Project No: ZC.MFG.S.14.10.040

ESKOM - MEDUPI POWER STATION

FGD RETROFIT PROJECT

Baseline &

AND EIA

SPECIALIST SOILS & LAND CAPABILITY STUDIES

Compiled For

February 2018

REPORT V1.2

Sustaining the Environment

Stonecap Trading 14 (Pty) Ltd

Our Ref: ZC.MFG.S.14.10.040
Your Ref: 12949-04-Let-001

07th February 2018

Zitholele Consulting
P.O. Box 6002
Halfway House
1685
Gauteng
South Africa

Attention: Mr. Mathys Vosloo

Dear Mr Vosloo,

Re: ESKOM MEDUPI POWER STATION – FGD RETROFIT PROJECT

BASELINE SOIL INVESTIGATION AND ENVIRONMENTAL IMPACT ASSESSMENT

Attached please find the baseline assessment and specialist opinion regarding the impact of the proposed retrofit that is being considered by Eskom on the area considered for the Flue Gas Desulphurisation Facility (FGD) needed as part of the support infrastructure to reduce SO_2 emissions at the Eskom Medupi Power Station.

This report details the results of the reconnaissance field assessment undertaken for the soils and land capability for the area of concern, and considers the impacts that the proposed development will have on the soils and ecosystem services.

Should you have any queries in this regard, please do not hesitate to contact us.

Yours sincerely,

Earth Science Solutions (Pty) Ltd

Ian Jones - B.Sc. (Geol), Pr.Sci.Nat 400040/08, EAPASA Certified

Director

Nelspruit Office:
Tel: 013-745 7000
E-mail: janine@earthscience.co.za
P. O. Box 2633, George 6530

Middelburg Office:
Tel: 044 873 2094
E-mail: ian@earthscience.co.za
P.O. Box 2633, George 6530

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Author	Ian Jones	Director ESS (Pty) Ltd		07th February 2018
Project Director	Mathys Vosloo	Project Leader		
Technical Review				

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Executive Summary

The Eskom Medupi Power Station is being commissioned as part of the national power supply needed by South Africa and the region.

As part of any power generation system that involves coal combustion, a amounts of waste/by-products (e.g. ash, gases, polluted effluents) are generated, all of which need to be managed.

The project is in the process of developing and installing a Flue Gas Desulphurisation (FGD) plant, as an air quality abatement technology. Part of the waste stream that will be generated by this plant is a by-product (gypsum) process. It is proposed that the gypsum be disposed with ash, at the ash disposal facilities since they classify as the same waste type, Type 3. Sludge and salts will be stored on site temporarily, approximately for five (5) years, and disposed at an authorised hazard waste disposal facility.

The specialist soils and land capability studies are part of the larger environmental assessment and assimilation of scientific input needed for the selection of a suitable site and the consideration of the sustainability of the proposed development in terms of the impacts.

The assessment of alternative disposal sites has subsequently been removed from the scope of the EIA application for the construction of the FGD infrastructure, rail yard and associated infrastructure. The three sites and combinations of sites vary in soil characteristics from highly sensitive wet based materials to moderately deep well drained materials with a moderate to good grazing land potential rating for all but the very shallow steep areas and wet based sensitive sites. These sites also vary somewhat in their geomorphological characteristics. The topography and climate are consistent across the area with flat to undulating landforms and arid to semi-arid climate. Only Site 3 (subsequently eliminated from the assessment) returned steep and rocky terrain.

The alternative assessment has been considered in terms of the present/pre development site utilisation potential and rated in terms of the land capability (based on the soils and geomorphology of the site) and the socio economics and ecosystem services of the sites. As such the outcomes do not place a significant weighting on the utilisation of the soil in terms of rehabilitation and workability. These aspects have been considered as part of the overall sustainability of the project and included in the impact assessment rating.

After lengthy consideration and debate, the South-eastern extent of Site 13 was tabled as the most suitable and environmentally sustainable option. The impact assessment has been undertaken on the area as described in the 12949-46 Rep-008 Bridging Document dated Nov 2017 Rev 0, which relate to the FGD infrastructure footprint within the MPS, and the proposed area associated with the construction of the rail yard and offloading and handling facilities.

The mapping and interpretation of this assessment has been undertaken in terms of the South African environmental legislation and the best practise guidelines as specified in terms of the international norms and best practise as a minimum requirement (IFC Principles)

A comprehensive reconnaissance study of the site was undertaken by a qualified earth scientist as part of the soils and land capability specialist study of the areas (Sites 2, 3, 12 and 13), while the impact assessment and consideration of site management recommendations (soil utilisation plan) has been assessed for the relevant portion of Site 13 and the Medupi Power Station footprint.

The major findings revealed:

- Differences in the geomorphology of the sites (Topography, attitude and ground roughness);
- Differences in soil depth across the sites as well as within the different sites;
- Differences in the texture of the soils (clay content and sand grain size);
- Differences in extent and functionality of the wet based soils across the areas of concern;
- Subtle but significant differences in soil structure (apedel to weak crumby structures);
- Significant differences in the land use and social impact on areas surveyed;

The soils are highly influenced by the parent materials from which they are derived (fine to medium grained sediments for the most part) and by the subtle but variable topography that results in a net positive erosive environment. The attitude of the underlying lithologies (generally flat lying/horizontal) and the negative water balance (evaporation is higher than rainfall) has also had an influence on the weathering processes at work and the pedogenetic mechanisms (soil forming) that contribute to the soil forms mapped.

There are soils with varying degrees of structure, from apedel and single grained silty and sandy loams to sandy clay loams, and those with slightly stronger structure (crumby to slight blocky) associated with the more clay rich soils found as colluvial accumulations in the lower slope and alluvial flood plains. These soils are significantly more clay rich and stronger in structure (pedocutanic to prismacutanic structures with clays typically in excess of 45%) than the in-situ derived soils.

The hydromorphic soils are also highly variable in character, with lower mid-slope transitional form soils and midslope seeps comprising sandy clay with loamy sub-soils and sandy topsoil, to small but significant areas with shallow wetness and structured wetland soil forms that are characterised by pale sandy clay topsoil's, poor organic carbon and well developed hydromorphic characteristics. These soils exhibit stronger than average structure.

In addition to the earth science component, it is also important to note that the present land use also varies, from areas that have already been disturbed by the Power Generation Facility to areas that support commercial livestock herds on low intensity natural grazing, and sites of undisturbed natural Bushveld (Limpopo Sweet Bushveld) that are managed for commercial wildlife hunting and associated activities (Lodges etc.).

These aspects have been taken into account in terms of the ecosystem services that are derived from the land when considering the alternatives.

Based on the reconnaissance soil, land use and land capability assessments carried out on the alternatives (Sites 2, 12 and 13), the site considered for further development is Site 13.

Of consequence to the findings of the specialist soils and land capability for Site 13 are the following:

- The area of concern has already been disturbed by the Medupi Power Generation construction and its associated support infrastructure;
- There are no commercial farming activities;
- There is no subsistence farming on the area;
- The land capability is considered to be of a disturbed nature;
- The majority of the area of concern comprises soils that are moderately shallow (500mm to 800mm);
- The soils are moderately easily worked and stored, albeit that erosion is an issue to be considered and managed.

GLOSSARY OF TERMS

Alluvium: Refers to detrital deposits resulting from the operation of modern streams and rivers.

Base status: A qualitative expression of base saturation. See base saturation percentage.

Black turf: Soils included by this lay-term are the more structured and darker soils such as the Bonheim, Rensburg, Arcadia, Milkwood, Mayo, Sterkspruit, and Swartland soil forms.

Buffer capacity: The ability of soil to resist an induced change in pH.

Calcareous: Containing calcium carbonate (calcrete).

Catena: A sequence of soils of similar age, derived from similar parent material, and occurring under similar macroclimatic conditions, but having different characteristics due to variation in relief and drainage.

Clast: An individual constituent, grain or fragment of a sediment or sedimentary rock produced by the physical disintegration of a larger rock mass.

Cohesion: The molecular force of attraction between similar substances. The capacity of sticking together. The cohesion of soil is that part of its shear strength which does not depend upon inter-particle friction. Attraction within a soil structural unit or through the whole soil in apedel soils.

Concretion: A nodule made up of concentric accretions.

Crumb: A soft, porous more or less rounded ped from one to five millimetres in diameter. See structure, soil.

Cutan: Cutans occur on the surfaces of peds or individual particles (sand grains, stones). They consist of material which is usually finer than, and that has an organisation different to the material that makes up the surface on which they occur. They originate through deposition, diffusion or stress. Synonymous with clayskin, clay film, argillan.

Desert Plain: The undulating topography outside of the major river valleys that is impacted by low rainfall (<25cm) and strong winds.

Denitrification: The biochemical reduction of nitrate or nitrite to gaseous nitrogen, either as molecular nitrogen or as an oxide of nitrogen.

Erosion: The group of processes whereby soil or rock material is loosened or dissolved and removed from any part of the earth's surface.

Fertilizer: An organic or inorganic material, natural or synthetic, which can supply one or more of the nutrient elements essential for the growth and reproduction of plants.

Fine sand: (1) A soil separate consisting of particles 0,25-0,1mm in diameter. (2) A soil texture class (see texture) with fine sand plus very fine sand (i.e. 0,25-0,05mm in diameter) more than 60% of the sand fraction.

Fine textured soils: Soils with a texture of sandy clay, silty clay or clay.

Hardpan: A massive material enriched with and strongly cemented by sesquioxides, chiefly iron oxides (known as ferricrete, diagnostic hard plinthite, ironpan, ngubane, ouklip, laterite hardpan), silica (silcrete, dorbank) or lime (diagnostic hardpan carbonate-horizon, calcrete). Ortstein hardpans are cemented by iron oxides and organic matter.

Land capability: The ability of land to meet the needs of one or more uses under defined conditions of management.

Land type: (1) A class of land with specified characteristics. (2) In South Africa it has been used as a map unit denoting land, mapable at 1:250,000 scale, over which there is a marked uniformity of climate, terrain form and soil pattern.

Land use: The use to which land is put.

Mottling: A mottled or variegated pattern of colours is common in many soil horizons. It may be the result of various processes *inter alia* hydromorphy, illuviation, biological activity, and rock weathering in freely drained conditions (i.e. saprolite). It is described by noting (i) the colour of the matrix and colour or colours of the principal mottles, and (ii) the pattern of the mottling.

The latter is given in terms of abundance (few, common 2 to 20% of the exposed surface, or many), size (fine, medium 5 to 15mm in diameter along the greatest dimension, or coarse), contrast (faint, distinct or prominent), form (circular, elongated-vesicular, or streaky) and the nature of the boundaries of the mottles (sharp, clear or diffuse); of these, abundance, size and contrast are the most important.

Nodule: Bodies of various shapes, sizes and colour that have been hardened to a greater or lesser extent by chemical compounds such as lime, sesquioxides, animal excreta and silica. These may be described in terms of kind (durinodes, gypsum, insect casts, ortstein, iron, manganese, lime, lime-silica, plinthite, salts), abundance (few, less than 20% by volume percentage; common, 20 – 50%; many, more than 50%), hardness (soft, hard meaning barely crushable between thumb and forefinger, indurated) and size (threadlike, fine, medium 2 – 5mm in diameter, coarse).

Overburden: A material which overlies another material difference in a specified respect, but mainly referred to in this document as materials overlying weathered rock.

Ped: Individual natural soil aggregate (e.g. block, prism) as contrasted with a clod produced by artificial disturbance.

Pedocutanic, diagnostic B-horizon: The concept embraces B-horizons that have become enriched in clay, presumably by illuviation (an important pedogenic process which involves downward movement of fine materials by, and deposition from, water to give rise to cutanic character) and that have developed moderate or strong blocky structure. In the case of a red pedocutanic B-horizon, the transition to the overlying A-horizon is clear or abrupt.

Pedology: The branch of soil science that treats soils as natural phenomena, including their

morphological, physical, chemical, mineralogical and biological properties, their genesis, their classification and their geographical distribution.

Slickensides: In soils, these are polished or grooved surfaces within the soil resulting from part of the soil mass sliding against adjacent material along a plane which defines the extent of the slickensides. They occur in clayey materials with a high smectite content.

Sodic soil: Soil with a low soluble salt content and a high exchangeable sodium percentage (usually EST > 15).

Swelling clay: Clay minerals such as the smectites that exhibit interlayer swelling when wetted, or clayey soils which, on account of the presence of swelling clay minerals, swell when wetted and shrink with cracking when dried. The latter are also known as heaving soils.

Texture, soil: The relative proportions of the various size separates in the soil as described by the classes of soil texture shown in the soil texture chart (see diagram on next page). The pure sand, sand, loamy sand, sandy loam and sandy clay loam classes are further subdivided according to the relative percentages of the coarse, medium and fine sand subseparates.

Vertic, diagnostic A-horizon: A-horizons that have both, a high clay content and a predominance of smectitic clay minerals possess the capacity to shrink and swell markedly in response to moisture changes. Such expansive materials have a characteristic appearance: structure is strongly developed, ped faces are shiny, and consistence is highly plastic when moist and sticky when wet.

1. INTRODUCTION AND TERMS OF REFERENCE

Eskom Holdings SOC Limited (Eskom) obtained an Environmental Authorisation (EA) in 2006 for construction and operation of the Medupi Power Station. According to the EA granted, the Medupi Power Station must "*install, commission and operate any required SO_2 abatement measures to ensure compliance with the applicable emission or ambient air quality standards published in terms of the National Environmental Management: Air Quality Act NEMAQA (Act No 39 of 2004)*".

In order to address the requirements prescribed by the EA, Eskom embarked on a programme to retrofit a Flue Gas Desulphurisation (FGD) system at each of the Units as part of its operations.
The Medupi FGD Retrofit Project is aimed at installation of FGD systems to the six (6) x 800 megawatt coal fired steam electric generating units. The Scoping Report (dated June 2015) described the need for and types of facilities that are necessary for the installation and operation of the Flue Gas Desulphurisation system.

The proposed activities associated with the installation and operation of the FGD system and associated infrastructure would trigger a number of listed activities, waste management activities and water uses in terms of the National Environmental Management Act, No 107 of 1998 (NEMA) and EIA regulations or 2014, as amended, as well as the National Environmental Management: Waste Act, No 59 of 2008 (NEMWA) and National Water Act, No. 36 of 1998 (NWA), respectively.

Zitholele Consulting was appointed to undertake the integrated Environmental Impact Assessment (EIA) process for the proposed Medupi Power Station FGD retrofit project. This process was initiated early in 2014 and the Final Scoping Report was accepted by the Department of Environmental Affairs (DEA) at the end of July 2015.
Since acceptance of the FSR, the project and EIA process experienced some delays as the project unfolded resulting in the need to adapt the EIA process in order for Eskom to meet its commitment to remain compliant to the NEMAQA. A Bridging Document was subsequently circulated to inform all registered Interested and Affected Parties (IAPs), key stakeholders and authorities of the proposed changes in October 2016.

The scope of work assessed in this DEIR includes assessment of the following activities and infrastructure:

- Construction and operation of a rail yard/siding to transport Limestone from a source defined point via the existing rail network to the Medupi Power Station and proposed rail yard / siding. The rail yard infrastructure will include storage of Flue (diesel) in above ground tanks and 15m deep excavation for tippler building infrastructure;
- Construction and operation of limestone storage area, preparation area, handling and transport via truck and conveyor to the FGD system located near the generation units of the Medupi Power Station;
- The construction and operation of the wet FGD system that will reduce the SO_2 content in the flue gas emitted;
- Construction and operation of associated infrastructure required for operation of the FGD system and required services to ensure optimal functioning of the wet FGD system. The associated FGD infrastructure include a facility for storage of Flue (diesel), installation of stormwater infrastructure and conservancy tanks for sewage;
- The handling, treatment and conveyance of gypsum and effluent from the gypsum dewatering plant. Disposal of gypsum on the existing ADF is not included in the current EIA application and will be addressed in the ADF WML amendment application.

- Pipeline for the transportation of waste water from the gypsum dewatering plant and its treatment at the WWTP that will be located close to the FGD infrastructure within the Medupi Power Station;
- Construction and operation of the WWTP;
- Management, handling, transport and storage of salts and sludge generated through the waste water treatment process at a temporary waste storage facility. In terms of the EIA process impacts related to the management of salts and sludge will be considered in the EIR. However, licencing of the storage activity and requirements relating to the waste storage facility will be assessed in the WML registration application process.
- The transportation of salts and sludge via trucks from the temporary waste storage facility to a final Waste Disposal Facility to be contracted by Eskom for the first 5 years of operation of the FGD system. Long term disposal of salts and sludge will be addressed though a separate independent EIA process to be commissioned by Eskom in future.
- Disposal of gypsum together with ash on the existing licenced ash disposal facility (ADF), with resulting increase in height of the ADF from 60m to 72m.

As part of the original scoping and assessment of alternatives for the DFGD site Earth Science Solutions (Pty) Ltd undertook a comprehensive reconnaissance site assessment of a number of potential sites identified by the client. The alternative assessment was then utilised by the lead consultants as part of the optimisation process and impact sustainability study.

As part of the environmental assessment, the soils, and land capability were investigated and the baseline conditions to the areas of concern were considered in better understanding the existing conditions and the potential impact of the developments being proposed. These studies were undertaken in conjunction with an investigation of the pre development (existing) land use.

Earth Science Solutions (PTY) Ltd was commissioned to carry out a comprehensive reconnaissance soil and land capability assessment of the development.

The studies considered the soils in terms of their physical and chemical properties, while other geomorphological aspects were also mapped as part of determining the land capability of the study area. To this end, the local climate, ground roughness, topographic features such as altitude, attitude and slope were recorded, in addition to the pre development land use which was noted as part of better understanding the eco system services of the area.

The soil wetness and its relative wetland status was also assessed as one of the more important soil features that might have a bearing on the site selection, with the semi-arid to arid climate and relative position of the study area within the Limpopo valley, features that are important to the overall biodiversity and sensitivity of the area within the ecological cycle.

Additional input and comment from the hydrologists and ecologists was also considered in rating the site sensitivity, with additional inputs from the ecological team needed in the interpretation and classification of the “wetland” status.

This document should be read in conjunction with the ecological, hydrological and biodiversity studies as these will help to better define the wetland status and natural connections that control the life cycle of the area.

This report has been structured so as to satisfy the requirements of the National Environmental Management Act (NEMA) as well as the other related laws and guidelines required in terms of the

Department of Agriculture, Water Affairs, etc., while the Performance Standards used by the World Bank in terms of the IFC Guidelines have been taken as best practice principles.

Using these guidelines and policy norms, the initial project was undertaken to answer the questions asked in terms of the site selection alternatives.

Aspects considered in the site investigation included:

- The current status of the soils (characterise and classify);
- Current level of soil disturbance;
- Agricultural potential/land capability;
- Assessment of occurrence and spatial distribution of the wet based soils, and
- The mapping of the present land use

To this end, a number of in-field site parameters were noted

These included:

- Soil character, inclusive of average soil depth, structure and wetness;
- Existing impacts due to present land use (disturbed).

Historically, the land has been utilised for wildlife game farming with some low intensity commercial grazing, while more recently the site has been developed as part of the power generation plant and its associated support infrastructure.

With the ever-increasing competition for land, it has become imperative that the full scientific facts for any new development site are known, and the effects/impacts on the land to be used by any other proposed enterprise be evaluated prior to the new activity being implemented.

during the initial site selection process the site assessment of a new alternative ADF site for disposal of wastes from year 21 – 50 have been removed from the scope of the EIA application and will be undertaken as a separate and independent environmental authorisation process

The already disturbed nature of this area being considered for the FGD, and the fact that the site has already been authorised for industrial use reduces the potential impact on the overall area.

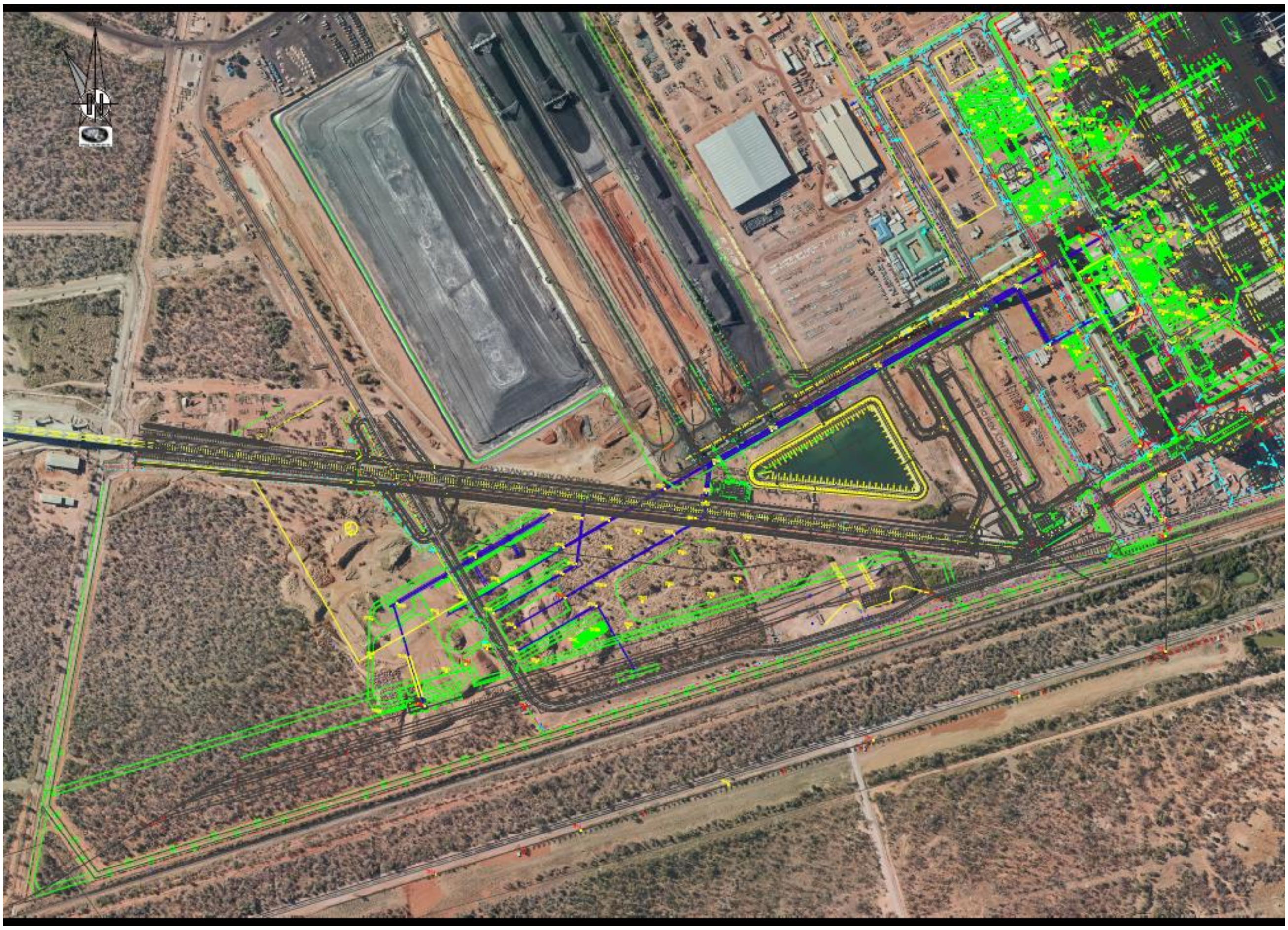

Figure 1.4 – Proposed development area for the rail yard and FGD infrastructure

2. DESCRIPTION OF THE PRE-CONSTRUCTION ENVIRONMENT

2.4 SOILS

2.4.1 Data Collection

In better understanding the potential impacts to the site delineated, all existing information and any Environmental Impact Statements relating to the area in general was used as input to the baseline of information for the planned Waste Disposal Facility (receive ash from the power station coal combustion process as well as gypsum from the FGD process and salts and sludge from the Waste Water Treatment Plant).

In addition, the 1:250 000 and 1:50 000 scale topocadastral maps, the Land Type Mapping, and the LiDAR Imagery was also used to better define and map the baseline conditions for the site.

The field inspection undertaken involved the characterisation and classification of the broad soils for the site, while an assessment of the geomorphological character of the area was important in assessing and rating the capability of the land.

The present land use was noted as part of the field study, and mapped using the aerial imagery available.

The soils were characterised and classified according to the Taxonomic Classification System and the soil forms were noted/recorded wherever a profile was examined, and the general soil groupings or major soil forms were mapped to ArcGIS.

The existing geomorphological information (Topocadastral maps and Land Type mapping) was captured and assimilated as part of the baseline information, and combined with the soil mapping as the basis for the land capability rating.

2.4.2 Description

Background information was obtained from the geological exploration conducted in the area (coal mining) and from the geotechnical mapping undertaken for the Matimba and Medupi projects. This information was of significance and useful to the soils study.

Information mapped included the depth of soil or saprolite to the calcrete interface, while the depths to weathered rock and the depth of the static water level associated with the fractured rock aquifer have all be used in better understanding the earth science of the site and their influence on the pedogenisis in the study areas.

These geomorphological characteristics are further influenced by the negative water balance and semi-arid climate, with the effects of evaporites and the development of calcrete and ferricrete/laterites being highlighted as aspects of importance to the ecological status and conditions that influence the land capability.

The major attributes of the groupings of soil include (Refer to Figure 2.4.2), the soil depth, structure and texture. These variables have been used to construct a soils map of the dominant soils units. These have been defined as:

- Shallow (<400mm) sandy to silty loam (salm/silm);
- Moderate to shallow (400mm to 600mm) sandy loam (salm);
- Moderate to deep (500mm to 750mm) sandy loam and sandy clay loams (sacllm);

- Wet based soils with a variety of depths and clay composition.

In line with the Taxonomic classification used, the major or dominant soil forms mapper include those of the orthic phase Hutton, Clovelly, Glenrosa and Mispah forms with sub dominant soils of the Tukulu, Valsrivier and Shortlands Form, while the major hydromorphic forms mapped include the Glencoe, Dresden, Avalon, Pinedene, Bloemdal and Westleigh forms.

The semi-arid climate and negative water balance combined with the horizontal attitude of the sedimentary host lithologies that characterise the Karoo sediments in the area have aided in the development of evaporites within the vadose zone. These include calcrete, and in places ferricrete or laterite (Ouklip) formation as a feature of some of the soil profile.

The presence of a hard pan calcrete and in places ferricrete and plinthic horizons is considered of importance to the soil moisture regime and in many cases is the reason for wet features within the soil profile (barrier layer). This moisture is important to the biodiversity, the presence of pans and water features within the landscape, and the success or failure of the wetland systems in the extreme. These soils classify as highly sensitive where they occur within the top 500mm of the soil profile.

In addition to the geomorphological aspects mentioned above, soil texture and structure also played a role in the soil classification and the resultant sensitivity of the materials mapped. The fine to medium grained nature of the top soils, the relatively low clay contents (<12%) and the generally low organic carbon renders the majority of the top soils highly sensitive to erosion.

This is only tempered by the relative flatness of the topography for all but a few areas, with a resultant moderate to low erosion index for most of the site if not well protected. Once the cover is disturbed or removed, the potential for erosion is increased.

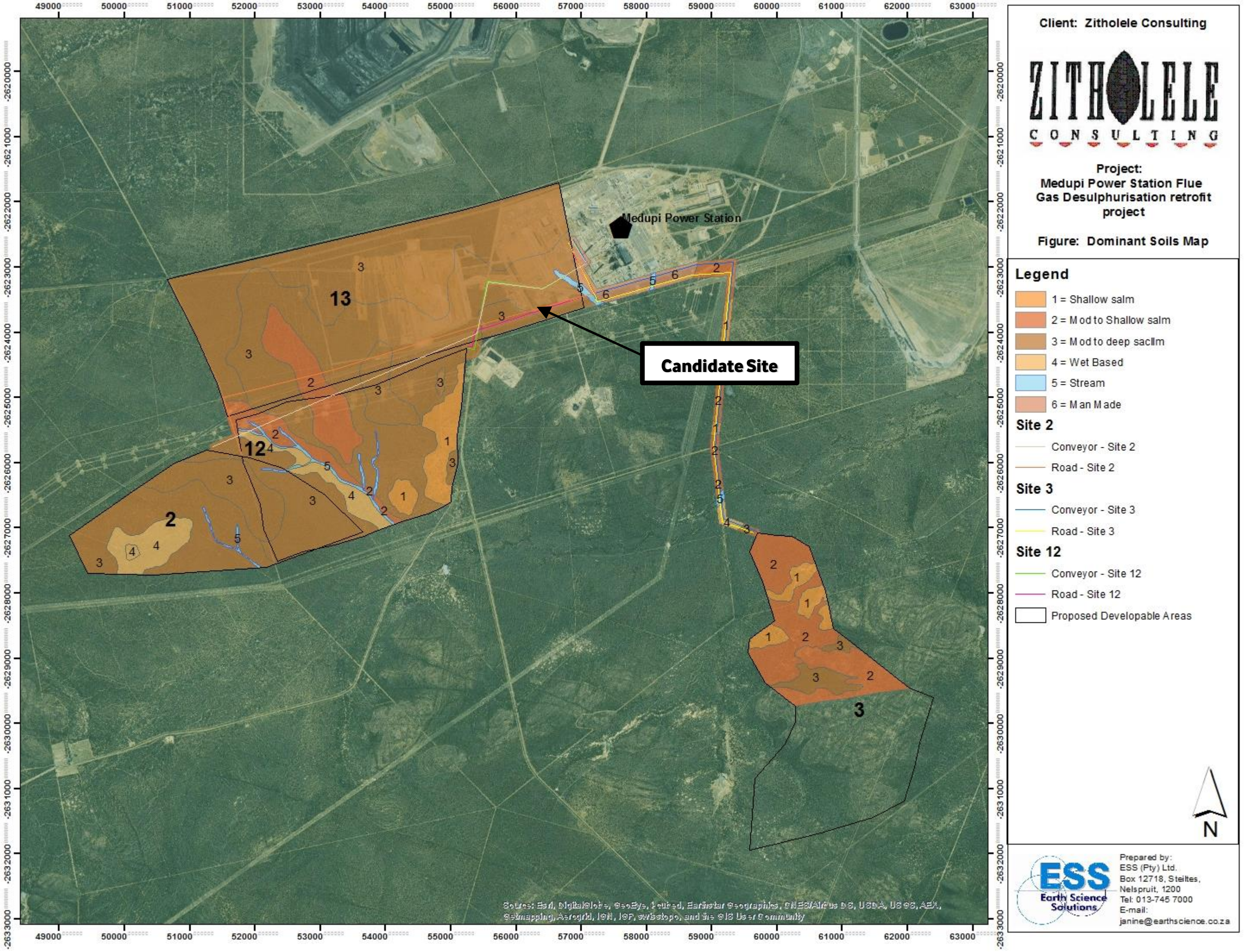

Figure 2.4.2 – Dominant Soils Map

The shallower soils comprise for the most part fine to medium grained sandy topsoils on lithocutanic subsoil (Glenrosa) or sandy loams on a hard rock base (Mispah). These soils are limited with, the majority of the area comprising deeper sandy loams and silty clay loams (800mm to 1.200mm) of the Hutton and Clovelly soil form.

The shallower soils and wet based materials are considered to be more sensitive/vulnerable in terms of their biophysical and ecological functionality and although limited in extent on the area of concern, their presence downslope of the site is noted...

Hydromorphic soils are often associated with wetlands or the transition to the wetlands, are generally found associated with either perched seep zones were the soils have been restricted within a concave land form, or in association with the moist grasslands and valley bottoms.

Overall, the effective rooting depths (utilisable soil - to top of mottled horizon) vary from 500mm to over 800mm, the area of concern (Refer to Figure 2.4.2) returning relatively much deeper and slightly more productive (better nutrient status, depth and water holding capabilities) land capability ratings than many of the other sites surveyed.

2.4.4 Characteristics of different Soil Groups

2.4.4.1 The Clay Rich Soils

In general the soils with the higher clay content are associated with the colluvial derived/transported materials, and are most often found associated with the lower lying streams and river deposits, albeit that the geology and underlying lithologies also influence the soil pedogenisis, with the more basic lithologies producing soils with more structure and heavier clay percentages.

These soils are not common on the area of concern.

2.4.4.2 Shallow soils

Although limited in extent, the sensitivity of the shallower soils is of importance. In the area of study, these soils are almost always founded directly on a hard rock interface, with little to no saprolite at the base of the "B" horizon and are considered of a poor to very poor land capability rating.

Removal of the vegetative cover and/or disturbance of the top soils will increase the erosion index to high.

2.4.4.3 Light Textured Soils

The light textured soils include the majority of the orthic form soils, as well as some of the deeper hydromorphic soil Forms.

The majority of these Forms are characterised by an orthic "A" horizon overlying a red or red-brown apedel (poorly structured) B, with indications of mottling within the lower "B" horizons in the case of the hydromorphic soils.

Depths to the "C" horizon or the plinthic layer vary from less than 500mm on the shallow forms to over 800mm on the deep colluvial soils. The soils generally show a very thin saprolitic horizon, with the sub soils founded directly on hard bedrock.

The sensitivity of these soils is highly variable and depended on the depth and relative texture (clay content) of the materials. However, on average, and for the dry soils that are greater than 700mm deep, these soils are of the least sensitive, are generally more easily worked on and with, and can be stored with relative ease and re-used at closure for rehabilitation.

The majority of the site considered for the development comprises soils with these ccharacteristics.

2.4.5 Soil Erodibility (E.I.)

The erosion indices for the dominant soil forms on the study sites classify as moderate to high. This is largely ascribed to the low, or at best moderate clay content of the “A” horizons, and the low organic carbon content. These factors are tempered somewhat by the relative flatness of the terrain for all but a few areas, and the generally well conserved vegetative cover (all but the shallow soils and over utilised valley bottoms). It should be noted however, that the vulnerability of the subsoil’s to erosion once the vegetative cover and topsoil layer have been disturbed or removed is markedly higher than for undisturbed soils. Good management of these soils for erosion and compaction will be essential.

2.5 PRE-DEVELOPMENT LAND CAPABILITY

2.5.1 Data Collection

The land capability of the study areas was classified according to the Canadian Land Inventory and Chamber of Mines Guidelines (1991). The criteria for this classification are set out in Table 2.5.1. The criteria are based on dryland cropping, on an average cropping regime and average climatic conditions for the region.

Table 2.5.1 Criteria for Pre-Mining Land Capability (Chamber of Mines 1991)

Criteria for Wetland

- Land with organic soils or supporting hygrophilous vegetation where soil and vegetation processes are water dependant.

Criteria for Arable land

- Land, which does not qualify as a wetland.
- The soil is readily permeable to a depth of 750 mm.
- The soil has a pH value of between 4.0 and 8.4.
- The soil has a low salinity and SAR
- The soil has less than 10% (by volume) rocks or pedocrete fragments larger than 100 mm in the upper 750 mm.
- Has a slope (in %) and erodibility factor (K) such that their product is <2.0
- Occurs under a climate of crop yields that are at least equal to the current national average for these crops.

Criteria for Grazing land

- Land, which does not qualify as wetland or arable land.
- Has soil, or soil-like material, permeable to roots of native plants, that is more than 250 mm thick and contains less than 50 % by volume of rocks or pedocrete fragments larger than 100 mm.
- Supports, or is capable of supporting, a stand of native or introduced grass species, or other forage plants utilisable by domesticated livestock or game animals on a commercial basis.

Criteria for Wilderness land

- Land, which does not qualify as wetland, arable land or grazing land.

The “land capability classification” as described above was used in conjunction with the soil units identified during the pedological survey and the overall geomorphology of the area.

The present day land use has been described from observations made during the site visit, and inspection of the satellite imagery supplied.

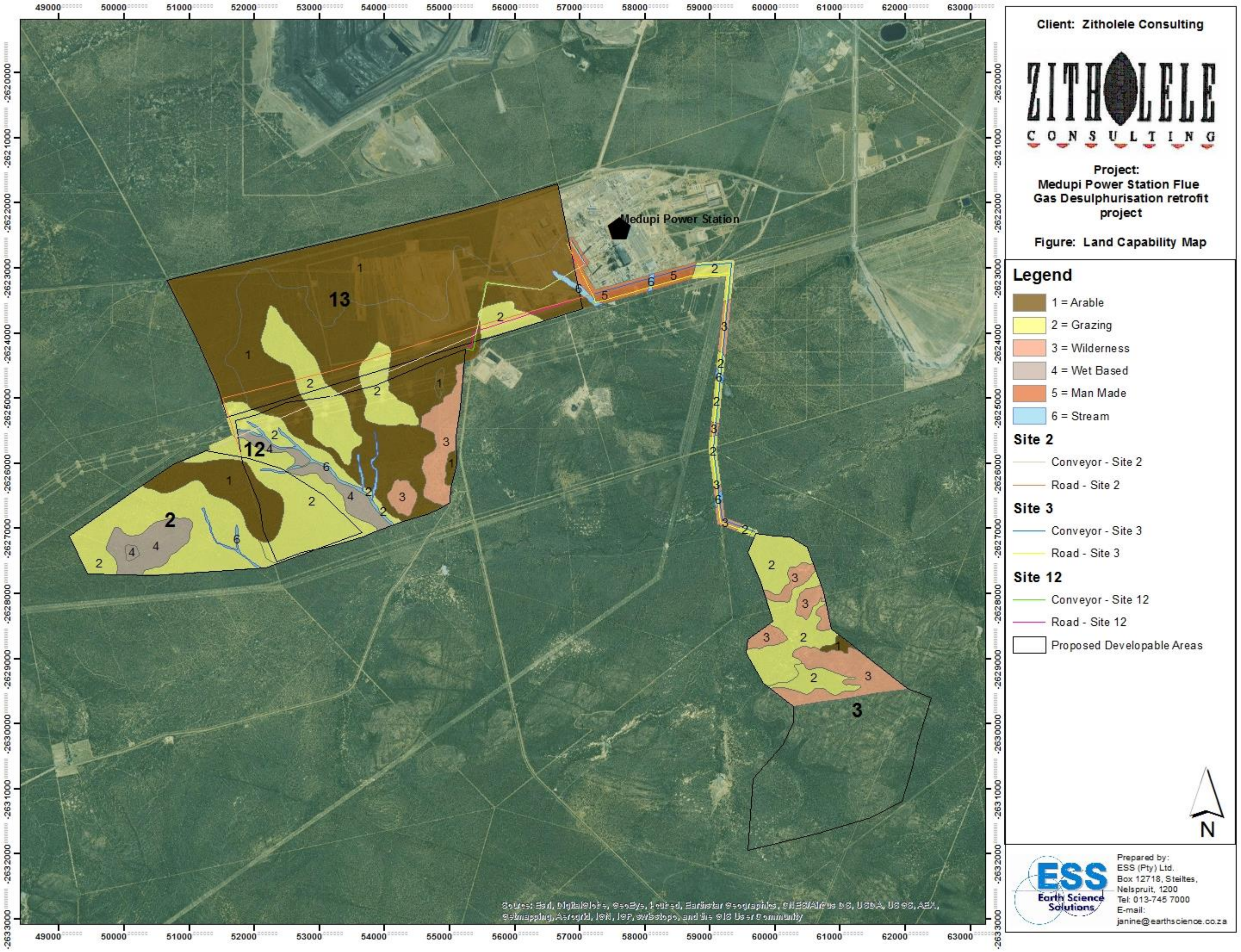

Figure 2.5 – Land Capability Plan

2.6 Baseline Results

The field data and additional input from the client, land owners and associate consultants was used as the basis for the alternatives assessment. Sustainability and the concept of “No Net Loss” was considered in conjunction with the legal requirements both locally as well as internationally.

The ability of the earth scientist to assist the development and planners in obtaining the best alternative for a development is not just the outcomes of the specific speciality, but is often found in the understanding of the interrelationship between the various disciplines. A straight association is not always a true reflection of the sensitivity of a resource to impact, and might require that a weighting is attached to the particular aspect being considered.

However, this is best left to the EAP as he/she has the cross section of the specialist information at hand, and so a straight (un-weighted) comparison of the alternatives has been used for this assessment.

With changes to the activities and design criteria for the proposed retrofit to the power station, an area within the already disturbed footprint of Site 13 was considered the best option and position for any development due to its already disturbed nature. .

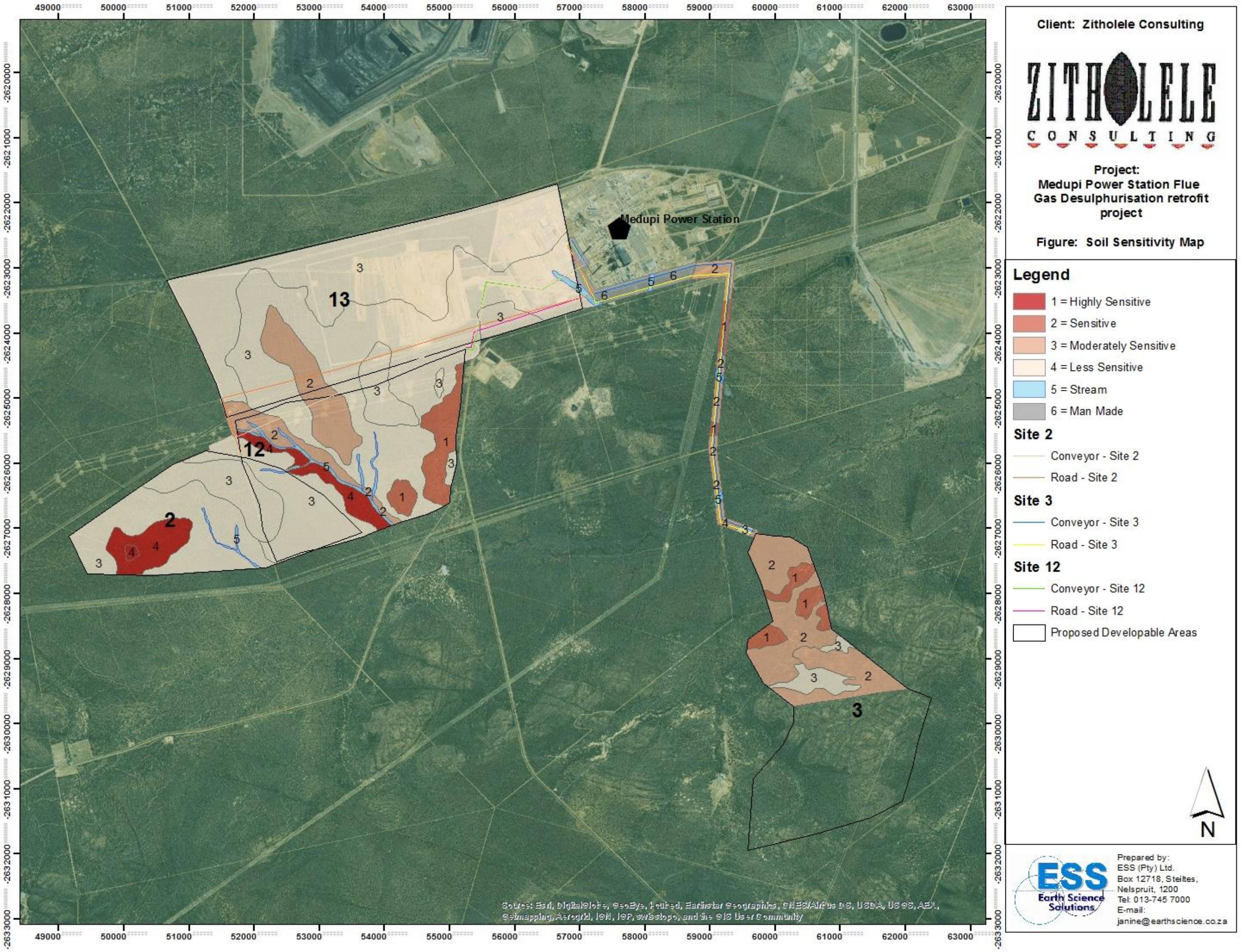

Figure 2.6 – Site Sensitivity Map

3 Impact Assessment

3.1 General

The infrastructure planned for the waste disposal facility will include (Refer to Design Reports) some large and heavy structures and relatively deep excavations. These will entail the removal of significant quantities of soil, and possibly the complete removal of soil and soft overburden in places were the foundations for the larger structures are to be excavated.

The conveyer route and maintenance/access roadways will required less engineering as the size and weight of implements and machinery will be relatively smaller/less, albeit that they will still require strong foundations with well-engineered sub-base for all plinth footings etc.

These soils will all be sterilized and lost from the system for the life of the operation and possibly beyond.

A number of site specific baseline (existing environment) conditions are of special significance and need mention here if the relative impacts of the activities being planned are to be understood.

Of significance are:

- FGD retrofit infrastructure to be constructed and operated within the Medupi Power Station footprint;
- Temporary storage of FGD WWTP solid waste (salts and sludge) at a hazardous waste storage facility within the Medupi Power Station footprint, to be removed by an accredited service provider to an approved waste disposal facility;
- Temporary trucking of salts and sludge from the FGD WWTP to a designated hazardous waste facility for disposal.
- Construction of a pollution control facility receiving dirty water runoff from the limestone holding area (licencing in terms of the NWA);
- Construction of infrastructure for the loading and offloading of gypsum and limestone at the proposed railway siding for the possible transport of limestone and gypsum to and from the power station, respectively.

These activities will have a bearing on the ratings being assigned to the overall impact significance, the loss of soil and land capability having a localised negative impact that is of significance to the ecological functionality of the area.

However, it is also important to note that the pre-development conditions or status quo for the area of concern is one of disturbed industrial. For the most part the site comprises land that has been cleared or disturbed to some degree by the power station development.

The concerns and probable impacts that could affect the soils and associated land capability are confined to:

- The loss of the soil resource due the **change in land use** and the removal of the resource from the existing system (Sterilization). These are generally associated with the construction of the facilities and the use of the footprint area for the development of industrial activities. These activities will result in the complete loss of the soil resource for the life of the project. The management of waste could potentially sterilize the soils permanently, if not removed/striped, stored and well managed;

- The loss of the soil resource due to **erosion** (wind and water) of unprotected materials due to the removal of vegetative cover and/or topsoil;
- The loss of the utilization potential of the soil and land capability due to **compaction** of areas adjacent to the constructed facilities by vehicle and construction activities;
- Loss of the resource due to **removal** of materials for use in other activities (dam wall construction, development of berms and the storage of the soils in stockpiles);
- The **contamination** of the resource due to spillage of raw materials and reagents (Gypsum, limestone etc.) that are transported to the site;
- The **contamination** of stored or in-situ materials due to dust or dirty water from the project area and transport routes;
- The loss of the soil utilization potential due to the **disturbance** of the soils and potential loss of nutrient stores through leaching and de-nitrification of the stored or disturbed materials.

3.2 Impact Assessment

3.2.1 Construction Phase

Issue - Loss of utilisable resource (sterilization and erosion), compaction and contamination or salinisation.

The construction phase will require:

- The stripping of all utilisable soil (Top 250mm to 700mm depending on activity);
- The preparation (levelling and compaction) of lay-down areas, foundations and pad footprint areas for stockpiling of utilisable soil removed from the footprint to the development area, Return Water Dams (RWD) and Soil Stockpiles,
- The stormwater management system (Dams, Water Reservoir etc.), and the foundations for the support infrastructure;
- The clearing, stripping and stockpiling from the construction of all access and conveyencing routes, electrical servitudes and water reticulation (pipelines and overhead power lines) etc.;
- The use of heavy machinery over unprotected soils;
- The creation of dust and loss of materials to wind and water erosion, and
- The possible contamination of the soils by dirty water, chemicals and hydrocarbons spills (dust and dirty water runoff);

Impact Risk

The loss of the utilization of the soil resource will negatively impact the land use practice. These activities are perceived to be of great economic benefit to the local economy and land owners and contribute to the ecosystem services.

The proposed retrofit project will, if un-managed and without mitigation have a **definite,** MODERATE to HIGH negative significance, that will affect the *development site and its immediate* surroundings for the medium to long term (life of the project and possibly beyond), and is *going to occur*.

The planned construction activities will result in:

- The loss of soil material and its ecosystem services as a result of its disturbance;
- Contamination by hydrocarbon and reagent chemical spills if not well managed
- Compaction of working/laydown areas and storage facility footprint an
- The potential for erosion (wind and water – dust and suspended solids) over unprotected areas;

These impacts will:

- Have a moderate negative intensity potential ranking based on the moderately confined nature of the infrastructure and the already disturbed nature of the area of concern;
- Continue throughout the construction phase and into the operational phase;
- Have a permanent but reversible (can be broken down and rehabilitated), and
- Be confined to the site only - localised.

However, with management, the loss, degree of contamination, compaction and erosion of this resource can be mitigated and reduced to a level that is more acceptable.

The reduction in the risk rating of the impact can be achieved by:

- Limiting the area of impact to as small a footprint as possible, inclusive of the resource (soils) stockpiles and the length of servitudes, access and haulage ways and conveyencing systems;
- Construction of the facility and associated infrastructure over the less sensitive soil groups (reduce impact over wetlands and soils sensitive to erosion and/or compaction);
- The development and inclusion of soil management as part of the general housekeeping operations, and the independent auditing of this management;
- Concurrent rehabilitation of all affected sites that are not required for the operation;
- The rehabilitation of temporary structures and footprint areas used during the pre-construction/feasibility investigation (geotechnical pits, trenching etc.);
- Effective soil stripping during the less windy months when the soils are less susceptible to erosion;
- Effective cladding of any berms and all soil stockpiles with vegetation or large rock fragments, and the minimising of the height of storage facilities to 15m and soil berms to 1,5m wherever possible;
- Restriction of vehicle movement over unprotected or sensitive areas, this will reduce compaction;

Residual Impact

The above management procedures will **probably** reduce the negative significance rating and resultant risk impact to a MODERATE or LOW. Based on the historical activities (disturbed nature of the site) these actions are *very likely to occur.*

3.2.2 Operational Phase

Issue Loss of utilisable resource (Sterilisation and erosion), compaction, de-nutrification and contamination or salinisation.

The operation of the planned FGD Facilities and support infrastructure/activities will see the impact of the transportation of materials into and out of the waste site, the potential for spillage and contamination of the in-situ and stockpiled materials, contamination due to dirty water run-off and/or contaminated dust deposition/dispersion, the de-nutrification of the stockpiled soils due to excessive through flow and the leaching out of nutrients and metals due to rain water on unconsolidated and poorly protected soils. The potential for compaction of the in-situ materials by uncontrolled vehicle movement and the loss to the environment down-wind and downstream of soil by wind and water erosion over un-protected ground is also likely if the activities are not well managed.

Un-managed soil stockpiles and soil that is left uncovered or unprotected will be lost to wind and water erosion, will lose the all-important, albeit moderately poor nutrient content and organic carbon stores (fertility), and will be prone to compaction.

A positive impact will be the rehabilitation of the temporary infrastructure used during the start-up and construction phase.

Impact Significance

In the un-managed scenario these activities will **probably** result in a MODERATE to HIGH negative significance that will affect the *development footprint and adjacent* sites for the medium to long term. These effects are *very* likely to occur.

The impacts on the soils during the operational phase can be mitigated with well initiated management procedures.

These should include:

- Minimisation of the area that can potentially be impacted (eroded, compacted, sterilised or de-nutrified);
- Timeous replacement of the soils so as to minimise/reduce the area of affect and disturbance;
- Effective soil cover and adequate protection from wind (dust) and dirty water contamination – vegetate and/or rock cladding;
- Regular servicing of all vehicles in well-constructed and bunded areas;
- Regular cleaning and maintenance of all haulage ways, conveyencing routes and service ways, drains and storm water control facilities;
- Containment and management of spillage;
- Soil replacement and the preparation of a seed bed to facilitate and accelerate the re-vegetation program and to limit potential erosion on all areas that become available for rehabilitation (temporary servitudes), and
- Soil amelioration (rehabilitated and stockpiled) to enhance the growth capability of the soils and sustain the soils ability to retain oxygen and nutrients, thus sustaining vegetative material during the storage stage.

It will be necessary as part of the development plan to maintain the integrity of the stored soils so that they are available for rehabilitation at decommissioning and closure. If the soil quantities and qualities (utilisable soils) are managed well throughout the operational phase, rehabilitation costs will be reduced and natural attenuation will more easily and readily take effect. This will result in a more sustainable "End Land Use" being achieved.

Residual Impact

In the *long term* (Life of the operation and beyond) and if implemented correctly, the above mitigation measures will **probably** reduce the negative impact on the utilisable soil reserves to a significance rating of MODERATE LOW in the medium term, and is *very likely* to occur.

However, if the soils are not retained/stored and managed, and a workable management plan is not implemented the residual impact will definitely incur additional costs and result in the impacting of secondary areas (Borrow Pits etc.) in order to obtain cover materials etc.

3.2.3 Decommissioning & Closure Phase

Issue: Net loss of soil volumes and utilisation potential due to change in material status (Physical and Chemical) and loss of nutrient base.

The impacts on the soil resource during the decommissioning and closure phase have both a positive and a negative effect, with:

- The loss of the soils original nutrient status during storag and the reduction in the already very low organic carbon by leaching of the soils while in storage;
- Erosion and de-oxygenation of materials while stockpiled;
- Compaction and dust contamination due to vehicle movement and wind impacts on the soil while rehabilitating the area;
- Erosion of soils during slope stabilisation and re-vegetation of disturbed areas;
- Contamination of replaced soils by use of dirty water for plant watering and dust suppression;
- Hydrocarbon or chemical spillage from contractor and supply vehicles.
- Positive impacts of reduction in areas of disturbance and return of soil utilization potential, uncovering of areas of storage and rehabilitation of compacted materials.

Impact Significance

The impact will **probably** remain the net loss of the soil resource if no intervention or mitigating strategy is implemented. The intensity potential will remain MODERATE and negative for the medium to short term for all of the activities if there is no active management (rehabilitation and intervention) in the decommissioning phase, and closure will not be possible. The impacts will be confined to the *development* area and its *adjacent* buffer, and is *likely* to happen.

This will result in an irreversible impact that is continuous.

However, with interventions and well planned management, there will be a MODERATE to HIGH positive intensity potential as the soils are replaced and fertilisation of the soils is implemented after removal of the infrastructure.

Ongoing rehabilitation during the operational and decommissioning phases will bring about a net long-term positive impact on the soils, albeit that the land capability will likely be reduced to grazing status.

The intensity potential of the initial activities during rehabilitation and closure will be moderate and negative due to the necessity for vehicle movement while removing the demolished infrastructure and rehabilitating the operational footprints. Dust will **potentially** be generated and soil will **probably** be contaminated, compacted and eroded to differing extents depending on the degree of management implemented.

The positive impacts of rehabilitation on the area are the reduction in the footprint of disturbance, the amelioration of the affected soils and oxygenation of the growing medium, the stabilizing of slopes and the revegetation of disturbed areas.

Residual Impacts

On closure of the operation the *long-term* negative impact on the soils will be reduced from a significance ranking of MODERATE to LOW if the management plan set out in the Environmental Management Plan is effectively implemented. These impacts will be confined to the development site and its adjacent environments, and is *very likely* to occur.

4. ENVIRONMENTAL MANAGEMENT PLAN

4.1 General

In accordance with the IFC Performance Principles and the concept of sustainability, it is incumbent on any developer to not only assess and understand the possible impacts that a development might cause, but to also propose and table management measures that will aid in minimising and were possible mitigate the effects.

The management of the natural resources (soils and land capability) have been assessed on a phase basis in keeping with the impact assessment (EIA) philosophy, while the Environmental Management Plan (EMP) has been designed as a working plan and utilization guide for soil and land management.

The plan is based on the site specifics of soil and geomorphology (topography, altitude, attitude, climate and ground roughness) and the activities proposed.

The plan gives recommendations on the stripping and handling of the soils throughout the life of the development along with recommendations for the utilization of the soils for rehabilitation at closure.

It has been assumed that all infrastructure will be removed and that the areas that were affected will be returned to as close as possible their pre-construction state.

The concept of stripping and storage of all “Utilisable” soil is recommended as a minimum requirement and as part of the overall Soil Utilization Philosophy.

In terms of the “Minimum Requirements”, **usable or utilisable soil** is defined here as all soil above an agreed subterranean cut-off depth defined by the project soil scientist, and will vary for different forms of soil encountered in a project area and the type of project being considered. It does not differentiate between topsoil (orthic horizon) and other subsoil horizons necessarily.

4.2 Construction Phase

The construction methods and final End Land Use (ELU) are important in deciding if the utilisable soils need to be stripped and retained, and ultimately how much of the materials will be needed for the rehabilitation (stripping volumes). Failure to remove and store the utilisable materials will result in the permanent loss of the growth medium.

Making provision for retention of utilisable material for the decommissioning and/or during rehabilitation will not only save significant costs at closure, but will ensure that additional impacts to the environment do not occur.

The depths of utilisable materials on area of concern range from 400mm to 800mm. It is important to note however that the area has already been disturbed as part of the Power Station construction, and topsoil has already been removed or disturbed in places.

Table 4.2 describes the proposed soil utilization during the construction phase.

Table 4.2 Construction Phase – Soil Utilization Plan

Phase	Step	Factors to Consider	Comments
Construction	Delineation of areas to be stripped		Stripping will only occur where soils are to be disturbed by activities that are described in the design report, and where a clearly defined end rehabilitation use for the stripped soil has been identified.
	Reference to biodiversity action plan		It is recommened that all vegetation is stripped and stored as part of the utilizable soil. However, the requirements for moving and preserving fauna and flora according to the biodiversity action plan should be consulted.
	Stripping and Handling of soils	Handling	Soils will be handled in dry weather conditions so as to cause as little compaction as possible. Utilizable soil (Topsoil and upper portion of subsoil B2/1) must be removed and stockpiled separately from the lower "B" horizon, with the ferricrete layer being seperated from the soft/decomposed rock, and wet based soils seperated from the dry soils if they are to be impacted.
		Stripping	The "Utilizable" soil will be stripped to a depth of 750mm or until hard rock/ferricrete is encountered. These soils will be stockpiled together with any vegetation cover present (only large vegetation to be removed prior to stripping). The total stripped depth should be 750mm, wherever possible.
	Delineation of Stockpiling areas	Location	Stockpiling areas will be identified in close proximity to the source of the soil to limit handling and to promote reuse of soils in the correct areas. All stockpiles will be founded on stabilized and well engineered "pads"
		Designation of Areas	Soils stockpiles will be demarcated, and clearly marked to identify both the soil type and the intended area of rehabilitation.

This "Soil Utilization Plan" is intimately linked to the "development plan", and it should be understood that if the plan of construction changes, these recommendations will probably have to change as well.

4.3 Operational Phase

The operational phase will see very little change in the development requirements, with the footprint of disturbance remaining constant, albeit that the temporary infrastructure might become redundant and rehabilitation of these features might be possible.

Maintenance and care of the soil and land resources will be the main management activity and objective required during the operational phase. Management of material loss, compaction and contamination are the main issues of consideration. Table 4.3 gives details and recommendations for the care and maintenance of the resource during the operational phase.

Table 4.3 Operational Phase – Soil Conservation Plan

Phase	Step	Factors to Consider	Comments
Operation	Stockpile management	Vegetation establishment and erosion control	Enhanced growth of vegetation on the Soil Stockpiles and berms will be promoted (e.g. by means of watering and/or fertilisation), or a system of rock cladding will be employed. The purpose of this exercise will be to protect the soils and combat erosion by water and wind.
		Storm Water Control	Stockpiles will be established/engineered with storm water diversion berms in place to prevent run off erosion.
		Stockpile Height and Slope Stability	Soil stockpile and berm heights will be restricted where possible to <1.5m so as to avoid compaction and damage to the soil seed pool. Where stockpiles higher than 1.5m cannot be avoided, these will be benched to a maximum height of 15m. Each bench should ideally be 1.5m high and 2m wide. For storage periods greater than 3 years, vegetative (vetiver hedges and native grass species - refer to Appendix 1) or rock cover will be essential, and should be encouraged using fertilization and induced seeding with water and/or the placement of waste rock. The stockpile side slopes should be stabilized at a slope of 1 in 6. This will promote vegetation growth and reduce run-off related erosion.
		Waste	Only inert waste rock material will be placed on the soil stockpiles if the vegetative growth is impractical or not viable (due to lack of water for irrigation etc.). This will aid in protecting the stockpiles from wind and water erosion until the natural vegetative cover can take effect.
		Vehicles	Equipment, human and animal movement on the soil stockpiles will be limited to avoid topsoil compaction and subsequent damage to the soils and seedbank.

4.4 Decommissioning and Closure

The decommissioning and closure phase will see:

- The removal of all infrastructure;
- The demolishing of all concrete slabs/plinths and the ripping of any hard/compacted surfaces;
- The backfilling of all voids and deep foundations and the reconstruction of the required barrier layer (compaction of ferricrete and clay rich materials) wherever feasible and engineering possible;
- Topdressing of the disturbed and backfilled areas with the stored “utilisable” soil ready for re-vegetation;
- Re-vegetation of the final phases of the disposal facility (ash disposal) and waste piles with utilisable soil;
- Vegetation of soil dumps and waste piles;
- Fertilization and stabilization of the backfilled and final cover materials (soil and vegetation) and
- The landscaping of the replaced soils to be free draining.

There will be a positive impact on the soil and land capability environments as the area of disturbance is reduced, the soils are returned to a state that can support low intensity wildlife grazing or sustainable conservation and the impacts of compaction and erosion are mitigated.

Table 4.4 summarises the proposed management and mitigation actions recommended.

Table 4.4 Decommissioning and Closure Phase – Soil Conservation Plan

Phase	Step	Factors to Consider	Comments
Decommissioning & Closure	Rehabilitation of Disturbed land & Restoration of Soil Utilization	Placement of Soils	Stockpiled soil will be used to rehabilitate disturbed sites either ongoing as disturbed areas become available for rehabilitation and/or at closure. The utilizable soil (500mm to 750mm) removed during the construction phase, must be redistributed in a manner that achieves an approximate uniform stable thickness consistent with the approved post development end land use (Conservation land capability and/or Low intensity grazing), and will attain a free draining surface profile. A minimum layer of 300mm of soil will be replaced.
		Fertilization	A representative sampling of the stripped and stockpiled soils will be analysed to determine the nutrient status and chemistry of the utilizable materials. As a minimum the following elements will be tested for: EC, CEC, pH, Ca, Mg, K, Na, P, Zn, Clay% and Organic Carbon. These elements provide the basis for determining the fertility of soil. based on the analysis, fertilisers will be applied if necessary.
		Erosion Control	Erosion control measures will be implemented to ensure that the soil is not washed away and that erosion gulleys do not develop prior to vegetation establishment.
	Pollution of Soils	In-situ Remediation	If soil (whether stockpiled or in its undisturbed natural state) is polluted, the first management priority is to treat the pollution by means of in situ bioremediation. The acceptability of this option must be verified by an appropriate soils expert and by the local water authority on a case by case basis, before it is implemented.
		Off site disposal of soils.	If in situ treatment is not possible or acceptable then the polluted soil must be classified according to the Norms and Standards (DEA) for the Handling, Classification and Disposal of Hazardous Waste (Local Dept of Water Affairs) and disposed of at an appropriate, permitted, off-site waste facility.

4.5 Monitoring and Maintenance

Nutrient requirements reported in this document are based on the monitoring and sampling of the soils at the time of the baseline survey. These values will definitely alter during the storage stage and will need to be re-evaluated before being used during rehabilitation. Ongoing evaluation of the nutrient status of the growth medium will be needed throughout the life of the project and into the rehabilitation and closure phases.

During the rehabilitation exercise, preliminary soil quality monitoring should be carried out to accurately determine the fertilizer and pH requirements that will be needed. Additional soil sampling should also be carried out annually after rehabilitation has been completed and until the levels of nutrients, specifically magnesium, phosphorus and potassium, are at the required levels for sustainable growth.

Once the desired nutritional status has been achieved, it is recommended that the interval between sampling is increased. An annual environmental audit should be undertaken. If growth problems develop, ad hoc, sampling should be carried out to determine the problem.

Monitoring should always be carried out at the same time of the year and at least six weeks after the last application of fertilizer.

Soils should be sampled and analysed for the following parameters:

pH (H_2O)	Phosphorus (Bray I)	
Electrical conductivity	Calcium mg/kg	
Cation exchange capacity	Sodium mg/kg;	
Magnesium mg/kg;	Potassium mg/kg	Zinc mg/kg;
Clay, sand and Silt	Organic matter content (C %)	

The following maintenance is recommended:

- The area must be fenced, and all animals kept off the area until the vegetation is self-sustaining;
- Newly seeded/planted areas must be protected against compaction and erosion (Vetiver hedges etc.);
- Traffic should be limited were possible while the vegetation is establishing itself;
- Plants should be watered and weeded as required on a regular and managed basis were possible and practical;
- Check for pests and diseases at least once every two weeks and treat if necessary;
- Replace unhealthy or dead plant material;
- Fertilise hydro seeded and grassed areas soon after germination, and
- Repair any damage caused by erosion.

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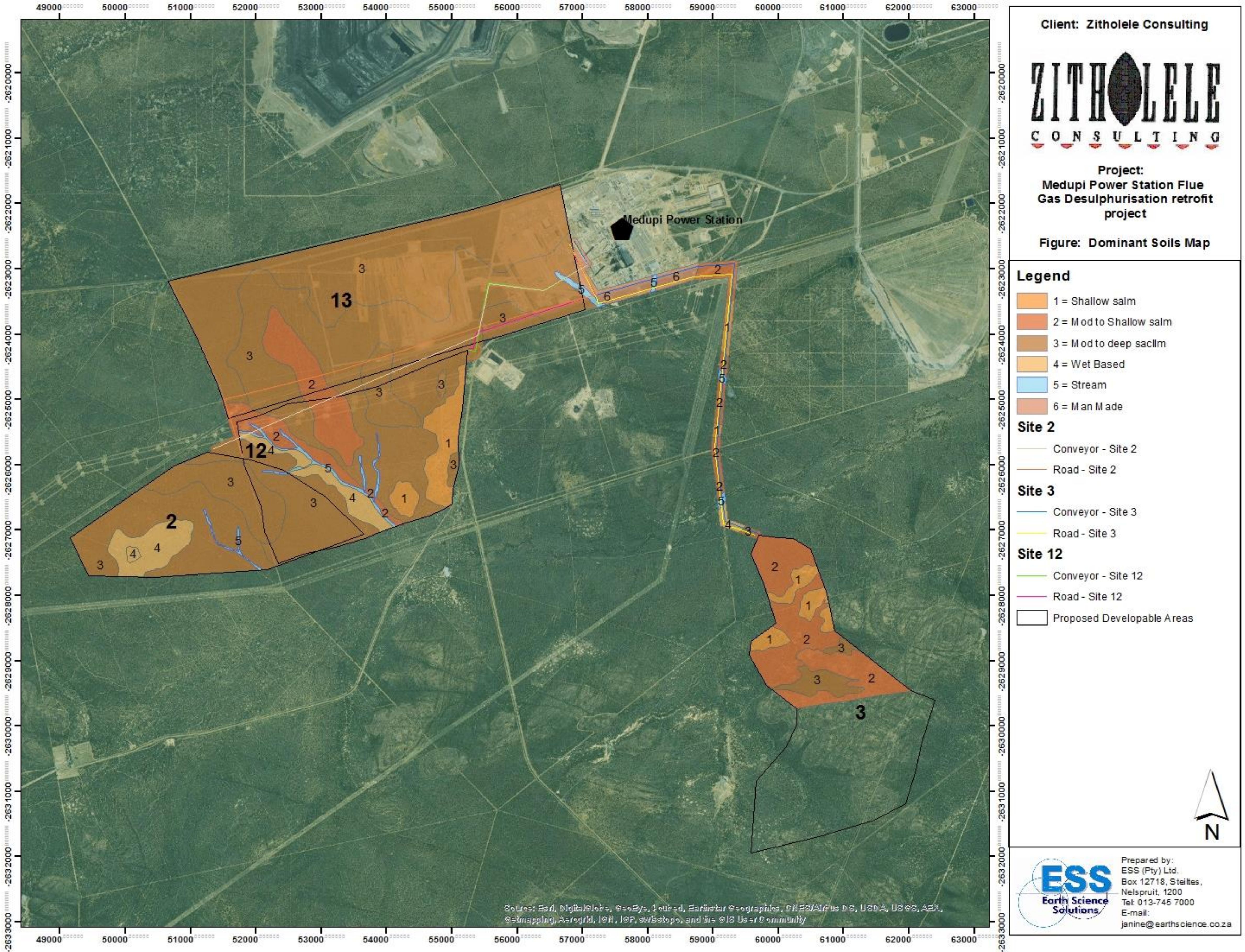
APPENDIX 1

SITE MAPS A3)

(Soils, Soil Groups and Land Capability)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Project:
Medupi Power Station Flue Gas Desulphurisation retrofit project
Figure: Dominant Soils Map
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1 = Shallow salm
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4 = Wet Based
5 = Stream
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Road - Site 2
Site 3
Conveyor - Site 3
Road - Site 3
Site 12
Conveyor - Site 12
Road - Site 12
Proposed Developable Areas
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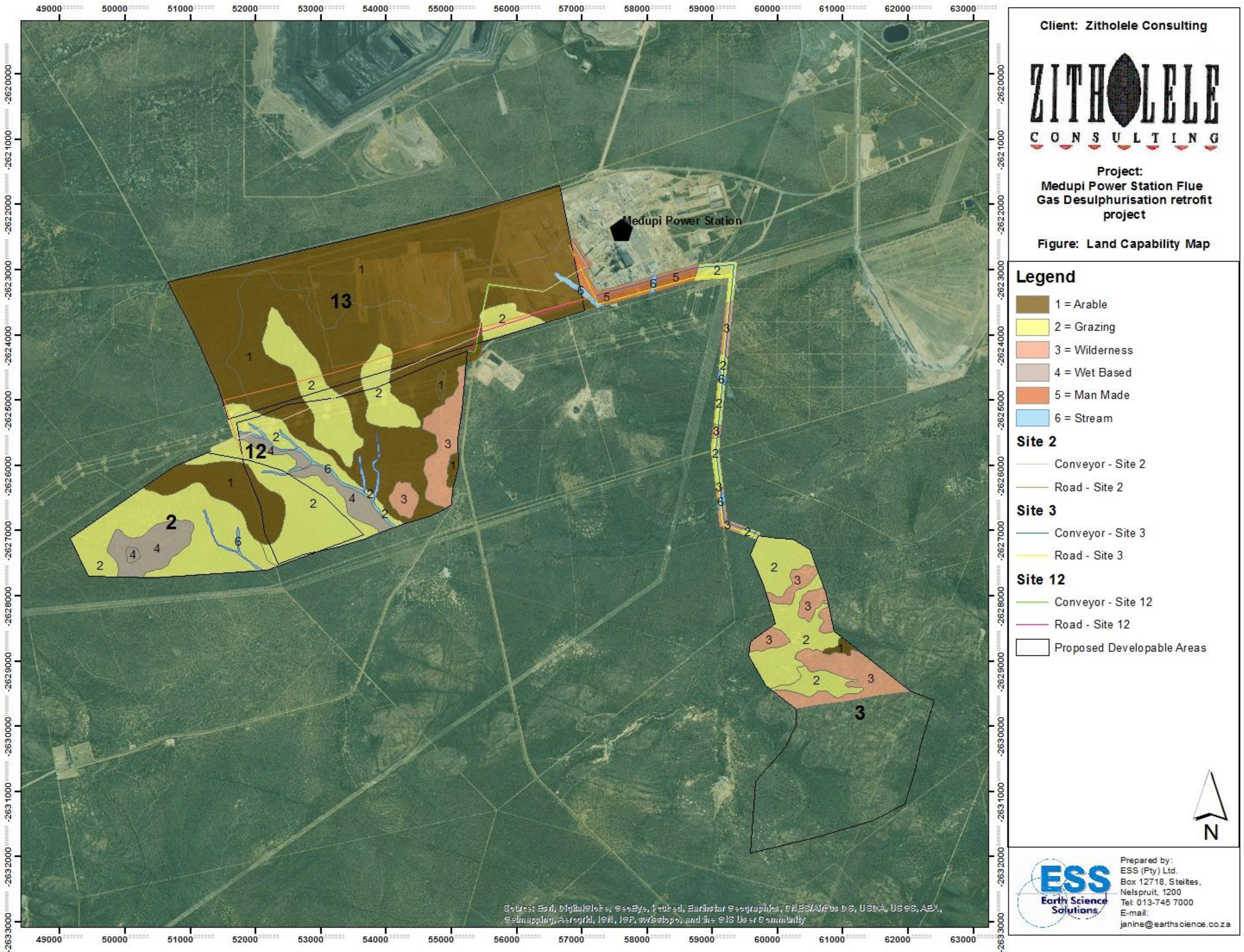
Prepared by:
ESS (Pty) Ltd.
Box 12718, Steiltes,
Nelspruit, 1200
Tel: 013-745 7000
E-mail:
janine@earthscience.co.za
Earth Science Solutions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Site 12
Conveyor - Site 12
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ESS Earth Science Solutions
Prepared by:
ESS (Pty) Ltd.
Box 12718, Steiltes,
Nelspruit, 1200
Tel: 013-745 7000
E-mail:
janine@earthscience.co.za
Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community
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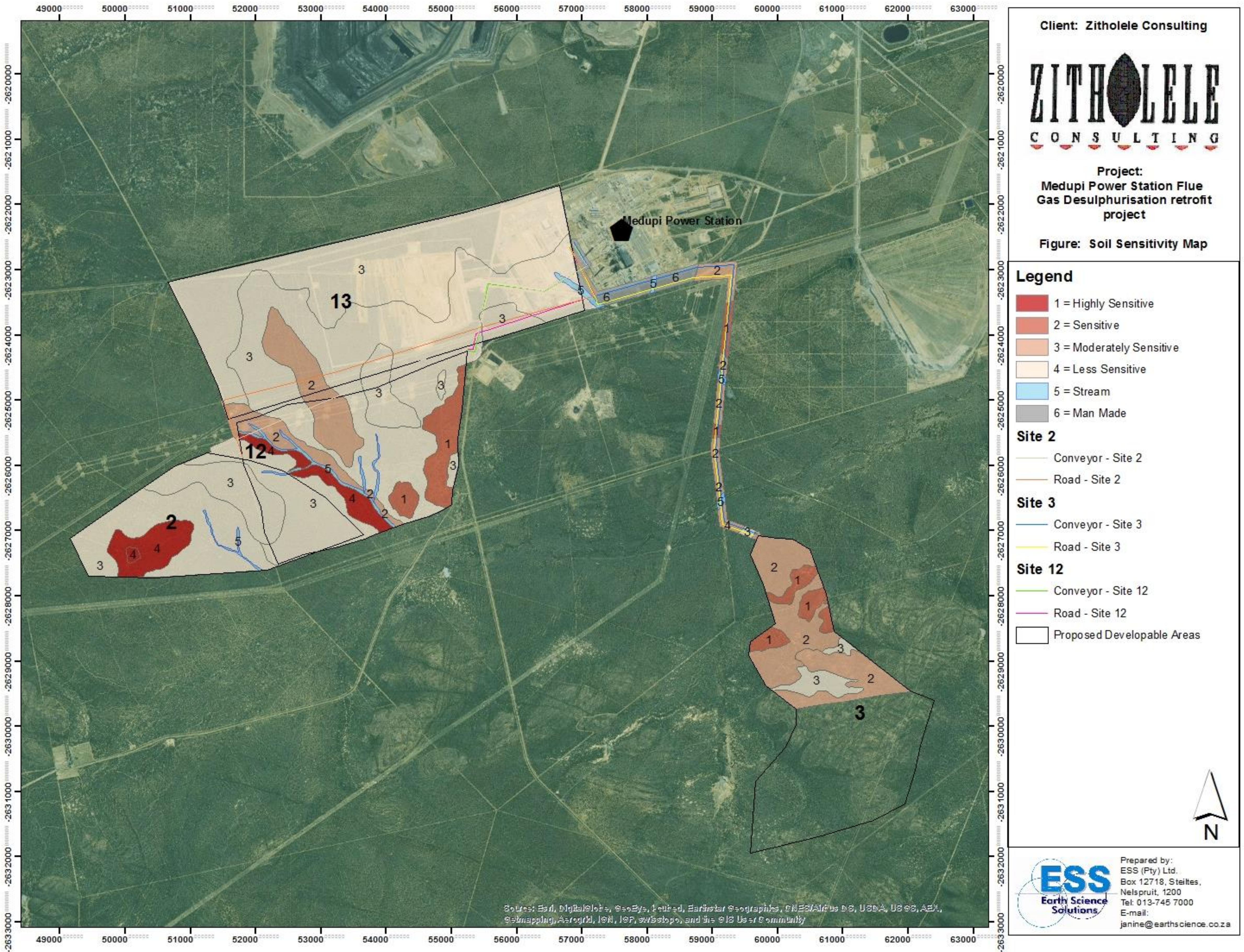
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