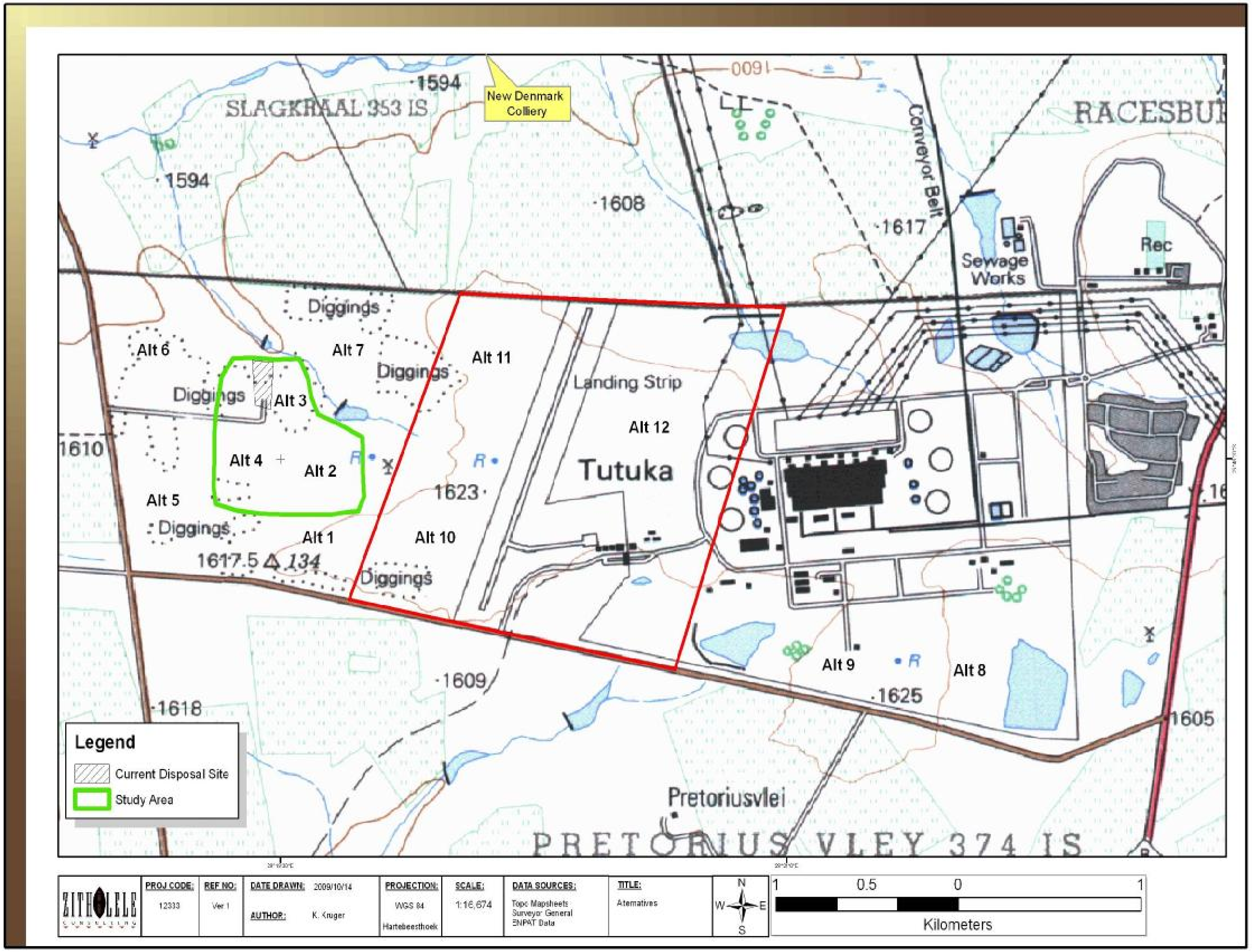

Figure 1-1: Proposed Study Area.

1.2 STUDY SCOPE

Eskom's Generation Division appointed Zitholele Consulting (Pty) Ltd, an independent environmental consultant, to conduct an EIA and Waste Management Licence application to evaluate the potential environmental and social impacts of the proposed project. As part of the environmental impact assessment for the aforementioned project it is required that certain biophysical specialist investigations are undertaken. Internal resources at Zitholele Consulting were appointed to undertake the Soils and Agricultural Potential assessment.

1.3 STUDY APPROACH

Internal resources at Zitholele Consulting undertook the soil impact specialist study through a one day site visit on the 4^{th} of January 2010. The study area encompasses the area of some 25 ha. The entire area was surveyed and soil samples were taken for characterising.

1.4 PROJECT PERSONNEL

The following project person was involved in the compilation of this report:

Konrad Kruger, BSc Hons (Geog)

Mr. Konrad Kruger graduated from the University of Pretoria with a BSc Honours in Geography in 2003. He has been involved in a variety of environmental projects in the last six years and has become specialised in undertaking specialist studies, mapping and environmental consulting. He has undertaken GIS mapping for mining, residential as well as industrial developments. He is also an experienced land ecologist and will provide expertise for this project in terms of soil surveys, land capability assessments and mapping.

1.5 ASSUMPTIONS AND LIMITATIONS

The following assumptions were made during the assessment:

- No laboratory analysis was included in the assessment and hence soils were assessed in the field.

2 BIOPHYSICAL RECEIVING ENVIRONMENT

This section details the receiving environment at the project location. For the context of this report the regional environment refers to a 30 km radius around the study area.

2.1 SOILS

2.1.1 Data Collection

The site visit was conducted in January 2010. Soils were augered at 150m intervals along the proposed railway line routes using a 150 mm bucket auger, up to refusal or 1.2 m. Soils were identified according to Soil Classification; a taxonomic system for South Africa (Memoirs on the Natural Resources of South Africa, no. 15, 1991). The following soil characteristics were documented:

- Soil horizons;
- Soil colour;
- Soil depth;
- Soil texture (Field determination);
- Wetness;
- Occurrence of concretions or rocks; and
- Underlying material (if possible).

2.1.2 Regional Description

The soils in the region are mostly derived from the geology of the region namely, predominantly shale, sandstone conglomerate and dolerite intrusions which feature prominently in the area. The soils are generally shallow with a dark brown colour.

2.1.3 Site Description

During the site visit it was noted that only soils originating from dolerite were identified and Figure 2-2 illustrates the location of the soil types. The land capability (agricultural potential) of the abovementioned soil form is described in more detail in Section 2.3.

Dark Soils

The dark soils are characterised by the dark colour of the topsoil which in this case originates from the weathering Dolerite, which produces dark clays. Generally these soils are not suitable for cultivation and in most cases are only usable as light grazing. The soil forms found was the Milkwood and Inhoek Soil Forms, which are described below.

Milkwood soil form

The Milkwood soil form is characterised by a Melanic A – horizon overlying hard rock. Milkwood soil is characterised by the dark colour of the topsoil and the shallow Dolerite in the soil profile. In several places the Dolerite is so shallow that it is visible on the surface. Please refer to Figure 2-1 for an illustration of a typical Milkwood soil form.

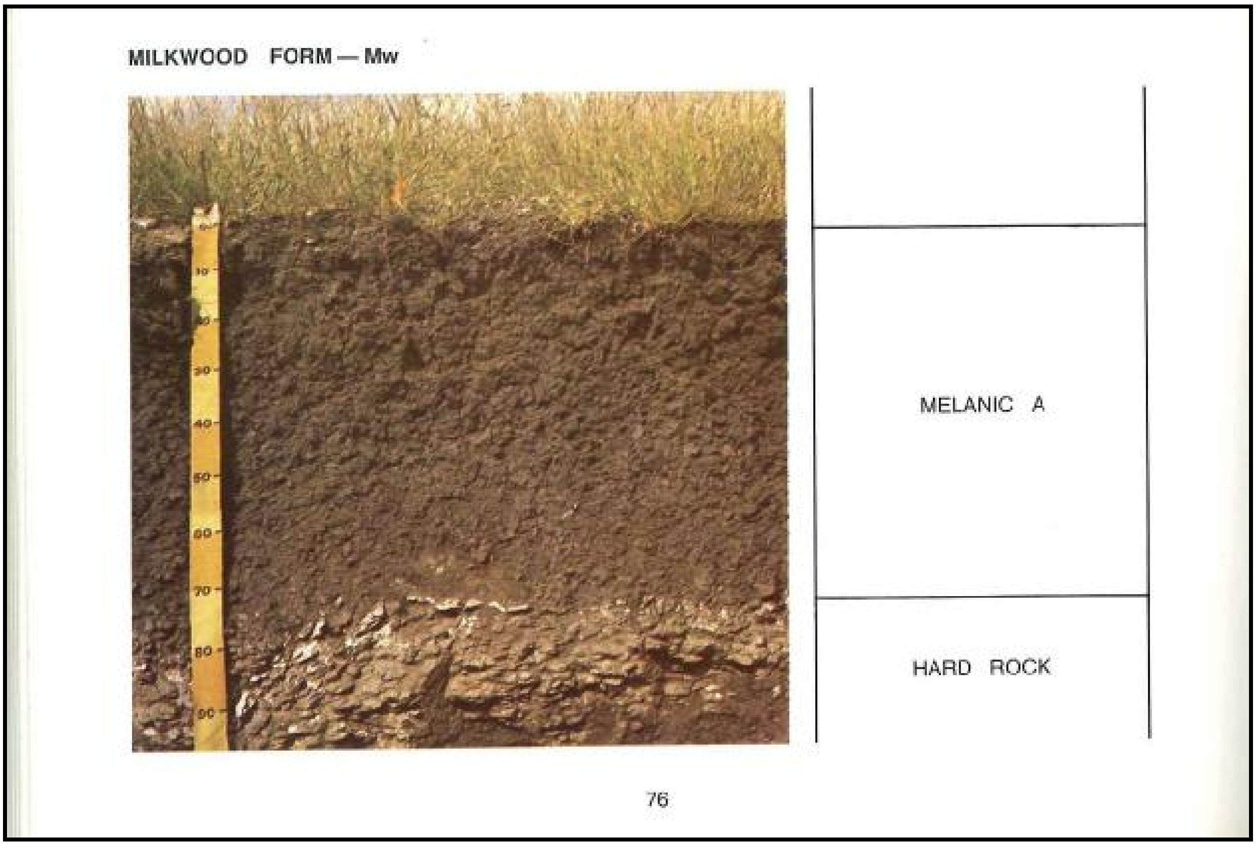

Figure 2-1: Milkwood soil form (Soil Classification, 1991).

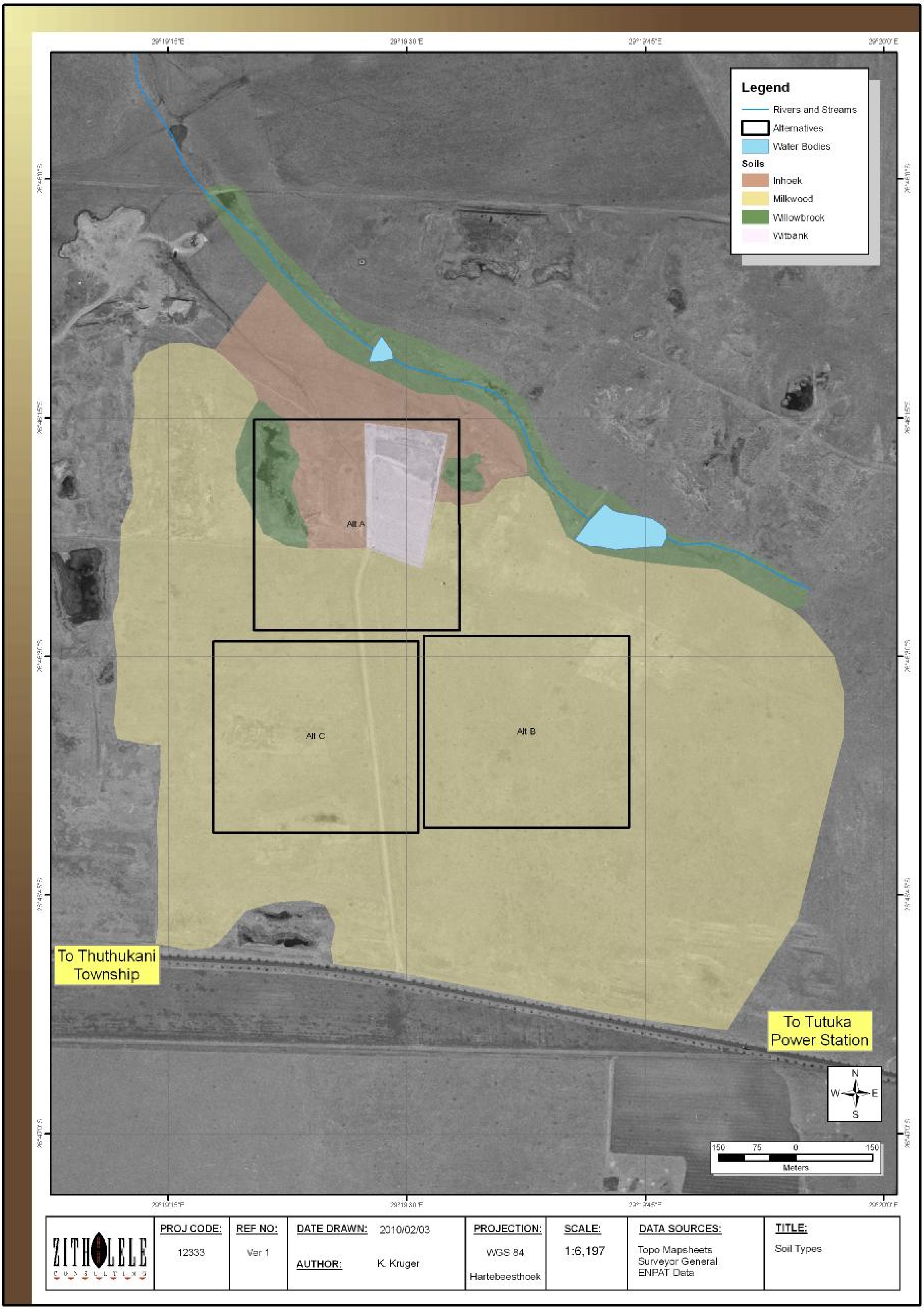

Figure 2-2: Soil Type Map

Inhoek Soil Form

Inhoek soils are typical in areas underlain by Dolerite. The dark topsoil with no further subsoil horizons is typical of the lower reaches of the slopes in the study area. This soil type is indicated in Figure 2-3 below.

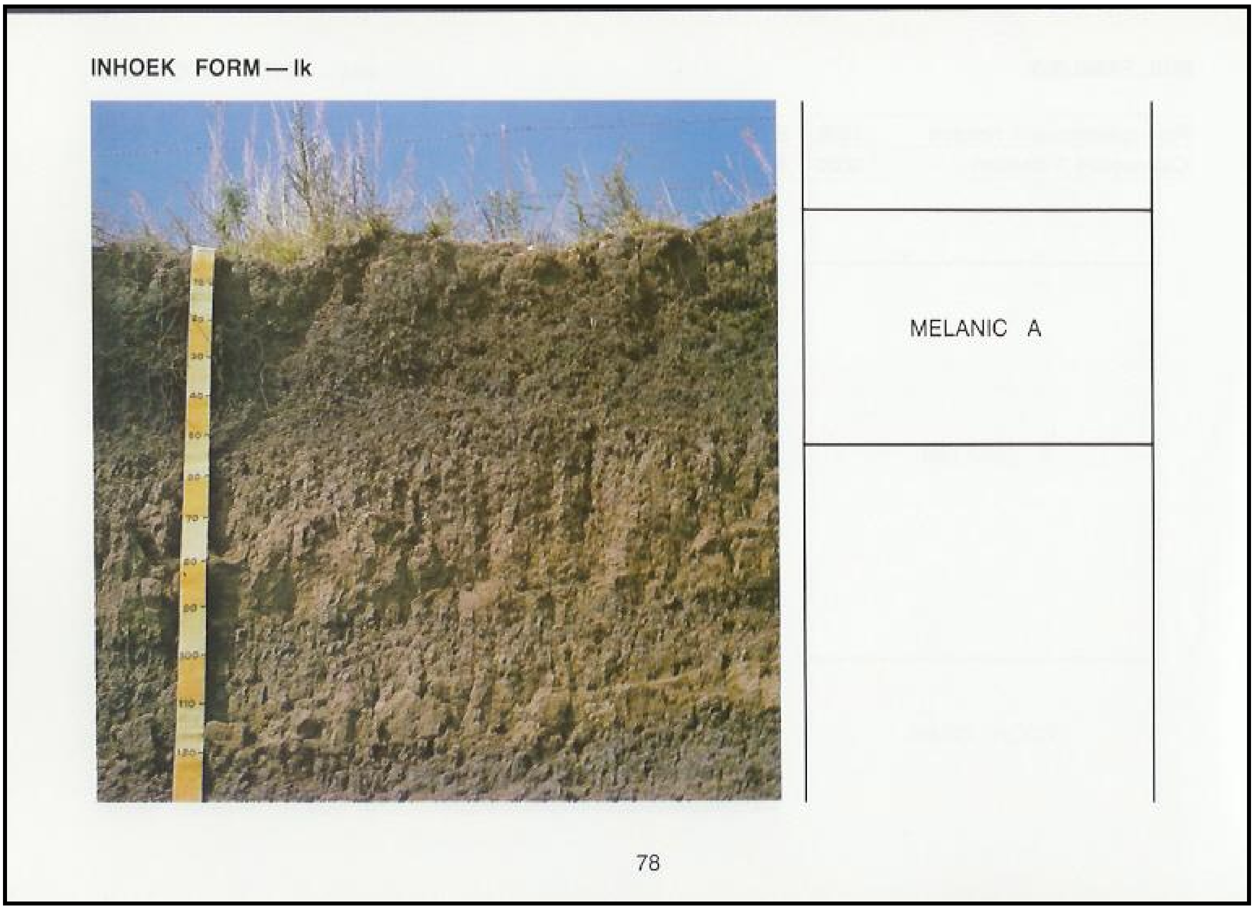

Figure 2-3: Inhoek soil form (Soil Classification, 1991)

Disturbed Soils

In the soil classification system there is a distinctive Soil Form called the Witbank form, which allows for the classification of soils that have been formed by human actions. On site the current waste disposal site is a perfect example of just such a case, where the domestic waste has been mixed with natural soil. The soil is made up of an Orthic A horizon over a man-made deposit, as indicated in Figure 2-4 below.

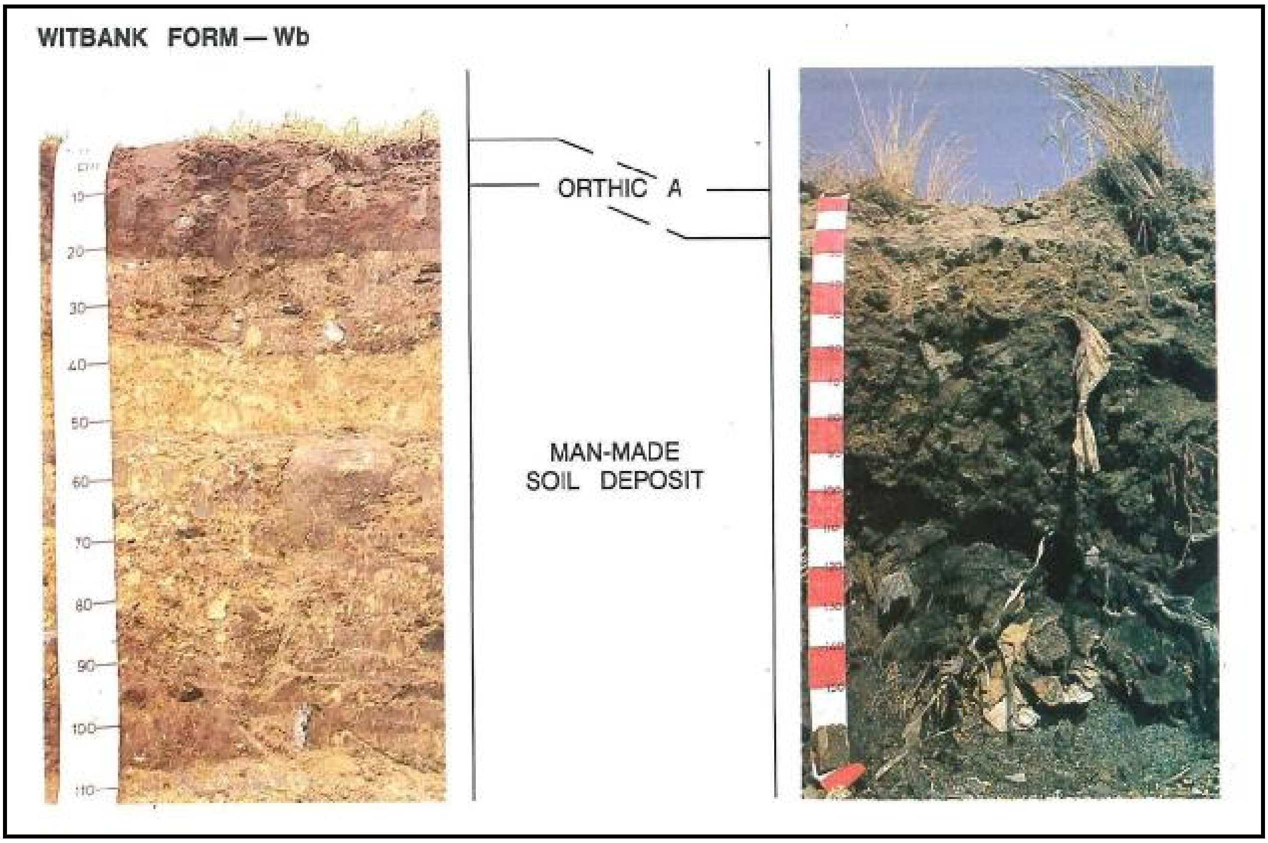

Figure 2-4: Witbank Soil Form (Soil Classification, 1991)

Clay Soils

The clay soil management unit is found in areas where clays have accumulated to such an extent that the majority of the soil matrix is made up of clay particles. These soils are usually indicative of seasonal or permanent wetland conditions. The main soil form found was the Willowbrook Soil Form as described below.

Willowbrook Soil Form

Willowbrook soils are characterised by Melanic A-horizon over a G-horizon. The G-horizon is invariably firm or very firm and its characteristics are described above. The Melanic horizon has several unique diagnostic criteria as a horizon, namely:

- Has a dark colour in the dry state.
- Lack slickensides that are diagnostic of vertic horizons.
- Has less organic carbon than required for diagnostic organic O horizon.
- Has structure that is strong enough so that the major part of the horizon is not both massive and hard or very hard when dry.

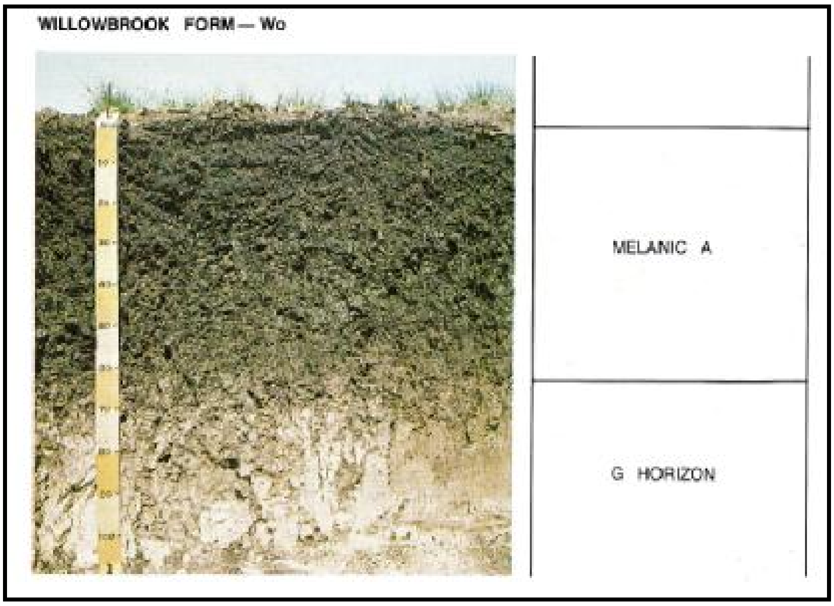

Figure 2-5: Willowbrook Soil Form (Soil Classification 1991)

2.2 AGRICULTURAL POTENTIAL (LAND CAPABILITY)

2.2.1 Data Collection

A literature review was conducted in order to obtain any relevant information concerning the area, including information from the Environmental Potential Atlas (ENPAT), Weather Bureau and Department of Agriculture. Results from the soil study were taken into account when determining the agricultural potential also known as the land capability of the site. The land capability assessment methodology as outlined by the National Department of Agriculture was used to assess the soil's capability to support agriculture on site.

2.2.2 Regional Description

The regional land capability is mostly class IV soils with limitations. This is evident in the large number of grazing land as opposed to cultivated lands found in the region. This is due to the fact that the effective soil depth is too shallow or too wet to cultivate, and livestock is grazed instead.

2.2.3 Site Description

According to the land capability methodology, the potential for a soil to be utilised for agriculture is based on a wide number of factors. These are listed in the table below along with a short description of each factor.

Table 2-1: Agricultural Potential criteria

Criteria	Description
Rock Complex	If a soil type has prevalent rocks in the upper sections of the soil it is a limiting factor to the soil's agricultural potential
Flooding Risk	The risk of flooding is determined by the closeness of the soil to water sources.
Erosion Risk	The erosion risk of a soil is determined by combining the wind and water erosion potentials.
Slope	The slope of the site could potentially limit the agricultural use thereof.
Texture	The texture of the soil can limit its use by being too sandy or too clayey.
Depth	The effective depth of a soil is critical for the rooting zone for agricultural crops.
Drainage	The capability of a soil to drain water is important as most grain crops do not tolerate submergence in water.
Mechanical Limitations	Mechanical limitations are any factors that could prevent the soil from being tilled or ploughed.
pH	The pH of the soil is important when considering soil nutrients and hence fertility.
Soil Capability	This section highlights the soil type's capability to sustain agriculture.
Climate Class	The climate class highlights the prevalent climatic conditions that could influence the agricultural use of a site.
Land Capability / Agricultural Potential	The land capability or agricultural potential rating for a site combines the soil capability and the climate class to arrive at the sites potential to support agriculture.

The soils identified in Section 2.2 above were classified according to the methodology proposed by the Agricultural Research Council – Institute for Soil, Climate and Water (2002). The criteria mentioned above were evaluated in the table below. Figure 2-6 illustrates the various land capability units on site.

Table 2-2: Land Capability of the soils within the study site

Table 2-3: Land Capability of the soils on site for agricultural use

Soil type	Inhoek	Willowbrook	Witbank	Milkwood
% of Site	7	10	3	80
Rock Complex	None	None	Yes – man made waste	Yes – hard rock
Flooding	Occasional	Yes	None	None
Erosion	Low	Low to moderate	Low to moderate	Low to moderate
Slope	15 degrees	5 – 10 degrees	15 degrees	15 degrees

Soil type	Inhoek	Willowbrook	Witbank	Milkwood
Water Erosion	Low to moderate	High	Low to moderate	Low to moderate
Wind Erosion	Low	Low	Low	Low
Texture (% clay)	15 – 45	40 +	15 – 45	15 – 45
Depth (mm)	> 800	100 - 399	100 - 399	100 - 399
Drainage	Indifferent	Indifferent	Indifferent	Indifferent
Mechanical Limitations	Clay content high	Clay content too high	Very Shallow soils on rock	Very Shallow soils on rock
pH	>5.0	>5.0	>5.0	>5.0
Climate Class	Slight			
Soil Capability	V	VI	VIII	VI
Land Capability	V - Grazing	VI - Grazing	VIII - none	VI - Grazing

No limitation	Low to Moderate	Moderate	High	Very Limiting

The site is made up of one main land capability class, namely class VI – grazing. None of the soils on site are suited to cultivation due to the high clay contents in the soils. The dominant class VI soils have continuing limitations that cannot be corrected; in this case rock complexes, clay content, stoniness, and a shallow rooting zone constitute these limitations.

Therefore the soils on site have the potential to support light grazing, as it is doing at present.

Figure 2-6: Agricultural Potential Map

3 IMPACT ASSESSMENT METHODOLOGY

The impacts will be ranked according to the methodology described below. Where possible, mitigation measures will be provided to manage impacts. In order to ensure uniformity, a standard impact assessment methodology was utilised so that a wide range of impacts can be compared with each other. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

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

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in Table 3-1.

Table 3-1: Quantitative rating and equivalent descriptors for the impact assessment criteria

Rating	Significance	Extent Scale	Temporal Scale
1	VERY LOW	*Isolated sites / proposed site*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

3.1 SIGNIFICANCE ASSESSMENT

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in Table 3-2 below.

Table 3-2 : Description of the significance rating scale

Rating		Description
5	Very high	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	High	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	Moderate	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	Very low	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity are needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	No impact	There is no impact at all - not even a very low impact on a party or system.

3.2 SPATIAL SCALE

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in Table 3-3.

Table 3-3 : Description of the spatial rating scale

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level).
3	Local	The impact will affect an area up to 5 km from the proposed study area.
2	Study Area	The impact will affect an area not exceeding the study area.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than proposed landfill footprint.

3.3 DURATION SCALE

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in Table 3-4.

Table 3-4: Description of the temporal rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of disposal site.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

3.4 DEGREE OF PROBABILITY

Probability or likelihood of an impact occurring will be described as shown in Table 3-5 below.

Table 3-5 : Description of the degree of probability of an impact occurring

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It is going to happen / has occurred

3.5 DEGREE OF CERTAINTY

As with all studies it is not possible to be 100% certain of all facts, and for this reason a standard "degree of certainty" scale is used as discussed in Table 3-6. The level of detail for specialist studies is determined according to the degree of certainty required for decision-making. The impacts are discussed in terms of affected parties or environmental components.

Table 3-6 : Description of the degree of certainty rating scale

Rating	Description
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Cannot know	The consultant believes an assessment is not possible even with additional research.
Do not know	The consultant cannot, or is unwilling, to make an assessment given available information.

3.6 QUANTITATIVE DESCRIPTION OF IMPACTS

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{\mathbf{3}} \times \frac{\text{Probability}}{\mathbf{5}}$$

An example of how this rating scale is applied is shown below:

Table 3-7 : Example of Rating Scale

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
	LOW	*Local*	Medium-term	*Could Happen*	
Impact to soil	**2**	***3***	**3**	**3**	**1.6**

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to five classes as described in the table below.

Table 3-8 : Impact Risk Classes

Rating	Impact Class	Description
0.1 – 1.0	**1**	**Very Low**
1.1 – 2.0	**2**	**Low**
2.1 – 3.0	**3**	**Moderate**
3.1 – 4.0	**4**	**High**
4.1 – 5.0	**5**	**Very High**

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

3.7 CUMULATIVE IMPACTS

It is a requirement that the impact assessments take cognisance of cumulative impacts. In fulfilment of this requirement the impact assessment will take cognisance of any existing impact sustained, any mitigation measures already in place and any additional impact to environment through continued and proposed future activities. Thereafter mitigation measures will be proposed and the residual impact will be calculated if these are implemented.

Using the criteria as described above an example of how the cumulative and residual impact assessment will be done is shown below:

Table 3-9: Impact Rating Example

Impact	Significance	Spatial Scale	Temporal Scale	Probability	Rating
Initial / Existing Impact (I-IA)	**2**	***2***	**2**	*1*	0.4
Additional Impact (A-IA)	**1**	***2***	**1**	*1*	0.3
Cumulative Impact (C-IA)	**3**	***4***	**2**	*1*	0.6
Residual Impact after mitigation (R-IA)	**2**	***1***	**2**	*1*	0.3

As indicated in the example above the Additional Impact Assessment (A-IA) is the amount that the impact assessment for each criterion will increase. Thus if the initial impact will not increase, as shown for temporal scale in the example above the A-IA will be 0, however, where the impact will increase by two orders of magnitude from 2 to 4 as in the spatial scale the A-IA is 2. The Cumulative Impact Assessment (C-IA) is thus the sum of the Initial Impact Assessment (I-IA) and the A-IA for each of the assessment criteria.

In both cases the I-IA and A-IA are assessed without taking into account any form of mitigation measures. As such the C-IA is also a worst case scenario assessment where no mitigation measures have been implemented. Thus a Residual Impact Assessment (R-IA) is also made which takes into account the C-IA with mitigation measures. The latter is the most probable case scenario, and for the purpose of this report is considered to be the final state Impact Assessment.

3.8 NOTATION OF IMPACTS

In order to make the report easier to read the following notation format is used to highlight the various components of the assessment:

- Significance or magnitude- IN CAPITALS
- Temporal Scale – in underline
- Probability – *in italics and underlined*.
- Degree of certainty - **in bold**
- Spatial Extent Scale – *in italics*

4 IMPACT ASSESSMENT

The Impact Assessment will highlight and describe the impact to the environment following the above mentioned methodology and will assess the following components:

- Soils and Agricultural Potential

The impact assessment was undertaken for the construction, operational and decommissioning phases of the project. The waste disposal site a waste dump with a single access point and an access road (Figure 4-1). It should be noted that there is currently a waste disposal site on the terrain and it is anticipated that the activities would be identical to the current operations.

Figure 4-1: Example of what the waste site would look like during operations

4.1 INITIAL IMPACT

At Alternative 1 the study site presently has an operating waste disposal site. The soils underneath the waste site have been covered with up to 5 m of waste and soil. This has rendered this area (±4 ha) sterile for agricultural use. Due to the relatively low agricultural potential of the natural soil in the area this impact is **low**.

Further impacts to soils in the study area for Alternative A and C include the use of soil as cover material at the waste disposal site or for road building material. This material is obtained from shallow borrow pits around the area to the south and west of the current waste disposal site. It has been indicated by the power station personnel that the current practises for obtaining cover material will continue.

At Alternative B the soil is still relatively undisturbed as the borrow activities did not extend to this area. Most possibly due to the hard nature of the Dolerites in this area preventing them being excavated easily.

In terms of agricultural use the study site is currently used as grazing land by cattle farmers, and as such the land is reaching its maximum agricultural potential.

In view of the discussion above the initial (baseline) impact to soils and land capability for Alternative A is rated as a MODERATE negative impact that occurs on the *study site* and will remain for the long term. The impact *has already occurred* and is therefore rated as a **Moderate** impact**.**

The initial impact to soils and land capability for Alternative C is rated as a LOW negative impact that occurs in *isolated sites* and will remain for the long term. This impact *has already occurred* and is therefore rated as **Moderate** negative impact.

The initial impact at Alternative B is significantly less as the soils have not been used for borrow material. Therefore the initial impact to soils is rated as a VERY LOW incidental negative impact acting on *isolated sites.* This impact is *likely* to occur and the therefore rated as a **Very Low** impact.

4.2 ADDITIONAL IMPACT

The additional impacts to soils and agricultural potential during construction of the waste disposal site include the clearing of vegetation in the area of the extended disposal site, compaction and levelling of the soil, covering of the soil by the liner and drainage systems and the installation of the storm water runoff control system. The clearing of the soil could potentially result in erosion as the vegetation is removed, exposing the soil to the erosion elements. Furthermore the construction vehicles have the potential to compact the soil by their movements or pollute the soil by spilling hydrocarbons. Both of these impacts reduce the agricultural potential of soils, but these soils already have a low potential. The placing of the waste site on the soil creates a long term impact that renders the underlying soil sterile and useless in terms of land capability. It should be noted though that the soils in this area have a low agricultural potential and are mostly only suitable for grazing purposes.

The additional impact to soils and agricultural potential during the construction phase is a MODERATE negative impact occurring in the *study area* and acting in the long term. This impact *will occur* and as such is rated as a **Moderate** impact. This is the same for all three Alternatives.

During the operational phase the impacts described above will remain, but the construction vehicles will be replaced with the vehicles transporting the waste to the site with the potential to generate hydrocarbon spillages. In addition more and more soil material will be removed from the adjacent landscape to be used as cover material on the waste disposal site. An indirect impact from the waste disposal site will be the formation of leachate that could pollute the underlying soils. It should be noted that this impact describes the unmitigated scenario. All these impacts are rated as a MODERATE negative impact occurring in the *study area* and acting in the long term. This impact *will occur* and is therefore rated as a **Moderate** impact.

During the rehabilitation and closure phase the waste site will be capped. This should remove the potential to generate leachate but the soils under the waste site will remain for all purposes sterile. This impact is rated as a LOW negative impact acting on the *study area* in the long term. This impact will occur and is therefore rated as a **Moderate** impact as show in **Table 4-1**.

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4.3 CUMULATIVE IMPACT

For Alternative A the cumulative impact during the construction phase remains as assessed above as the additional impact and the initial impact occur in the same area. Therefore the impact remains a **Moderate** impact. The same is applicable for the closure and operational phases.

When moving to Alternative B and C the scenario changes as these sites do not have an existing impact from a waste disposal site. As the additional impact from the development is rated as a **Moderate** negative impact the cumulative impact increases in both cases to be a **Moderate** residual impact.

4.4 MITIGATION MEASURES

- Ensure that the waste disposal site is lined and a leachate collection system is installed to prevent leachate from entering the underlying soil;
- Ensure that the waste body has a storm water drainage system that prevents dirty water from contaminating the adjacent soil;
- Ensure that all machinery on site is in a good working order and that no servicing of machinery will be allowed on site;
- Limit all activities to the proposed waste disposal site;
- Ensure that adequate storm water control measures are in place to prevent erosion;

- Spread absorbent sand on areas where oil spills are likely to occur, such as the refuelling area in the hard park (if present);
- Oil-contaminated soils are to be removed to a contained storage area and bio-remediated or disposed of at a licensed facility;
- If soils are excavated for the levelling operations, ensure that the soil is utilised elsewhere for cover material in the waste site;
- Ensure that soil is stockpiled in such a way as to prevent erosion from storm water;
- When closing the site ensure that the site is properly capped to prevent the infiltration of water into the waste body; and
- As part of closure, investigate the possibility of removing the waste material and rehabilitating the underlying soil to its former condition.

4.5 RESIDUAL IMPACT

The residual impact with the successful implementation of the mitigation measures mentioned above will be slightly less significant as the probability reduces slightly. Therefore the rating reduces to **Moderate.** This is relevant for both the construction and operational phases. In the case of the closure phase it is standard procedure to cap and close the site without removing the final waste body. In so doing the soil will remain sterile under the waste body. This is rates as a **Moderate** impact.

Table 4-1: Impact Rating Matrix for soils and agricultural potential

Construction phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Initial – Alt A	Moderate	Study site	Long Term	Is occurring	**3.0 – Moderate**
Initial – Alt B	Very Low	Isolated sites	Short Term	Incidental	**0.5 – Very Low**
Initial – Alt C	Low	Isolated sites	Long Term	Has occurred	**2.67 – Moderate**
Additional	Moderate	Study site	Long Term	Will occur	**3.0 - Moderate**
Cumulative	Moderate	Study site	Long Term	Will occur	**3.0 - Moderate**
Residual	Low	Study site	Long Term	Will occur	**2.67 - Moderate**
Operational Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Additional	Moderate	Study site	Long Term	Will occur	**3.0 - Moderate**
Cumulative	Moderate	Study site	Long Term	Will occur	**3.0 - Moderate**
Residual	Moderate	Study site	Long Term	Very Likely	**2.4 – Moderate**
Closure and Rehabilitation Phase					
Impact Type	**Significance**	**Spatial**	**Temporal**	**Probability**	**Rating**
Residual	Low	Study site	Long Term	Very Likely	**2.13 - Moderate**

5 CONCLUSION

In conclusion, the study site has four main soil types, dark soils (Inhoek), shallow soils (Milkwood), clay soils (Willowbrook) and disturbed soils (Witbank). All of these have a relatively low agricultural potential due to the shallow soils, the high clay content and the disturbed nature of the soils. Therefore the agricultural potential is limited to grazing.

The current operations at the Tutuka Power Station include an existing waste disposal site that is currently impacting on the soil resources. In addition soil is sourced from the adjacent land to serve as cover material at the current site.

The proposed development will impact on the soil resources and hence the agricultural potential during construction by compacting and moving soil. In addition construction vehicles can spill lubricants and hydrocarbons that can also find their way into the soil system. Due to the nature of a waste disposal site construction and the high likelihood of the impact occurring this impact is rated as a **Moderate** impact.

During the operational phase there is a potential for surface water to come into contact with the domestic waste on the site and to either form leachate or contaminated runoff that can impact on the soils. In addition the soil under the waste site will be covered with an ever increasing amount of waste. This unmitigated scenario was rated as a **Moderate** impact. With the successful implementation of the mitigation measures this impact can be reduced to a lower scoring **Moderate** impact.

During the closure phase the impact will be the same as assessed during the construction phase with earth-moving equipment operating on site. Once the closure is completed and the rehabilitation taken effect the impact will remain a **Moderate** impact as the soil will remain covered by the waste body and there is still a potential for leachate generation, although the likelihood is lower.

The assessment of the soils and agricultural potential at the proposed Tutuka general waste disposal site has found that the proposed development has the potential to impact on the soils and the agricultural potential. However these impacts can be mitigated by the successful implementation of the mitigation measures proposed in this report. Although the mitigation measures will not eliminate the impact, it will ensure that the impact is limited to the footprint of the waste disposal site and the cover material source areas. It is therefore recommended that the development be approved conditional to the implementation of the abovementioned mitigation measures.

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