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ENVIRONMENTAL

Environmental Impact Assessment for Sibanye Gold Limited's West Rand Tailings Retreatment Project

Soils, Land Capability, and Land Use Impact Assessment

Project Number:

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EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) is undertaking a series of specialist investigations on behalf of Sibanye Gold regarding the proposed development of the Sibanye Regional Tailings Storage Facility (RTSF) and its associated pipeline routes. The specialist surveys are currently underway.

The project, known as the West Rand Tailings Retreatment Project (WRTRP), envisages the progressive reclamation of the various existing Tailings Storage Facility's (TSFs) and their treatment through a new Central Processing Plant (CPP) that is to be constructed within the mining footprint. The by-product (tailings) will be deposited on a new RTSF near the Gold Fields' Doornpoort TSF. The construction will include all of the support infrastructure such as pump stations, bulk water storage facilities, thickeners, water and slurry pipelines, roads and power lines.

This report summarises the findings of the specialist soils investigation and details the impacts that could be expected to occur from the construction and operation of the proposed RTSF and the related infrastructure pipeline routes etc (Kloof, Driefontein, Cooke and Ezulwini Mining Right Areas). The project components include the following:

- The delineation of soil types, including the determination of physical and chemical properties of the dominant soils indicated in the project area;
- The Determination and rating of the existing land capability;
- The determination and mapping of the current land use; and
- A detailed soil report describing all of the above.

The conservation of South Africa's limited soil resources is essential. In the past misuse and poor management of the soil resource has led to the loss of these resources through erosion and destabilisation of the natural systems.

The management of land use and the soil as an important resource requires that an accurate understanding of the geomorphology of an area is known, and the soils are mapped and their attributes reported on. The aim of these studies is to provide an accurate record of the soil resources of an area. Land capability and land potential are then determined from these results in combination with the geomorphology of the site (climate, geology, topography etc.). The objective of determining the land capability/potential is to find and identify the most sustainable use of the soil resource without degrading the system.

Methodology

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land Type Data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types.

A more detailed study of the soils present within the project area was conducted during field visits in February 2015. The site was traversed by vehicle and on foot. A soil auger was used to characterise and classify the soil form and depth. The soil was hand augured to the first restricting layer or a depth of 1.2 m. Soil survey positions were recorded as waypoints using a handheld GPS. Soil forms (types of soil) found in the landscape were identified using the Taxonomic Soil Classification, a System developed for South African. Landscape features such as existing open trenches were also helpful in mapping the soil profile and classifying the soil form and depth.

Land capability is determined by a combination of soil, terrain and climate information/features (geomorphology). Capability is defined by the most intensive long term sustainable use of land under rain-fed conditions.

Findings

Kloof mining right area

The soils in the Kloof mining right area have been classified using the regional Land Type mapping and nomenclature, and the moderate to intensive cultivation land capabilities can be confirmed by the current land use. The land use was predominantly cultivation.

The RTSF site was dominated by the plinthic catena soils of the Avalon, Westleigh, and Dresden forms. These accounted for 77.5% of the RTSF site.

The RTSF site was dominated by the Class II (intensive cultivation) and Class III (moderate cultivation) land capabilities occupying 83.2% of the area.

The pipeline covers a variety of soils along its length, with soils of the Ba1 land type to the RTSF site with a Bb23 land type. The Ba1 land type is dominated by a mix of deep red Hutton soil on the midslopes and shallow rocky Mispah soils on the crest positions.

The Bb23 land type is dominated by midslope and footslope landscape positions. The midslope positions are dominated by the Longlands and Wasbank soil forms, and the footslopes are dominated by Valsrivier soils.

The pipeline falls within a Class III land capability (moderate Cultivation) according to the land type database (Land Type Survey Staff, 1972 - 2006).

The CPP falls within the Ba1 land type (mix of deep red Hutton's in the midslopes and shallow rocky Mispah's on the crest).

The CPP falls within a Class III land capability (moderate Cultivation).

Driefontein Mining Right Area

The pipeline route trends or traverses four different land types and three different land capability classes.

The pipeline section from the Driefontein 5 TSF to the Driefontein 3 TSF is underlain predominantly by soils of the Fb15 land type (Shallow rocky Soils, Mispah), which has a Class VI land capability (moderate grazing). It then crosses into the Ab7 land type (deep well drained red soils, Hutton), which has a Class II land capability (intensive cultivation) just before reaching the Driefontein 3 TSF site.

The pipelines sections from the Driefontein 3 TSF to the WBT/BWFS, and then to the K10 water supply are all within the Ab7 land type (deep well drained red soils, Hutton), which has a Class II land capability (intensive cultivation).

The pipeline sections from the WBT/BWFS site moving south towards the CPP, crosses three different land types and land capability classes. Starting on the Ab7 land type (deep well drained red soils, Hutton), which as a Class II land capability (intensive cultivation) at the WBT/BWFS. It then moves south crossing the Fb15 land type (Shallow rocky Soils, Mispah), which has a Class VI land capability (moderate grazing) into the Ba1 land type (mix of deep red Hutton's in the midslopes, and shallow rocky Mispah's on the crest), which has a Class III land capability (moderate Cultivation).

The pipeline section towards the Kloof processing plant falls within the Fb5 land type (Shallow rocky Soils, Mispah), which has a Class VI land capability (moderate grazing).

The Driefontein 5 TSF site is situated in the Fb15 land type. The Fb land type is dominated by shallow rocky soils, most likely the Mispah soil form. The Driefontein 5 TSF falls within the Class VI land capability (moderate grazing).

The Driefontein 3 TSF site falls within the Ab7 land type. The Ab land type is dominated by freely draining deep red soils, most likely to be the Hutton soil form. The Driefontein 3 TSF site falls within the Class II land capability (intensive cultivation).

Cooke Mining Right Area

The Cooke TSF site falls within the Ab7 land type. The Ab land type is dominated by freely draining deep red soils, most likely to be the Hutton soil form. The Cooke TSF site falls within the Class II land capability (intensive cultivation).

The Cooke 4 South TSF is situated in the Fb5 land type (Shallow rocky Soils, Mispah). The Cooke 4 South TSF is situated in the Class VI land capability (moderate grazing).

The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Fb5 land type (Shallow rocky Soils, Mispah) to the Ab7 land type (deep well drained red soils, Hutton). The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Class VI land capability (moderate grazing) to the Class II land capability (intensive cultivation).

Ezulwini Mining Right Area

The pipeline sections for the Ezulwini mining right area start at the CPP site, in the Ba1 land type (mix of deep red Hutton's in the midslopes and shallow rocky Mispah's on the crest) and move into the Fb5 land type (Shallow rocky Soils, Mispah) at the Cooke 4 South TSF site. The pipeline sections for the Ezulwini mining right area start at the CPP site, in the Class III land capability (moderate Cultivation) and move into the Class VI land capability (moderate grazing) at the Cooke 4 South TSF site.

Conclusion and Recommendation

The soils in the Kloof mining right area was dominated by the plinthic catena soils of the Avalon, Westleigh and Dresden soil forms. These soils have relatively high land capabilities and the land use matches these potentials at the RTSF, RWD, and AWTF sites are used for cultivation/grazing.

The Driefontein mining right area has significant portions which have a land capability class of II (intensive cultivation). However the pipelines will be constructed above ground and the reclamation of the TSF sites will improve the land capability and land use of the TSF sites if mitigation measures are taken.

The Cooke mining right area falls almost entirely in the Class II (intensive cultivation) land capability. However the pipelines will be constructed above ground and the reclamation of the TSF sites will improve the land capability and land use of the TSF site if mitigation measures are taken.

The Ezulwini mining right area falls within two land capability classes. A land capability of Class III (moderate cultivation) for the pipeline section from the CPP to the Cooke 4 South TSF and Class VI (moderate grazing) at the Cooke 4 South TSF site. The pipelines will be constructed above ground and the reclamation of the TSF site will improve the land capability and land use of the TSF sites if mitigation measures are taken.

The impacts associated with the pipelines are manageable and minor compared to the loss of land use and capability associated with the construction of the RTSF. The primary concern in this study is the loss of agricultural land (land for crop production). The generally disturbed nature of the project area renders the land capability conversion of the RTSF footprint from agricultural to mining the as the most significant impact when considering the loss of potential land use for agricultural purposes. Very little mitigation can be provided for the potential loss of this land, however this loss of land use, when considered with the overall benefit of the project is considered minor. In isolation the impact would be considered to be moderate, however the entire benefit of the project needs to be taken into consideration.

The Impacts associated with the RTSF site is moderate as a result of the RTSF site not being decommissioned. This will permanently change the land capability and land use negatively.

The following recommendations must be followed:

- A land contamination study to be conducted after the TSF sites have been reclaimed to assess the land contamination status;
- Soils to be stripped according to the soil stripping guidelines;
- Phytoremediation feasibility study to be undertaken at the reclaimed TSF sites after land contamination studies have been completed;
- The final end land use for the reclaimed TSF’s needs to be determined through a collaborative process and should be aligned with regional closure plans.

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1 Introduction

The conservation of South Africa's limited soil resources is essential. In the past misuse and poor management of the soil resource has led to the loss of these resources through erosion and destabilisation of the natural systems.

Soils can be seen as the foundation for ecological function. Without a healthy soil system for microbes to thrive in, the flora and fauna would be negatively impacted, which intern feeds the natural soil system with organics and nutrients.

To identify soils accurately, it is necessary to undertake a soil survey. The aim is to provide an accurate record of the soil resources of an area. Land capability and land potential is then determined from these results. The objective of determining the land capability/potential is to find and identify the most sustainable use of the soil resource without degrading the system.

Soil mapping is essential to determine the types of soils present, their depths, their land capability and land potential. These results will then be used to give practical recommendations on preserving and managing the soil resource.

1.1 Project background

There is a long history of gold and uranium mining in the broader West Rand area with an estimated 1.3 billion tonnes of surface tailings, containing in excess of 170 million pounds of uranium and 11 million ounces of gold. Sibanye Gold Limited (SGL) currently owns the majority of the tonnage and its gold and uranium content. SGL plans to ultimately exploit all these resources to develop a strong, long life and high yield surface business. Key to the successful execution of this development strategy is the West Rand Tailings Retreatment Project (WRTRP). The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The ultimate WRTRP involves the construction of a large-scale Central Processing Plant (CPP) for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases to eventually treat up to 4mt/month of tailings inclusive of current arisings. The resultant tailings will be deposited on a modern tailings storage facility (TSF) called the regional TSF (RTSF).

1.2 The ultimate project

Simplistically, SGL's surface historical TSF holdings in the West Rand can be divided into three blocks; the Northern, Southern and Western Blocks. Each of these blocks contains a number of historical TSFs. Each of the blocks will be reclaimed in a phased approach. Initially the Driefontein 3 TSF (Western Block) together with the Cooke TSF (Northern Block) will be reclaimed first. Following reclamation of Driefontein 3 TSF, Driefontein 5 TSF (Western Block) and Cooke 4 Dam south (C4S) (Southern Block) will be reclaimed.

- Western Block comprises: Driefontein 1, 2, 3, 4 and 5 TSF, and Libanon TSF. Once the Driefontein 3 and 5 TSFs have been depleted the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 and the Libanon TSF, will be processed through the CPP;
- Northern Block comprises: Cooke TSF, Venterspost North TSF, Venterspost South TSF and Millsite Complex (38, 39 and 40/41 and Valley). Venterspost North and South TSFs and Millsite Complex (38, 39 and 40/41 and Valley) will be processed with the concurrent construction of Module 2 float and gold plants; and
- Southern Block comprises: Kloof No.1 TSF, Kloof No.2 TSF, South Shaft TSF (future), Twin Shaft TSF (future), Leeudoorn TSF and C4S TSF. Following completion of the Module 3 float and gold plants, Kloof 1 and 2 TSFs, South Shaft TSF (future), Twin Shaft TSF (future) and Leeudoorn TSF will be reclaimed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 Mt/m (1Mt/m from Driefontein 3 (followed sequentially by Driefontein 5 and C4S) and 0.5 Mt/m from Cooke TSF). Reclamation and processing capacity will ultimately ramp up to 4 Mt/m over an anticipated period of 8 years. At the 4Mt/m tailings retreatment capacity, each of the blocks will be reclaimed and processed simultaneously.

The tailings material will be centrally treated in a CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulphuric acid, an important reagent required for uranium leaching.

To minimise the upfront capital required for the WRTRP, only essential infrastructure will be developed during initial implementation. Use of existing and available infrastructure may be used to process gold and uranium until the volumetric increase in tonnage necessitates the need to expand the CPP.

The authorisation, construction and operation of a new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original West Wits Project (WWP) and Cooke Uranium Project (CUP). The “deposition area” on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF if proved viable will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

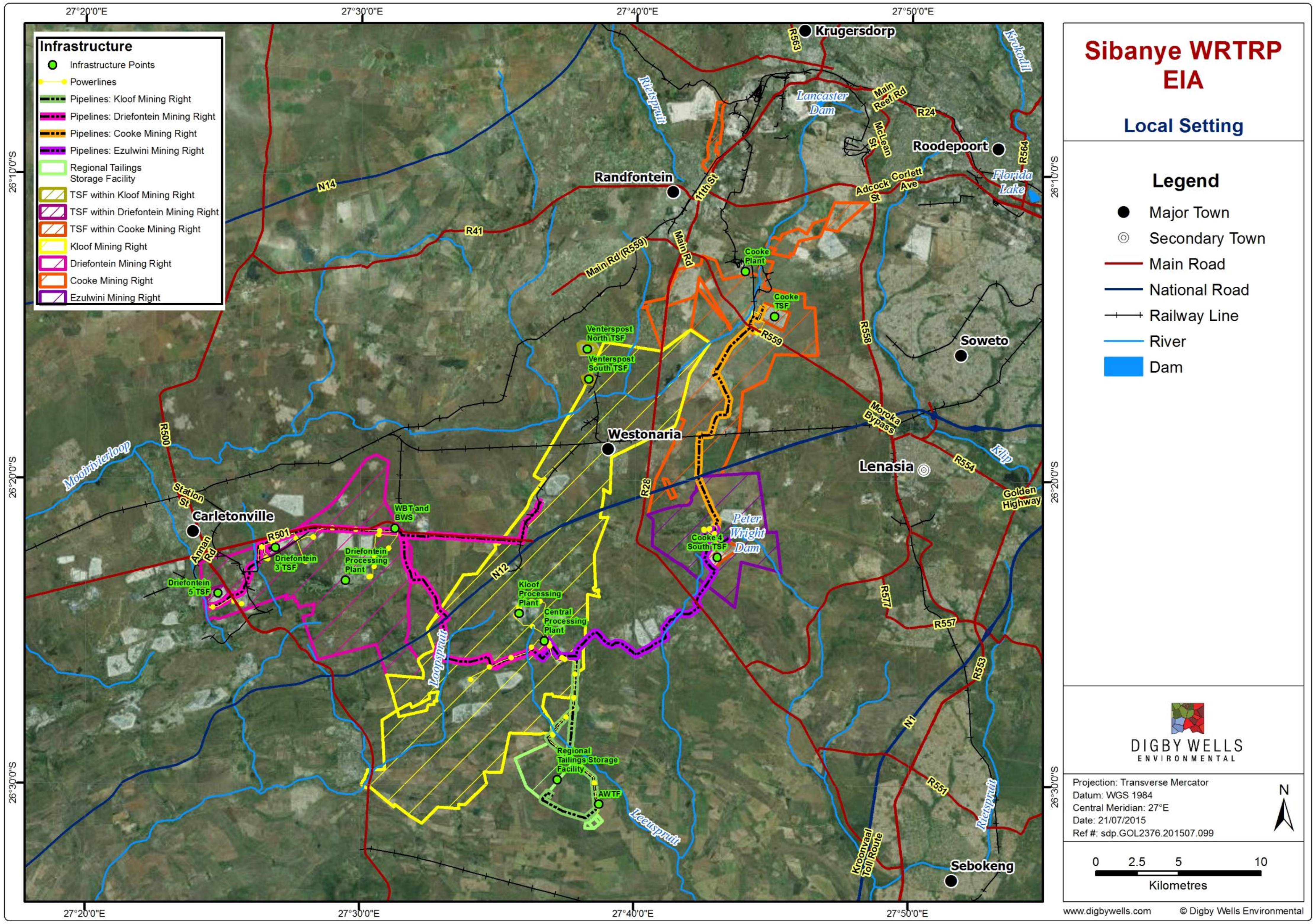
Note: Amendments to various MWPs and EMPs will be applied for in due course pending the inclusion of additional TSFs as the WRTRP grows to process 4 Mt/m. The RTSF will be assessed for the complete footprint to ensure that the site is suitable for all future deposition requirements.

1.3 Initial implementation

Due to capital constraints in developing a project of this magnitude, it needs to be implemented over time. The initial investment and development will be focused on those assets that will put the project in a position to partially fund the remaining development.

This entails the design and construction of the CPP (gold module, floatation plant, uranium plant, acid plant and a roaster), to retreat up to 1.5 Mt/m from the Driefontein 3 and 5 TSFs, C4S TSF and the Cooke TSF. Driefontein 3, 5 and C4S TSFs will be mined sequentially over 11 years, whilst the Cooke TSF will be mined concurrent to these for a period of 16 years. The resultant tailings will be deposited onto the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50k tonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.



Plan 1: Local Setting

1.4 Terms of reference

Digby Wells Environmental is undertaking a series of investigations with regards to SGL's proposed West Rand Tailings Retreatment Project (WRTRP).

This report summarises the soils that occupy the proposed RTSF, associated pipelines (slurry, tailings and associated infrastructure with the pipelines) as well as the infrastructures associated with the entire project area. The relevant soil study components include the following:

- The delineation of soil types in the project area;
- Determining the existing land capability;
- Determine current land use;
- A detailed soil report describing all the above; and
- An impact assessment report.

1.5 Project Activity List and Impacts Description

The impact assessment is aimed at identifying impacts related to the various activities listed in Table 1-1 from a soils perspective. The activities associated with soil impacts are highlighted below and discussed within the impact section below.

The following primary activities of the WRTRP need to be assessed:

Table 1-1: Primary activities of the WRTRP

Category	Activity
Infrastructure	Pipeline Routes (water, slurry and tailings).
	West, North and South Block Thickeners (WBT, NBT and SBT) and West, North and South Bulk Water Storage (BWFS) complexes.
	Cooke thickener.
	Collection sumps and pump stations at the Driefontein TSF 3 and 5, Ezulwini South TSF and Cooke TSF.
	CPP incorporating Module 1 float and gold plants and No1 uranium, roaster and acid plants) and RTSF.
	RTSF Return Water Dams (RWD) and the Advanced Water Treatment Facility (AWTF) complex.
Processes	Abstraction of water: K10 shaft, Cooke 1 and 2 Peter Wright Dam
	Disposal of the residue from the AWTF.
	Hydraulic reclamation of the TSFs (which include temporary storage of the slurry in a sump).
	Gold, uranium and sulfur extraction at the CPP (tailings to RTSF) and possible uranium extraction at Ezulwini (tailings to Ezulwini North Dump).

Category	Activity
	Water distribution at the AWTF for discharge or sale.
Pumping in Western Block	Pumping water from K10 to the BWFSF located next to the WBT.
	Pumping water from the BWFSF to the Driefontein TSFs that will be reclaimed.
	Pumping slurry from the TSF sump to the WBT (for Driefontein TSF 3 and 5).
	Pumping the thickened slurry from the WBT to the CPP (2 pipeline route options).
Pumping in Southern Block	Possible pumping 50 kt/m of uranium and sulfur rich slurry from the CPP to Ezulwini for extraction of uranium.
	Pumping of up to 1.5 Mt/m of tailings to the RTSF.
	Pumping water from the RTSF return water dams to the AWTF.
	Discharging treated water to the Leeuspruit.
	Pumping of 1 Mt/m of tailings from the C4S to the SBT.
	Pumping from the SBT to the CPP.
	Pumping residue from the AWTF to the RTSF.
Pumping in Northern Block	Pumping 500 kt/m of tailings from the Cooke Dump to the Cooke thickener.
	Pumping from the Cooke thickener to the CPP.
Electricity supply	Power supply from West Drie 6 substation to Driefontein TSF 3.
	Power supply from West Drie Gold substation to Driefontein TSF 5.
	Power supply from East Drie Shaft substation to WBT and BWFSF.
	Power supply from Kloof 1 substation to the CPP.
	Power supply from Kloof 4 substation to the RTSF and AWTF.
	Power supply from the Cooke substation to the Cooke thickener.
	Power supply from the Cooke Plant to the Cooke TSF
	Power supply from Ezulwini plant to the C4S TSF

2 Details of the Specialist

Wayne Jackson is a Soils Scientist & Hydrologist, and has been employed at Digby Wells for approximately 3 years. Prior to his employment at Digby Wells Wayne worked as a precision farming consultant and as a civil engineering technical assistant. Wayne completed a B.Sc. degree (Soil Science and Hydrology) from the University of Kwa-Zulu Natal and has 7 years of consulting experience.

Wayne specialises in soil surveying using the South African taxonomic classification system, Soil sample analysis, Fertilizer recommendations, rehabilitation strategies, land contamination assessments, water resources analyses, drainage designs, water reticulation systems (Bulk & infield), crop water demand assessments, Compliance Monitoring and Integrated Waste Management Plans. Wayne has gained experience working throughout Africa specifically Liberia, Tanzania, Cameroon, and DRC.

3 Aims and Objectives

This reports aims to provide an accurate record of the soil resources of the study area through provision of the following data:

- The land type data describing the soil types expected in the area;
- Surveyed soils found on site;
- The land capability which is derived from the soil survey results;
- The land use as noted in the field;
- The potential impacts associated with this project; and
- Management, mitigation and recommendations for the project.

In addition this report will also provide a desktop review of the ultimate project to identify any potentially fatal flaws associated with future aspects of the project, as they are currently understood.

4 Methodology

4.1 Desktop Review

The Geluksdal study assessed the soil, land capability and land use along the proposed pipelines leading towards the proposed area 35 TSF. This information is still valid.

The Gold Fields Tailings storage facility EIA phase Soil, land use & land capability survey report: by Viljoen and Associates, 2009 covers the proposed B2/B3 TSF site. The information is still valid and useful because soil types and properties only change over long time periods. However, the sampling methodology used is not a standard soil survey technique and the findings need to be confirmed through a swift reconnaissance survey.

As part of the desktop assessment, baseline soil information was obtained using published South African Land Type Data. Land type data for the site was obtained from the Institute for Soil Climate and Water (ISCW) of the Agricultural Research Council (ARC) (Land Type Survey Staff 1972 - 2006). The land type data is presented at a scale of 1:250 000 and comprises of the division of land into land types.

The above information was used in the previous studies of the project area and is sufficient as the pipeline routes have a limited impact due to being constructed above ground. The remaining infrastructure will have a small footprint and as such the impact is limited.

This is used in the baseline section as well as in the pipeline description section.

4.2 Soil Sampling and Classification

A study of the soils present within the project area was conducted during field visit on the 3rd February 2015 to the 6th February 2015. The site was traversed by vehicle and on foot. A soil auger was used to determine the soil form and depth. The soil was hand augured to the first restricting layer or 1.2 m. Soil survey positions were recorded as waypoints using a handheld Samsung tablet. Soil forms (types of soil) found in the landscape was identified using the South African soil classification system (Soil Classification Working Group, 1991). Landscape features such as existing open trenches were also helpful in determining soil types and depth.

4.3 Land Capability

Land capability is determined by a combination of soil, terrain and climate features. Land capability is defined by the most intensive long term sustainable use of land under rain-fed conditions. At the same time an indication is given about the permanent limitations associated with the different land use classes (Schoeman, et al., 2000) (Smith, 2006).

Land capability is divided into eight classes and these may be divided into three capability groups. Table 4-1 shows how the land classes and groups are arranged in order of decreasing capability and ranges of use. The risk of use increases from class I to class VIII (Smith, 2006).

Table 4-1: Land capability class and intensity of use (Smith, 2006)

Land Capability Class	Increased Intensity of Use									Land Capability Groups
I	W	F	LG	MG	IG	LC	MC	IC	VIC	**Arable Land**
II	W	F	LG	MG	IG	LC	MC	IC		
III	W	F	LG	MG	IG	LC	MC			
IV	W	F	LG	MG	IG	LC				
V	W		LG	MG						**Grazing Land**
VI	W	F	LG	MG						
VII	W	F	LG							
VIII	W									**Wildlife**

W - Wildlife **MG - Moderate Grazing** **MC - Moderate Cultivation**
F- Forestry **IG - Intensive Grazing** **IC - Intensive Cultivation**
LG - Light Grazing **LC - Light Cultivation** **VIC - Very Intensive Cultivation**

4.3.1 Land capability flow chart

The land capability flow chart shown in Figure 4-1 was chosen as the rainfall in the area is between 620mm and 900mm.The criteria used to classify the land capability is based on the following criteria;

- Slope (%);
- Topsoil Texture (clay %);
- Effective rooting depth; and

- Permeability class topsoil.

Once a land capability is derived from this the capability class is adjusted using the soil characteristics discussed in the sections to follow.

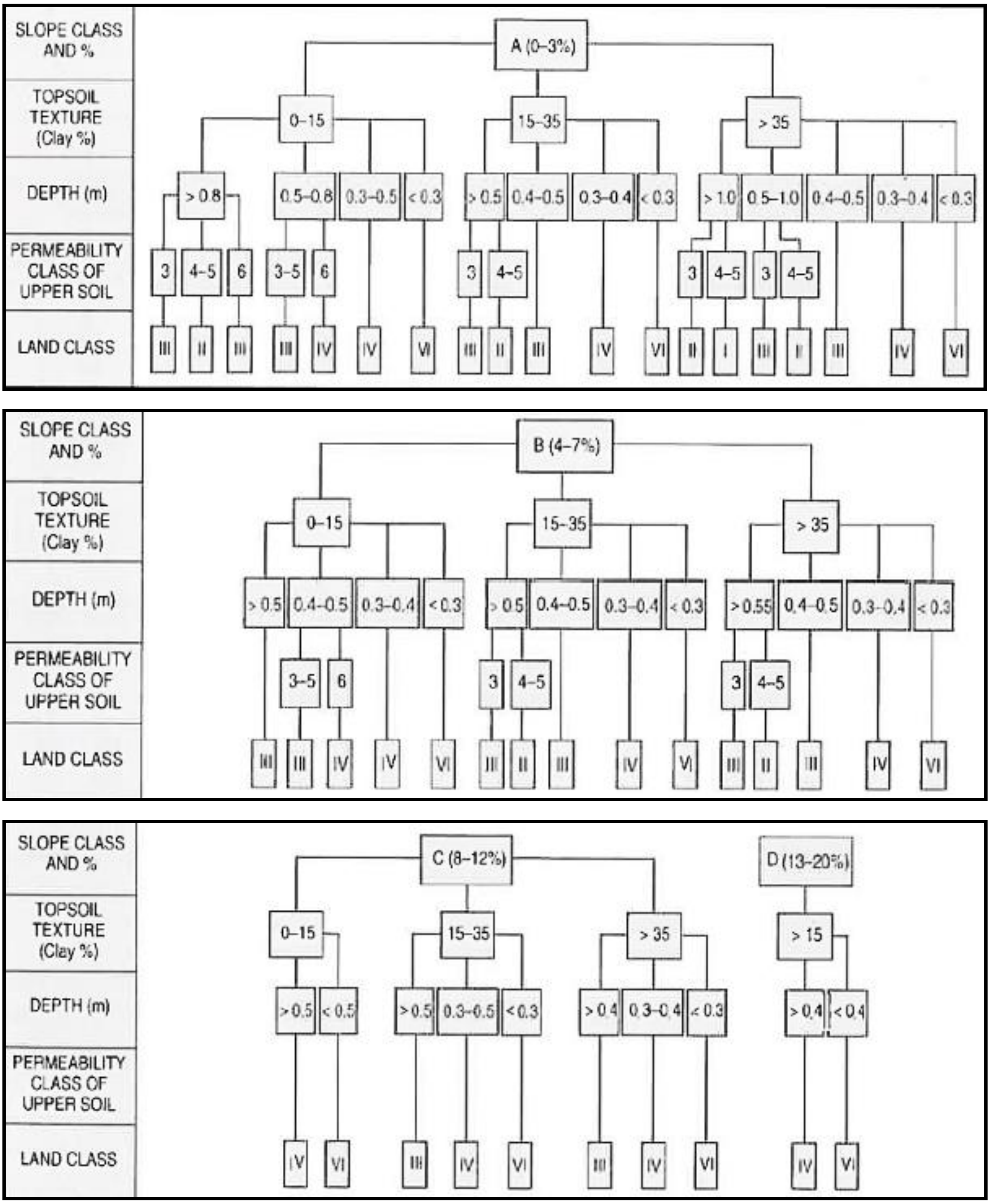


Figure 4-1: Land capability flow chart for areas with rainfall of between 620mm and 900mm (Smith, 2006)

4.3.2 Soil characteristics to determine and adjust land capability

The tables below are to be used to adjust the land capability that was derived from the flow chart (Figure 4-1) above.

4.3.2.1 Soil permeability

Soil permeability is calculated using an infield test technique, by applying a couple of drops of water to the soil surface and recording the number of seconds it takes to be absorbed into the soil. Table 4-2 shows the classification system. The permeability class is then used to adjust the value from the flow chart as per Table 4-3

Table 4-2: The soil permeability classes (Smith, 2006).

Class	Rate (seconds)	Description	Texture
7	<1	Extremely Rapid	Gravel and coarse sand, 0 to 10% clay
6	1 to 3	Rapid	5 to 10% clay
5	4 to 8	Good	> 10% clay
4	9 to 20	Slightly restricted	
3	21 to 40	Restricted	Strong structure, grey colour, mottled, >35% clay
2	41 to 60	Severely restricted	Strong structure, weathered rock, >35% clay
1	>60	Impermeable	Rock and very strong structure, >35% clay

Table 4-3: The soil permeability adjustment factors (Smith, 2006).

Permeability Class	Adjustment to be made
1 to 2	If in subsoil, rooting is likely to be limited. Use the permeability of topsoil in the flow chart. If this is the permeability of the topsoil, then the topsoil is probably dark structured clay, in which case a permeability class 3 can be used in the flow chart.
3 to 5	Classify as indicated in the flow chart
6	Topsoil should have < 15% clay - use the flow chart
7	Downgrade land classes I -III to land class IV

4.3.2.2 Soil wetness factors

Soil wetness is divided into the five categories shown in Table 4-4; these describe varying degrees of wetness at various depths. Wetness affects plant production when the roots are wet for extended periods of time near the surface, and as a result this will downgrade a soils land capability based on the below definitions.

Table 4-4: The soil wetness adjustment factors (Smith, 2006).

Class	Definition	Land Class
W0	Well drained - no grey colour with mottling within 1,5m of the surface. Grey colour without mottling is acceptable.	No Change
W1	There is no evidence of wetness within the top 0,5m. Occasionally wet - grey colours and mottling begin between 0,5m and 1,5m from the surface	Downgrade Class I to Class II, otherwise no change
W2	Temporarily wet during the wet season. No mottling in the top 0,2m but grey colours and mottling occur between 0,2m and 0,5m from surface. Included are: soils with G horizons (highly gleyed and often clayey) at depths of more than 0,5m; soils with E horizon over G horizon where the depth to the G horizon is more than 0,5m.	Downgrade to Class IV
W3	Periodically wet. Mottling occurs in top 0,2m, and includes soils with a heavily gleyed or G horizon at a depth of less than 0,5m. Found in bottomlands.	Downgrade to Class V (a)
W4	Semi-permanently/permanently wet at or above soil surface throughout the wet season. Usually an organic topsoil or an undrained vlei. Found in bottomlands.	Downgrade to Class V (b)

4.3.2.3 Soil rockiness factors

Soil rockiness affects the management of a soil in a negative way. And the soils land capability will be reduced as described in Table 4-5 accordingly.

Table 4-5 : The soil rockiness adjustment factors (Smith, 2006).

Class	Definition	Land Class
R 0	No rockiness	No change
R 1	2 to 10% rockiness	Downgrade class I to class II, otherwise no change
R 2	10 to 20% rockiness	Downgrade class II to class III, otherwise no change
R 3	20 to 30% rockiness	Downgrade class I - III to class IV
R 4	>30% rockiness	Downgrade classes I, II, III, and IV to class VI

4.3.2.4 Surface crusting

Surface crusting has an effect on initial infiltration and could cause erosion to some degree. Table 4-6 shows how to adjust the flow chart results for land capability accordingly.

Table 4-6: The soil crusting adjustment factors (Smith, 2006).

Class	Definition	Land Class
t0	No surface crusting when dry	No Change
t1	Slight surface crusting when dry	Downgrade class I to II, no Change
t2	Unfavourable surface crusting when dry	Downgrade class I to II, no Change

4.4 Current Land Use

Land use was identified using aerial imagery and then ground-truthed while out in the field.

The land use categories are split into:

- Cultivated;
- Natural;
- Mines;
- Urban Built-Up; and
- Waterbodies.

5 Assumptions and Limitations

The following assumptions were made:

- That the pipelines will be constructed above ground;
- The pipelines and associated infrastructure have been assessed at a desktop level using existing studies of the area; and
- The historical TSF sites will be completely reclaimed and their footprints rehabilitated.

The limitations identified for this project include:

- Although the geotechnical test pit holes were used in conjunction with the soil auger holes, the two specialities essentially classify the upper soils differently; and
- A field survey was conducted on the RTSF site only and the land type data was used for the pipeline routes and associated infrastructure.

6 Screening Assessment

The project area has been studied in detail and the following reports were reviewed and incorporated were possible:

- Golder Associates Africa Pty (Ltd). (2010). *Environmental Impact Assessment (EIA) for the Proposed Uranium Plant and Cooke Dump Re-processing Infrastructure, Soils and Land Capability Assessment;*

- Viljoen & Associates. (2009). *Goldfields Tailings Storage Facility EIA Phase Soil, Land Use & Land Capability Survey.* EcoPartners;
- Digby Wells Environmental. (2012). *Intergrated Water Use License Application & Intergrated Water and Waste Management Plan - Geluksdal Tailings Storage and Pipeline Infrastructure Project; and*
- SLR Global Environmental Solutions. (2015). *Sibanya Gold - West Rand Retreatment Project (WRTRP).*

The SLR report detailed soil properties from a geotechnical point of view, which does not address the land capability and land use, however the test pit photos were analysed and compared to soil field survey findings to confirm soil boundaries.

All the above mentioned reports provided valuable information that assisted with the compilation of this report. It was determined that the information contained in the above reports was reviewed and compared to existing Land Type data and as a result this information was sufficient enough to utilise for the proposed infrastructure areas for the Driefontein/Cooke/Ezulwini mining right areas, supplemented with additional information gathered from other specialist reports and field assessments conducted by Digby Wells.

The screening survey showed that dominant soil forms over the above mentioned areas are:

- Red well-drained soils on foot slopes of Land Type Ab;
- Shallow rocky soils on the steep escarpment of Land Type Fb;
- Red soils and rocky soils on crests of Land Type Ba and; and
- Various hydromorphic and shallow soils on rock in midslopes and foot slopes of Land Type Bb.

The primary concern in this study is the loss of agricultural land (land for crop production). The generally disturbed nature of the project area renders the land capability conversion of the RTSF footprint from agricultural to mining the as the most significant impact when considering the loss of potential land use for agricultural purposes. Very little mitigation can be provided for the potential loss of this land, however this loss of land use, when considered with the overall benefit of the project is considered minor. In isolation the impact would be considered to be moderate, however the entire benefit of the project needs to be taken into consideration.

7 Baseline Environment

The land type data gathered during the scoping phase suggested the following dominant soils:

- Red well-drained soils on foot slopes of Land Type Ab.
- Shallow rocky soils on the steep escarpment of Land Type Fb.
- Red soils and rocky soils on crests of Land Type Ba and,

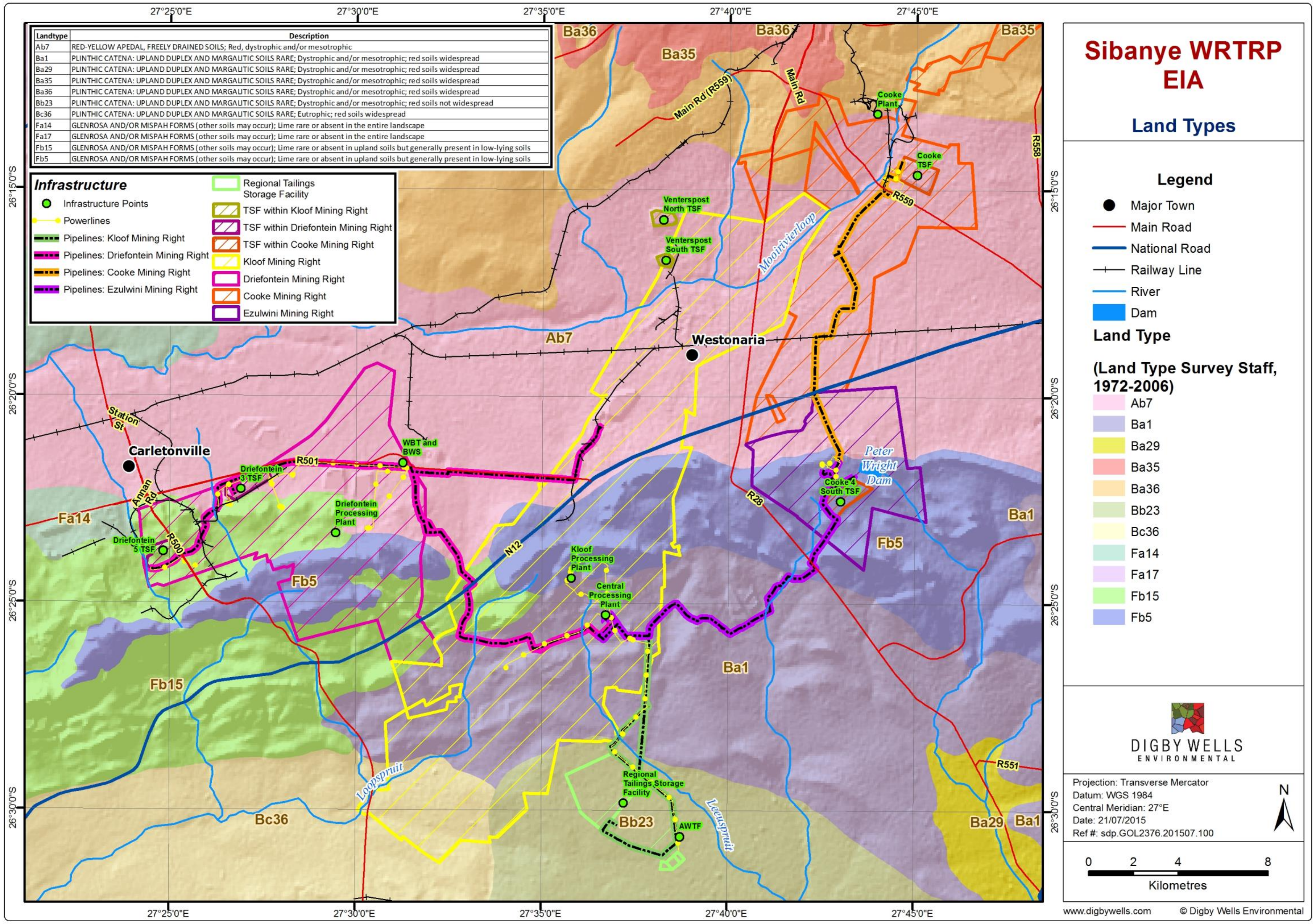
- Various hydromorphic and shallow soils on rock in midslopes and foot slopes of Land Type Bb.

7.1 Land Type Data

The soils found in the project area are represented by four possible land types as summarised in Table 7-1 and shown in Plan 2.

Table 7-1: Dominant soil types and slopes occurring within the project area

Dominant Land Type	Description	Dominant soil types	Dominant Land Capability	Potential occurrence % per land type
Ab	Land Type Ab is dominated by the foot slope landscape position (82%). Red well drained soils are common in this landscape position.	Red well drained soils for example Hutton soils.	II	90
Fb	Land Type FB is dominated by midslope (33%) and footslope (42%) positions but also contains scarp (5%) landscape positions due to the presence of rocky outcrops.	Shallow stony soils and rocks are common in this Land Type.	VI	59
Ba	Land Type Ba is dominated by crest (30%) and midslope (55%) landscape positions. The crest positions are dominated by red soils but also contain a fair amount of rock outcrops.	Deep red and shallow stony soils for example Hutton and Mispah soils respectively.	III	47
Bb	Land Type Bb is dominated by midslope (38%) and footslope positions (42%).	This Land Type is characterised by mixed soils such as shallow Mispah soils, wet soil such as Longlands and Wasbank soils as well as heavy clay soils such as Valsrivier and Sterkspruit soils.	III	59



Plan 2: The land type map for the WRTRP project area (Land Type Survey Staff, 1972 - 2006)

7.2 Field Survey Findings

The RTSF was assessed during the field visit with the pipelines and other infrastructure being assessed from a desktop level. The findings are split into the four mining right areas namely:

- The Kloof mining right area which includes the following infrastructure;
  - Pipeline route from the Central Processing Plant (CPP) to the RTSF;
  - CPP; and
  - Regional Tailings Storage Facility (RTSF).
- The Driefontein mining right area which includes the following infrastructure;
  - Pipeline route from the K10 water supply to WBT and BWFSF;
  - Driefontein 3 TSF;
  - Driefontein 5 Tailings Storage Facility (TSF);
  - Pipeline route from Driefontein 3 and 5 to West Block Thickener (WBT) and Bulk Water Storage (BWFS);
  - Pipeline route from WBT and BWFS to CPP.
- The Cooke mining right area which includes the following infrastructure;
  - Cooke TSF;
  - Cooke 4 South TSF; and
  - Pipeline route from Cooke TSF and Cooke 4 South TSF to the CPP.
- The Ezulwini mining right area which includes the following infrastructure;
  - Pipeline route from CPP to the Ezulwini processing plant.

The WRTRP project area has many soil forms across all four mining right areas. For the overall project area the Land Type data was utilised to get an indication of the overall soil forms that could be found. Further to this the fieldwork that was conducted concentrated on the footprint of the RTSP facility. The soil forms for the entire project area are presented below, with further information regarding each specific mining right area given.

7.2.1 Soils Found in the Project Area

General descriptions of the soils classified/found during the site assessment (infield soil survey) and those that have been described in terms of the Land Type Mapping (desktop study) are described below.

7.2.1.1 Dresden Soil Form

7.2.1.1.1 Description

The Dresden soil form consists of Orthic A topsoil over a Hard Plinthic B horizon as shown in Figure 7-1. Iron and manganese oxides within this layer have segregated and cemented irreversibly to a hard mass due to repeated periods of saturation in the presence of oxygen.

7.2.1.1.2 Behaviour

The hard plinthic Horizon acts as an impeding layer that restricts water movement and root penetration.

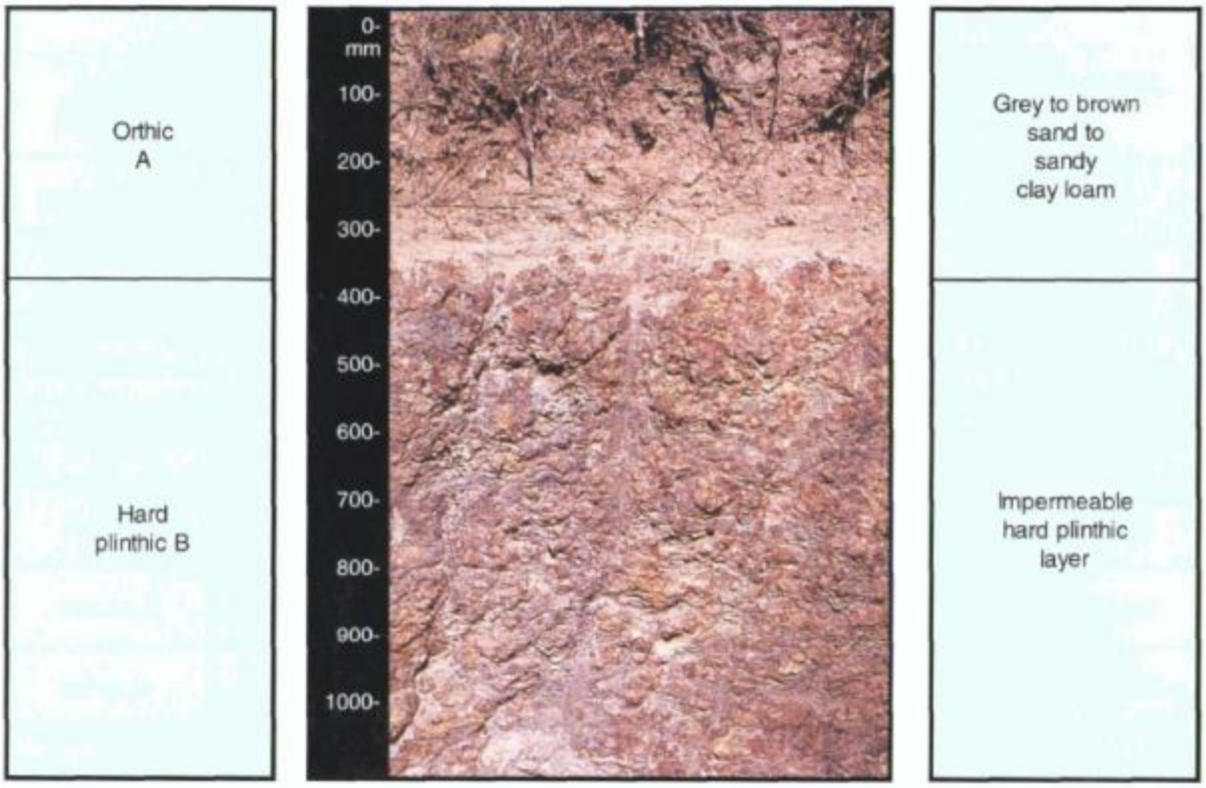


Figure 7-1: Shows a typical cross section the Dresden soil form (SASA, 1999).

7.2.1.2 Avalon Soil Form

7.2.1.2.1 Description

The Avalon Soil form depicted in Figure 1-2 consists of an Orthic A topsoil, on a Yellow-Brown Apedal B horizon, over a Soft Plinthic horizon.

7.2.1.2.2 Behaviour

Avalon soils are freely draining and chemically active. Manganese and iron oxides accumulate under conditions of a fluctuating water table forming localised mottles or soft iron concretions in the soft plinthic horizon.

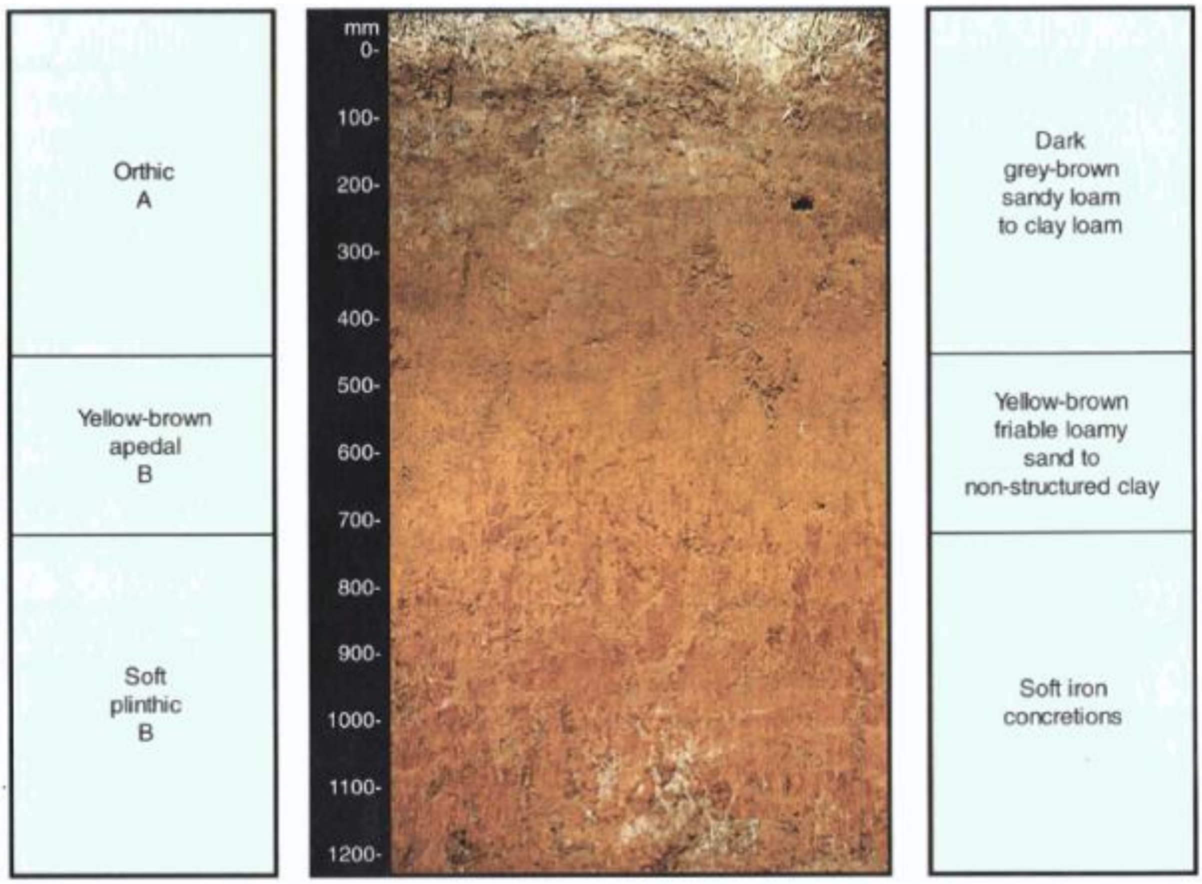


Figure 1-2: Shows a typical cross section the Avalon soil form (SASA, 1999).

7.2.1.3 Clovelly Soil Form

7.2.1.3.1 Description

The Clovelly soil form consists of an Orthic A topsoil, on a Yellow-Brown Apedal B horizon, underlain by unspecified material as shown in Figure 1-3.

7.2.1.3.2 Behaviour

These soils are freely draining and as a result, can be slightly acidic due to the low Cation Exchange Capacity (CEC).

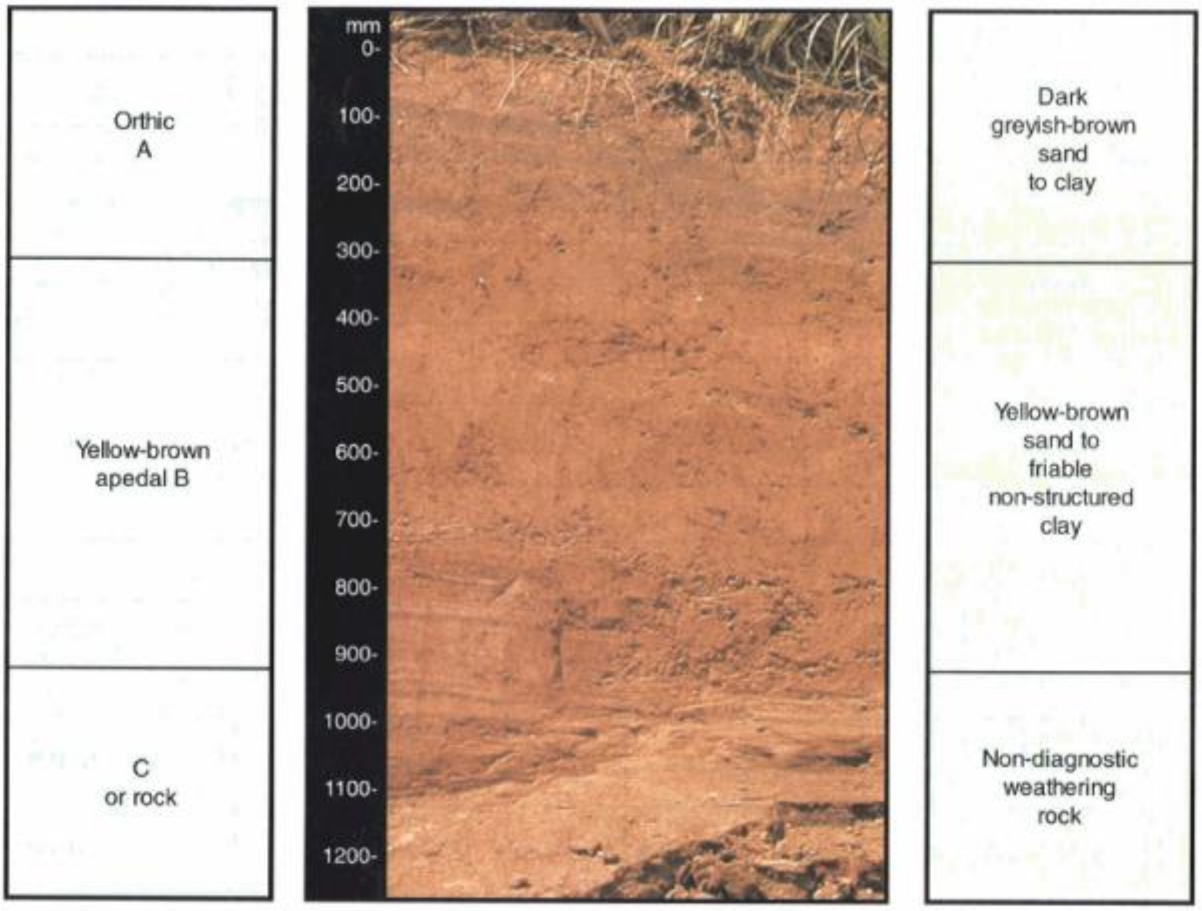


Figure 1-3: Shows a typical cross section the Clovelly soil form (SASA, 1999).

7.2.1.4 Hutton

7.2.1.4.1 Description

The Hutton soil form consists of an Orthic A horizon over a red apedal B horizon on an unspecified C horizon as shown in Figure 1-4.

7.2.1.4.2 Behaviour

The Hutton soil form is very well drained and is often a deep soil. Theses soils have a low Cation Exchange Capacity (CEC) due to the low clay content.

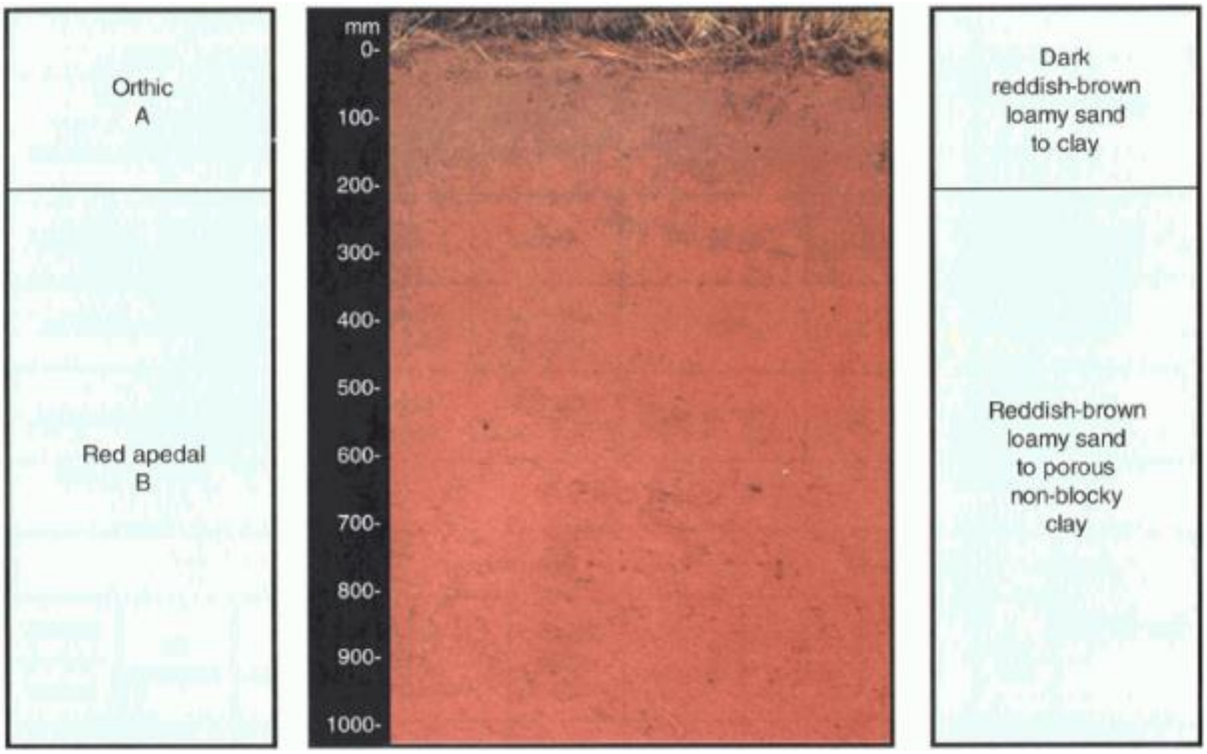


Figure 1-4: Shows a typical cross section the Hutton soil form (SASA, 1999).

7.2.1.5 Arcadia Soil Form

7.2.1.5.1 Description

The Arcadia soil form consists of a Vertic A horizons over an unspecified horizon, which is either due to bedrock or not being able to auger deeper than 1.2m as shown in Figure 1-5. They are more commonly known as “Turf soils” or “Black cotton soils”. They have a high clay percentage (> 55% clay) and have shrink swell properties.

7.2.1.5.2 Behaviour

Arcadia soils are extremely physically active. They shrink when dry and swell when wet (Fey, et al. 2010). The soil moves objects to the surface known as heave and can exceed 100 mm, this upward movement can lift buried pipes and poles to the surface. With the start of the rainy season, Arcadia soils are dry and cracked and water infiltration is high bypassing the soil body and potentially recharging the groundwater or downslope soils. When it rains, the soil swells and the cracks close and infiltration rate slows (Fey, et al. 2010). Arcadias have typically inverted profiles and lack horizons due to the random mixing when wet, therefore are not sensitive to disturbance (Soil Classification Working Group 1991).

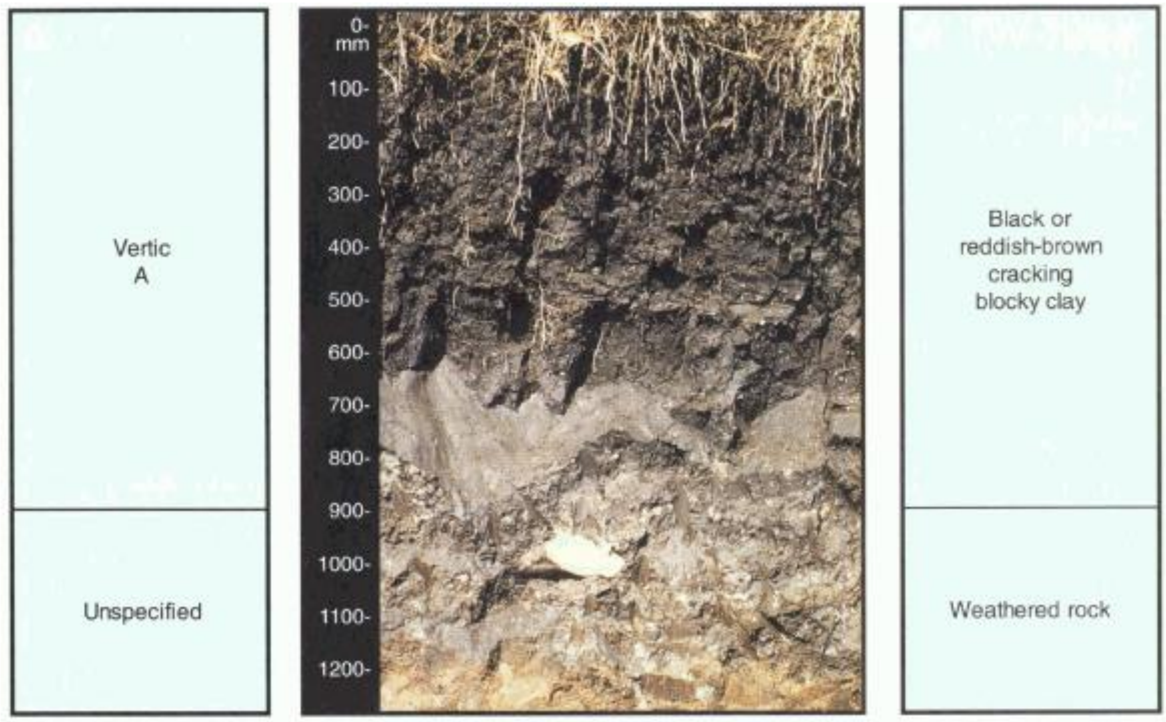


Figure 1-5: Shows a typical cross section the Arcadia soil form (SASA, 1999).

7.2.1.6 Oakleaf

7.2.1.6.1 Description

The Oakleaf soil form is classified as an Orthic A horizon, over a Neocutanic B horizon, over an unspecified horizon as shown in Figure 1-6. These soils are similar to the Clovelly and Hutton soil forms, but younger in the development phase as the clay is variegated in the soil matrix and not uniformly distributed.

7.2.1.6.2 Behaviour

These soils are similar to the Clovelly and Hutton soil forms, but younger in the development phase as the clay is variegated in the soil matrix and not uniformly distributed.

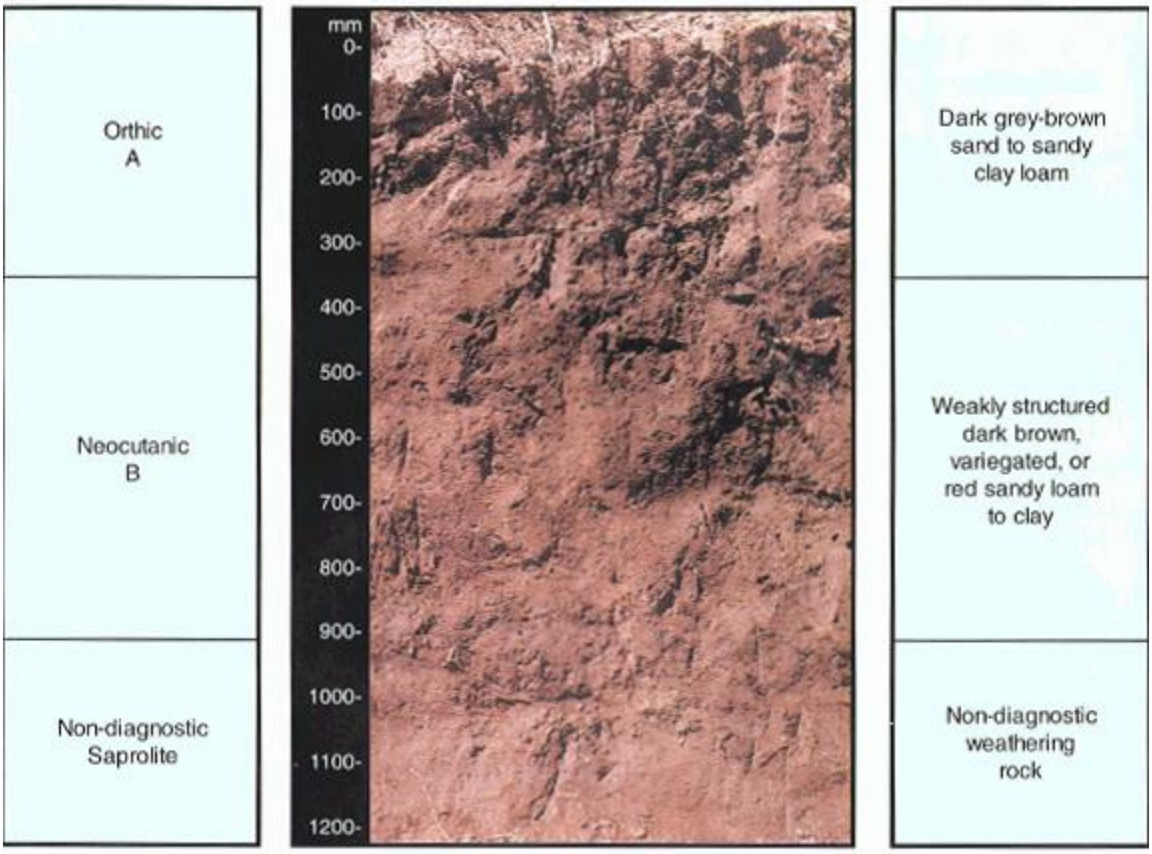


Figure 1-6: Shows a typical cross section the Oakleaf soil form (SASA, 1999).

7.2.1.7 Tukulu

7.2.1.7.1 Description

The Tukulu soil form is classified as an Orthic A horizon, over a Neocutanic B horizon, over an unspecified horizon with signs of wetness as shown in Figure 1-7. These soils are similar to the Oakleaf but with signs of wetness in the C horizon.

7.2.1.7.2 Behaviour

These soils are generally freely drained in the neocutanic B horizon, but the C horizon is restrictive and shows signs of wetness.

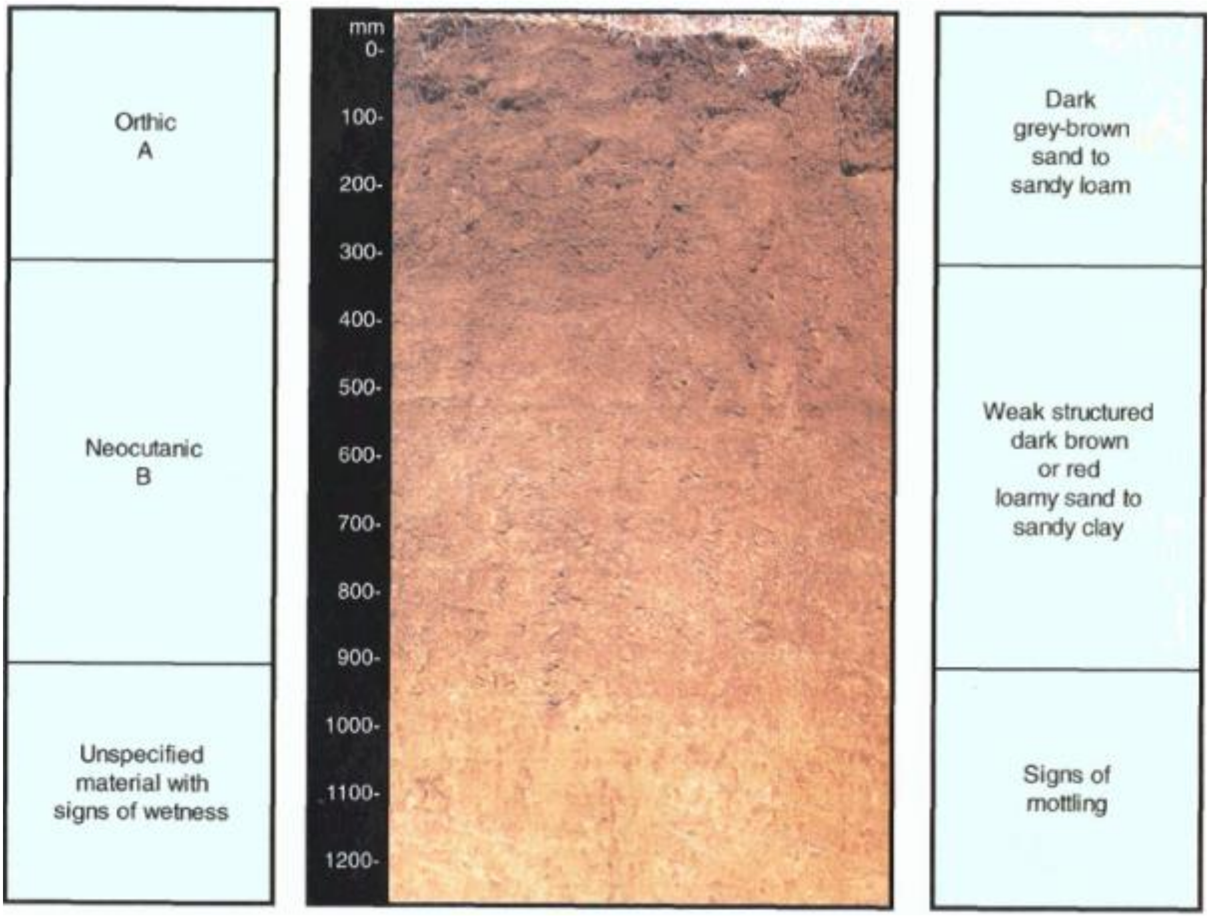


Figure 1-7: Shows a typical cross section the Tukulu soil form (SASA, 1999).

7.2.1.8 Westleigh

7.2.1.8.1 Description

The Westleigh soil form consists of an Orthic A horizon over a Soft Plinthic B horizon as shown in Figure 1-8. These soils are generally fairly shallow with many iron/manganese concretions in the plinthic horizon.

7.2.1.8.2 Behaviour

The Westleigh soil form is formed as a result of periods of wetting and drying in plinthic B horizon.

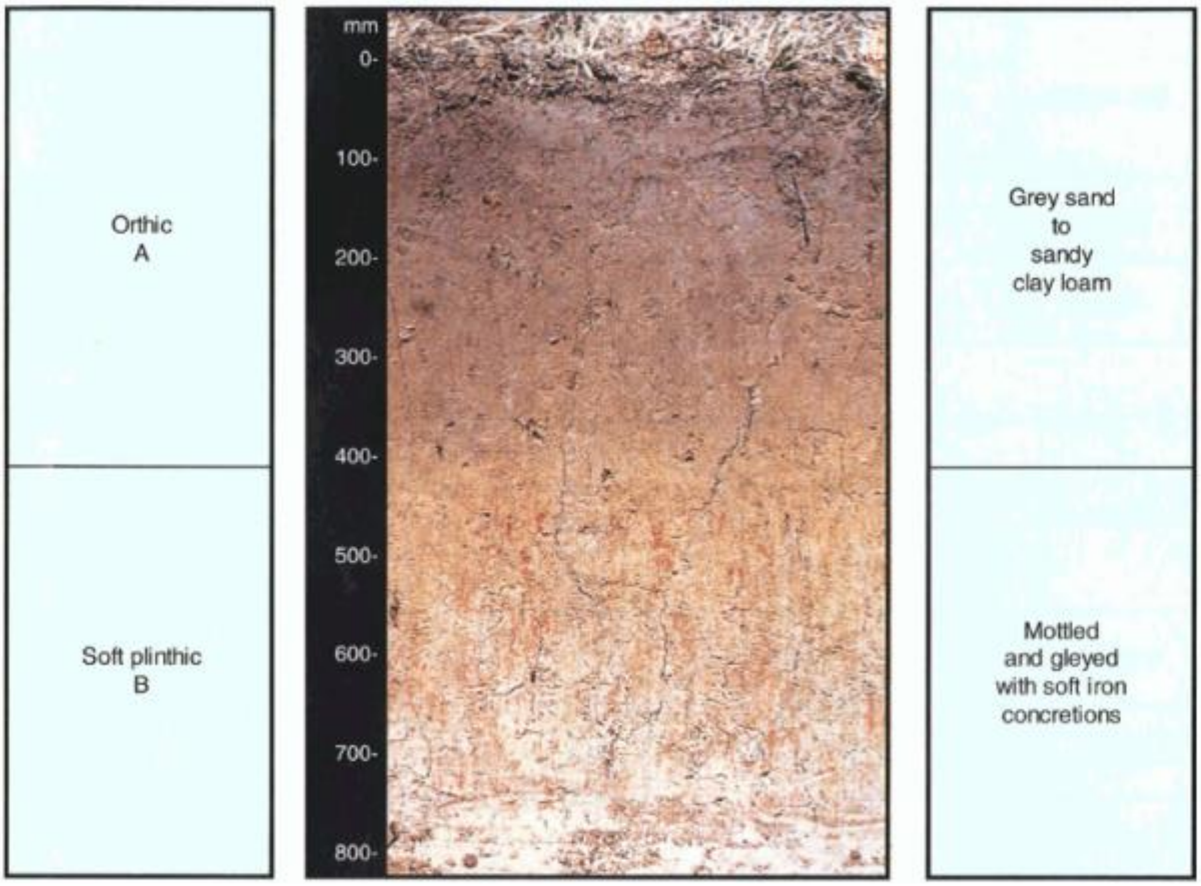


Figure 1-8: Shows a typical cross section the Westleigh soil form (SASA, 1999).

7.2.1.9 Mispah

7.2.1.9.1 Description

The Mispah soil form consists of an Orthic A horizon over hard rock as shown in Figure 1-9. These soils are fairly shallow.

7.2.1.9.2 Behaviour

These soils are shallow and are often found on steep slopes or on crest positions. They have a high erosion hazard and a shallow rooting depth.

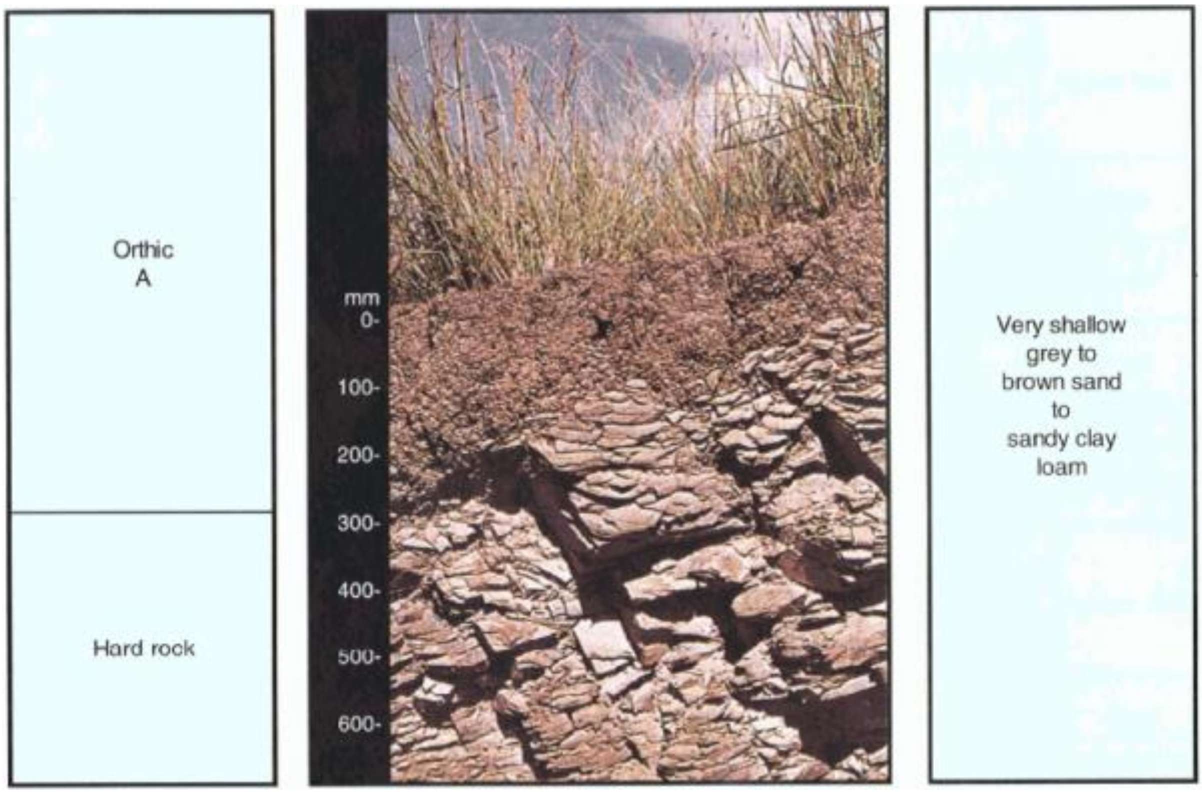


Figure 1-9: Shows a typical cross section the Mispah soil form (SASA, 1999).

7.3 Soil Forms for Mining Right Areas

Provided below is a brief summary of the soil forms for each of the mining rights areas.

7.3.1 Kloof Mining Right Area

The Kloof mining right area was assessed and split into the following infrastructure components;

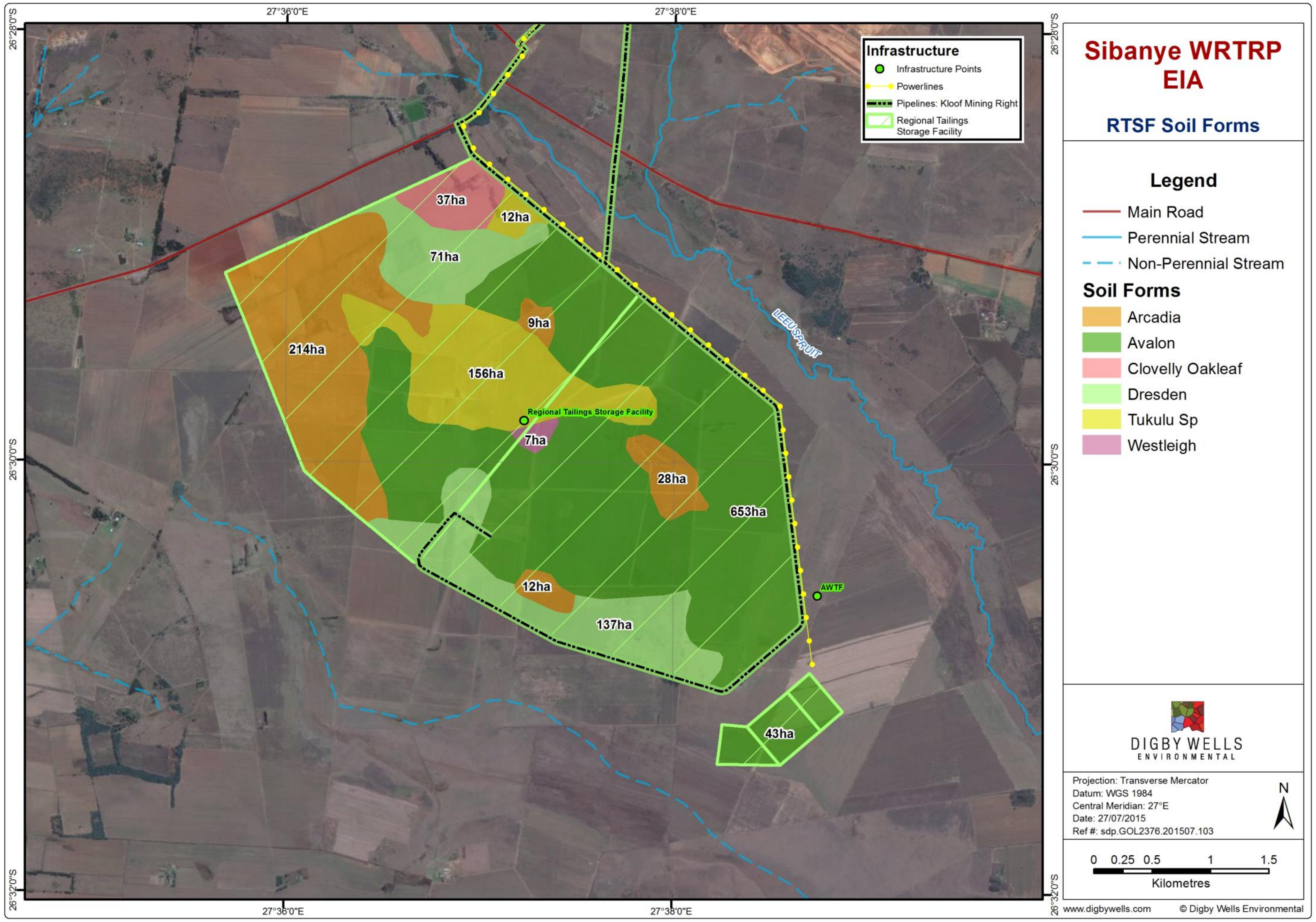
- Pipeline route from the Central Processing Plant (CPP) to the RTSF;
- CPP; and
- Regional Tailings Storage Facility (RTSF).

7.3.1.1 Regional Tailings Storage Facility (RTSF)

The RTSF site was dominated by the plinthic catena soils of the Avalon, Westleigh, Dresden, and Tukulu forms. These accounted for 77.5% of the RTSF site. The soil forms by percentages are shown in Table 7 - 2.

Table 1-2: Dominant soils in the RTSF site by percentage occupied

Soil Form	Area Occupied (Ha)	Percentage Occupied (%)
Avalon	653	48.8
Arcadia	263	19.7
Dresden	218	15.5
Tukulu	168	12.6
Clovelly/Oakleaf	37	2.8
Westleigh	7	0.6
Total	1336	100



Plan 3: Soil Forms within the RTSF Footprint

7.3.1.2 Central Processing Plant (CPP)

The CPP falls within the Ba1 land type (mix of deep red Hutton's in the midslopes and shallow rocky Mispah's on the crest).

7.3.1.3 Pipeline

The pipeline runs from the CPP with a Ba1 land type to the RTSF site with a Bb23 land type.

The Ba1 land type is dominated by a mix of deep red Hutton soil on the midslopes and shallow rocky Mispah soils on the crest positions.

The Bb23 land type is dominated by midslope and footslope landscape positions. The midslope positions are dominated by the Longlands and Wasbank soil forms, and the footslopes are dominated by Valsrivier soils.

7.3.2 Driefontein Mining Right Area

The Driefontein mining right area includes the following infrastructure;

- Pipeline route from the K10 water supply to WBT and BWFS;
- Driefontein 3 TSF;
- Driefontein 5 Tailings Storage Facility (TSF);
- Pipeline route from Driefontein 3 and 5 to West Block Thickener (WBT) and Bulk Water Storage (BWFS);
- Pipeline route from WBT and BWFS to CPP.

7.3.2.1 Driefontein 5 Tailings Storage Facility

The Driefontein 5 TSF site is situated in the Fb15 land type. The Fb land type is dominated by shallow rocky soils, most likely the Mispah soil form.

7.3.2.2 Driefontein 3 Tailings Storage Facility

The Driefontein 3 TSF site falls within the Ab7 land type. The Ab land type is dominated by freely draining deep red soils, most likely to be the Hutton soil form.

7.3.2.3 Pipeline

The pipeline route moves into four land types. The pipeline section from the DRI 5 TSF to the Driefontein 3 TSF is mainly within the Fb15 land type (Shallow rocky Soils, Mispah), and then crosses into the Ab7 land type (deep well drained red soils, Hutton) just before reaching the Driefontein 3 TSF site.

The pipelines sections from the Driefontein 3 TSF to the WBT/BWFS, and then to the K10 water supply are all within the Ab7 land type (deep well drained red soils, Hutton).

The pipeline sections from the WBT/BWFS site moving south towards the CPP, crosses three different land types. Starting on the Ab7 land type (deep well drained red soils, Hutton) at the WBT/BWFS it moves south crossing the Fb15 land type (Shallow rocky Soils, Mispah) into the Ba1 land type (mix of deep red Hutton's in the midslopes, and shallow rocky Mispah's on the crest).

The pipeline section towards the Kloof processing plant falls within the Fb5 land type (Shallow rocky Soils, Mispah).

7.3.3 Cooke Mining Right Area

The Cooke mining right area includes the following infrastructure;

- Cooke TSF;
- Cooke 4 South TSF; and
- Pipeline route from Cooke TSF and Cooke 4 South TSF to the CPP.

7.3.3.1 Cooke Tailings storage facility

The Cooke TSF site falls within the Ab7 land type. The Ab land type is dominated by freely draining deep red soils, most likely to be the Hutton soil form. This was confirmed by the report conducted by Golder Associates Africa Pty (Ltd), 2010.

7.3.3.2 Cooke 4 South Tailings storage facility

The Cooke 4 South TSF is situated in the Fb5 land type (Shallow rocky Soils, Mispah).

7.3.3.3 Pipeline

The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Fb5 land type (Shallow rocky Soils, Mispah) to the Ab7 land type (deep well drained red soils, Hutton).

7.3.4 Ezulwini Mining Right Area

The Ezulwini mining right area which the following infrastructure;

- Pipeline route from CPP to the Ezulwini processing plant.

7.3.4.1 Pipeline

The pipeline sections for the Ezulwini mining right area start at the CPP site, in the Ba1 land type (mix of deep red Hutton's in the midslopes and shallow rocky Mispah's on the crest) and move into the Fb5 land type (Shallow rocky Soils, Mispah) at the Cooke 4 South TSF site.

7.4 Land Capability

Land capability is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long term use of land under rain-fed conditions.

The RTSF was assessed in the field with the land capability map shown in Plan 4. The remainder of the infrastructure was assessed by desktop land type data as shown in Plan 5.

7.4.1 Kloof Mining Right Area

The Kloof mining right area was assessed and split into the following infrastructure components;

- Pipeline route from the Central Processing Plant (CPP) to the RTSF;
- CPP; and
- Regional Tailings Storage Facility (RTSF).

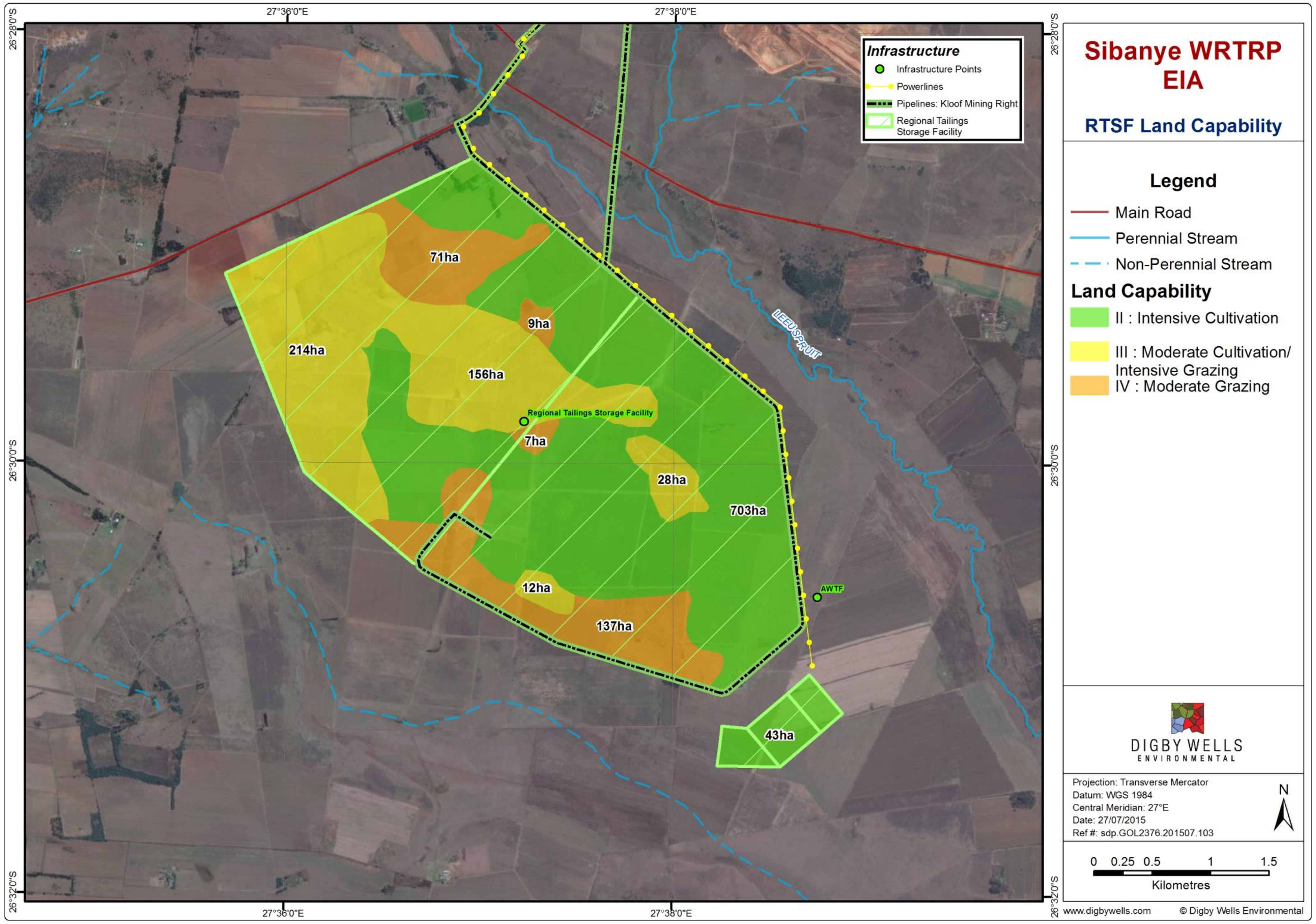
7.4.1.1 Regional Tailings Storage Facility (RTSF)

The RTSF site was dominated by the Class II and Class III land capabilities occupying 83.2% of the area (Refer to Table 7 - 3).

The RTSF site has relatively high land capability potential and as a result the dominant land use in the area is Cultivation (crops and grazing).

Table 1-3: Dominant Land Capability in the RTSF site by percentage occupied.

Land Capability Class	Area Occupied (Ha)	Percentage Occupied (%)
II	702	52.5
III	410	30.7
IV	224	16.2
Total	1336	100



Plan 4: The land capability map for the RTSF site in the Kloof mining right area.

7.4.1.2 Central Processing Plant (CPP)

The CPP falls within a Class III land capability (moderate cultivation).

7.4.1.3 Pipeline

The pipeline falls within a Class III land capability (moderate cultivation) according to the land type database (Land Type Survey Staff, 1972 - 2006).

7.4.2 Driefontein Mining Right Area

The Driefontein mining right area which includes the following infrastructure;

- Pipeline route from the K10 water supply to WBT and BWFS;
- Driefontein 3 TSF;
- Driefontein 5 Tailings Storage Facility (TSF);
- Pipeline route from Driefontein 3 and 5 to West Block Thickener (WBT) and Bulk Water Storage (BWFS);
- Pipeline route from WBT and BWFS to CPP.

7.4.2.1 Driefontein 5 Tailings Storage Facility

The Driefontein 5 TSF falls within the Class VI land capability (moderate grazing).

7.4.2.2 Driefontein 3 Tailings Storage Facility

The Driefontein 3 TSF site falls within the Class II land capability (intensive cultivation).

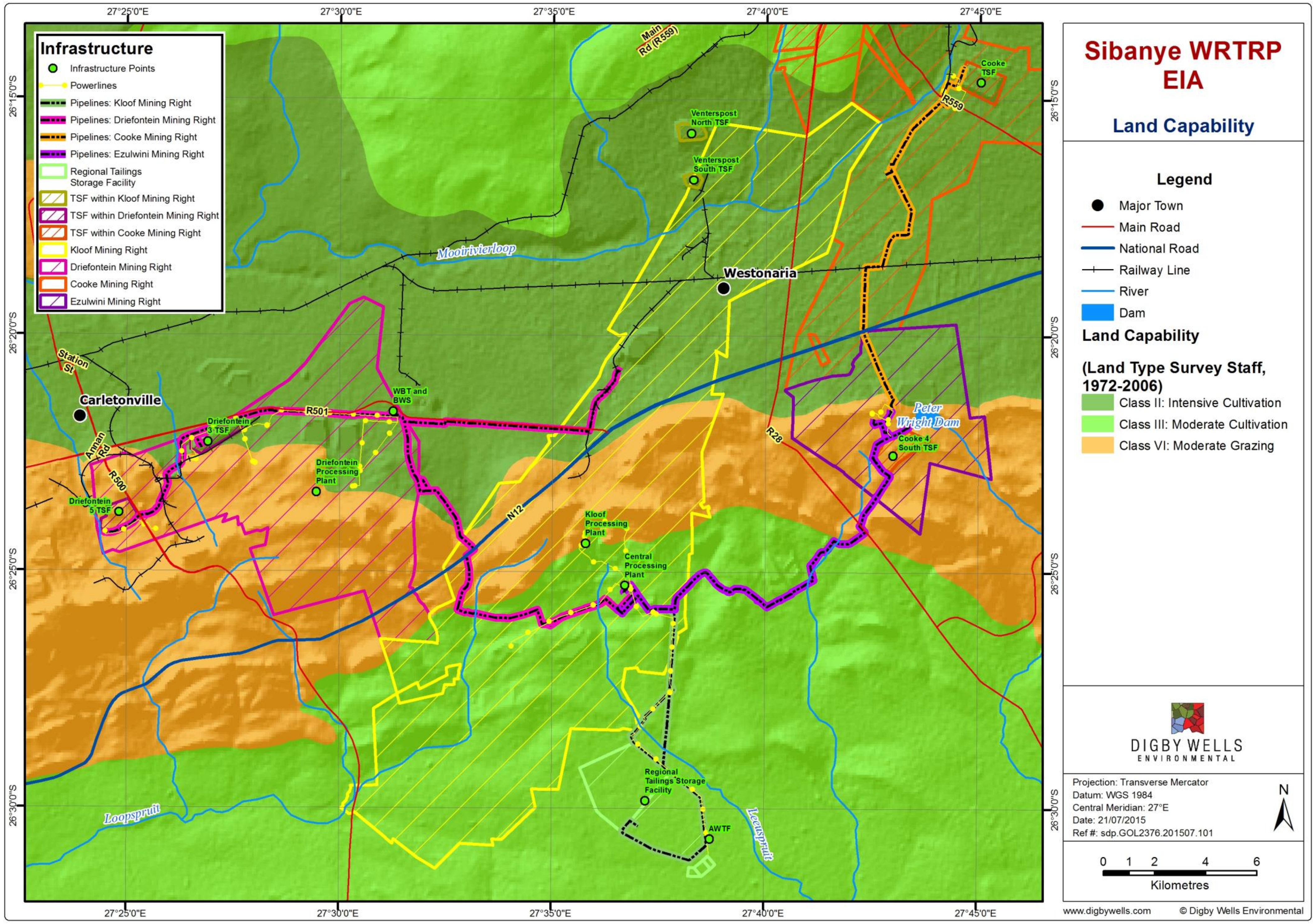
7.4.2.3 Pipeline

The pipeline route moves into three land capability classes. The pipeline section from the Driefontein 5 TSF to the Driefontein 3 TSF is mainly within the Class VI land capability (moderate grazing), and then crosses into the Class II land capability (intensive cultivation) just before reaching the Driefontein 3 TSF site.

The pipelines sections from the Driefontein 3 TSF to the WBT/BWFS, and then to the K10 water supply are all within the Class II land capability (intensive cultivation).

The pipeline sections from the WBT/BWFS site moving south towards the CPP, crosses three different land types. Starting on the Class II land capability (intensive cultivation) at the WBT/BWFS it moves south crossing the Class VI land capability (moderate grazing) into the Class III land capability (moderate cultivation).

The pipeline section towards the Kloof processing plant falls within the Class VI land capability (moderate grazing).



Plan 5: The land capability map for the WRTRP project area (Land Type Survey Staff, 1972 - 2006)

7.4.3 Cooke Mining Right Area

The Cooke mining right area which includes the following infrastructure;

- Cooke TSF;
- Cooke 4 South TSF; and
- Pipeline route from Cooke TSF and Cooke 4 South TSF to the CPP.

7.4.3.1 Cooke Tailings storage facility

The Cooke TSF site falls within the Class II land capability (intensive cultivation/arable).

7.4.3.2 Cooke 4 SouthTailings storage facility

The Cooke 4 South TSF is situated in the Class VI land capability (moderate grazing).

7.4.3.3 Pipeline

The pipeline sections coming from the Ezulwini mining right area to the Cooke TSF, moves from the Class VI land capability (moderate grazing) to the Class II land capability (intensive cultivation).

7.4.4 Ezulwini Mining Right Area

The Ezulwini mining right area which includes the following infrastructure;

- Pipeline route from CPP to the Ezulwini processing plant.

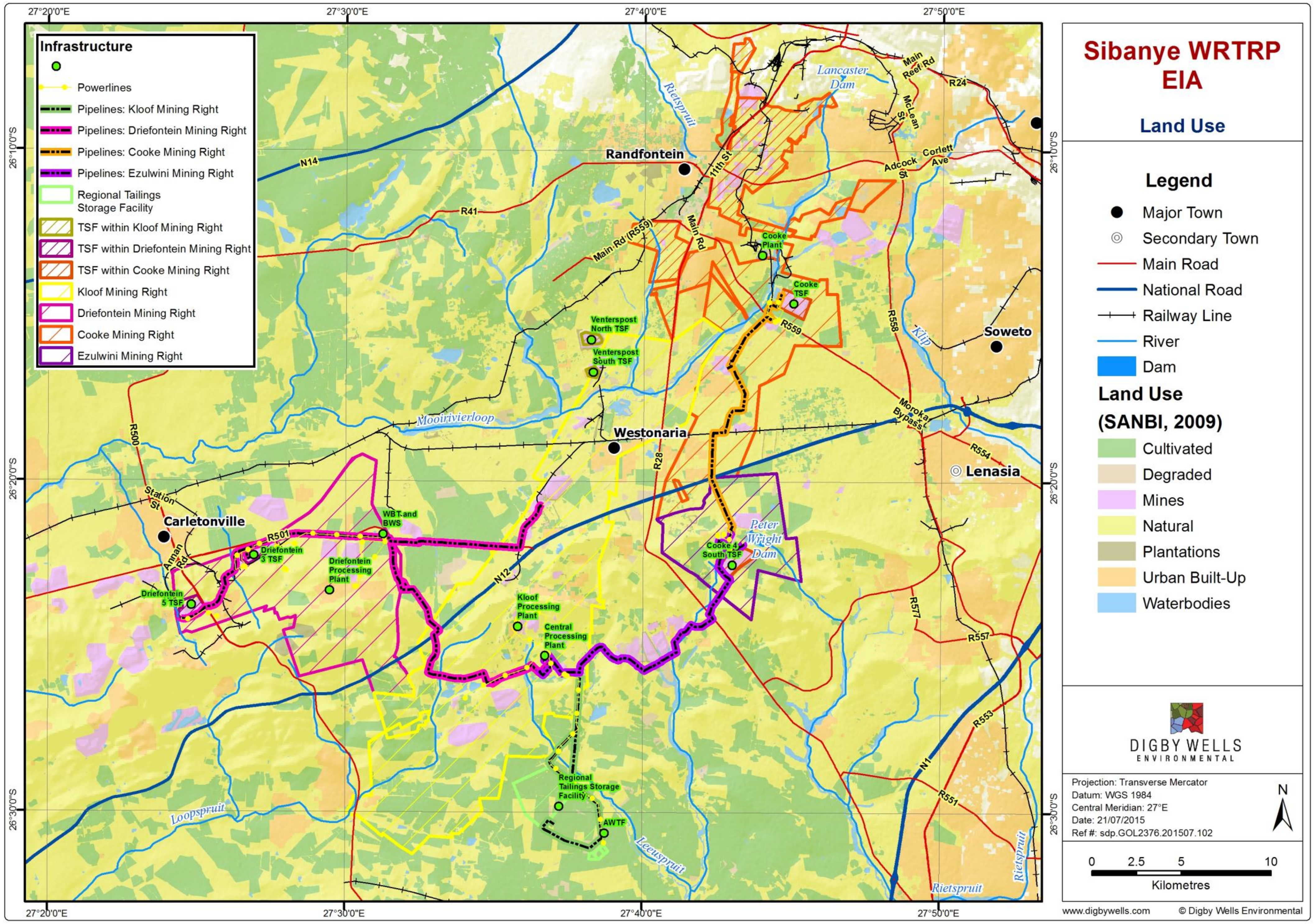
7.4.4.1 Pipeline

The pipeline sections for the Ezulwini mining right area start at the CPP site, in the Class III land capability (moderate Cultivation) and move into the Class VI land capability (moderate grazing) at the Cooke 4 South TSF site.

7.5 Land Use

The land use was delineated in field for the RTSF site, but the pipelines and other TSF sites desktop information was utilised for the remainder of the project area: The land use is for the project area is the following (Refer to Plan 6):

- Cultivated Fields (crops and grazing);
- Degraded;
- Mines, urban areas and plantations; and
- Natural areas and waterbodies.



Plan 6: The land use map for the WRTRP project area

7.5.1 Kloof Mining Right Area

The Kloof mining right area was assessed and split into the following infrastructure components;

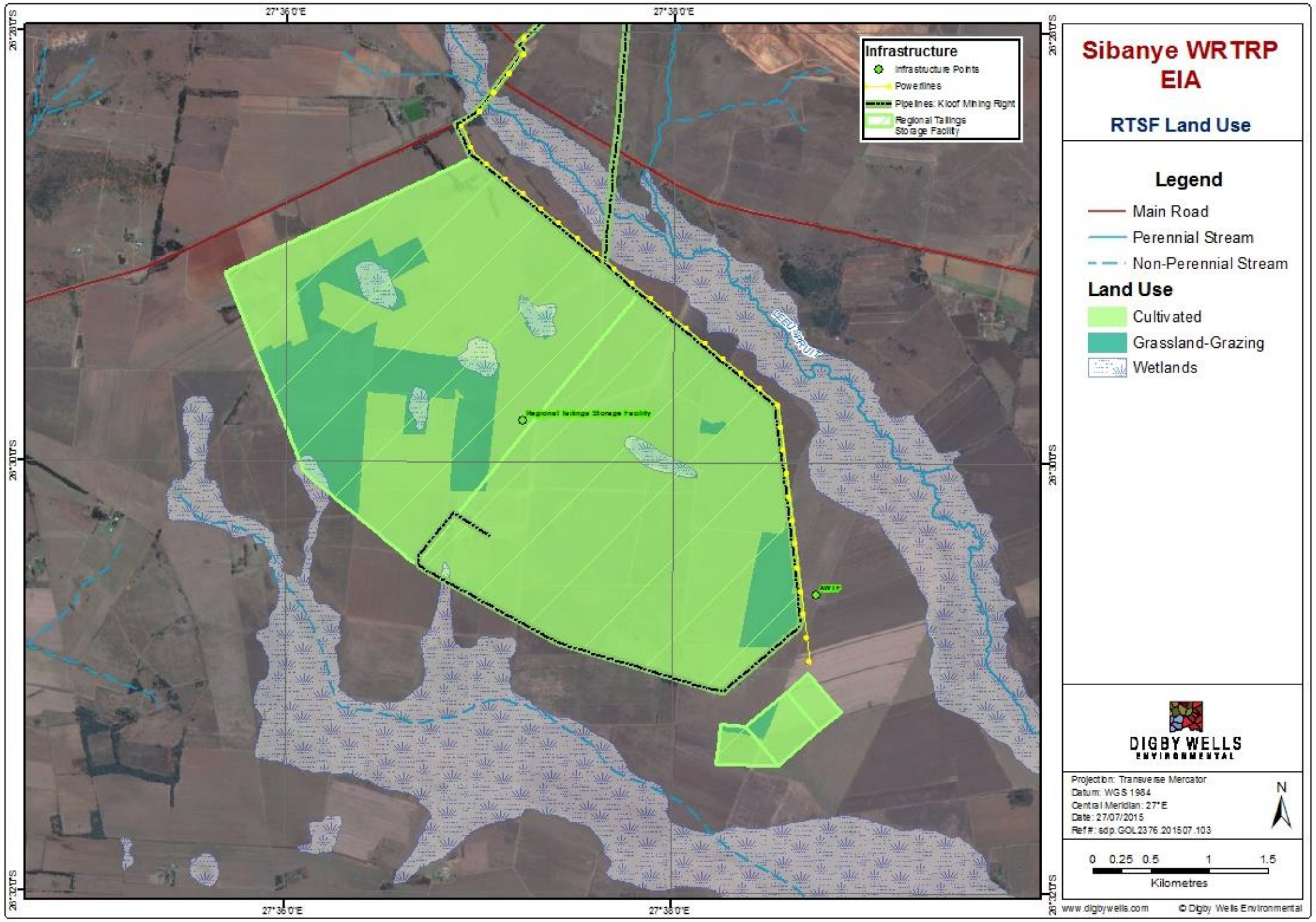
- Pipeline route from the Central Processing Plant (CPP) to the RTSF;
- CPP; and
- Regional Tailings Storage Facility (RTSF).

7.5.1.1 Regional Tailings Storage Facility (RTSF)

The RTSF Site was dominated by Cultivation whether it was annual crops or planted grazing. These soils had classes of IV (moderate cultivation) and above as shown in Plan 7.

7.5.1.2 Pipeline

The Pipelines mainly follow road servitudes but the predominant land use for most of the WRTRP project area is Cultivated and veld/grazing.



Plan 7: The land use map for the RTSF site

8 Sensitivity analysis and no-go areas

The areas that would be considered as sensitive from an agricultural perspective would be the areas that have a land capability of Class II (Intensive cultivation) or higher. These areas add value to the food production systems of South Africa.

The pipeline routes will not pose a significant impact as they will be constructed above ground and their footprints small.

The RTSF site in the Kloof mining right area was delineated by field observations. A significant portion (702 ha) of the RTSF site falls within the Class II land capability, the soils associated with this land capability are the deep (>800mm) Avalon and Tukulu soil forms (Described in section 7).

The RTSF site will have a significant impact on the land capability as it will be reduced from agricultural to not usable.

9 Impacts Assessment

9.1 Impact Assessment Methodology

The impacts are assessed based on the impact's magnitude as well as the receiver's sensitivity, culminating in an impact significance which identifies the most important impacts that require management.

Based on international guidelines and South African legislation, the following criteria are taken into account when examining potentially significant impacts:

- Nature of impacts (direct/indirect, positive/ negative);
- Duration (short/medium/long-term, permanent(irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Possibility to mitigate, avoid or offset significant adverse impacts.

Details of the impact assessment methodology used to determine the significance of physical, bio-physical and socio-economic impacts are provided below.

The significance rating process follows the established impact/risk assessment formula:

Significance = Consequence x Probability x Nature

Where

Consequence = Intensity + Extent + Duration

And

Probability = Likelihood of an impact occurring

And

Nature = Positive (+1) or negative (-1) impact

Note: In the formula for calculating consequence, the type of impact is multiplied by +1 for positive impacts and -1 for negative impacts

The matrix calculates the rating out of 147, whereby Intensity, Extent, Duration and Probability are each rated out of seven as indicated in Table 9-1. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation and again after consideration of the mitigation measure proposed in this aquatic impact assessment report. The significance of an impact is then determined and categorised into one of eight categories, as indicated in Table 9-2, which is extracted from Table 9-1. The description of the significance ratings is discussed in Table 9-1.

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, i.e. there may already be certain types of mitigation measures included in the design (for example due to legal requirements). If the potential impact is still considered too high, additional mitigation measures are proposed.

Table 9-1: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	**Positive impacts**			
7	Irreplaceable damage to highly valued items of great natural or social significance or complete breakdown of natural and / or social order.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable damage to highly valued items of natural or social significance or breakdown of natural and / or social order.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.
5	Very serious widespread natural and / or social baseline changes. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	On-going serious natural and / or social issues. Significant changes to structures / items of natural or social significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
3	On-going natural and / or social issues. Discernible changes to natural or social baseline.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor natural and / or social impacts which are mostly replaceable. Very little change to the baseline.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.
1	Minimal natural and / or social impacts, low-level replaceable damage with no change to the baseline.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	Very limited Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 9-2: Probability/Consequence matrix

	Significance																																					
Probability 7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	-21	**-20**	**-19**	**-18**	**-17**	**-16**	**-15**	**-14**	**-13**	**-12**	**-11**	**-10**	**-9**	**-8**	**-7**	**-6**	**-5**	**-4**	**-3**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**
	Consequence																																					

Table 9-3: Significance rating description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive)
36 to 72	An important positive impact. The impact is insufficient by itself to justify the implementation of the project. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive)
-3 to -35	An acceptable negative impact for which mitigation is desirable but not essential. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Negligible (negative)
-36 to -72	An important negative impact which requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Minor (negative)
-73 to -108	A serious negative impact which may prevent the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe effects	Moderate (negative)
-109 to -147	A very serious negative impact which may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	Major (negative)

9.2 No-go Option

The following no-go options were considered:

- During the no-go option it is assumed that no infrastructure will be constructed and that the current TSF sites will not be reclaimed.
- The RTSF site will continue to be used for cultivation and the soils and land capability will have no impact associated with them.
- The remaining infrastructure areas will also have no impacts associated with them as they will remain as they are currently.
- The pipeline routes will also not be impacted on any more than the current state.
- The existing TSF sites however will continue impacting on the soil of the surrounding area through contaminated water runoff and contaminated dust being blown onto the soil.

9.3 Kloof Mining Right Area Impact Assessment

9.3.1 Construction Phase

9.3.1.1 Project activities assessed

The impact to consider during the construction phase is the placement and construction of pipelines and the potential impacts associated with compaction and loss of topsoil as a resource.

Whilst the construction takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

Is saying this it must be considered that the pipelines that will be constructed will be placed within existing servitudes and alongside roads. Taking this into account the expected impacted as a result would be considered lower than anticipated as these areas have already been impacted upon.

One of the major impacts to consider during the construction phase and associated with the RTSF is potential loss of agricultural land as a result of the construction of the RTSF. In light of this this is probably one of the major impacts associated with soils during the construction phase of the proposed project. It must be noted that not all the land is agricultural land (crop production) and that a portion of the land is utilised for grazing and there are wetlands scattered through the landscape. Taking this into account the impact to loss of agricultural land is considered slightly lower than if all the land was all used for crop production.

The RTSF, RWD, AWTF and CPP sites will be stripped of topsoil and the construction of the infrastructure will commence. The stripped soils will be stockpiled according to the rehabilitation plan and closure plan recommendations.

Table 9-4: Interactions and Impacts during construction

Interaction	Impact
Site clearing – RTSF, RWD, AWTF, CPP	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability and land use.
Soil Stockpiling - RTSF, RWD, AWTF, CPP	Loss of topsoil as a resource – Erosion and Compaction
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.3.1.2 Impact description: Loss of topsoil resource

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

The loss of topsoil as a resource (which is directly related to loss of agricultural potential) will have a negative impact as a result of the construction activities associated with the RTSF.

The loss of agricultural land will directly impact four farmers involved in crop production and livestock breeding. It is assumed that all activities associated with agricultural activities will stop once construction of the RTSF commences. This impact would be considered the most severe impact from a soils perspective. This impact is considered a moderate impact taking into account the importance of farming for the country. This impact cannot me mitigated against with respect to loss of arable land.

9.3.1.3 Impact description: Loss of land capability

When the topsoil is removed from the RTSF, RWD, AWTF, and CPP sites, the land capability is reduced from a Class II, Class III, and Class IV to not usable. The land use will change from cultivated land (crops and grazing land) to mining.

9.3.1.4 Management Objectives

The following management objectives have been recommended:

- The management objectives are to limit the impacts that could occur on the site as far as possible.

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading.
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil.
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.
- Vegetation cover on all stockpiled soil is essential to eliminate erosion.
- Soils are only to be stripped by truck and shovel methods.

9.3.1.5 Management Actions and Targets

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure; and
- Implement land rehabilitation measures as defined in rehabilitation report.
- Follow adequate stripping guidelines, as described in the soil stripping guidelines section.
- The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, as to reduce compaction;
- The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;

- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be sued for their designated final purposes; and
- The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

9.3.1.6 Impact ratings

The construction phase impacts described are rated in Table 9-5.

Table 9-5: Impact rating for loss of topsoil as a resource during construction phase of the pipelines in the Kloof mining right area.

Activity and Interaction: Pipeline routes site clearing and construction			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resource as a result of construction of pipelines			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 60
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Effective storm water management, erosion protection, rehabilitation and limiting access where only construction will be undertaken.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 30
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	

Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

Table 9-6: Impact rating for loss of topsoil as a resource during construction phase of the RTSF, RWD, AWTF, and CPP sites in the Kloof mining right area.

Activity and Interaction: ■ **Construction of the RTSF which includes Compaction, erosion, stripping and stockpiling of soil.**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource through compaction, erosion, and contamination.			
Prior to mitigation/ management			
Duration	Project Life (7)	Topsoil will be stripped and stockpiled if this is done without following the mitigation measures the impact will have a long term affect.	Moderate (negative) – 91
Extent	(3)Local	Loss of topsoil will only occur within and immediately around the Project site.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state by vegetating them. Compaction should be avoided.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project infrastructure area.	
Intensity	Moderate (3)	Loss of topsoil may result in loss of land capability and land use.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

Table 9-7: Impact rating for loss of land capability and land use during construction phase of the RTSF, RWD, AWTF, and CPP sites in the Kloof mining right area.

Activity and Interaction: ▪ **Construction of the RTSF which includes Compaction, erosion, stripping and stockpiling of soil.**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Removal of soil layers will impact on the land capability because vegetation can no longer be supported. **The land use will also change from cultivated to mining**			
Prior to mitigation/ management			
Duration	Permanent (7)	The removal of soil from a profile reduces the land capability from a rateable index to non-existent; this impact is permanent if not mitigated.	Moderate negative (negative) – 105
Extent	Limited (2)	The impact will only occur on the project infrastructure area.	
Intensity	Very Serious (6)	The land capability will be reduce from Class II, III, and IV to no capability.	
Probability	Certain (7)	By removing the topsoil the impact on land capability is certain.	
Nature	Negative		
Mitigation/ Management actions			
No land capability mitigation is possible during the construction phase because the land capability will be reduced to nothing and the land use is changed from agriculture/grazing to mining.			

9.3.2 Operational Phase

9.3.2.1 Project activity assessed

During the operational phase similar impacts will occur as these pipelines would need to be maintained via servitudes.

Table 9-8: Interactions and Impacts during operational phase.

Interaction	**Impact**
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.3.2.2 Impact description

The most significant impact to soil is anticipated during the construction phase of the project. There is potential that further loss of soil could occur if appropriate mitigation is not adopted, such as loss of valuable topsoil from stockpiles. Erosion along pipeline routes and movement of machinery in areas that machinery should not be operating, thus potentially resulting in compaction of areas that have not been previously impacted upon.

Contamination of soils due to hydrocarbon spills and/or reagents used in the machinery and vehicles could have a negative impact that potentially moves off site and will be in place for the life of the operation if unmanaged.

During the operational phase of the RTSF site there could be contamination offsite to soils if the facility is not managed correctly as a result of contaminated runoff and/or wind-blown dust from the RSTF.

9.3.2.3 Management Objectives

The management objectives are to limit the impacts that could occur on the sites and the following has been recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil; and
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

9.3.2.4 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement dust suppression measures; and

- Proper storm management design is to be implemented to minimise and control dirty water runoff.

9.3.2.5 Impact ratings

Table 9-9: Impact rating for loss of topsoil as a resource during operational phase for the pipelines in the Kloof mining right area.

Activity and Interaction: ▪ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

Table 9-10: Impact rating for loss of topsoil as a resource during operation of phase of the RTSF in the Kloof mining right area.

Activity and Interaction: ▪ **Operation of the RTSF which includes loss of topsoil as a resource through contamination.**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Contaminated run off and/or dust could settle on the soil surfaces on or around the dump including the stockpiles. This will impact on the soil quality and the topsoil resource could be lost.			
Prior to mitigation/ management			
Duration	Project Life (5)	Contamination if unmitigated could last for many years.	Moderate (negative) – 84
Extent	Local (3)	The impact will occur within and immediately around the Project site.	
Intensity	On-going serious (4)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	It is certain that this impact will occur	
Nature	Negative		
Mitigation/ Management actions			
Storm water management must reduce and control dirty water runoff and dust suppression			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Negligible (negative) – 30
Extent	Limited (2)	If mitigation measures are followed the impact area can be reduced	
Intensity	Minor (3)	If contamination occurs, it will still be a serious negative impact.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

9.3.3 Decommissioning and Closure Phase

9.3.3.1 Project activity assessed

The impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

During the decommissioning and rehabilitation phase of the RTSF, the RTSF will be capped and covered with a vegetative cover.

During the decommissioning and rehabilitation phase of the RWD, WATF, and CPP the infrastructure will be removed and the areas will be rehabilitated with the soils that have been stockpiled.

Table 9-11: Interactions and Impacts during decommissioning and rehabilitation phases.

Interaction	Impact
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.3.3.2 Impact description

It is anticipated that the following impacts may occur during the decommissioning phase:

- When topsoil is compacted or eroded, the soil profile loses effective rooting depth, water holding capacity and fertility; and
- The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result erosion could be caused.

9.3.3.3 Management Objectives

The following is management objectives are recommended:

- Management of areas that have been rehabilitated;
- Assessment of areas of compaction and erosion after pipelines have been removed; and
- Monitoring of the soil placed on the RTSF and vegetation establishment.

9.3.3.4 Management Actions and Targets

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;

- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement land rehabilitation measures as defined in rehabilitation report.
- Follow rehabilitation guidelines;
- The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil is to be moved when the soil is dry, as to reduce compaction;
- After the completion of the project the area is to be cleared of all infrastructure;
- The foundations to be removed;
- Topsoil to be replaced for rehabilitation purposes;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; and
- Stockpiles should only be used for their designated final purposes.

9.3.3.5 Impact ratings

The impacts are described in Table 9-12.

Table 9-12: Impact rating for loss of topsoil as a resource during decommissioning and rehabilitation phase of the pipelines in the Kloof mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	

Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

9.4 Driefontein Mining Right Area Impact Assessment

9.4.1 Construction Phase

9.4.1.1 Project activities assessed

The impact to consider during the construction phase is the placement and construction of pipelines and the potential impacts associated with compaction and loss of topsoil as a resource.

Whilst the construction takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

Is saying this it must be considered that the pipelines that will be constructed will be placed within existing servitudes and alongside roads. Taking this into account the expected impacted as a result would be considered lower than anticipated as these areas have already been impacted upon.

The BWFS site will be stripped of topsoil and the construction of the infrastructure will commence. The stripped soils will be stockpiled according to the rehabilitation plan recommendations.

Table 9-13: Interactions and Impacts during construction

Interaction	Impact
Site clearing	Loss of topsoil as a resource – Erosion and Compaction

Interaction	Impact
	Loss of Land capability
Exposure of soils due to loss of vegetation	Soil erosion due to wind and surface water runoff; Loss of land capability due to erosion
	Siltation of surface water resources leading to deteriorated water quality and quantity
	Siltation of wetlands due to erosion
	Change in habitat and potential change in species composition.
	Siltation of wetlands)

9.4.1.2 Impact description: Loss of topsoil resource

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

The loss of topsoil as a resource (which is directly related to loss of agricultural potential) will have a negative impact as a result of the construction activities associated with the BWSF.

9.4.1.3 Impact description: Loss of land capability

When the topsoil is removed from BWSF site, the land capability is reduced from a Class II, Class III, and Class IV to not usable. The land use will change from cultivated/grazing to mining.

9.4.1.4 Management Objectives

The following management objectives have been recommended:

- The management objectives are to limit the impacts that could occur on the site as far as possible.
- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading.
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil.
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.
- Vegetation cover on all stockpiled soil is essential to eliminate erosion.

- Soils are only to be stripped by truck and shovel methods.

9.4.1.5 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure; and
- Implement land rehabilitation measures as defined in rehabilitation report.

- Follow adequate stripping guidelines, as described in the soil stripping guidelines section.
- The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, as to reduce compaction;
- The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be sued for their designated final purposes; and
- The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

9.4.1.6 Impact ratings

The construction phase impacts described are rated in Table 9-14.

Table 9-14: Impact rating for loss of topsoil as a resource during construction phase of the pipelines in the Driefontein mining right area.

Activity and Interaction: Pipeline routes site clearing and construction			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resource as a result of construction of pipelines			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 60
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Effective storm water management, erosion protection, rehabilitation and limiting access where only construction will be undertaken.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 30
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

The impacts are described in Table 9-15.

Table 9-15: Impact rating for loss of topsoil as a resource during construction phase BWSF site in the Driefontein mining right area.

Activity and Interaction: ▪ **Construction of the BWSFwhich includes Compaction, erosion, stripping and stockpiling of soil.**

Dimension	Rating	Motivation	Significance
Impact Description: Loss of topsoil as a resource through compaction, erosion, and contamination.			
Prior to mitigation/ management			
Duration	Project Life (5)	Topsoil will be stripped and stockpiled if this is done without following the mitigation measures the impact will have a long term affect.	Moderate (negative) – 84
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project site.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state by vegetating them. Compaction should be avoided.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project infrastructure area.	
Intensity	Moderate (3)	Loss of topsoil may result in loss of land capability and land use.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

Table 9-16: Impact rating for loss of land capability and land use during construction BWSF site in the Driefontein mining right area.

Activity and Interaction: ▪ **Construction BWSF siteswhich includes Compaction, erosion, stripping and stockpiling of soil.**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Removal of soil layers will impact on the land capability because vegetation can no longer be supported. **Change in land use.**			
Prior to mitigation/ management			

Duration	Project Life (5)	The removal of soil from a profile reduces the land capability from a rateable index to non-existent; this impact is permanent if not mitigated.	Moderate (negative) – 77
Extent	Limited (2)	The impact will only occur on the project infrastructure area.	
Intensity	Serious (4)	The land capability will be reduce from Class II, III, and IV to no capability.	
Probability	Certain (7)	By removing the topsoil the impact on land capability is certain.	
Nature	Negative		
Mitigation/ Management actions			
No land capability mitigation is possible during the construction phase because the land capability will be reduced to nothing and the land use is changed from agriculture/grazing to mining.			

9.4.2 Operational Phase

9.4.2.1 Project activity assessed

During the operational phase similar impacts will occur as these pipelines would need to be maintained via servitudes.

Table 9-17: Interactions and Impacts during operational phase.

Interaction	Impact
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.4.2.2 Impact description

The most significant impact to soil is anticipated during the construction phase of the project. There is potential that further loss of soil could occur if appropriate mitigation is not adopted, such as loss of valuable topsoil from stockpiles. Erosion along pipeline routes and movement of machinery in areas that machinery should not be operating, thus potentially resulting in compaction of areas that have not been previously impacted upon.

Contamination of soils due to hydrocarbon spills and/or reagents used in the machinery and vehicles could have a negative impact that potentially moves off site and will be in place for the life of the operation if unmanaged.

9.4.2.3 Management Objectives

The management objectives are to limit the impacts that could occur on the sites and the following has been recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil; and
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

9.4.2.4 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement dust suppression measures; and
- Proper storm management design is to be implemented to minimise and control dirty water runoff.

9.4.2.5 Impact ratings

Table 9-18: Impact rating for loss of topsoil as a resource during operational phase for the pipelines in the Driefontein mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited	

		scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

The impacts are described in Table 9-19.

Table 9-19: Impact rating for loss of topsoil as a resource during operational phase of collection sumps, pump stations, WBT and BWSF sites in the Driefontein mining right area.

Activity and Interaction: ▪ **Reclamation activities leading to contamination or site runoff.**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Contaminated run off and/or dust could settle on the soil surfaces on or around the dump including the stockpiles. This will impact on the soil quality and the topsoil resource could be lost.			
Prior to mitigation/ management			
Duration	Project Life (5)	Contamination if unmitigated could last for many years.	Moderate (negative) – 70
Extent	Limited (2)	The impact will occur within and immediately around the Project site.	
Intensity	On-going (3)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration	

		takes a very long time.	
Probability	Certain (7)	It is certain that this impact will occur	
Nature	Negative		
Mitigation/ Management actions			
Storm water management must reduce and control dirty water runoff and dust suppression			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Negligible (negative) – 30
Extent	Limited (2)	If mitigation measures are followed the impact area can be reduced	
Intensity	Minor (3)	If contamination occurs, it will still be a serious negative impact.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

9.4.3 Decommissioning and Closure Phase

9.4.3.1 Project activity assessed

The impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

During the decommissioning and rehabilitation phase of the RWD, BWSF, and CPP the infrastructure will be removed and the areas will be rehabilitated with the soils that have been stockpiled.

One of the largest positive impacts would be the final rehabilitation of the TSF footprints. This will essential allow for alternative land uses to be considered for the area that the TSF was located, however prior to a land use being determined it is recommended that a land contamination assessment be conducted and the required soil clean-up is done.

9.4.3.2 Impact description

When topsoil is compacted or eroded, the soil profile loses effective rooting depth, water holding capacity and fertility.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result erosion could be caused.

The reclamation of the TSF sites would have improved the soil quality by reducing the impacts on the surrounding soils by removing the contaminant source. The TSF footprint area will also be remediated and the land use and capability can be improved.

9.4.3.3 Management Objectives

The following management objectives are recommended:

- Management of areas that have been rehabilitated;
- Assessment of areas of compaction and erosion after pipelines have been removed;
- Monitoring of the soil placed and vegetation establishment;
- After the TSF sites have been reclaimed the footprint area must undergo a land contamination assessment to assess the extent of the contamination, before an alternative land use is decided upon;
- A remediation feasibility study must be conducted to assess phytoremediation options or complete removal and replacement of the topsoil on the footprint; and
- All parties involved must then decide on the most appropriate land use.

9.4.3.4 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement land rehabilitation measures as defined in rehabilitation report.
- Follow rehabilitation guidelines;
- The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil is to be moved when the soil is dry, as to reduce compaction;
- After the completion of the project the area is to be cleared of all infrastructure;
- The foundations to be removed;
- Topsoil to be replaced for rehabilitation purposes;

- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Stockpiles should only be used for their designated final purposes;
- A land contamination study must be done on the soils after reclamation has been completed;
- If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and
- Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.

9.4.3.5 Impact ratings

The impacts are described in Table 9-20 and Table 9-21.

Table 9-20: Impact rating for loss of topsoil as a resource during decommissioning and rehabilitation phase of the pipelines in the Driefontein mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			

Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur.	
Nature	Negative		

Table 9-21: Impact rating for change in land use and land capability after reclamation activities

Activity and Interaction: ▪ **Change in land use after reclamation has been undertaken**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Potential change in land use and land capability from mining to another determined land use – positive impact.			
Prior to mitigation/ management			
Duration	Permanent (7)	Land use change will be permanent	Moderate (positive) – 105
Extent	Limited (2)	The impact will only occur on the project infrastructure area (TSF Footprints).	
Intensity	Great Improvement (6)	Improvement in land capability.	
Probability	Certain (7)	Certain that there will be a change in land capability.	
Nature	Positive		
Mitigation/ Management actions			
Land reclamation, land contamination assessments and land use identification			

9.5 Cooke Mining Right Area Impact Assessment

9.5.1 Construction Phase

9.5.1.1 Project activities assessed

The impact to consider during the construction phase is the placement and construction of pipelines and the potential impacts associated with compaction and loss of topsoil as a resource.

Whilst the construction takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

Is saying this it must be considered that the pipelines that will be constructed will be placed within existing servitudes and alongside roads. Taking this into account the expected impacted as a result would be considered lower than anticipated as these areas have already been impacted upon.

Table 9-22: Interactions and Impacts during construction

Interaction	Impact
Exposure of soils due to loss of vegetation	Soil erosion due to wind and surface water runoff; Loss of land capability due to erosion
	Siltation of surface water resources leading to deteriorated water quality and quantity
	Siltation of wetlands due to erosion
	Change in habitat and potential change in species composition.
	Siltation of wetlands)

9.5.1.2 Impact description: Loss of topsoil resource

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

9.5.1.3 *Management Objectives*

The following management objectives have been recommended:

- The management objectives are to limit the impacts that could occur on the site as far as possible.
- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading.
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil.
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

- Vegetation cover on all stockpiled soil is essential to eliminate erosion.
- Soils are only to be stripped by truck and shovel methods.

9.5.1.4 Management Actions and Targets

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure; and
- Implement land rehabilitation measures as defined in rehabilitation report.

- Follow adequate stripping guidelines, as described in the soil stripping guidelines section.
- The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, as to reduce compaction;
- The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately;
- The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be sued for their designated final purposes; and
- The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

9.5.1.5 Impact ratings

The construction phase impacts described are rated in Table 9-23.

Table 9-23: Impact rating for loss of topsoil as a resource during construction phase of the pipelines in the Cooke mining right area.

Activity and Interaction: Pipeline routes site clearing and construction			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resource as a result of construction of pipelines			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 60
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Effective storm water management, erosion protection, rehabilitation and limiting access where only construction will be undertaken.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 30
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

9.5.2 Operational Phase

9.5.2.1 Project activity assessed

During the operational phase similar impacts will occur as these pipelines would need to be maintained via servitudes.

Table 9-24: Interactions and Impacts during operational phase.

Interaction	Impact
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.5.2.2 Impact description

The most significant impact to soil is anticipated during the construction phase of the project. There is potential that further loss of soil could occur if appropriate mitigation is not adopted, such as loss of valuable topsoil from stockpiles. Erosion along pipeline routes and movement of machinery in areas that machinery should not be operating, thus potentially resulting in compaction of areas that have not been previously impacted upon.

Contamination of soils due to hydrocarbon spills and/or reagents used in the machinery and vehicles could have a negative impact that potentially moves off site and will be in place for the life of the operation if unmanaged.

9.5.2.3 Management Objectives

The management objectives are to limit the impacts that could occur on the sites and the following has been recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil; and
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

9.5.2.4 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;

- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement dust suppression measures; and
- Proper storm management design is to be implemented to minimise and control dirty water runoff.

9.5.2.5 Impact ratings

Table 9-25: Impact rating for loss of topsoil as a resource during operational phase for the pipelines in the Cooke mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	

Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

9.5.3 Decommissioning and Closure Phase

9.5.3.1 Project activity assessed

The major impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

During this phase the tailings will be removed and pumped to the RTSF site. The current status of the soils under the dump is unknown and the land capability is non-existent, the land use is mining at presently.

9.5.3.2 Impact description

The impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

The reclamation of the TSF sites will improve the soil quality by reducing the impacts on the surrounding soils by removing the contaminant source. The TSF footprint area will also be remediated and the land use and capability can be improved

9.5.3.3 Management Objectives

The following management objectives are recommended:

- Management of areas that have been rehabilitated;
- Assessment of areas of compaction and erosion after pipelines have been removed;
- Monitoring of the soil placed and vegetation establishment;
- After the TSF sites have been reclaimed the footprint area must undergo a land contamination assessment to assess the extent of the contamination, before an alternative land use is decided upon;

- A remediation feasibility study must be conducted to assess phytoremediation options or complete removal and replacement of the topsoil on the footprint; and
- All parties involved must then decide on the most appropriate land use.

9.5.3.4 Management Actions and Targets

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated;
- Implement land rehabilitation measures as defined in rehabilitation report.
- Follow rehabilitation guidelines;
- The topsoil should be moved by means of an excavator bucket, and loaded onto dump trucks;
- Topsoil is to be moved when the soil is dry, as to reduce compaction;
- After the completion of the project the area is to be cleared of all infrastructure;
- The foundations to be removed;
- Topsoil to be replaced for rehabilitation purposes;
- The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate;
- Stockpiles should only be used for their designated final purposes;
- A land contamination study must be done on the soils after reclamation has been completed;
- If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; and
- Phytoremediation feasibility studies could be considered as part of the contaminated land assessment.

9.5.3.5 Impact ratings

The impacts are described in Table 9-26.

Table 9-26: Impact rating for loss of topsoil as a resource during decommissioning and rehabilitation phase of the pipelines in the Cooke mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur.	
Nature	Negative		

Table 9-27: Impact rating for change in land use and land capability after reclamation activities

Activity and Interaction: ▪ **Change in land use after reclamation has been undertaken**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Potential change in land use and land capability from mining to another determined land use – positive impact.			
Prior to mitigation/ management			
Duration	Permanent (7)	Land use change will be permanent	Moderate (positive) – 105
Extent	Limited (2)	The impact will only occur on the project infrastructure area (TSF Footprints).	
Intensity	Great Improvement (6)	Improvement in land capability.	
Probability	Certain (7)	Certain that there will be a change in land capability.	
Nature	Positive		
Mitigation/ Management actions			
Land reclamation, land contamination assessments and land use identification			

9.6 Ezulwini Mining Right Area Impact Assessment

9.6.1 Construction Phase

9.6.1.1 Project activities assessed

The impact to consider during the construction phase is the placement and construction of pipelines and the potential impacts associated with compaction and loss of topsoil as a resource.

Whilst the construction takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

Is saying this it must be considered that the pipelines that will be constructed will be placed within existing servitudes and alongside roads. Taking this into account the expected impacted as a result would be considered lower than anticipated as these areas have already been impacted upon.

Table 9-28: Interactions and Impacts during construction

Interaction	Impact
Exposure of soils due to loss of	Soil erosion due to wind and surface water runoff; Loss of land

Interaction	Impact
vegetation	capability due to erosion
	Siltation of surface water resources leading to deteriorated water quality and quantity
	Siltation of wetlands due to erosion
	Change in habitat and potential change in species composition.
	Siltation of wetlands)

9.6.1.2 Impact description: Loss of topsoil resource

When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase.

Land will be potentially cleared increasing the runoff potential over the area, this intern will increase the potential for erosion to occur.

9.6.1.3 *Management Objectives*

The following management objectives have been recommended:

- The management objectives are to limit the impacts that could occur on the site as far as possible.
- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading.
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil.
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.
- Vegetation cover on all stockpiled soil is essential to eliminate erosion.
- Soils are only to be stripped by truck and shovel methods.

9.6.1.4 *Management Actions and Targets*

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;

- Only the designated access routes are to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure; and
- Implement land rehabilitation measures as defined in rehabilitation report.

9.6.1.5 Impact ratings

The construction phase impacts described are rated in Table 9-29.

Table 9-29: Impact rating for loss of topsoil as a resource during construction phase of the pipelines in the Ezulwini mining right area.

Activity and Interaction: Pipeline routes site clearing and construction			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil resource as a result of construction of pipelines			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 60
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
Effective storm water management, erosion protection, rehabilitation and limiting access where only construction will be undertaken.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 30
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

9.6.2 Operational Phase

9.6.2.1 *Project activity assessed*

During the operational phase similar impacts will occur as these pipelines would need to be maintained via servitudes.

Table 9-30: Interactions and Impacts during operational phase.

Interaction	Impact
Soil Compaction by heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

9.6.2.2 *Impact description*

The most significant impact to soil is anticipated during the construction phase of the project. There is potential that further loss of soil could occur if appropriate mitigation is not adopted, such as loss of valuable topsoil from stockpiles. Erosion along pipeline routes and movement of machinery in areas that machinery should not be operating, thus potentially resulting in compaction of areas that have not been previously impacted upon.

Contamination of soils due to hydrocarbon spills and/or reagents used in the machinery and vehicles could have a negative impact that potentially moves off site and will be in place for the life of the operation if unmanaged.

9.6.2.3 *Management Objectives*

The management objectives are to limit the impacts that could occur on the sites and the following has been recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil; and
- Stripped soils are to be placed in the correct stockpile allocations to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state.

9.6.2.4 *Management Actions and Targets*

The following management actions and targets have been recommended:

- Ensure proper storm water management designs are in place;

- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Only the designated access routes are to be used to reduce any unnecessary compaction; and
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated.

9.6.2.5 Impact ratings

Table 9-31: Impact rating for loss of topsoil as a resource during operational phase for the pipelines in the Ezulwini mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very	

		limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

9.6.3 Decommissioning and Closure Phase

9.6.3.1 Project activity assessed

The impacts to consider in the decommissioning and rehabilitation of the pipelines will be the loss of topsoil as a resource through compaction and erosion. Whilst the decommissioning and removal of the pipeline takes place vehicles will drive on the soil surface compacting it. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential

9.6.3.2 Impact description

When topsoil is compacted or eroded, the soil profile loses effective rooting depth, water holding capacity and fertility.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation’s ability to grow and as a result erosion could be caused.

9.6.3.3 Management Objectives

The following management objectives are recommended:

- The pipelines need to be monitored for erosion. As soon as erosion occurs corrective actions must be taken to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded, if contamination has occur these soils need to be removed and dumped in a licensed landfill site, and replaced with good quality topsoil; and
- After the pipelines have been removed the route must be assessed for compaction and possible erosion risk areas and corrected or protected immediately.

9.6.3.4 Management Actions and Targets

The following management actions and targets are recommended:

- Ensure proper storm water management designs are in place;
- If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;

- Only the designated access routes are to be used to reduce any unnecessary compaction;
- Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and
- Implement land rehabilitation measures as defined in rehabilitation report.

9.6.3.5 Impact ratings

The impacts are described in Table 9-32.

Table 9-32: Impact rating for loss of topsoil as a resource during decommissioning and rehabilitation phase of the pipelines in the Ezulwini mining right area.

Activity and Interaction: ■ **Pipeline routes**			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The maintenance and inspections of the pipeline route will cause a loss of topsoil as a resource if compaction, erosion and contamination occur.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Minor (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
Maintenance and inspections on the pipeline must be done on the existing roads to minimise compaction and erosion.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Negligible (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if	

		mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur.	
Nature	Negative		

10 Cumulative Impacts

The major impacts associated with mining are the disturbance of natural occurring soil profiles consisting of layers or soil horizons. Rehabilitation of disturbed areas aims to restore land capability but the South African experience is that post mining land capability usually decreases compared to pre-mining land capability. Soil formation is determined by a combination of five interacting main soil formation factors. These factors are time, climate, slope, organisms and parent material. Soil formation is an extremely slow process and soil can therefore be considered as a non-renewable resource.

Soil quality deteriorates during stockpiling and replacement of these soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. Depth however can be imitated but the combined soil quality deterioration and resultant compaction by the machines used in rehabilitation, leads to a net loss of land capability. A change in land capability then forces a change in land use.

The impact on soil is moderate because natural soil layers are stripped and stockpiled for later use in rehabilitation. In addition, soil fertility is impacted because stripped soil layers are usually thicker than the defined topsoil layer. The topsoil layer is the layer where most plant roots are found and is generally 0.25 m thick.

Although a significant portion of arable land will be lost at the RTSF site. The reclaimed sites will have an increase in land use and land capability. This will not be at the same level of the land capability and land use of the RTSF site.

11 Unplanned Events and Low Risks

Low risks can be monitored to gauge if the baseline changes and mitigation is required. Table 11-1 shows the risk of hydrocarbon spills of occurring as well as mitigation measures to reduce this risk and to manage the risk.

Table 11-1: The risk of hydrocarbon spills of occurring as well as mitigation measures to reduce this risk and to manage the risk.

Unplanned event	Potential impact	Mitigation/ Management/ Monitoring
Hazardous substances spillage	Soil contamination	■ Prevent any spills from occurring. Machines must be parked within hardpark areas and must be checked daily for fluid leaks; ■ If a spill occurs it is to be cleaned up immediately and reported to the appropriate authorities; ■ All vehicles are to be serviced in a correctly bunded

		area or at an off-site location; ■ Leaking vehicles will have drip trays place under them where the leak is occurring; ■ Pipelines must be maintained; ■ Pipeline must be checked regularly for leaks; and ■ If there are leaks the pipelines must be repaired immediately.

12 Environmental Management Plan

An Environmental management Plan (EMP) is generally considered an environmental management tool that is implemented with the objective of mitigating the undue, or reasonably avoidable adverse impacts, associated with the development of a project. It is also considered a tool to enhance any potential positive impacts that could be realised due to the development of a project. According to UNEP, “An environmental management plan builds continuity into the EIA process and helps to optimize environmental benefits at each stage of project development. The key objectives of environmental management plans are to:

- Identify the actual environmental, socioeconomic and public health impacts of the project and check if the observed impacts are within the levels predicted in the EIA;
- Determine that mitigation measures or other conditions attached to project approval (e.g. by legislation) are properly implemented and work effectively;
- Adapt the measures and conditions attached to project approval in the light of new information or take action to manage unanticipated impacts if necessary;
- Ensure that the expected benefits of the project are being achieved and maximized; and
- Gain information for improving similar projects and EIA practice in the future.

- The EMP must consider each activity and its potential impacts during the construction, operational, decommissioning and post closure phases. The EMP must address all potentially significant impacts during these phases.

12.1 Activities with potentially significant impacts

The table below is a brief summary of the impacts per MRA that received a moderate or major rating and therefore are seen to be activities with significant impacts.

Table 12-1: Potentially Significant Impacts of the WRTRP on Soils, Land Capability, and Land Use

Aspects	Potential Significant impacts
Kloof Mining Right Area	

Stripping of topsoil, compaction, and erosion from RTSF and infrastructure areas	Loss of topsoil as a resource, loss of land capability and land use.
Decommissioning of the RTSF; this is to remain in perpetuity.	The land capability and land use has been change negatively permanently.
Driefontein Mining Right Area	
Stripping of topsoil, compaction, and erosion from infrastructure areas	Loss of topsoil as a resource, loss of land capability and land use.
Cooke Mining Right Area	
None	None
Ezulwini Mining Right Area	
None	None

12.2 Soil and land capability rehabilitation practises

Considering the importance and time of formation of the soil properties then it is clear that managing soil stockpiles properly should have a high priority in mining operations. Topsoil (the first 0.25 m) should be stored separately from subsoil because it contains more nutrients organic carbon, and microbes than subsoil. The topsoil stockpiles should be limited in height because aeration can be compromised which in turn influences microbial activity and therefore soil quality.

Allowing subsoil to contaminate topsoil dilutes the nutrient and organic matter content causing soil infertility. Infertility imbalances then have to be reclaimed and optimised by using costly fertilizers.

More important than chemical imbalances which can be easily restored at cost, is soil compaction and volumes of replacement during soil reclamation. Heavy equipment is used during soil reclamation and soil is compacted beyond agricultural reclamation leaving behind areas of low soil and land capabilities. Such areas have limited land use options and specialized management needs. Rehabilitated soils will have crop production limitations but these can be minimised during the rehabilitation process through careful soil cover replacement management.

The Avalon, Westleigh, Dresden, Clovelly, and Tukulu soil types present within the project site can all be stripped and stockpiled together because the inherent soil properties are similar. The Arcadia needs to be stripped separately.

Table 12-2 contains information regarding estimated volumes of stripped soil to be stockpiled for use in rehabilitation. It is recommended that the topsoil (the top 0.25 m of the soil profile) be stripped first then the remaining subsoil from the same areas.

It must be noted that even though the table below provided recommendations regarding the amount of topsoil and subsoil that can be stripped, not all usable soil will be stripped from the RTSF footprint. The rehabilitation plan provides further detail regarding this. In summary 0.25 m of soil will be stripped from the RTSF footprint and will be utilised for capping of the facility, with additional material being taken from the starter wall during rehabilitation. This equates to a soil cover depth of 0.2m over the RTSF. A 205% contingency has been built into the stripping ratio to potentially cater for any loss of soil.

Table 12-2: Estimated soil volumes to be stockpiled for re-use after stripping, use the soil types plan as a guide

Soil Forms		Area (ha)	Stripping Depth (m)	Estimated Volume (m3)	Stockpile Allocation
Avalon	Topsoil	653	0.25	1 959 000	S1
	Subsoils		0.5	3 265 000	S2
Dresden	Topsoil	218	0.25	654 000	S1
	Subsoils				
Clovelly	Topsoil	37	0.25	111 000	S1
	Subsoils		0.7	259 000	S2
Westleigh	Topsoil	7	0.25	21 000	S1
	Subsoils				
Tukulu	Topsoil	168	0.25	504 000	S1
	Subsoils		0.5	840 000	S2
Arcadia	Topsoil	263	0.25	789 000	S3
	Subsoils		0.25	789 000	S4

12.3 Summary of Mitigation and Management

Table 12-3 to Table 12-5 provide a summary of the proposed project activities, environmental aspects and impacts on the receiving environment. Information on the frequency of mitigation, relevant legal requirements, recommended management plans, timing of implementation, and roles / responsibilities of persons implementing the EMP.

Table 12-3: Impacts

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Kloof Mining Right area					
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Construction, Operational, and Decommissioning/Rehabilitation	Length of pipeline	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all phases
RTSF, RWD, AWTF, CPP- Loss of topsoil as a resource through compaction and erosion	Construction, operation, and decommissioning and rehabilitation	RTSF, RWD, AWTF, CPP	■ Follow adequate soil stripping guidelines proposed. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum	Chamber of Mines – Guidelines for the rehabilitation of mined land	Construction

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			height of 4 m; ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil will be avoided by prohibiting traffic on stockpiles; ■ Stockpiles will only be used for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from		

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; and ■ Only the designated access routes are to reduce any unnecessary compaction.		
RTSF -Loss of topsoil as a resource through contamination	Operation	Surrounding areas	■ Dust suppression; ■ Implement dust suppression measures; and ■ Proper storm management design is to be implemented.	Chamber of Mines – Guidelines for the rehabilitation of mined land	Operation
RTSF, RWD, CPP, and AWTF – Loss of Land Capability and Land Use	Construction, Decommissioning and Rehabilitation Phase	The footprint of the Infrastructure	■ After the completion of the project the area is to be cleared of all infrastructure; ■ The foundations to be removed; and ■ Topsoil to be replaced for rehabilitation purposes.	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all Phases
Driefontein Mining Right Area					
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Construction, Operational, and Decommissioning/Rehabilitation	Length of pipeline route	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all phases

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		
Collection Sumps, Pump Stations, WBT, and BWSF at the Driefontein TSF 3 and 5 – Loss of topsoil as a resource	Construction, Operational, and Decommissioning/Rehabilitation	The footprint of the Infrastructure	■ Follow soil utilisation/ stripping guidelines, as described in the soil stripping guidelines section. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum height of 4 m; ■ Topsoil is to be stripped when the soil is dry, so as to reduce compaction and minimise the effects on soil structure; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all phases

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			■ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ■ Foundation excavated soil should also be stockpiled; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ■ Stockpiles should only be used for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to reduce		

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			any unnecessary compaction; and ■ Implement land rehabilitation measures as defined in rehabilitation report.		
Reclamation of Driefontein TSF 3 and 5 – the land capability and land use	Decommissioning and Rehabilitation Phase	The footprint of the Infrastructure	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; ■ Assessment of potential end land uses.	Chamber of Mines – Guidelines for the rehabilitation of mined land	Decommissioning and Rehabilitation Phase
Cooke Mining Right Area					
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Construction, Operational, and Decommissioning/Rehabilitation	Length of pipeline route	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all phases

Activities	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
			reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		
Reclamation of Cooke TSF, and Cooke 4 South TSF – the land capability and land use	Decommissioning and Rehabilitation Phase	The footprint of the Infrastructure	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site. ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; and ■ Assessment of potential end land uses.	Chamber of Mines – Guidelines for the rehabilitation of mined land	Decommissioning and rehabilitation
Ezulwini Mining Right Area					
Pipeline in all mining right areas - the loss of soils as a resource through compaction and erosion.	Construction, Operational, and Decommissioning/Rehabilitation	Length of pipeline route	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence	Chamber of Mines – Guidelines for the rehabilitation of mined land	Through all phases

Activities	Phase	Size and scale of disturbanc e	Mitigation Measures	Compliance with standards	Time period for implementation
			of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		

Table 12-4: Objectives and Outcomes of the EMP

Activities	Potential impacts	Aspects affected	Phase	Mitigation	Standard to be achieved/objective
Kloof Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction, Operational, and Decommissioning/Rehabilitation	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary	Chamber of Mines – Guidelines for the rehabilitation of mined land

				compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	
RTSF, RWD, AWTF, and CPP	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction and operation,	■ Follow adequate stripping guidelines, as described in the soil stripping guidelines section. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately; ■ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;	Chamber of Mines – Guidelines for the rehabilitation of mined land

				■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ■ Stockpiles should only be sued for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to reduce any unnecessary compaction; and ■ Implement land rehabilitation measures as defined in rehabilitation report.	

RTSF			Operation	■ Implement dust suppression measures; and ■ Proper storm management design is to be implemented.	Chamber of Mines – Guidelines for the rehabilitation of mined land
RWD, CPP, and AWTF	Loss of topsoil as a resource – Compaction and Erosion		decommissioning, and Rehabilitation	■ After the completion of the project the area is to be cleared of all infrastructure; ■ The foundations to be removed; and ■ Topsoil to be replaced for rehabilitation purposes.	Chamber of Mines – Guidelines for the rehabilitation of mined land
RWD, CPP, and AWTF	Loss of Land Capability and Land Use		Construction, Operation, decommissioning, and Rehabilitation	■ After the completion of the project the area is to be cleared of all infrastructure; ■ The foundations to be removed; and ■ Topsoil to be replaced for rehabilitation purposes.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Driefontein Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction, Operational, and Decommissioning/Rehabilitation	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to	Chamber of Mines – Guidelines for the rehabilitation of mined land .

				reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	
Collection Sumps, Pump Stations, WBT, and BWSF	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction, Operational, and Decommissioning/Rehabilitation	■ Follow adequate stripping guidelines, as described in the soil stripping guidelines section. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;	Chamber of Mines – Guidelines for the rehabilitation of mined land

				■ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ■ Stockpiles should only be sued for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to reduce any unnecessary compaction; and	

				■ Implement land rehabilitation measures as defined in rehabilitation report.	
Collection Sumps, Pump Stations, WBT, and BWSF	Loss of Land Capability and Land Use	Soils	Construction, Operation, decommissioning, and Rehabilitation	■ After the completion of the project the area is to be cleared of all infrastructure; ■ The foundations to be removed; and ■ Topsoil to be replaced for rehabilitation purposes.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Reclamation of Driefontein 5 & 3 TSF	Land Capability and Land Use	Soils	Decommissioning and Rehabilitation	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; and ■ Assessment of potential end land uses.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Cooke Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction, Operational, and Decommissioning/Rehabilitation	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;	Chamber of Mines – Guidelines for the rehabilitation of mined land .

				■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	
Reclamation of Cooke TSF, and Cooke 4 South TSF	Land Capability and Land Use	Soils	Decommissioning and Rehabilitation	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; and ■ Assessment of potential end land uses.	Chamber of Mines – Guidelines for the rehabilitation of mined land
Ezulwini Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	Construction, Operational, and Decommissioning/Rehabilitation	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions	Chamber of Mines – Guidelines for the rehabilitation of mined land

				(erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.	.

Table 12-5: Mitigation

Activities	Potential impacts	Aspects affected	Mitigation	Time period for implementation	Compliance with standards
Kloof Mining Right area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;	Through all phases	Chamber of Mines – Guidelines for the rehabilitation of mined land .

			■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		
RTSF, RWD, AWTF, and CPP	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Follow adequate stripping guidelines, as described in the soil stripping guidelines section. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks); ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m	Construction and Operation	Chamber of Mines – Guidelines for the rehabilitation of mined land

			thick will then be stripped and stockpiled separately; ■ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ■ Stockpiles should only be sued for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;		

			■ Only the designated access routes are to reduce any unnecessary compaction; and ■ Implement land rehabilitation measures as defined in rehabilitation report.		
RTSF	Loss of topsoil as a resource – Contamination		■ Implement dust suppression measures; and ■ Proper storm management design is to be implemented.	Operational	Chamber of Mines – Guidelines for the rehabilitation of mined land
RTSF, RWD, CPP, and AWTF	Loss of Land Capability and Land Use		■ After the completion of the project the area is to be cleared of all infrastructure; ■ The foundations to be removed; ■ The RTSF site is to be capped with topsoil and revegetated; and ■ Topsoil to be replaced for rehabilitation purposes.	Decommissioning	Chamber of Mines – Guidelines for the rehabilitation of mined land
Driefontein Mining Right area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to	Through all phases	Chamber of Mines – Guidelines for the rehabilitation of mined land .

			reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		
Collection Sumps, Pump Stations, WBT, and BWSF	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Follow adequate stripping guidelines, as described in the soil stripping guidelines section. ■ The topsoil should be stripped by means of an excavator bucket, and loaded onto dump trucks; ■ Topsoil stockpiles are to be kept to a maximum height of 4 m; ■ Topsoil is to be stripped when the soil is dry, as to reduce compaction; ■ The topsoil 0.25 m of the soil profile should be stripped first and stockpiled separately; ■ The subsoil approximately 0.3 – 0.8 m thick will then be stripped and stockpiled separately;	Through all phases	Chamber of Mines – Guidelines for the rehabilitation of mined land

			■ Soils to be stripped according to the soil stripping ratios and stockpiled accordingly; ■ The handling of the stripped topsoil will be minimized to ensure the soil's structure does not deteriorate; ■ Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles; ■ Stockpiles should only be sued for their designated final purposes; ■ The stockpiles will be vegetated (details contained in rehabilitation plan) in order to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil; ■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to reduce any unnecessary compaction; and		

			▪ Implement land rehabilitation measures as defined in rehabilitation report.		
Collection Sumps, Pump Stations, WBT, and BWSF	Loss of Land Capability and Land Use	Soils	▪ After the completion of the project the area is to be cleared of all infrastructure; ▪ The foundations to be removed; and ▪ Topsoil to be replaced for rehabilitation purposes.	Decommissioning and rehabilitation	Chamber of Mines – Guidelines for the rehabilitation of mined land
Reclamation of Driefontein 5 & 3 TSF	Land Capability and Land Use	Soils	▪ A land contamination study must be done on the soils after reclamation has been completed; ▪ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; ▪ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; and ▪ Assessment of potential end land uses.	Decommissioning and rehabilitation	Chamber of Mines – Guidelines for the rehabilitation of mined land
Cooke Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	▪ Ensure proper storm water management designs are in place; ▪ If erosion occurs, corrective actions (erosion berms) must be taken to minimize any further erosion from taking place;	Through all phases	Chamber of Mines – Guidelines for the rehabilitation of mined land .

			■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		
Reclamation of Cooke TSF, and Cooke 4 South	Land Capability and Land Use	Soils	■ A land contamination study must be done on the soils after reclamation has been completed; ■ If soils are severely contaminated the must be stripped and disposed of at a licensed waste disposal site; ■ Phytoremediation feasibility studies could be considered as part of the contaminated land assessment; and ■ Assessment of potential end land uses.	Decommissioning and rehabilitation	Chamber of Mines – Guidelines for the rehabilitation of mined land
Ezulwini Mining Right Area					
Pipelines	Loss of topsoil as a resource – Compaction and Erosion	Soils	■ Ensure proper storm water management designs are in place; ■ If erosion occurs, corrective actions	Through all phases	Chamber of Mines – Guidelines for the rehabilitation of mined land

			(erosion berms) must be taken to minimize any further erosion from taking place; ■ If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; ■ Only the designated access routes are to be used to reduce any unnecessary compaction; ■ Compacted areas are to be ripped to loosen the soil structure and vegetation cover re-instated; and ■ Implement Land rehabilitation measures as defined in rehabilitation report.		.

Table 12-6: Prescribed environmental management standards, practice, guideline, policy or law

Specialist field	Applicable standard, practice, guideline, policy or law			
Soils	Chamber of Mines – Guidelines for the rehabilitation of mined land			

13 Consultation Undertaken

A formal stakeholder engagement process is being undertaken. Through this process stakeholders have the opportunity to comment on all aspects of the project and specialist studies.

14 Comments and Responses

Comments have been received for soils and responses provided. Please refer to the comments and response report appended to the EIA.

15 Conclusion and Recommendations

The soils in the Kloof mining right area was dominated by the plinthic catena soils of the Avalon, Westleigh and Dresden soil forms. These soils have relatively high land capabilities and the land use matches these potentials at the RTSF, RWD, and AWTF sites are used for cultivation/grazing.

The Driefontein mining right area has significant portions which have a land capability class of II (intensive cultivation). However the pipelines will be constructed above ground and the reclamation of the TSF sites will improve the land capability and land use of the TSF sites if mitigation measures are taken.

The Cooke mining right area falls almost entirely in the Class II (intensive cultivation) land capability. However the pipelines will be constructed above ground and the reclamation of the TSF sites will improve the land capability and land use of the TSF site if mitigation measures are taken.

The Ezulwini mining right area falls within two land capability classes. A land capability of Class III (moderate cultivation) for the pipeline section from the CPP to the Cooke 4 South TSF and Class VI (moderate grazing) at the Cooke 4 South TSF site. The pipelines will be constructed above ground and the reclamation of the TSF site will improve the land capability and land use of the TSF sites if mitigation measures are taken.

The impacts associated with the pipelines are manageable and minor compared to the loss of land use and capability associated with the construction of the RTSF. The primary concern in this study is the loss of agricultural land (land for crop production). The generally disturbed nature of the project area renders the land capability conversion of the RTSF footprint from agricultural to mining the as the most significant impact when considering the loss of potential land use for agricultural purposes. Very little mitigation can be provided for the potential loss of this land, however this loss of land use, when considered with the overall benefit of the project is considered minor. In isolation the impact would be considered to be moderate, however the entire benefit of the project needs to be taken into consideration.

The Impacts associated with the RTSF site is moderate as a result of the RTSF site not being decommissioned. This will permanently change the land capability and land use negatively.

The following recommendations must be followed:

- A land contamination study to be conducted after the TSF sites have been reclaimed to assess the land contamination status;
- Soils to be stripped according to the soil stripping guidelines;
- Phytoremediation feasibility study to be undertaken at the reclaimed TSF sites after land contamination studies have been completed;
- The final end land use for the reclaimed TSF's needs to be determined through a collaborative process and should be aligned with regional closure plans.

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