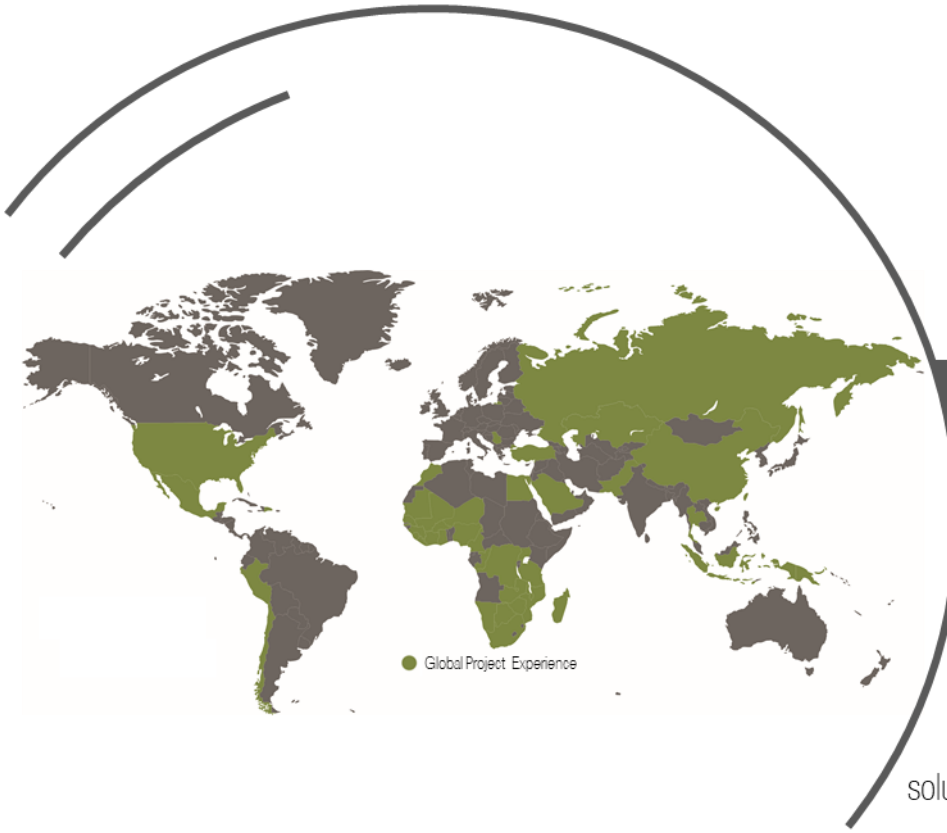

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Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project

Soils, Land Use and Land Capability Impact Assessment

Prepared for:
Sasol Mining (Pty) Ltd

Project Number:
SAS6986

March 2021

Digby Wells and Associates
(South Africa) (Pty) Ltd
Company Registration: 2010/008577/07

Turnberry Office Park,
Digby Wells House.
48 Grosvenor Road,
Bryanston,2191

Phone: +27 (0) 11 789 9495
Fax: +27 (0) 11 789 9495
E-mail: info@digbywells.com
Website: www.digbywells.com

Directors: J Leaver (Chairman)*,
NA Mehlomakulu*, DJ Otto, A Mpelwane,
M Rafundisani
*Non-Executive

This document has been prepared by Digby Wells Environmental.

Report Type:	Soils, Land Use and Land Capability Impact Assessment
Project Name:	Basic Assessment Process for the Construction of Pump Station and Pipeline for the Wollie se Gat Project
Project Code:	SAS6986

Name	Responsibility	Signature	Date
Aamirah Dramat	Report Compiler		March 2021
Willnerie Janse van Rensburg	Report Compiler & Site Assessment		March 2021
Arjan van ‘t Zelfde	Senior Reviewer		March 2021

DETAILS AND DECLARATION OF THE SPECIALIST

Digby Wells and Associates (South Africa) (Pty) Ltd

Contact person: Willnerie Janse van Rensburg

Digby Wells House
Turnberry Office Park
48 Grosvenor Road
Bryanston
2191

Tel: 011 789 9495
Fax: 011 789 9498
E-mail: Willnerie.vRensburg@digbywells.com

Full name:	Willnerie Janse van Rensburg
Title/ Position:	Soil Scientist
Qualification(s):	B.Sc. Honours Soil Science
Experience (years):	5
Registration(s):	SACNASP: 117870

I, Willnerie Janse van Rensburg, declare that: –

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
    - I declare that there are no circumstances that may compromise my objectivity in performing such work;
    - I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and

- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

March 2021

Signature of the Specialist *Date*

Findings, recommendations and conclusions provided in this report are based on the best available scientific methods and the author's professional knowledge and information at the time of compilation. Digby Wells employees involved in the compilation of this report, however, accepts no liability for any actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, and by the use of the information contained in this document.

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EXECUTIVE SUMMARY

Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) appointed Digby Wells Environmental (Digby Wells) to conduct a Wetland Impact Assessment to form part of a Basic Assessment (BA) Process to obtain an Environmental Authorisation (EA) for the Twistdraai Export Plant (TEP) operation near Secunda, Mpumalanga province. The Project Area focused on the demarcated area for the newly proposed pipeline from Wollie se Gat to the solution trench at the Discard Dump.

A soil reconnaissance assessment was undertaken for the proposed pipeline. The findings were compared to the results from the previously conducted assessment (Digby Wells Environmental, 2019).

The soil forms within the Project Area are Arcadia, Rensburg and Witbank soil forms. These soils are high in clay content and young with observed evidence of emerging soil development in the form of colour variations and clay lamellae. These soils are mainly associated with wetlands and low-lying areas and highly susceptible to erosion. The Witbank soils were a mixture of topsoil, subsoil and gravel, associated with and impacted by historical mining activities and associated infrastructures such as a conveyor belt, roads and trenches. The soils were shallow and heavily disturbed with evidence of excavations, stockpiling and the presence of Alien Invasive Plants (AIPs).

The dominant land use of the Project Area is infrastructure related to the Sasol Synfuels Operations (SSO). The cumulative impacts of the current land use have a significant effect on the current soil resources and therefore impacting the land use and land capability of the Project Area. Possible contaminated soil observed in the Project Area (white residue and sulphur smell) has the potential to directly impact the water quality and quantity as well as vegetation of the area.

Based on the impact assessment and baseline information, it is the opinion of the specialist that this project will have minor to negligible negative impacts on the soil, land use and land capability when monitoring and mitigation measures are followed. The pipeline may have a positive effect on the long-term on the soils as the contaminated water will be stopped from entering the system. The Project Area is heavily disturbed in its current state and proposed, future activities are likely to have a positive, long-term effect due to the proposed rehabilitation activities, including reshaping and introducing a AIPs Plan, if properly implemented.

It is however important to implement the proposed mitigation measures to ensure minimal impacts to the area. The soils are high in clays (vertic soils) and thus highly susceptible to erosion. It is highly advised to implement erosion control and not to leave/stockpile the soils in barren conditions for long periods.

A Rehabilitation Audit Program and Erosion Monitoring Program, one year after the Rehabilitation Phase is recommended to ensure successful rehabilitation and to achieve the committed land use and sustainability of the soils, land use and land capability after mining activities have ceased.

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ACRONYMS, ABBREVIATIONS AND DEFINITION

°C	Degrees Celsius
AIP	Alien Invasive Plant
ARC	Agricultural Research Council
CARA	The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)
Digby Wells	Digby Wells Environmental
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
GPS	Global Positioning System
ha	Hectare
HDPE	High Density Polyethylene
I&APs	Interested and Affected Parties
ISCW	Institute for Soil, Climate and Water
IWULA	Integrated Water Use License Application
km	Kilometre
L	Litre
m	Metre
m.a.m.s.l.	Metres above mean sea level
mm	Millimetre
MM	Mine Manager
MPRDA	Mineral and Petroleum Resources Development Act 2002 (Act No. 28 of 2002)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
OM	Organic Material
PCD	Pollution Control Dam
PM	Project Manager
PPP	Public Participation Process

RBCT	Richards Bay Coal Terminal
RoM	Run of Mine
RWD	Return Water Dam
SANAS	South African National Accreditation System
Sasol	Sasol Mining (Pty) Ltd
SCS	Sasol Coal Supply
SEP	Stakeholder Engagement Process
SSO	Sasol Synfuels Operation
SSV	Soil Screening Values
SWMP	Storm Water Management Plan
TCTS	Twistdraai Colliery Thubelisha Shaft
TEP	Twistdraai Export Plant
WML	Water Management License
WUL	Water Use License
WULA	Water Use License Application

Legal Requirement		**Section in Report**
(1)	A specialist report prepared in terms of these Regulations must contain-	
(a)	details of- (i) the specialist who prepared the report; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Before Introduction.
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1
cA	And indication of the quality and age of the base data used for the specialist report;	Appendix A
cB	A description of existing impacts on site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7
(d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section7
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of the equipment and modelling used;	Section 5 and Appendix A

Legal Requirement		Section in Report
(f)	Details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying site alternatives;	Section 8
(g)	an identification of any areas to be avoided, including buffers;	Section 7
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 7
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 3
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 7
(k)	any mitigation measures for inclusion in the EMPr;	Section 9
(l)	any conditions/aspects for inclusion in the environmental authorisation;	Section 9
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 10
(n)	a reasoned opinion (Environmental Impact Statement) -	Section 13
	whether the proposed activity, activities or portions thereof should be authorised; and	
	if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the Environmental Management Programme (EMPr), and where applicable, the closure plan;	
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 11
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q)	any other information requested by the competent authority.	

1. Introduction

Sasol Mining (Pty) Ltd Twistdraai Export Plant (TEP) appointed Digby Wells Environmental (Digby Wells) to conduct a Wetland Impact Assessment to form part of the Basic Assessment (BA) Process for the application of an Environmental Authorisation (EA) for the construction of a pump station and associated infrastructure (i.e., pump and pipeline through a wetland) at and from Wollie se Gat to the Twistdraai Export Plant (TEP) Fine Coal and Discard Facility. Wollie se Gat is an old quarry located in close proximity to Sasol Synfuels Operations (SSO), near Secunda, Mpumalanga province.

The Soil, Land Use and Land Capability Impact Assessment was undertaken as part of Appendix 6 of the EIA Regulations, 2014 (as amended) under the National Environmental Management Act (NEMA).

1.1. Project Locality

The Project Area falls under the jurisdiction of the Govan Mbeki Local Municipality which is located in the Gert Sibande District Municipality, Mpumalanga Province (as shown in Figure 1-1 and Figure 1-2). The Project Area is approximately 4 km south of Secunda, 8 km south-west of Trichardt and 10 km east of Embalenhle. The Bossiespruit Dam is located directly south of the Project Area.

The TEP is situated approximately 4 kilometres (km) south of Secunda within the secondary area of the Sasol SSO. The Project Area is focused on the direct area around the proposed pipeline, extending from Wollie se Gat to the solution trench at the Discard Dump. The proposed pipeline is approximately 380 m in length. The Project Area included a 500 m buffer zone around the pipeline (Figure 1-3).

Table 1-1: Summary of the Project Area Project Location Details

Province	Mpumalanga
District Municipality	Gert Sibande District Municipality
Local Municipality	Govan Mbeki Local Municipality
Nearest Town	Secunda (4 km), Trichardt (8 km), Embalenhle (10 km)
GPS Co-ordinates (relative centre point of study area)	26°33'28.85"S
	29°11'38.02"E

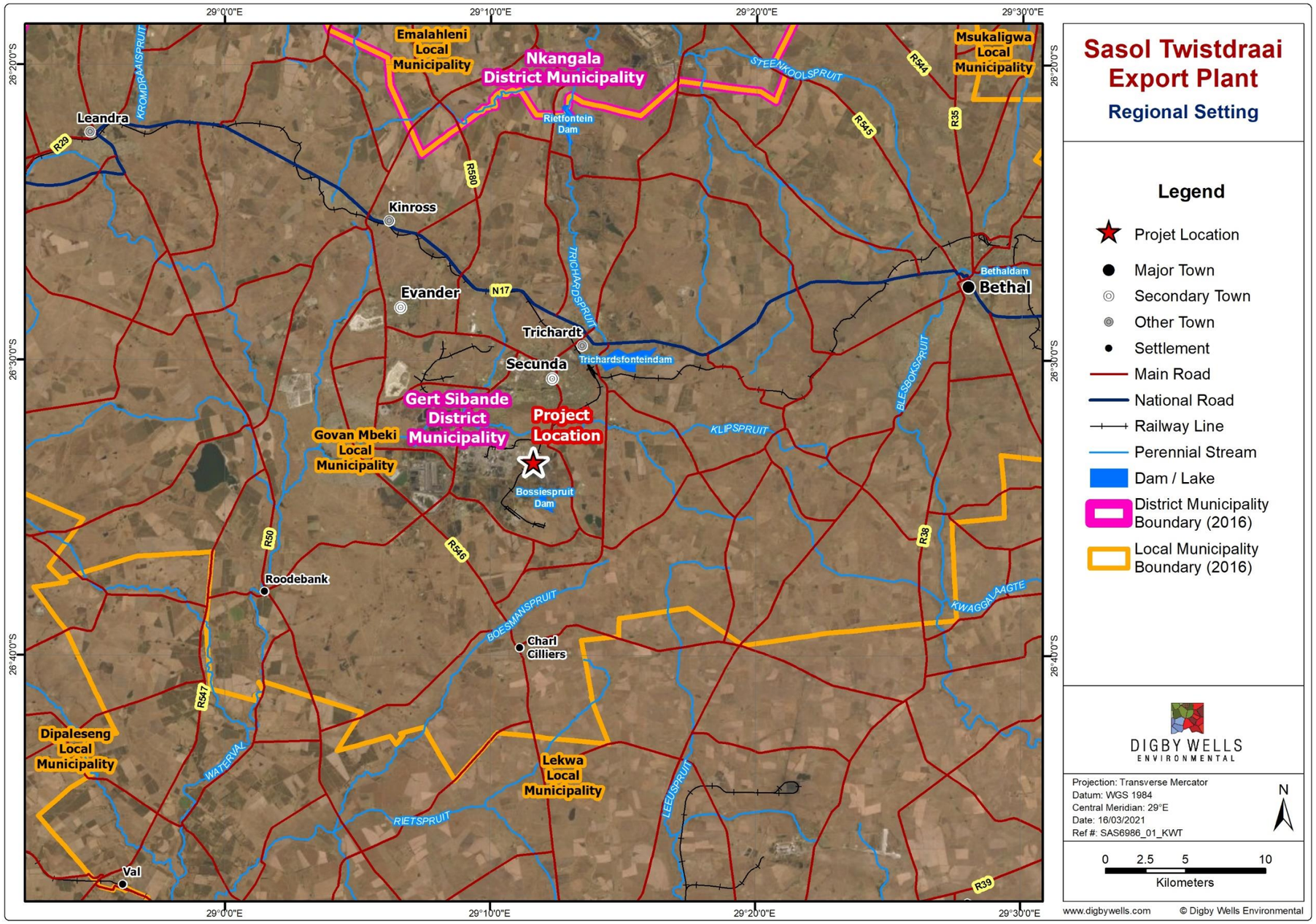


Figure 1-1: Regional Setting

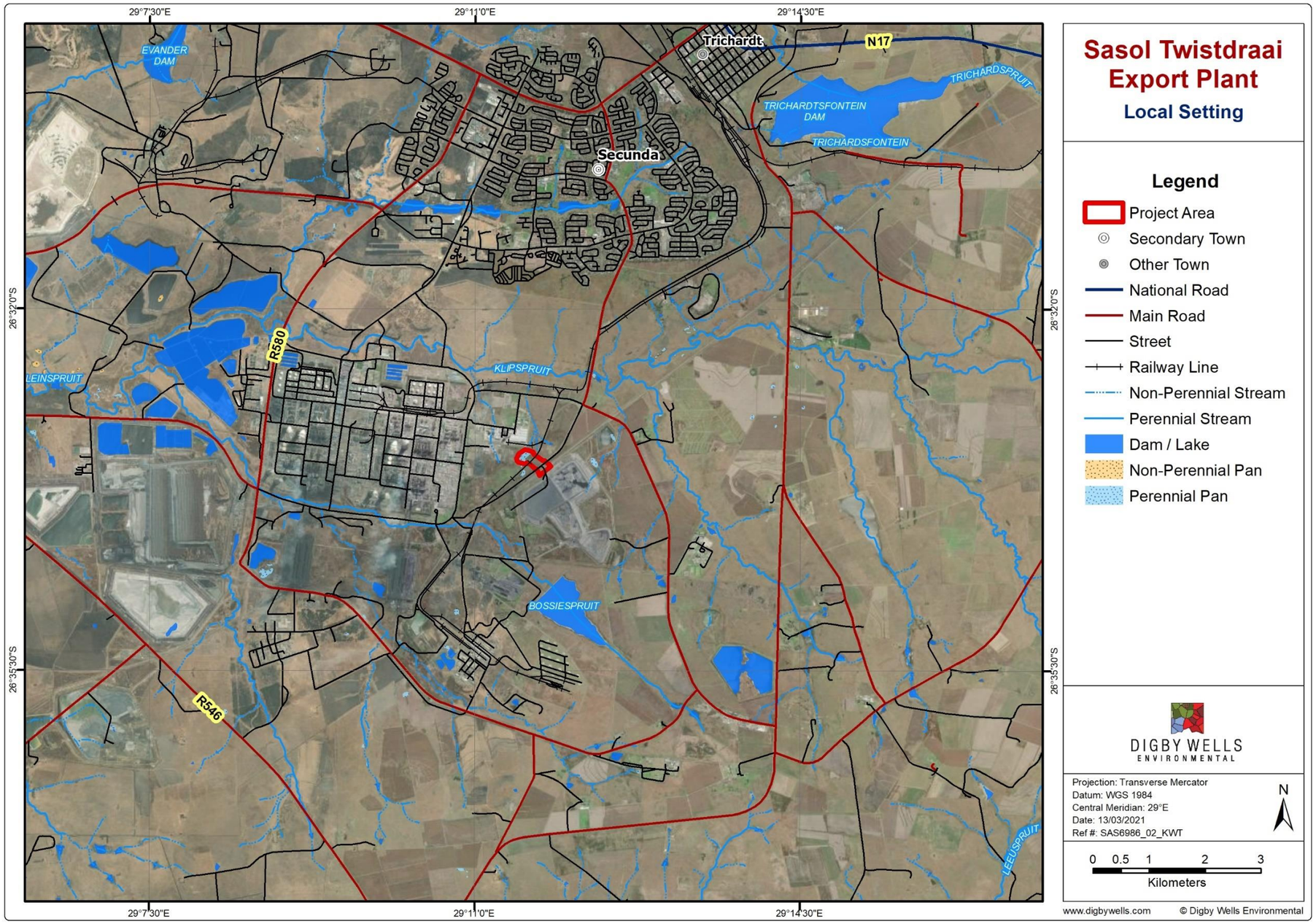


Figure 1-2: Local Setting

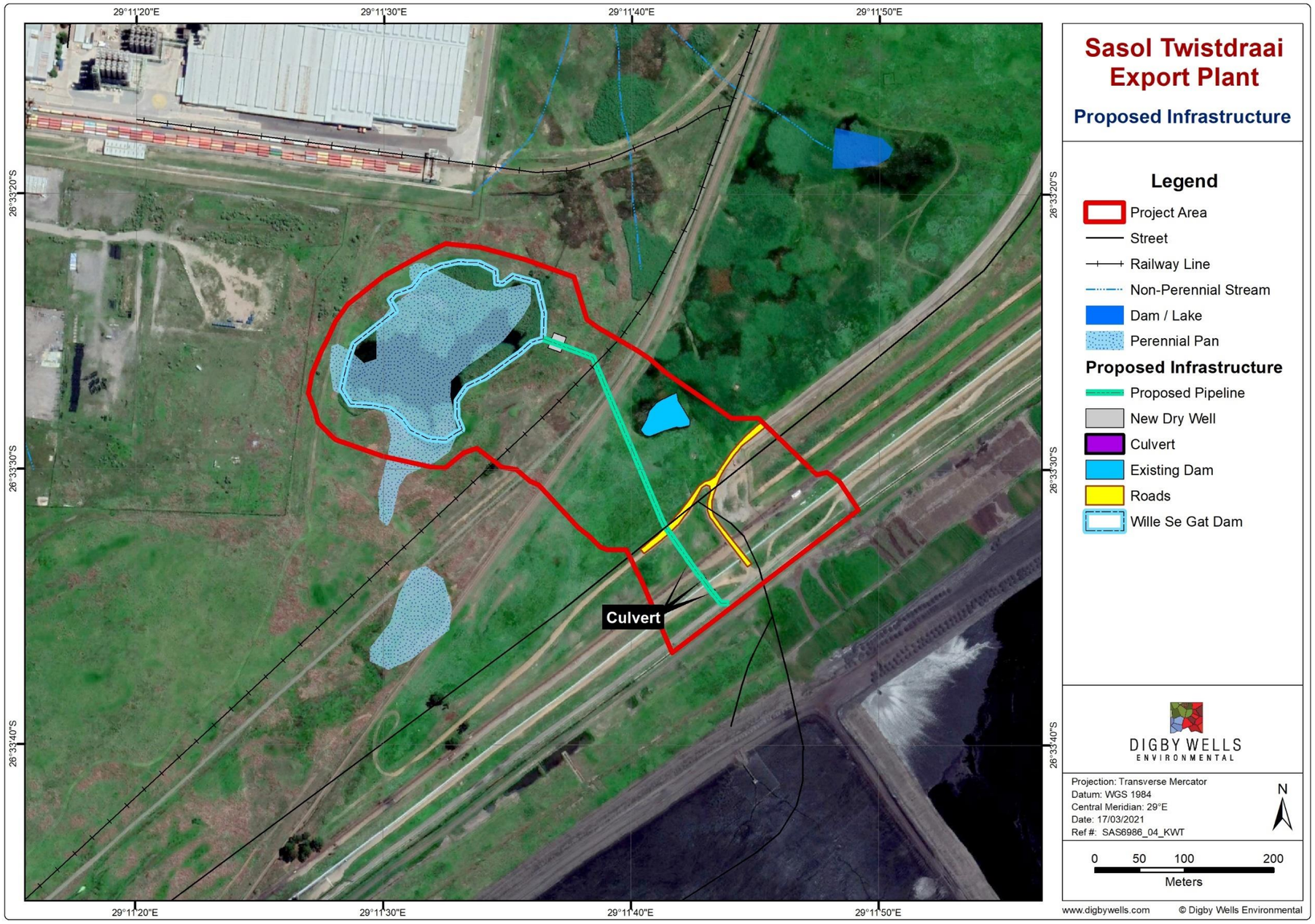


Figure 1-3: Infrastructure Layout

1.2. Project Background

The TEP receives coal via an overland conveyor belt from the Twistdraai Colliery Thubelisha Shaft (TCTS) underground mining operation. The Run of Mine (RoM) coal is stockpiled prior to going to the beneficiation plant where it is washed, crushed, and screened. The processed coal is then separated into different product stockpiles, depending on the grade of the coal.

The export-grade coal is reclaimed from the product stockpiles and transported to the load-out silo, where it is loaded onto rail trucks through a rapid load-out station and transported directly to the Richards Bay Coal Terminal (RBCT) for export. The remaining coal, which generally contains a high ash content, known as the secondary product or Middlings, is separated from the primary product and stockpiled at the Middlings Stockpile Area for use by the SSO via SCS. Thereafter, the coal is blended with coal received from other Sasol Mining mines.

The discard coal extracted from the beneficiation plant is transported via a conveyor belt to a stockpile at the discard dump and disposed of using trucks. The discard material is used to build the outer walls of the Twistdraai Discard disposal facility for the containment of the slurry and fine coal. Water from the discard dump is drained via penstocks to the Return Water Dam (RWD) and reused as process water back into the plant. The remaining fine coal is thickened and pumped via a pipeline, to the discard dump and fine coal facility.

Sasol appointed an external service provider to assess the potential impacts from the Twistdraai Discard Disposal Facility on RESM 7 and 13 and recommended practical workable and implementable solutions that can be implemented to mitigate the identified problems (Aquisim, 2019). The assessment concluded that the Twistdraai Discard Disposal Facility potentially is the single major contamination source at the monitoring points RESM 13 and RESM 7.

One of the proposed remediation options that were considered and that will be implemented, is the interception of contaminated water to ensure the contamination is limited and confined to the immediate area. Therefore, pumping water from Wollie se Gat is a cost-effective remediation option. The water will be abstracted from Wollie se Gat and pumped to the lined solution trenches and allowed to flow to the RWD from where it is re-used in the process.

1.3. Proposed Infrastructure and Activities

The project entails the construction of a pipeline from Wollies se Gat to the RWD. The project will include associated infrastructure such as an office building, temporary ablutions blocks, a pump station and the pipeline. It is foreseen that the water from Wollies se Gat will be pumped via a High Density Polyethylene (HDPE) pipeline with a diameter of 200 mm and a length of 380 m to the solution trench at the Twistdraai Discard Disposal Facility.

The project will entail the pre-construction, construction and operational phases as set out in Table 1-2 below.

Table 1-2: Project Phases and Associated Activities

Project Phase	Activities
Construction Phase	Development and upgrading of a permanent access road to the site.
	Clearing and grubbing of approximately 0.3 hectare (ha).
	Establishment of the laydown area and contractors camp.
	Construction of the pump station and the pipeline from the pump station to the Discard Dump solution trench.
	Installation of parking bays for the construction area and vehicles.
	Installation of temporary warning signage.
	Topsoil stripping and stockpiling.
	Provision of sanitation facilities during the construction phase.
	Demarcation of the site using fencing and gates.
	Waste generation and removal of waste.
Operational Phase	Maintenance will be undertaken of the pumps as required.
Rehabilitation Phase	All rubble and redundant material shall be removed from site to an appropriate licensed facility.
	Areas where compaction has occurred will be ripped to allow the growth of vegetation.
	Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovering and continuity of the wetland vegetation.

1.4. Alternatives Considered

Alternatives to be considered to ensure minimal impacts to the soil includes:

- Construct surface infrastructure outside delineated wetlands; and
- Construct the pipe above the soil surface to prevent disturbance to the soils and wetland.

2. Relevant Legislation, Standards and Guidelines

The Project is required to comply with all the obligations in terms of the provisions of the national legislations, regulations, guidelines and by-laws. The legal framework and guidelines directing the Soil Impact Assessment are detailed in Table 2-1.

Table 2-1: Applicable Legislation, Regulations, Guidelines and By-Laws

Legislation, Regulation, Guideline or By-Law	Applicability
Section 24 of the Constitution of the Republic of South Africa,1996 (Act No. 108 of 1996) Soil and land are protected under the Act that states that everyone has the right to an environment that is not harmful to their health or wellbeing. It also states that the environment must be protected for the benefit of present and future generations through responsible legislative measures. The Act: • Prevents pollution and ecological degradation; • Promote conservation and secure ecological sustainability; and • Promote justifiable economic and social development using natural resources.	• The construction of the pipeline will directly impact the soils and land as well as create possible pollution and degradation thereof; • The Impact Assessment will assess the possibility of pollution and include an Environmental Management Plan and Monitoring Program for the conservation of the ecological sustainability; and • Provide recommendations to prevent, avoid, and rehabilitate possible impacts.
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). NEMA (as amended) was set in place in accordance with Section 24 of the Constitution. Certain environmental principles under NEMA must be adhered to, to inform decision making for issues affecting the environment. Section 24(1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The NEMA requires that pollution and degradation of the environment be avoided, or, where it cannot be avoided be minimised and treated.	Activities that will influence the soil, land use and land capability of the proposed Project Area are listed in Table 1-2 and have been identified as Listed Activities in the Listing Notices (as amended) and therefore require environmental authorisation before being undertaken.
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA). The NEM:WA seeks to regulate waste management to protect health and environment by providing reasonable measures, including the provision of the remediation of contaminated land. Section 7(2)(d) of the NEM:WA sets the National Norms and Standards for the remediation of contaminated land and soil quality.	• The pipeline is proposed to manage contaminated water entering a wetland. The construction of the pipe will however affect the natural biodiversity; and • The Impact Assessment will assess the soil and its environment of the area and provide remediation measures to improve the soil quality.
The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA).	A Soil Impact Assessment was undertaken to assess impacts to the soils and its environment. Required

Legislation, Regulation, Guideline or By-Law	Applicability
The CARA is to provide control over the utilization of the natural agricultural resources to promote the conservation of the soil, the water sources and the vegetation and the combating of weeds and invader plants, and the matters connecting therewith. CARA defines the environmental conservation regulations as the protection of land against soil erosion, the prevention of water logging and salinization of soils by means of suitable soil conservation works to be constructed and maintained.	mitigation measures are provided to provide control over the natural agricultural resources to promote conservation of the soil, land use and land capability. Mitigation measures are provided to prevent erosion, water logging and salinization of the soils.

3. Assumptions, Limitations and Exclusions

The compilation of this Report is based on the following assumptions and limitations in Table 3-1.

Table 3-1: Limitations and Assumptions with Resultant Consequences of this Report

Assumptions and Limitations	Consequences
It was out of the scope of the report to do a detailed soil chemical and physical analysis. Soil characteristics and descriptions in the report were supported by previously data obtained from relevant resources (Digby Wells Environmental, 2019).	Limited updated soil baseline analysis data was available to use for rehabilitation and soil remediation purposes.
The area surveyed was based on the layout presented by Sasol.	The study does not include any other information other than the identified Project Area.
Soils are contiguous hence differentiation is not abrupt, and the transition zone cannot be completely captured during any given soil survey.	The soil distribution map of the Project Area may not be absolutely accurate.
The soils within the capability classes are similar only with respect to the degree of limitations in soil use for agricultural purposes or with respect to the impact on the soils when they are so used.	Not all soils have the same land use and are used according to their capabilities, each soil will react differently to the land use and impacts to the soils.
Soils situated within the 500 m of the area were assessed mostly on a desktop level with very limited ground-truthing.	Some discrepancies within the zone may occur.

4. Details of the Specialist

The following is a list of Digby Wells' staff who were involved in the Soil, Land Use and Land Capability Impact Assessment:

- **Arjan van 't Zelfde** is a Senior Consultant with 15 years' experience in soil science and hydrogeology. Arjan received a M.Sc. degree in Soil Science (SAQA approved) as part of the B.Sc./M.Sc. programme Soil, Water and Atmosphere, Wageningen University, The Netherlands. He specialises in soil capability assessments, soil contamination assessments and hydrogeological numerical groundwater flow modelling and has worked in multiple countries such as The Netherlands, Ireland, Senegal, and South Africa. Arjan is a registered Professional Natural Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (Registration Number: 115656).
- **Willnerie Janse van Rensburg** is a Soil Scientist in the Rehabilitation, Closure and Soils Division at Digby Wells. She received her Bachelor of Science in Environmental Geography as well as her Honours degree in Soil Science from the University of the Free State. She has five years' experience in the fields of Soil Science and Environmental Science. She has experience in completing soil surveys, land capability assessments, irrigation scheduling and provides recommendations on soil amelioration. Willnerie also completes wetland delineations and assessments. She has undertaken work in Lesotho, Botswana and throughout South Africa. Willnerie is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.
- **Aamirah Dramat** is an Assistant Rehabilitation Consultant in the Rehabilitation, Closure and Soils Department at Digby Wells. She received her Bachelor of Science Degree in Applied Biology and Environmental and Geographical Science (EGS) as well as her Honours Degree in Biological Sciences from the University of Cape Town. She joined Digby Wells in 2020 as a Rehabilitation Intern and has since gained experience in the environmental services sector with specialised focus in Soils, Wetlands and Rehabilitation, both locally and internationally. She has been involved in the report compilation and undertaking of Baseline Assessments, Environmental Impact Assessments (EIAs), Rehabilitation and Closure Plans (RCPs), Rehabilitation Strategy and Implementation Plans (RSIPs), Alien Invasive Plant (AIP) Assessments, Re-vegetation Trial Studies and Monitoring Assessments. Aamirah is registered as a Candidate Natural Scientist with the South African Council for Natural Scientific Professionals.

5. Methodology

This section provides the methodology used in the compilation of the Soil, Land Use and Land Capability Impact Assessment. A detailed methodology is described in Appendix A and is summarized in Figure 5-1 below.

Desktop Assessment and Literature Review

The following sources were used to obtain baseline soil information such as generalised soil patterns and terrain types for the Project site:

- South African land type data by the Institute for Soil, Climate and Water (ISCW) of the Agricultural Research Council (ARC) (ARC, 2006);
- Aerial imagery;
- Land use and land capability data;
- Existing Land Type data (Land Type Survey Staff, 1972 - 2006); and
- Existing studies conducted in the area.

Land Use

Land use was identified by aerial imagery during the desktop assessment and verified during the site-inspection. Land use maps indicate delineated areas of similar land use (Land Type Survey Staff, 1972 - 2006).

Land use categories are:

- Plantations;
- Natural;
- Waterbodies;
- Mines;
- Urban built-up; and
- Agriculture.

Land Suitability (Agricultural Potential)

Soil agricultural potential was determined by soil forms, land capability, soil analysis, hydrology and current land use. The process involved allocating terrain and soil factors to an area of land. The soil chemical analysis was considered in determining the final suitability of the soil. The suitability guidelines according to Schoeman et al., (2000) were used.

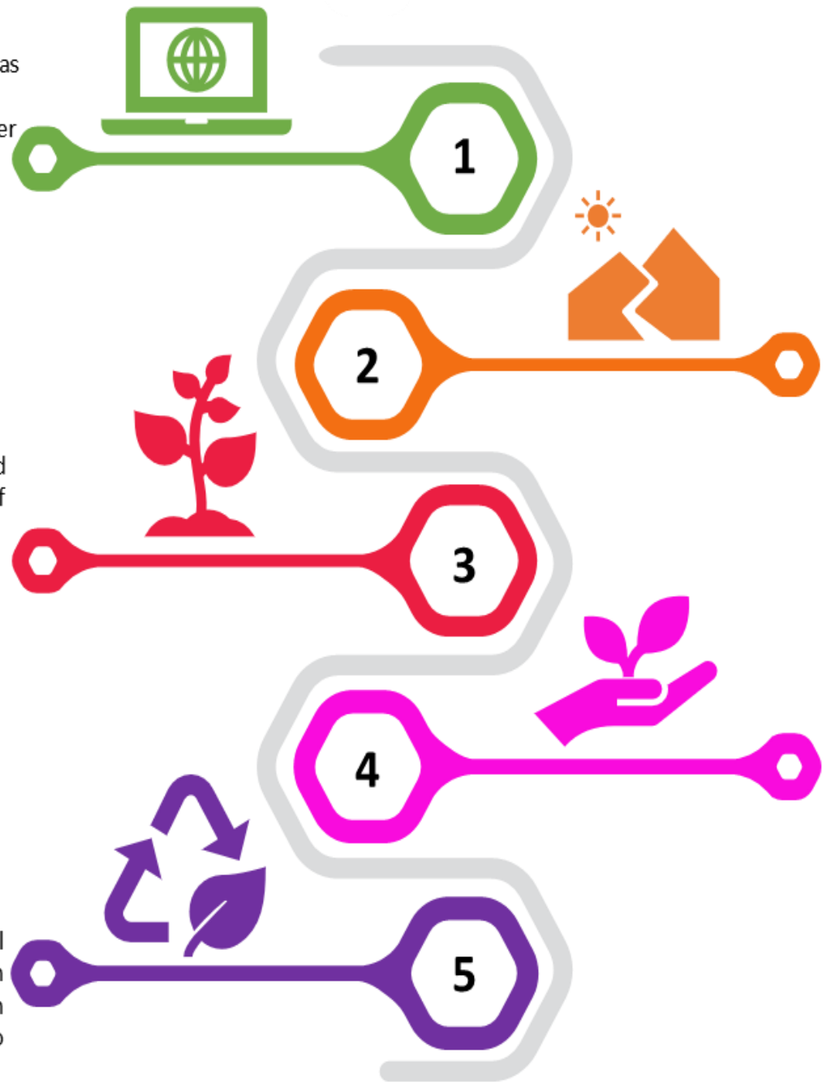


Figure 5-1: Soil, Land Use and Land Capability Assessment Methodology

Soil Classification

A hand soil auger was used to determine the soil properties to a maximum depth of 1.2 m or to the first restricting layer. Soils were classified using the Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991). Soil Properties included:

- Topography, aspect and slope;
- Soil form and family;
- Soil depth;
- Estimated soil texture;
- Soil structure, coarse fragments, calcareousness;
- Underlying material; and
- Vegetation.

Land Capability

Land capability is defined by the most suitable land use under rain-fed conditions. Land capability was determined by assessing a combination of soil, terrain and climate features. The land was rated into 8 classes with subgroups that have the same relative degree of limitation or potential.

6. Baseline Environment

The baseline assessment of the environment was desktop assessed and are presented in Table 6-1 below.

Table 6-1: Baseline Environment of the Project Area

Characteristics of the Highveld Ecoregion (Kleynhans, Thirion, & Moolman, 2005)		**Plant Species Characteristic of the Soweto Highveld Grasslands** (Mucina & Rutherford, 2012) Figure 6-1	
Terrain Morphology Figure 6-2	Plains; Low Relief; Plains; Moderate Relief; Lowlands; Hills and Mountains; Moderate and High Relief; Open Hills; Lowlands; Mountains; Moderate to high Relief Closed Hills. Mountains; Moderate and High Relief.	Graminoids	*Andropogon appendiculatus, Brachiaria serrata, Cymbopogon pospischilii, Cynodon dactylon, Elionurus muticus, Eragrostis capensis, E. chloromelas, E. curvula, E. plana, E. planiculmis, E. racemosa, Heteropogon contortus, Hyparrhenia hirta, Setaria nigrirostris, S. sphacelata, Themeda triandra, Tristachya leucothrix, Andropogon schirensis, Aristida adscensionis, A. bipartita, A. congesta, A. junciformis subsp. galpinii, Cymbopogon caesius, Digitaria diagonalis, Diheteropogon amplectens, Eragrostis micrantha, E. superba, Harpochloa falx, Microchloa caffra, Paspalum dilatatum.*
Vegetation Types Figure 6-1	Mixed Bushveld (limited); Rocky Highveld Grassland; Dry Sandy Highveld Grassland; Dry Clay Highveld Grassland; Moist Cool Highveld Grassland; Moist Cold Highveld Grassland; North Eastern Mountain Grassland; Moist Sandy Highveld Grassland; Wet Cold Highveld Grassland (limited); Moist Clay Highveld Grassland; Patches Afromontane Forest (very limited).	Herbs	*Hermannia depressa, Acalypha angustata, Berkheya setifera, Dicoma anomala, Euryops gilfillanii, Geigeria aspera var. aspera, Graderia subintegra, Haplocarpha scaposa, Helichrysum miconiifolium, H. nudifolium var. nudifolium, H. rugulosum, Hibiscus pusillus, Justicia anagalloides, Lippia scaberrima, Rhynchosia effusa, Schistostephium crataegifolium, Selago densiflora, Senecio coronatus, Hilliardiella oligocephala, Wahlenbergia undulata.*
Altitude (m.a.m.s.l.) (modifying) Figure 6-3	1 100-2 100, 2 100-2 300 (very limited)	Geophytic Herbs	*Haemanthus humilis subsp. hirsutus, H. montanus.*
Mean Annual Precipitation (MAP) (mm)	400 to 1 000	Herbaceous Climber	*Rhynchosia totta.*
Coefficient of Variation (% MAP)	<20 to 35	Low Shrubs	*Anthospermum hispidulum, A. rigidum subsp. pumilum, Berkheya annectens, Felicia muricata, Ziziphus zeyheriana.*
Rainfall Seasonality	Early to late summer	Status	Endangered.
Mean Annual Temp. (°C)	12 to 20	**Topography and Slope** Figure 6-2 **and** Figure 6-3	
Mean Daily Summer Temp. (°C): February	10 to 32	The topography of the Project Area, as depicted in below lies in a typical Highveld area and drains to the south towards the Vaal River System. The area characterised by undulating topography of grassland and cultivated fields with surface elevations ranging from 1 590-1 660 metres above mean sea level (m.a.m.s.l.). The average slope for most of the Project Area is approximately 0.9-2.7 degrees (°), with a small south-eastern region of the Project Area having an average slope of 2.8-4°.	

Mean Daily Winter Temp. (°C): July	-2 to 22	**Geology** Figure 6-4
Median Annual Simulated Runoff (mm)	5 to >250	The Project Area is dominated by fine-grained felsic rocks located within the Highveld Coalfield, which comprises the coal bearing Vryheid Formation of the Ecca group in the Karoo Supergroup sequence (Johnson, Van Vuuren, Hegenberger, Key, & Shoko, 1996). The Karoo Supergroup is made up of four layers: the Drakensburg, Vryheid, Pietermaritzburg and Dwyka. The regional Dwyka Formation consists of diamictite, glaciolacustrine siltstone, pebbly mudstone and fluvio-glacial gravel and conglomerate. The Pietermaritzburg Formation overlies the Dwyka and consists of a thin siltstone bed that is sporadically developed in the Bosjesspruit Mine coal reserve area. The coal is hosted in the Vryheid Formation, which overlies the Dwyka and Pietermaritzburg Formations and forms the main thickness of the Karoo sequence in the Highveld Coalfield (Digby Wells Environmental, 2021).

Land Types and Dominant Soil Forms (Figure 6-5**)**

Land Type	Soil Form		Geology	Characteristics
Ea17	• Arcadia • Avalon • Bonheim • Glenrosa • Mayo • Milkwood	• Mispah • Rensburg • Swartland • Valsrivier • Westleigh	• Dolerite; and • Sandstone, grit and shale of the Ecca Group, Karoo Sequence.	• Consists of soil with significant accumulation of smectitic (swelling) clay (vertic horizon); and • Black or red clays comprise >50% of land type.

Land Capability (Figure 6-6**)**

Class	Classification	Dominant Limitation Influencing the Physical Suitability for Agricultural Use
III	Arable Land – Moderate Cultivation/Intensive Cultivation	Soils have severe limitations that reduce the choice of plants or require special conservation practices, or both.

Land Use (Figure 6-7**)**

The land use was described as:

- Predominantly:
  - Natural Grassland;
  - Herbaceous Wetlands;
  - Fallow Lands and Old Fields (grass); and
  - Mine: Fine Coal and Discard Dumps.
- Minor Areas:
  - Artificial Flooded Mine Pits (historical borrow pit);
  - Mine: Borrow Pits and Quarries; and
  - Other Bare.

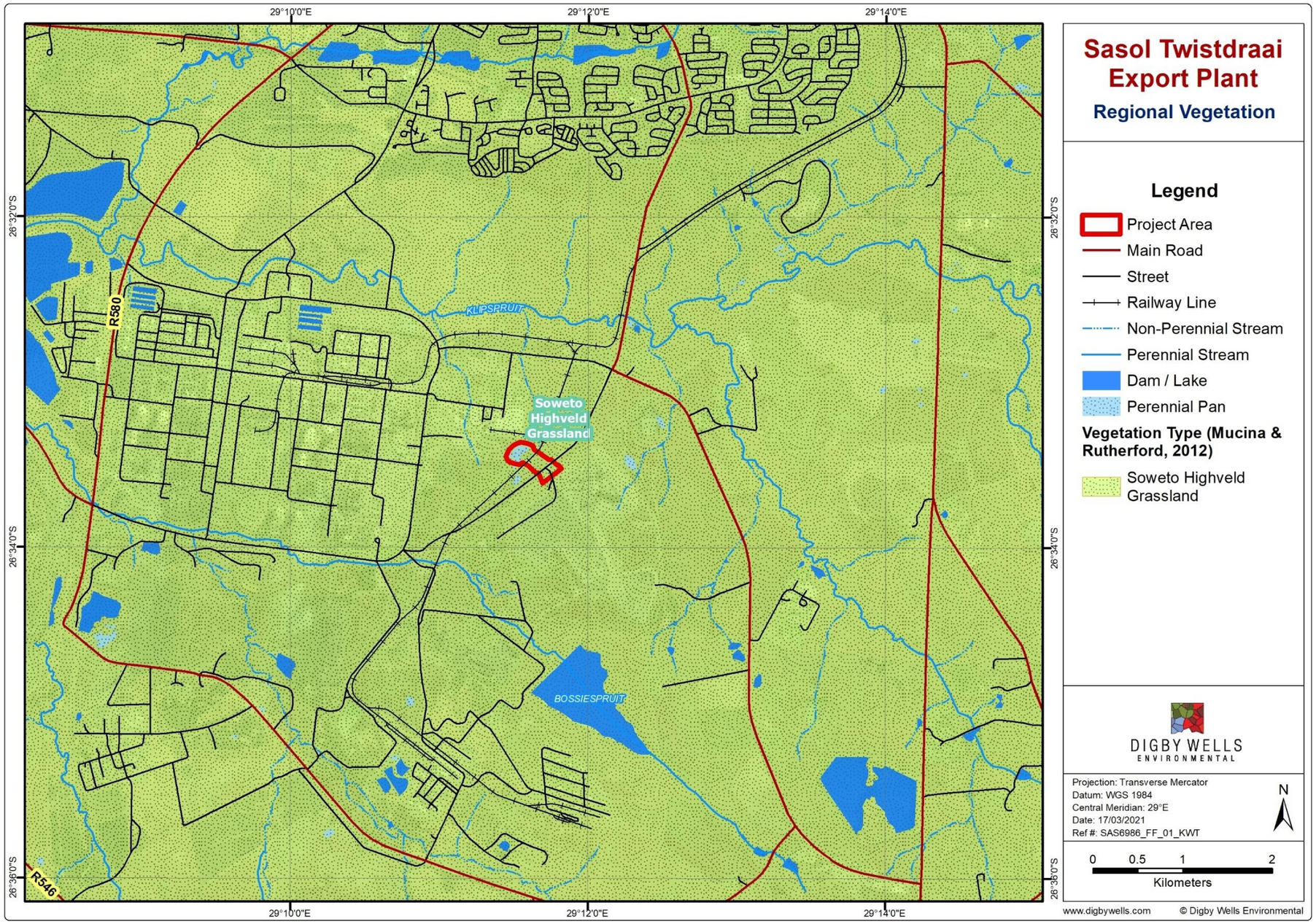


Figure 6-1: Regional Vegetation of the Project Area

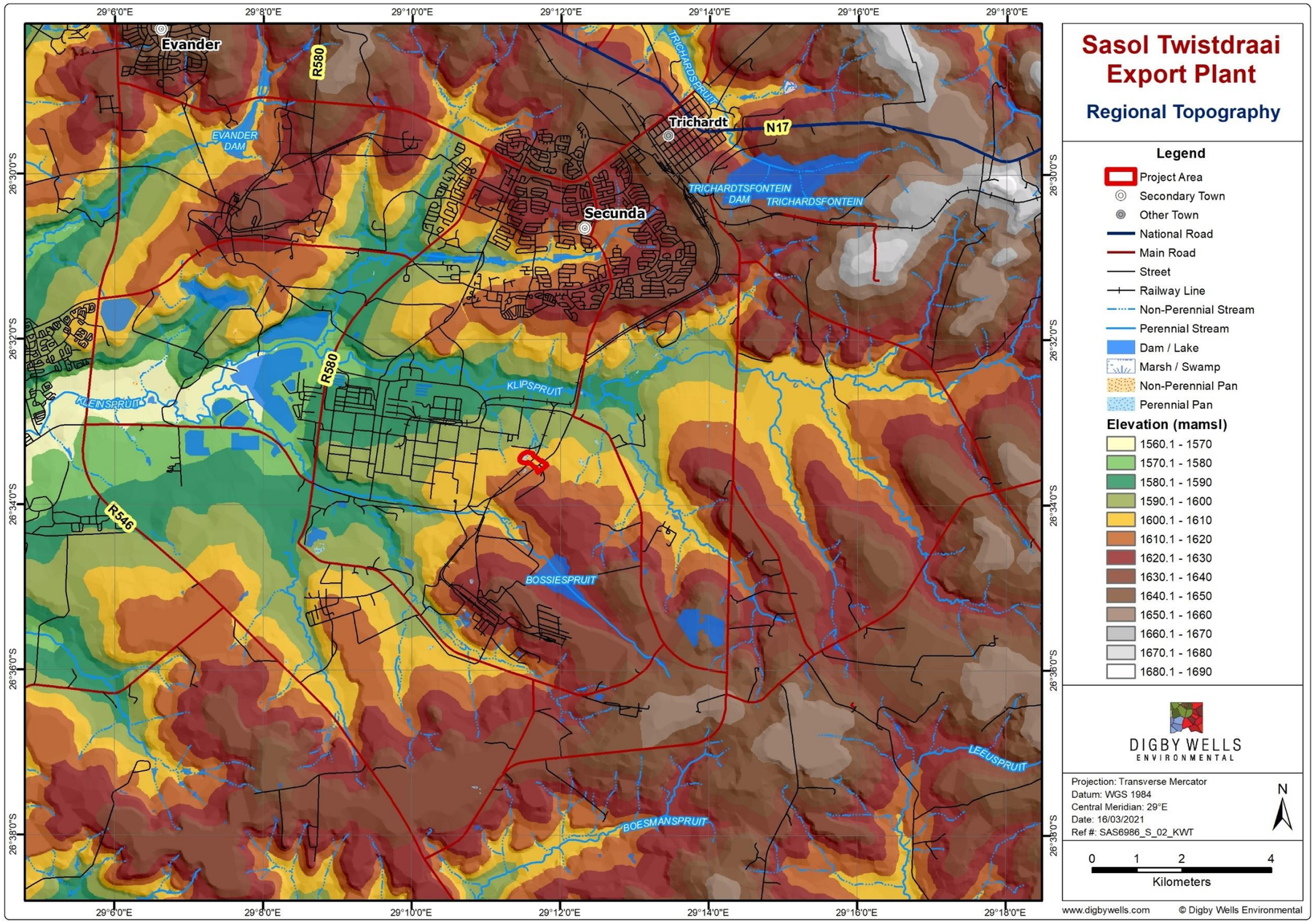


Figure 6-2: Topography of the Project Area

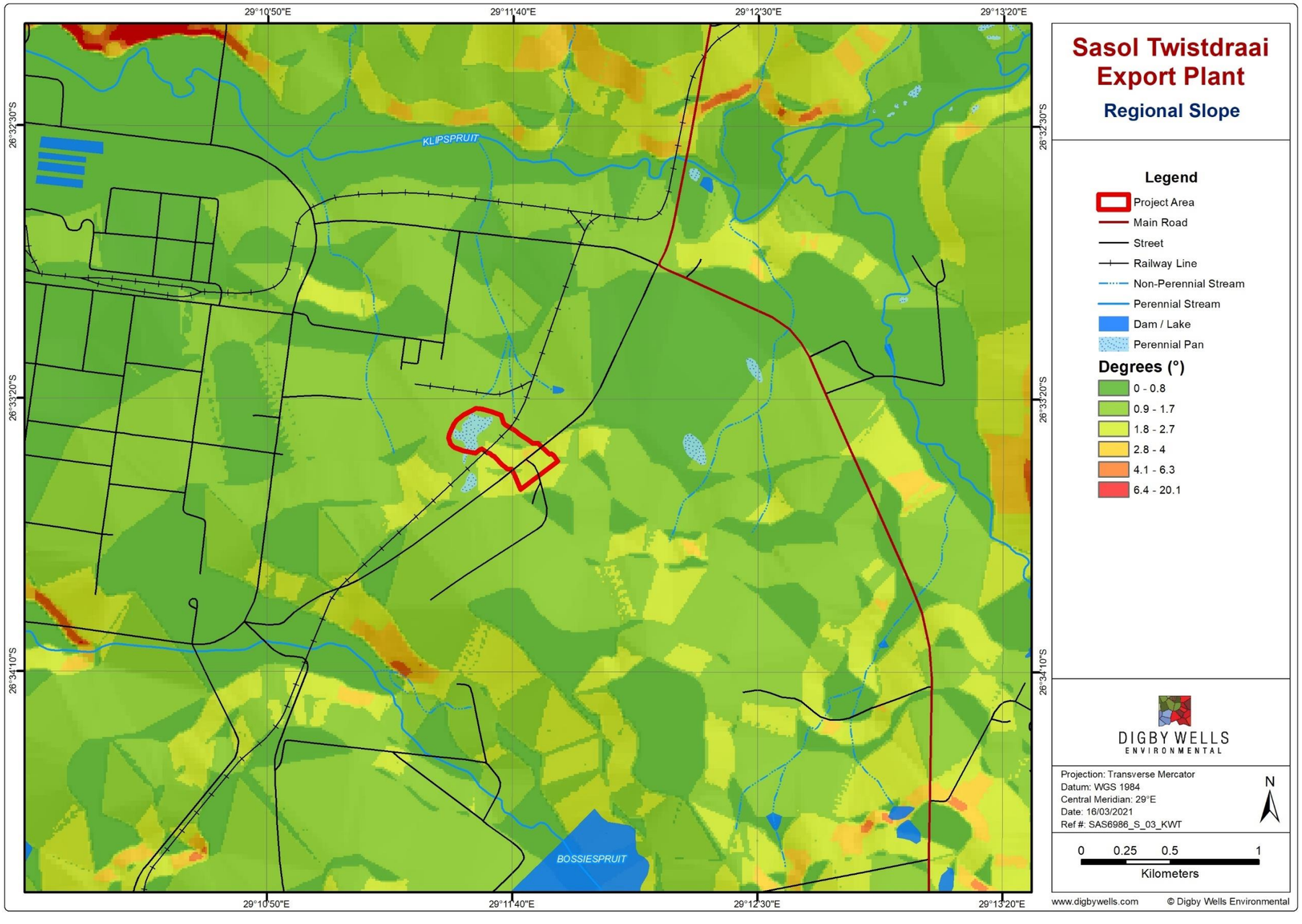


Figure 6-3: Slope of the Project Area

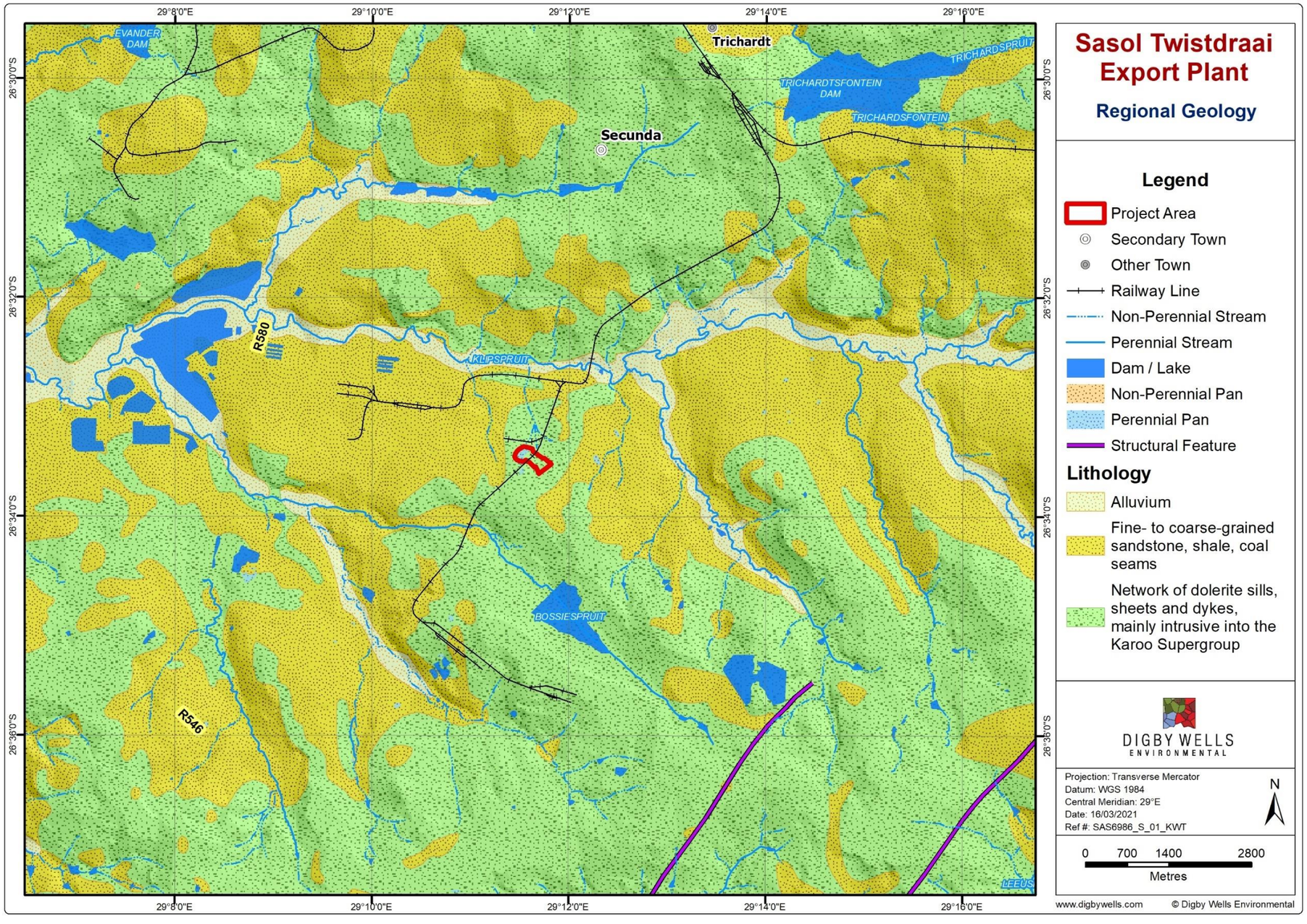


Figure 6-4: Geology of the Project Area

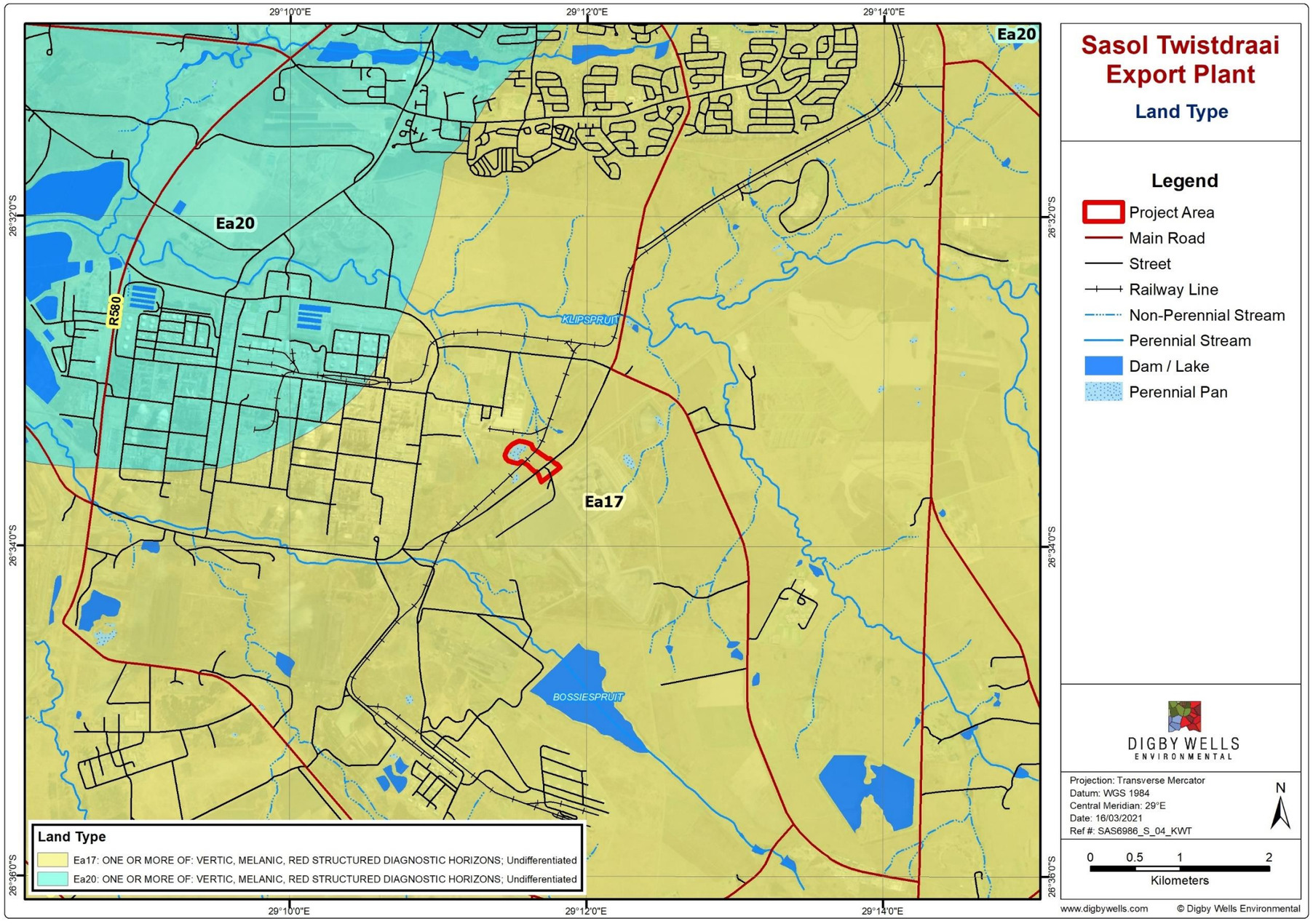


Figure 6-5: Land Types of the Project Area

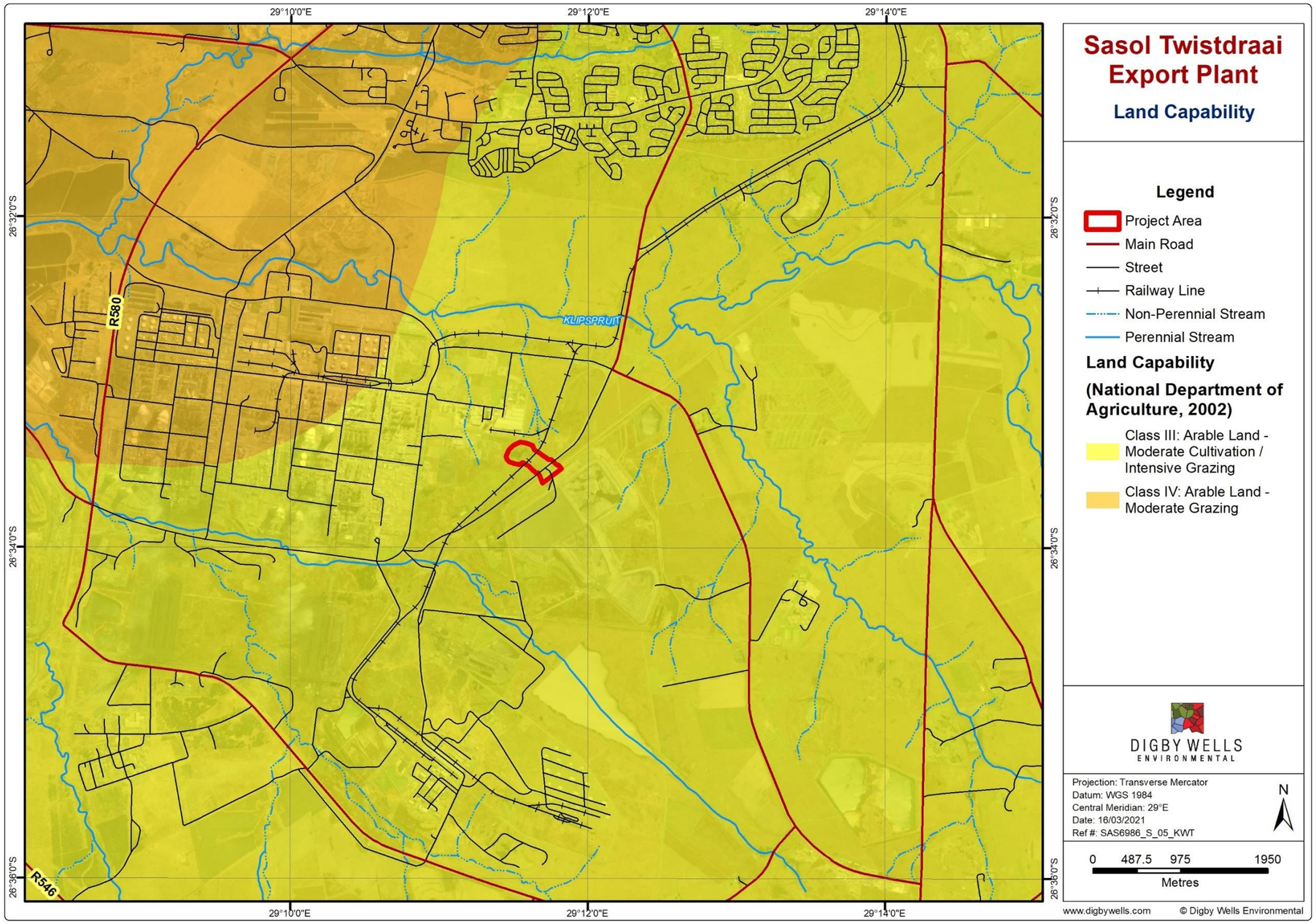


Figure 6-6: Land Capability of the Project Area

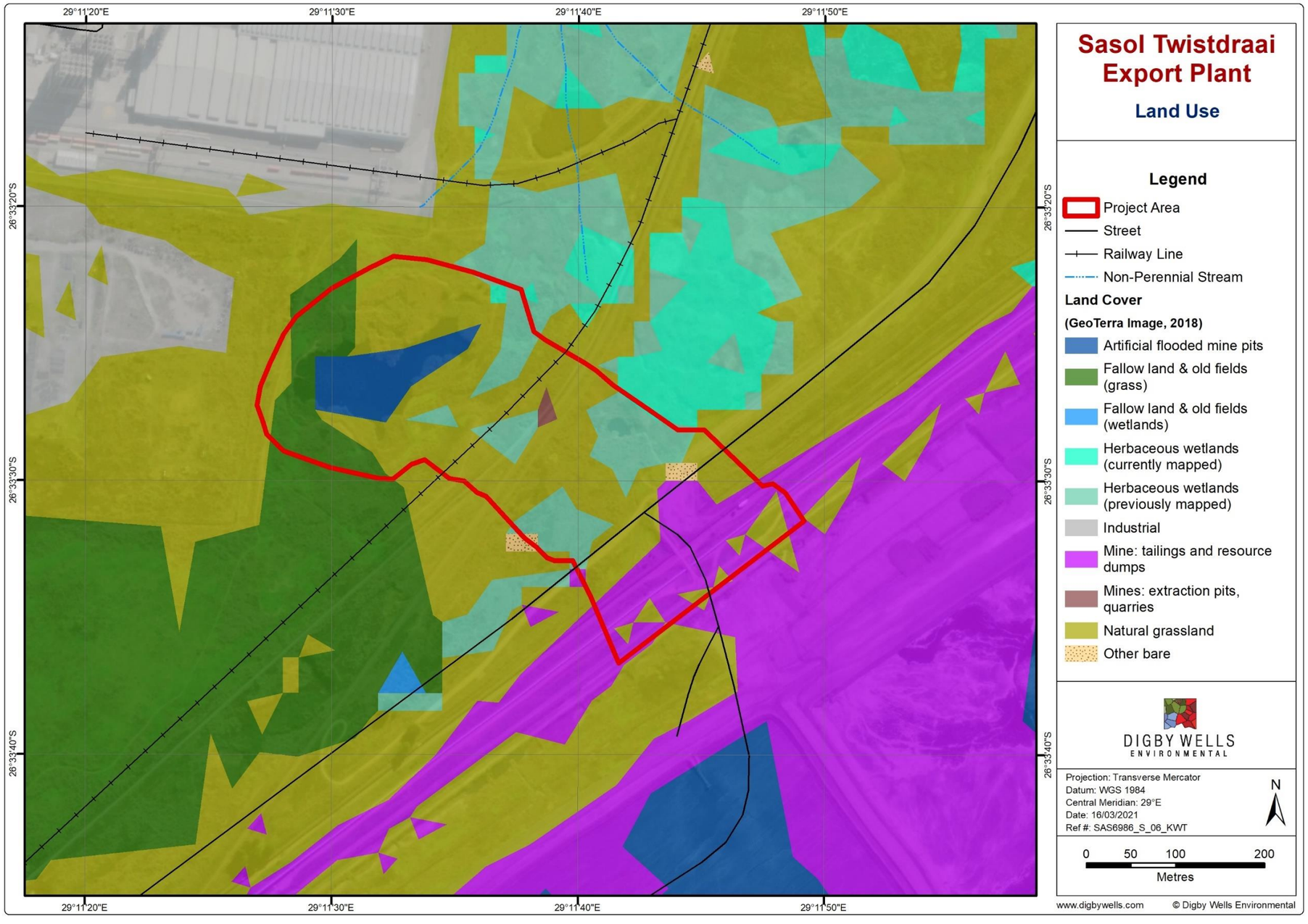


Figure 6-7: Land Use of the Project Area

7. Findings and Discussion

A soil reconnaissance assessment was undertaken for the proposed pipeline and 500 m buffer. The findings were compared to the previously conducted Impact Assessment (Digby Wells Environmental, 2019). The results of the assessment are presented in the subsections below.

7.1. Soil Forms

The soil forms within the Project Area are described in the subsections below together with photos taken during the field survey. The following soil forms were identified and delineated within the Project Area:

- Arcadia;
- Rensburg; and
- Witbank

Soil forms are conceptual generalizations based on specific soil properties. Each soil form is composed of soil horizons, uniquely combined, and integrated. The typical augured soil horizons were identified as:

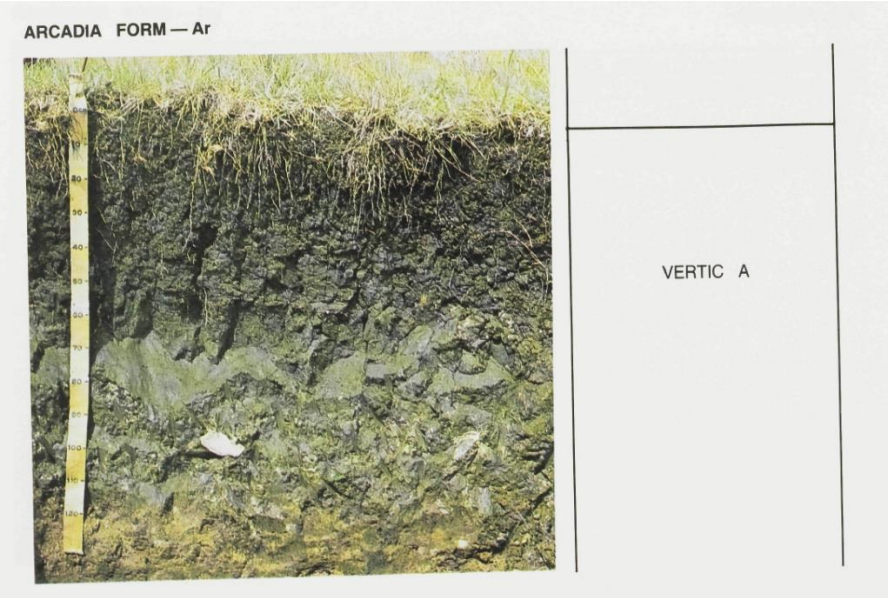
- Vertic A-horizons overlying an G-horizon or unspecified material in the low-lying areas. These soils are high in clay content, young soils with evidence of emerging soil development in the form of colour variations and clay lamellae. These soils are mainly associated with wetlands and low-lying areas; and
- A mixture of topsoil, subsoil and gravel, associated with historical infrastructure, including the conveyor belt construction, road construction and trench construction. The soils were shallow and heavily disturbed with evidence of excavations, stockpiling and Alien Invasive Plants (AIPs).

Arcadia and Rensburg soils are typically associated with wetlands and low-lying areas, also known as hydromorphic soils. These soils are very high in clay content, causing permanent, seasonal and/or temporary waterlogging. Waterlogged conditions create anaerobic soil conditions which in effect change the soil chemical and physical characteristics, therefore changing the hydrological functioning, vegetation type and biophysical nature of the area.

A large section of the Project Area has historically been and is currently being impacted by previous industrial activities and infrastructures. These activities have caused changes to the soil physical, chemical and biological functioning, therefore changing the natural soil form to Witbank (man-made soils). The area has disturbed topographies, water ponding, increased surface runoff and increased AIPs.

Each soil form is described in the subsections below together with the distribution map in Figure 7-1.

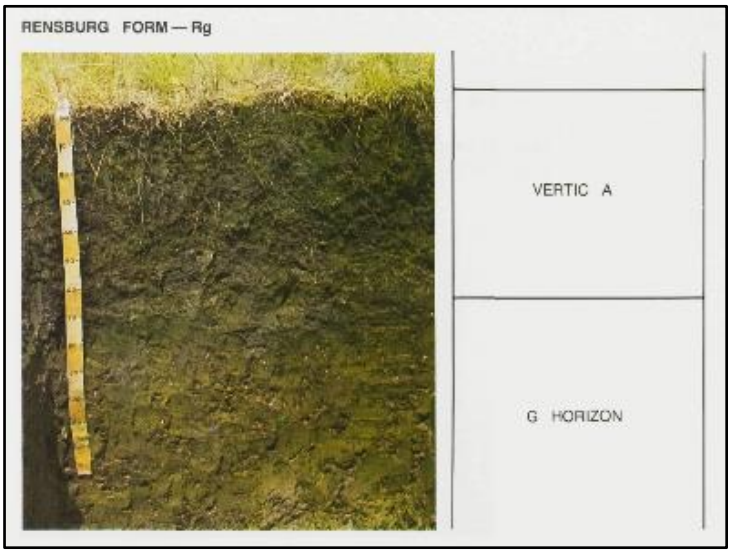
7.1.1. Arcadia (Ar)

Soil Sequence	Vertic A -horizon	Unspecified B-Horizon
Master Horizons	A	C
Average Depth	0 – 400 mm	>400
Horizon Description	Dark, black, strongly structures soil. Clayey texture with clear signs of slicken-slides and swell and shrink properties. Iron mottles, many shallow roots. Abrupt transition to the C-horizon.	Hard, dark, black, strongly structures soil. Clayey texture, auger restrictions at 400 mm. Impermeable layer causing water ponding (wetland formation).
Typical Arcadia Soil Profile (Soil Classification Working Group, 1991)		
		
Site Specific Arcadia Soil Form (Field Survey Photos, March 2021)		
Arcadia soils dominated the Project Area. Arcadia soils are associated wetlands due to the high clay content, low permeability and high, water holding capacity. The soils are clayey, dark and well structured. The soils are highly erodible when unvegetated and large erosion gullies and deep trenches may form when soils are exposed. A white residue was observed on the soil surface which might be related to seepage from the Discard Dump.		

7.1.2. Rensburg (Rg)

Soil Sequence	Vertic A -horizon	G-horizon
Master Horizons	A	B
Average Depth	0 – 500 mm	>500 mm
Horizon Description	Dark, black, strongly structures soil. Clayey texture with clear signs of slicken-slides and swell and shrink properties. Many shallow roots. Gradual transition to the B-horizon.	Light grey-brown with mottles (hydromorphic soils), sandy-clay-loam, macro matrix pores, few roots.

Typical Rensburg Soil Profile (Soil Classification Working Group, 1991)



Rensburg Soil Form (Field Survey Photos, March 2021)

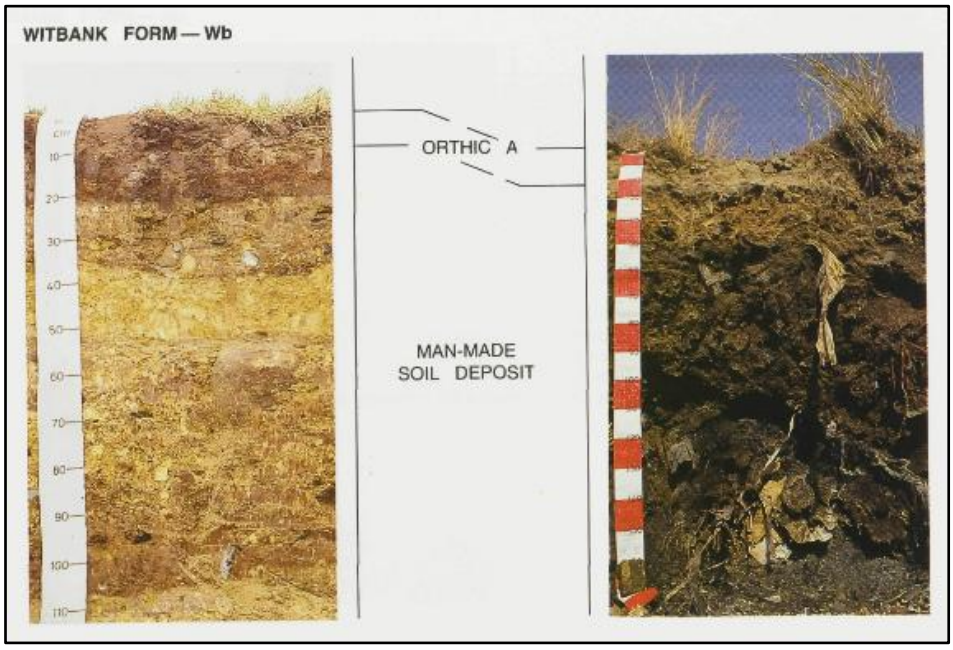
The Rensburg soil forms consists of a vertic topsoil over a G-horizon. The G-horizon has a light soil matrix with a colour pattern which some green, red and black hues to the reduction of iron and manganese under permanent or periodic anaerobic conditions. The G-horizon has a firmer consistence than the overlying Vertic horizon and is classified as a hydromorphic soil. The Rensburg soils in the Project were deeper than the Arcadia soils and associated with the more seasonal wetland areas.

Dark, black topsoil overlying a clayey light soil matrix B-horizon with AIPs prefiltration

7.1.3. Witbank (Wb)

Soil Sequence	Orthic A-horizon	Manmade Soil Deposit
Master Horizons	A	C
Average Depth	N/A	N/A
Horizon Description	Dark brown, clayey texture mixed with gravel, sand and large peds, high roots and proliferation of AIPs.	Mixture of various gravel, topsoil and subsoils, previously disturbed area. Excavations, stockpiling, water ponding and infillings.

Typical Witbank Soil Profile (Soil Classification Working Group, 1991)



Witbank Soil Form (Field survey photos, March 2021)

The Project Area are in a mine area and consist of previously disturbed areas due to anthropogenic activities related infrastructure and construction. Large sections of the Project Area have been excavated, backfilled, soil mixture, soil compaction and water ponding with geomorphological changes.

Highly disturbed area with infestation of AIPs. Excavations and infillings with unnatural topographies.

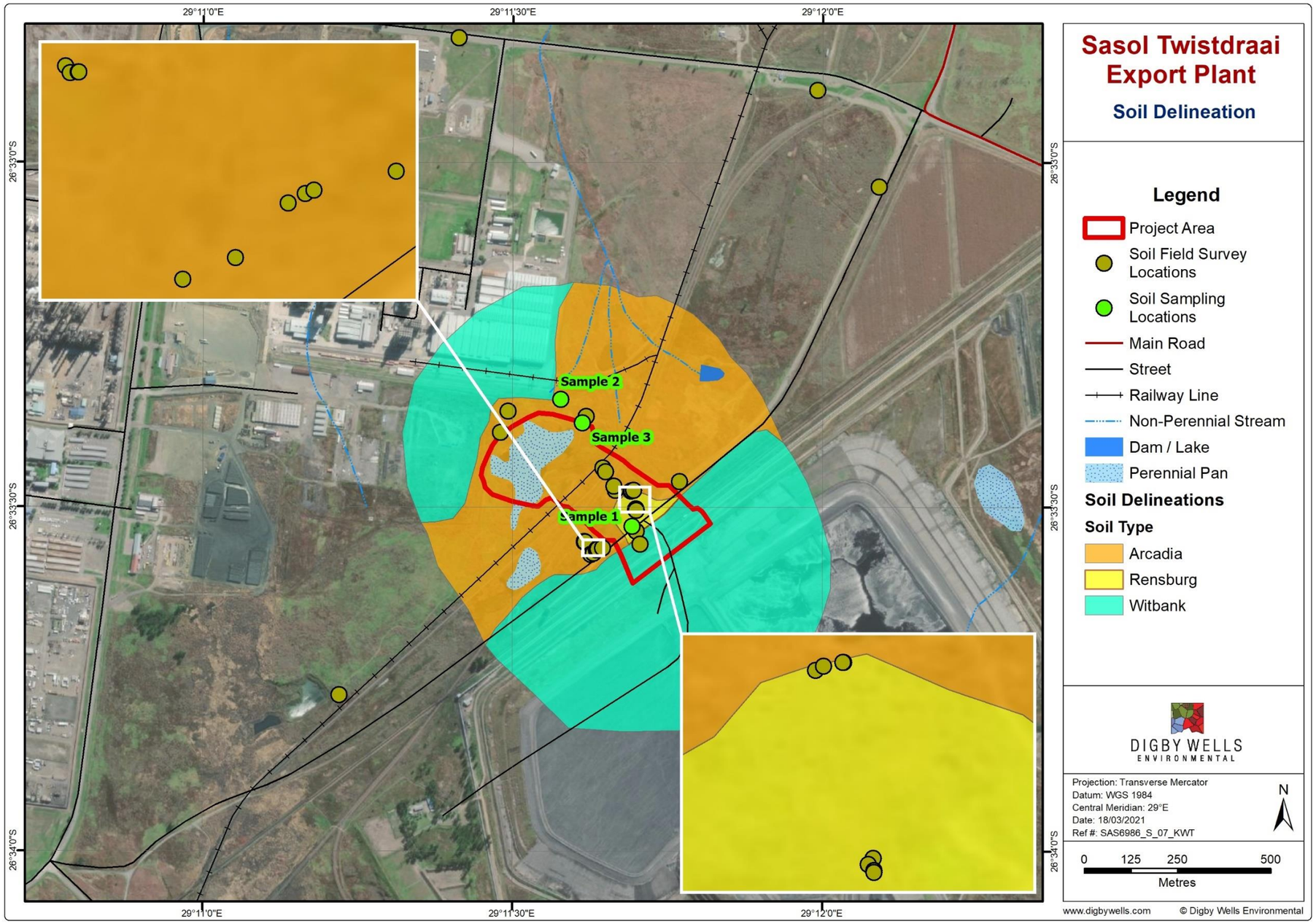


Figure 7-1: Soil Delineation Map

7.2. Land Use

The present land use was identified using satellite images and verified during a rapid site survey.

The dominant land use of the Project Area is mining together with all mining related activities and infrastructure as shown in Table 7-1. These include:

- Railways;
- Formal and informal roads;
- Fence lines and power lines;
- Dams;
- Mine buildings;
- Conveyor belt;
- Solution trench; and
- Discard Dump.

Table 7-1: Land Use Activities

8. Soil Impact Assessment

The soil impacts were assessed for the three phases of the project life, including the construction, operational and post-closure/rehabilitation phases. The impacts were assessed based on the impact's magnitude as well as the receiving environments sensitivity, concluding in an impact significance rating which identifies the most important impacts that require management.

The impacts identified in this section are a result of both the environment in which the proposed project activities will take place, as well as the actual activities. The impacts that could affect the soil and land capability are:

- Loss of the soil resource and natural geomorphology due to the excavation, removal and infilling of the soil;
- Loss of the soil resource due to head-cut, surface, wind and water erosion of unprotected soils;
- Change in soil chemical, physical and biological characteristics due to excavation, mixing and compaction of areas during construction;
- Contamination of the soil resource due to hydrocarbons spillages; and
- Loss of the soil resource due to the disturbance and clearing of vegetation and AIPs proliferation.

8.1. Construction Phase

Activities during the Construction Phase that may have potential impacts on the soil are described in Table 8-1 below.

The mitigation hierarchy includes firstly the avoidance of an impact. When it is not possible to avoid an impact, such as in the case of during the Construction Phase, the next step is or to minimize the impact and thereafter rectify or reduced the impact. When it is not possible to rectify or reduce the impact, offsets need to be implemented.

The aim during the Construction Phase is to:

- Keep the impacted area size to a minimal with as little changes to the natural state of the Project Area as far as possible;
- Prevent the spillage, seepage and runoff of hydrocarbons and other hazardous materials on the soils; and
- Strip the topsoil and the remaining vegetation as per the rehabilitation guideline and place in the allocated locations for the various soil types.

Table 8-1: Construction Phase Interactions and Impacts of Activity Rating

1. Activity and Interaction: Development and upgrading of a permanent access road to the site.			
Impact: • Soil compaction; • Reduced infiltration rate, reduced rooting depth (vegetation cover) and increased surface runoff; • Soil erosion (surface erosion, head cut erosion) and sediment release to wetlands; • Alteration of topographies; and • Soil contamination from hydrocarbon or hazardous substance spills and leakages.			
Description: Due to the high erodibility and clayey nature of the soils, the construction activities for the proposed infrastructure may lead to erosion, head-cut erosion, compaction, increased surface runoff, changes to the natural geomorphology and fertility of the soils. Roads crossing wetland systems may lead to erosion and new channel formation that may lead to sedimentation and loss of vegetation. The clayey soils have various restrictions to vegetation and when not managed, the disturbances may lead to proliferation of AIPs. The high clayey soils may lead to infrastructure collapsing, cracking and other construction risks.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Permanent (7)	The road will be permanent, thus permanent loss of soil/land use.	Moderate (negative) - 84
Extent	Local (3)	Impact will only be on site and immediate surroundings.	
Intensity	Minor Loss (2)	Due to the area being very impacted already, the intensity will be moderate.	
Probability	Definite (7)	The road will definitely be built, and soil be lost/compacted/eroding.	
Nature	Negative		
Mitigation Measures			

- 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 to increase the land capability (vegetation growth potential);
- Unused roads must be rehabilitated to prevent hardened surfaces; and
- Implement a stormwater management plant to prevent impacts from the roads to the soils (erosion, head-cut erosion, increased runoff, loss of soil, water ponding).

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Beyond Project Life (6)	The road will be permanent, however if managed, impacts will not be permanent.	Minor (negative) - 40
Extent	Limited (2)	Impact will only be on site if mitigated and managed.	
Intensity	Minor Loss (2)	Due to the area being very impacted already, the intensity will be minor.	
Probability	Probable (4)	The road will definitely be built, however, impacts less when mitigation measures are followed and there is already established roads that could be used.	
Nature	Negative		

2. Activity and Interaction: Clearing and grubbing of approximately 0.3 ha.

Impact:

- Soil compaction and topsoil loss leading to reduced fertility;
- Soil erosion (and sediment release to wetlands); and
- Alteration of natural drainage lines and topographies.

Description:

During the construction phase, site clearing is necessary for the preparation of surface infrastructure where vegetation will be removed along with topsoil. When soil is removed, the physical and chemical properties are changed, and the soils will deteriorate unless properly managed. When the organic material is removed, either by the clearing of an area for development of infrastructure or by erosion; the soil fertility status is reduced and may result in soil acidification. Vehicles will drive on the soil surface during the construction phase, thereby causing compaction. This reduces infiltration rates, and the ability for plant roots to penetrate the compacted soil. The loss of vegetation cover will exacerbate runoff potential that may lead to increased erosion as well as the loss of organic material.

Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Site clearing should take place during construction but the impact last for the long term without mitigation.	Minor (negative) - 65
Extent	Local (3)	Impact will only be in small areas of the Project Area.	
Intensity	Serious Loss (5)	Impacts might be serious when mitigation is not followed. The soils have a high susceptibility to erosion.	
Probability	Likely (5)	Impacts will likely occur without mitigation.	
Nature	Negative		
Mitigation Measures			
• If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place; • If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; • Bush clearing contractors will only clear bushes and trees larger than 0.5m the remaining vegetation will be stripped with the top 300 mm of topsoil (usable soil) to conserve as much of the nutrient cycle, organic matter and seed bank as possible; • The handling of the stripped usable soil will be minimised to ensure the soil's structure does not deteriorate significantly; • Compaction of the removed and stockpiled usable soil must be avoided by prohibiting traffic on stockpiles; • Stockpiles should only be used for their designated final purposes; and • The stockpiles should be vegetated if standing longer than 1 month to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Site clearing should only take place during construction and impacts should not be longer than 1 year when managed and mitigated.	Negligible (negative) - 28
Extent	Limited (2)	Impact will only be in a small section, if any when mitigation is followed.	
Intensity	Minor Loss (2)	Due to the area being very impacted already, the intensity will be minor.	

Probability	Probable (4)	It is probable that impacts will occur, even though mitigation measures are followed. Soils will be stripped and cleared of vegetation.	
Nature	Negative		

3. Activity and Interaction: Establishment of the laydown area and contractors camp.

Impact:

- Soil compaction;
- Soil erosion and sedimentation; and
- Soil contamination.

Description:

The laydown area will create hardened surfaces that will lead to increased runoff, erosion and sedimentation of the wetlands.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Medium Term (3)	Construction should only take place during construction but the impact last for the medium term without mitigation.	Minor (negative) - 36
Extent	Local (3)	Impact could extend beyond the immediate area.	
Intensity	Moderate Loss (3)	Impacts could be serious and cause loss of soil, soil fertility and biodiversity.	
Probability	Probable (4)	Impacts are probable to occur without mitigation.	
Nature	Negative		

Mitigation Measures

- The laydown area shall be located in an already disturbed area, no new areas shall be cleared;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Ensure proper storm water management designs are in place;
- 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 to increase the land capability (vegetation growth potential).

Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Impacts should only take place during construction and the impact only for a short while when mitigation is followed.	Negligible (negative) - 28
Extent	Limited (3)	Impact should only take place at the area and not beyond.	
Intensity	Minor Loss (2)	Impacts should be minor when mitigation is followed.	
Probability	Probable (4)	Impacts are still probably going to occur even though mitigation is followed.	
Nature	Negative		

4. Activity and Interaction: Construction of the pump station and the pipeline from the pump station to the Discard Dump solution trench.

Impact:

- Removal of the soil changing the natural geomorphology;
- Soil erosion and sedimentation;
- Soil compaction and topsoil loss leading to reduced fertility;
- Soil contamination from spills from machinery as well as potential spills from the pipeline;
- Migration of contaminants into groundwater and contaminate freshwater systems; and
- Decrease in land use and land capability (agricultural potential).

Description:

The soils in the Project Area are highly erodible and could potentially lead to loss of soil, erosion and deep gully forming. The establishment of infrastructure could potentially result in the direct loss of soil and soil fertility as the soil will be excavated and potentially mixed. While soils are stockpiled, it will compact, erode and consequently decreased fertility and rehabilitation success. The longer the soils are exposed, the higher the impacts to the soils. Potential spillage may occur from machinery, causing soil contamination, decreasing the land use and rehabilitation success.

Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Beyond Project Life (6)	Construction of the pipe may cause impacts beyond the life of the project.	Moderate (negative) - 98
Extent	Local Area (3)	The impacts to the soils could lead to impacts to the local area through erosion and sedimentation	

Intensity	Serious Loss (5)	Construction could result serious loss of soils due to the high erodibility of the soils	
Probability	Definite (7)	Loss of soils will definitely occur without mitigation.	
Nature	Negative		

Mitigation Measures

- Excavation shall be undertaken during the dry season where practically possible;
- Small equipment shall be used to minimize the area of impact within the immediate wetland area;
- All soil removed from the trench shall be stockpiled separately adjacent to the trench, within the 4 m servitude area. A new road will have to be constructed and vegetation cleared to connect the existing road to the new construction area. This shall be done to a maximum of 4 m servitude and vehicle movement restricted to the servitude;
- The area will be revegetated after construction if not self-vegetated within 3 months;
- Conserve the topsoil so that it can be used for the rehabilitation of the disturbed areas;
- Movement, stockpiling of brings and cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occurs, it will be dealt with immediately;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion; and
- The handling of the stripped usable soil will be minimised to ensure the soil's structure does not deteriorate significantly.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Long Term (4)	Construction of the pipe may cause impacts, however only for the long term when mitigation is followed.	Minor (negative) - 60
Extent	Limited (2)	The impacts should only take place in small areas when mitigation and rehabilitation are followed.	
Intensity	Serious Loss (6)	Impacts to the soils might still be serious, even though mitigation is followed.	
Probability	Likely (5)	Impacts to the soils will likely still taken place even with mitigation.	
Nature	Negative		

5. Activity and Interaction: Installation of parking bays for the construction area and vehicles.

Impact:

- Soil compaction;
- Soil erosion and sedimentation; and
- Soil contamination.

Description:

Due to the high erodibility and clayey nature of the soils, the infrastructure may lead to erosion, head-cut erosion, compaction, increased surface runoff, changes to the natural geomorphology and fertility of the soils. The clayey soils have various restrictions to vegetation and when not managed and planned, the disturbances may lead to proliferation of AIPs.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Medium Term (3)	Construction should only take place during construction but the impact last for the medium term without mitigation. Impacts such as soil contamination could have a large impact.	Minor (negative) - 40
Extent	Local (3)	Impact could extend beyond the immediate area.	
Intensity	Serious Loss (4)	Impacts could be serious and cause loss of soil, soil contamination, soil fertility and biodiversity loss.	
Probability	Probable (4)	Impacts are probable to occur without mitigation.	
Nature	Negative		

Mitigation Measures

- Parking bays will be allocated in already disturbed and cleared areas outside wetland areas;
- Construction shall be undertaken during the dry season where practically possible;
- Small equipment shall be used to minimize the area of impact within the immediate wetland area;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Ensure proper storm water management designs are in place;
- 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 to increase the land capability (vegetation growth potential).

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Short Term (2)	Impacts can be mitigated immediately and should not last long.	Negligible (negative) - 21
Extent	Limited (2)	Impact should only be at the point source or where the impact has occurred if mitigated soon enough.	
Intensity	Moderate Loss (3)	Impacts could be moderate even if mitigation is followed.	
Probability	Unlikely (3)	Impacts are unlikely to occur when mitigation measures are followed.	
Nature	Negative		

6. Activity and Interaction: Installation of temporary warning signage.

Impact:

- Soil compaction;
- Soil erosion and sedimentation; and
- Soil contamination.

Description:

The temporary installation may lead to soil compaction leading to increased runoff and consequently erosion.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance

Duration	Medium Term (3)	Construction should only take place during construction but the impact last for the medium term without mitigation. Impacts such as soil compaction/erosion from the infrastructure could have a large impact (erosion).	Minor (negative) - 40
Extent	Local (3)	Impact could extend beyond the immediate area – head cut erosion.	
Intensity	Serious Loss (4)	Impacts could be serious and cause loss of soil, soil contamination, soil fertility and biodiversity loss.	
Probability	Probable (4)	Impacts are probable to occur without mitigation.	
Nature	Negative		

Mitigation Measures

- Movement and construction activities, such as mixing of cement will take place outside of the wetlands and no spillage will take place within the wetland area.
- All movement must be contained to one road. Where practical possible, as little as possible movement within the wetlands and catchment will take place.
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Ensure proper storm water management designs are in place;
- 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 to increase the land capability (vegetation growth potential).

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Immediate (1)	Impact will be temporary and should not be for a long term.	Negligible (negative) - 8
Extent	Very Limited (1)	Impact will only occur in immediate area and not beyond when mitigation is followed.	
Intensity	Minor Loss (2)	There will still be small impacts to the soils, even though mitigated.	

Probability	Rare/Improbable (2)	It is rare that large impact will occur from the temporary construction of signs.	
Nature	Negative		
7. Activity and Interaction: Topsoil stripping and stockpiling.			
Impact: • Compaction of soil and therefore increased surface runoff; • Increased erosion on unprotected soils and consequently sedimentation as these soils is highly erodible; • Removal of vegetation and top soil decreasing the soil fertility; and • Compaction, ponding, and changes to the natural hydrological functioning of the landscape.			
Description: The removal of vegetation and topsoil during the construction of the trench will result in direct changes to the soil geomorphology. This will alter the hydrological regime and flow of water which may contribute to loss of wetlands. The soil stripping may lead to soil compaction leading to increased runoff and consequently erosion. While soils are stockpiled, they are compacted and limit rehabilitation and reinstalment of soils and vegetation cover.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Beyond Project Life (6)	Site clearing should only take place during construction but the impact last for the beyond Project life when mitigation measures are not followed.	Moderate (negative) - 105
Extent	Local Area (3)	The loss of soils through erosion may extend beyond the Project Area.	
Intensity	Serious (6)	Site clearing will result in large and permanent impacts to the soils.	
Probability	Definite (7)	Soils will definitely be impacted due to soil stripping and stockpiling.	
Nature	Negative		
Mitigation Measures			

- The topsoil should be stripped by means of an excavator bucket and loaded onto dump trucks;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- The handling of the stripped usable soil will be minimised to ensure the soil's structure does not deteriorate significantly; and
- Compaction of the removed usable soil must be avoided by prohibiting traffic on stockpiles.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Long Term (4)	Site clearing should only take place during construction. When rehabilitation and mitigation is followed the impacts should not last beyond project life.	Minor (negative) - 72
Extent	Limited (3)	When mitigation is followed, impacts should only extend to the Project Area and not beyond.	
Intensity	Serious (5)	Site clearing will result in large and permanent impacts to the soils.	
Probability	Almost Certain (6)	Soils will almost certainly be impacted and disturbed due to soil stripping.	
Nature	Negative		

8. Activity and Interaction: Provision of sanitation facilities during the Construction Phase.

Impact:

- Soil and water contamination.

Description:

Sanitation facilities may leak and contaminate the water and soil. This will affect the soil rehabilitation success.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Short Term (2)	Sanitation facilities should only take place during construction. The impact last for the short term.	Negligible (negative) - 10
Extent	Very Limited (1)	Impacts will only be in one small area, outside wetland areas.	

Intensity	Minor Loss (2)	Impacts should be minor due to the short term of these facilities.	
Probability	Rare/improbable (2)	Impacts are improbable due to the small areas and temporary nature of the impact.	
Nature	Negative		

Mitigation Measures

- Install portable toilets for the personnel and provide trash cans all over the site outside wetland areas;
- Portable toilets shall not be placed within the wetlands;
- An agreement with a service provider shall be in place to service the portable toilets weekly to prevent this from becoming a nuisance;
- All waste shall be removed at the end of each week once construction activities are completed for the day; and
- If any spillage occurs, clean up and remediate immediately.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Immediate (1)	Sanitation facilities should only take place during construction.	Negligible (negative) - 6
Extent	Very Limited (1)	Impacts, if any will only be in one small area, outside wetland areas.	
Intensity	Minimal Loss (1)	Impacts, if any should be minor due to the short term of these facilities and will be remediated immediately if spillages occur.	
Probability	Rare/Improbable (2)	Impacts are improbable due to the small areas and temporary nature of the impact.	
Nature	Negative		

9. Activity and Interaction: Demarcation of the site using fencing and gates

Impact:

- Soil compaction;
- Soil erosion and sedimentation; and
- Soil contamination.

Description:

Demarcation of the site may lead to soil compaction leading to increased runoff and consequently erosion. Spillage may occur from the machinery/vehicles.

Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	Construction should only take place during the construction phase. The impact last for the medium term.	Moderate (negative) - 21
Extent	Very Limited (1)	Impact will only be in limited areas around the Project Area.	
Intensity	Moderate Loss (3)	Loss and impacts to soils will be minimal, however could potentially lead to compaction and erosion.	
Probability	Unlikely (3)	Impacts are unlikely due to the small areas.	
Nature	Negative		

Mitigation Measures

- Movement and construction activities, will take place outside of the wetlands and no spillage will take place within the wetland area;
- No mixing of cement will take place on the soil;
- All movement must be contained to one road. Where practical possible, as little as possible movement within the wetlands and catchment will take place;
- If any erosion occurs, corrective actions (erosion berms) must be taken to minimise any further erosion from taking place;
- If erosion has occurred, topsoil should be sourced and replaced and shaped to reduce the recurrence of erosion;
- Ensure proper storm water drainage from infrastructure areas;
- 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 to increase the land capability (vegetation growth potential).

Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Construction should only take place during the construction phase. The impact last for the short term if mitigated immediately.	Minor (negative) - 10
Extent	Very Limited (1)	Impact will only be in limited areas around the Project Area.	

Intensity	Minor Loss (2)	Loss and impacts to soils will be minor if mitigation and rehabilitation measures are followed.	
Probability	Rare/Improbable (2)	Impacts are improbable due to the small areas and when mitigation is followed.	
Nature	Negative		

10. Activity and Interaction: Waste generation and removal of waste.

Impact:

- Soil contamination
- Decreased soil fertility, and land capability; and
- Soil compaction.

Description:

During waste removal, spillages may occur which could lead to soil contamination. During the removal process, vehicles may compact the soils, leading to hardened surfaces, increased runoff, erosion and sedimentation.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Beyond Project Life (6)	Waste and the removal should only take place during construction, but the impact could last beyond the Project life – soil contamination.	Moderate (negative) - 84
Extent	Local Area (3)	Impacts could extend to the local area and the surrounding area if not mitigated.	
Intensity	Serious (5)	Impacts might result in serious impacts to the soils.	
Probability	Almost Certain (6)	It is almost certain that compaction, erosion, and possible contamination may take place from the waste material and removal thereof.	
Nature	Negative		

Mitigation Measures

• All movement of construction equipment shall be contained to one road and small servitude; • Waste removal trucks shall not be allowed to leave the demarcated road and enter any wetlands; • Light vehicles should be used where possible; • Waste will be disposed of at a registered landfill site; • All waste shall be removed and stockpiled in one designated area; and • If any spillage occurs, clean up and remediate immediately.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Long Term (4)	Waste and the removal should only take place during construction, and when mitigation is followed, should only last during construction phase.	Negligible (negative) - 32
Extent	Limited (2)	Impacts should only extent to the activity area.	
Intensity	Minor (2)	Impacts will be minor when mitigation is followed.	
Probability	Probably (4)	There is a possibility that impacts might still occur even when mitigation is followed.	
Nature	Negative		

8.2. Operational Phase

Activities during the Operational Phase that may have potential impacts on the soil are described in Table 8-2 below.

The aim during the Operational Phase is to:

- Limit operational activities to the operational area and no areas outside of the operational area should be disturbed;
- Corrective actions must be taken as soon as erosion occurs to limit and reduce the impact from spreading;
- Bare areas need to be assessed for compaction or contamination and ripped if required and reseeded; and
- If contamination has occurred, these soils need to be removed and disposed of in a licensed landfill site and replaced with good quality usable soil.

Table 8-2: Operational Phase Interactions and Impacts of Activity Rating

1. Activity and Interaction: Maintenance will be undertaken of the pumps as required.			
Impacts: • Soil compaction; • Soil erosion due to increased runoff; and • Soil contamination due to spillage form pump and vehicles.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Impacts could last for the long term if compaction, erosion or spillage of hydrocarbons occur.	Negligible (negative) - 33
Extent	Local (3)	Impact will only be in a small section of the Project Area.	
Intensity	Moderate Loss (3)	Impacts could lead to moderate loss of soil and land capability.	
Probability	Unlikely (3)	It is unlikely that impacts from the maintenance might occur.	
Nature	Negative		
Mitigation Measures			
• Keep to designated areas. Movement must be restricted to development footprint; • Light vehicles should be used where possible; • All movement of personnel and light vehicles shall be contained to one road; and • Where practically possible, as little as possible movement within the wetlands will take place and access of vehicles denied.			
Post-Mitigation			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	If an impact occurs and is remediated immediately, impact will only last for a short while.	Negligible (negative) - 12
Extent	Limited (2)	Impact will only be within the immediate footprint if mitigated soon enough.	
Intensity	Minor Loss (2)	Impacts could lead to minor losses of soil and land capability if mitigated correctly.	

Probability	Rare/Impossible (2)	It is rare that impacts from the maintenance will occur, especially when mitigation measures are followed.	
Nature	Negative		

8.3. Rehabilitation Phase

Activities during the Rehabilitation Phase that follows the construction phase that may have potential impacts on the soil are described in Table 8-3 below.

The major impacts to consider in the rehabilitation of the site will be the loss of topsoil as a resource through compaction and erosion. Whilst the rehabilitating, 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 soils of the Project Area are highly erosible and should be always protected (vegetated).

The aim during the Rehabilitation Phase is to:

- Rectify, reduce, and rehabilitate the impacts to the soil of the Project Area; and
- Rehabilitate the affected areas to near-natural conditions without resulting in additional impacts to the wetland ecology throughout the process.

Table 8-3: Decommissioning Phase Interactions and Impacts of Activity Rating

1. Activity and Interaction: All rubble and redundant material shall be removed from site to an appropriate licensed facility.			
Impacts: • Soil compaction; and • Soil erosion and sedimentation leading to loss of soil.			
Prior to Mitigation/Management			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Short Term (2)	Rehabilitation and removal of waste will only be for a short period.	Negligible (negative) - 30
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Minor Loss (2)	The activity will only cause minor losses to soils, if any. Designated roads will be used, and no new areas will be compacted.	

Probability	Unlikely (5)	It is unlikely that impacts will result from the activity.	
Nature	Negative		

Mitigation Measures

- Keep to designated areas. Movement must be restricted to development footprint;
- Light vehicles should be used where possible;
- All movement of personnel and light vehicles shall be contained to one road;
- Waste will be stored outside the wetland and removed as quickly as possible from the site;
- All movement of construction equipment shall be contained to one road and small servitude;
- Waste will be disposed of at a registered landfill site;
- All waste shall be stockpiled in one designated area; and
- If any spillage occurs, clean up and remediate immediately.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Immediate (1)	The removal of waste will be less than one month and have limited effects.	Negligible (negative) - 6
Extent	Very Limited (1)	The activity will only be within the waste storage area.	
Intensity	Minimal to no Loss (1)	The activity will only cause minimal loss to soils.	
Probability	Rare/Improbable (2)	It is unlikely that impacts will result from the activity.	
Nature	Negative		

2. Activity and Interaction: Areas where compaction has occurred will be ripped to allow the growth of vegetation.

Impacts:

- Soil erosion due to wind and surface water runoff;
- Sedimentation of wetlands and low lying areas leading to deteriorated water quality and quantity and loss of vegetation cover;
- Change in habitat and potential change in species composition – increased AIPs; and
- Deep soil compaction and loss of soil structure due to the high clay content of the soils.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance

Duration	Long Term (4)	If ripping is not done at the right time, soil structure can be destroyed and take long to remediate.	Minor (negative) - 55
Extent	Limited (2)	The activity will only be within the Project Area and where soils are being ripped.	
Intensity	Serious Loss (5)	Impacts can be serious and cause long term damage to the soils when mitigation measures are not followed.	
Probability	Likely (5)	It is likely that impacts to the Project Area will occur when mitigation measures are not followed.	
Nature	Negative		

Mitigation Measures

- Only rip at the end of the wet season/ beginning of the dry season to prevent breakdown of soil aggregates;
- Do not till/rip in the wet season as this will cause damage to the soil geomorphology as well as the equipment used;
- Rip to at least 400 mm to prevent deep compaction and therefore waterlogging of newly vegetated areas;
- Re-vegetate the area as soon as ripping has occurred to prevent soils to be exposed for long periods. The vertic soils are highly susceptible to erosion;
- Shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas;
- Implement a AIPs program to prevent proliferation of AIPs and deterioration of soil fertility; and
- Avoid creating narrow preferential flow paths as the this could lead to erosion gullies as the soils are susceptible to erosion.

Post-Mitigation

Dimension	Rating	Motivation	Significance
Duration	Medium Term (3)	If ripping is not done at the right time, soil structure can be destroyed and medium time to remediate.	Negligible (negative) - 32
Extent	Limited (2)	The activity will only be within the Project Area and where soils are being ripped.	
Intensity	Moderate Loss (3)	Impacts will only be moderate when mitigation measures are followed.	

Probability	Probable (4)	Impacts will probably still occur as the soils will be exposed for a period and due to the clay nature of the soils.	
Nature	Negative		

3. Activity and Interaction: Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovering and continuity of the wetland vegetation.

Impacts:

- Soil erosion due to wind and surface water runoff;
- Soil geomorphological changes (loss of structure, fertility, Organic Material (OM); and
- Proliferation of AIPs.

Prior to Mitigation/Management

Dimension	Rating	Motivation	Significance
Duration	Short Term (2)	Reshaping and revegetation of the areas will only occur for a short period.	Negligible (negative) - 24
Extent	Limited (2)	The activity will only be within the Project Area.	
Intensity	Minor Loss (2)	Activity will help improve the impacts and therefore will have very limited impacts, however, could lead to soil erosion and geomorphological changes.	
Probability	Probable (4)	It is possible that increases AIPs will occur as well as erosion and geomorphological changes.	
Nature	Negative		

Mitigation Measures

- Only reshape and work the land at the end of the wet season/ beginning of the dry season to prevent breakdown of soil aggregates;
- Do not till/rip/shape in the wet season as this will cause damage to the soil geomorphology as well as the equipment used;
- Re-vegetate the area as soon as ripping has occurred to prevent soils to be exposed for long periods. The vertic soils are highly susceptible to erosion;
- Shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas;
- Avoid creating narrow preferential flow paths as the this could lead to erosion gullies as the soils are susceptible to erosion; and
- Rehabilitation work should be performed during the dry season, unless it is highly urgent and could be detrimental to health of wetland areas.

Post to Mitigation/Management

Dimension	Rating	Motivation	
Duration	Short Term (2)	Reshaping and revegetation of the areas will only occur for a short period when mitigation is followed.	Negligible (negative) - 15
Extent	Very Limited (1)	The activity will only be within small areas, where seen necessary to do so.	
Intensity	Minor Loss (2)	Activity will help improve the impacts and therefore will have very limited impacts, however, could still lead to geomorphological impacts.	
Probability	Unlikely (3)	It is unlikely that large impacts will arise from the activity when mitigation measures are followed.	
Nature	Negative		

8.4. Cumulative Impacts

Cumulative impacts on soil resources were viewed in the light of similar mining or related operations within the catchment that contribute similar or related pollutants to soil resources within or downstream of the Project Area.

Industrial and associated activities that historically and currently impacting the soil resources include:

- Geomorphological changes to the natural soils and landscape. These include excavations, infillings, compaction, ponding, hardened surfaces and mixing of soil;
- Loss of habitat, vegetation and growth medium through vegetation clearing, ripping, AIPs proliferation, and vehicle movement;
- Erosion, loss of topsoil and organic material and sedimentation due to hardened surfaces, vehicle movement, sedimentation causing loss of basal cover and suffocating vegetation growth;
- Sedimentation and pollution of water courses (wetlands); and
- Soil contamination through possible acid and sulphate, mine impacted water (seepage from the Discard Dump) and possible heavy metals.

The cumulative impacts may therefore have a significant effect on the current soil resources and therefore impacting the land use and land capability of the Project Area. Possible contaminated soil (white residue and sulphur smell) has the potential to directly impact the water quality and quantity as well as vegetation of the area.

8.5. Unplanned and Low Risk Events

There is a risk of accidental spillages of hazardous substances, for example hydrocarbons or oils from vehicles or other construction machineries. Contamination is the result of accidental spillage of contaminated water or leakages of oil and hydrocarbons from equipment used.

Table 8-4 outlines mitigation measures that must be adopted in the event of unplanned impacts throughout the life of the proposed Project.

Table 8-4: Unplanned Events and Associated Mitigation Measures

Unplanned Risk	Mitigation Measures
• Hazardous substance spillage from pipeline or machinery.	• Prevent any spills from occurring; • If a spill occurs it is to be cleaned up (Drizit spill kit/ Zupazorbtype spill kit, oil or chemical spill kit) immediately and reported to the appropriate authorities; • Pipelines must be checked regularly for leaks; • Pipelines must be maintained; • Ensure emergency response plans are in place; • Contractors must ensure that all employees are aware of the procedure for dealing with spills and leaks and undergo training on site; • Ensure that emergency spill equipment is available; • All machines are to be serviced and refuelled in demarcated bunded areas, workshops or at appropriate off-site locations; • If a significant (> 5 litres (L)) spill occurs, it is to be cleaned up immediately, reported to the appropriate authorities and recorded; and • Contaminated soils must be disposed in a registered and licensed Waste Land Facility.

9. Environmental Management Programme

The Environmental Management Programme (EMPr) is described in Table 9-1 below.

Table 9-1: Environmental Management Programme

Phase	Activities	Potential Impacts	Mitigation Measure	Mitigation Type	Period for Implementation
Construction	• Development and upgrading of a permanent access road to the site; • Clearing and grubbing of approximately 0.3 ha; • Establishment of the laydown area and contractors camp; • Construction of the pump station and the pipeline from the pump station to the Discard Dump solution trench; • Installation of parking bays for the construction area and vehicles; • Installation of temporary warning signage; • Topsoil stripping and stockpiling; • Provision of sanitation facilities during the Construction Phase; • Demarcation of the site using fencing and gates; and • Waste generation and removal of waste	• Reduced infiltration rate, reduced rooting depth (vegetation cover) and increased surface runoff; • Soil erosion (surface erosion, head cut erosion) and sediment release to wetlands; • Alteration of topographies; • Alteration of natural drainage lines and topographies; • Removal of the soil changing the natural geomorphology; • Soil contamination from spills from machinery as well as potential spills from the pipeline; • Migration of contaminants into groundwater and contaminate freshwater systems; • Removal of vegetation and top soil decreasing the soil fertility; and • Compaction, ponding, and changes to the natural hydrological functioning of the landscape.	• 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 to increase the land capability (vegetation growth potential) once construction is completed; • Unused roads must be rehabilitated to prevent hardened surfaces; • Implement a stormwater management plant to prevent impacts from the roads to the soils (erosion, head-cut erosion, increased runoff, loss of soil, water ponding); • The handling of the stripped usable soil will be minimised to ensure the soil's structure does not deteriorate significantly; • Compaction of the removed and stockpiled usable soil must be avoided by prohibiting traffic on stockpiles; • Excavation shall be undertaken during the dry season where practically possible; • Small equipment shall be used to minimize the area of impact within the immediate wetland area; • All soil removed from the trench shall be stockpiled separately adjacent to the trench, within the 3 m servitude area. A new road will have to be constructed and vegetation cleared to connect the existing road to the new construction area. This shall be done to a maximum of 4 m servitude and vehicle movement restricted to the servitude; • Conserve the topsoil so that it can be used for the rehabilitation of the disturbed areas; • Movement, stockpiling of brings and cement will take place outside of the wetlands and no spillage will take place within the wetland area. If any spillage occurs, it will be dealt with immediately; • Place sediment trapping berms on the boundary of the 100 m buffer or end of development; • Parking bays will be constructed outside wetland areas; • Waste will be disposed of at a registered landfill site; • All waste shall be removed and stockpiled in one designated area; and • If any spillage occurs, clean up and remediate immediately.	Concurrent rehabilitation throughout the life of the project	Life of Construction Phase
Operational	• Maintenance will be undertaken of the pumps as required.	• Soil compaction; • Soil erosion due to increased runoff; and • Soil contamination due to spillage form pump and vehicles.	• Keep to designated areas. Movement must be restricted to development footprint; • Light vehicles should be used where possible; • All movement of personnel and light vehicles shall be contained to one road; and • Where practically possible, as little as possible movement within the wetlands will take place and access of vehicles denied.	Concurrent rehabilitation throughout the project	Life of Operational Phase
Rehabilitation	• All rubble and redundant material shall be removed from site to an appropriate licensed facility;	• Soil compaction;	• Keep to designated areas. Movement must be restricted to development footprint; • All movement of personnel and light vehicles shall be contained to one road;	Concurrent rehabilitation throughout the project	Life of Rehabilitation and beyond

	• Areas where compaction has occurred will be ripped to allow the growth of vegetation; and • Area shall be shaped and contoured to mimic its surrounding areas and to encourage the recovering and continuity of the wetland vegetation.	• Sedimentation of wetlands and low lying areas leading to deteriorated water quality and quantity and loss of vegetation cover; • Change in habitat and potential change in species composition – increased AIPs; • Deep soil compaction and loss of soil structure due to the high clay content of the soils; • Soil erosion due to wind and surface water runoff; • Soil geomorphological changes (loss of structure, fertility, OM); and • Proliferation of AIPs.	• Waste will be stored outside the wetland and removed as quickly as possible from the site; • All movement of construction equipment shall be contained to one road and small servitude; • Waste will be disposed of at a registered landfill site; • All waste shall be removed at the end of the day and disposed of to an area agreed with the Environmental Practitioner; • If any spillage occurs, clean up and remediate immediately; • Only rip and reshape at the end of the wet season/ beginning of the dry season to prevent breakdown of soil aggregates; • Do not till/rip in the wet season as this will cause damage to the soil geomorphology as well as the equipment used; • Rip to at least 400 mm to prevent deep compaction and therefore waterlogging of newly vegetated areas; • Re-vegetate the area as soon as ripping has occurred to prevent soils to be exposed for long periods. The vertic soils are highly susceptible to erosion; • Shaping of landscape should be performed in a manner the will water to drain freely towards wetland areas; • Implement a AIPs program to prevent proliferation of AIPs and deterioration of soil fertility; • Avoid creating narrow preferential flow paths as the this could lead to erosion gullies as the soils are susceptible to erosion; and • Rehabilitation work should be performed during the dry season unless it is highly urgent and could be detrimental to health of wetland areas.		

10. Monitoring Programme

A monitoring programme is essential as a management tool to detect negative impacts as they arise and to ensure that the necessary mitigation measures are implemented together with ensuring effectiveness of the management measures in place. Table 10-1 describes the monitoring plan which should be followed from the Construction Phase through to the Rehabilitation and monitoring phase. Table 10-1 includes each element of monitoring together with the frequency of monitoring.

- Monitoring should be done in terms of:
  - EIA Regulations, 2014 (GN R 982 of 4 December 2014 as amended by GN R326 of 7 April 2017) promulgated under the NEMA;
  - National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
  - National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA);
  - The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA); and
  - Results of chemical analyses of soils obtained must be measured against the SSV and reference samples and clearly demonstrate that the selection of guideline values is consistent with the principles of the Framework.

The TEP Senior Manager (SM)and the Environmental Practitioner (EP) are responsible to report on results of the monitoring program.

Table 10-1: Monitoring Plan

Monitoring Element	Comment	Requirement	Frequency
• Soil erosion and sedimentation inspections; • Random inspection of soil thickness on rehabilitated sections; • Fertility analysis and amelioration procedures prior to re-vegetation; and • Evaluating and readjusting the rehabilitation plan.	• A final post-mining rehabilitation performance assessment must be completed with information that is adequate for closure applications.	• Assessment of rehabilitated soil thickness and soil characteristics by means of auger observations using a detailed grid; • Erosion occurrences; • Vegetation cover and basal cover inspection; • Soil acidity and salt pollution analyses (pH, electrical conductivity and sulphate) at 0-250 mm soil depth; • Fertility analysis (exchangeable cations **K**, **Ca**, **Mg** and **Na** and **P**) every 16 ha (400 m x 400 m); and • Bulk density analysis.	• Once, one year after the construction phase; and • Once, one year after the rehabilitation phase.

11. Stakeholder Engagement Comments Received

The consultation process affords Interested and Affected Parties (I&APs) opportunities to engage in the BA process. The objectives of the Stakeholder Engagement Process (SEP) include the following:

- To ensure that I&APs are informed about the Project;
- To provide I&APs with an opportunity to engage and provide comment on the Project;
- To draw on local knowledge by identifying environmental and social concerns associated with the Project;
- To involve I&APs in identifying methods in which concerns can be addressed;
- To verify that stakeholder comments have been accurately recorded; and
- To comply with the legal requirements.

The Public Participation Process (PPP) has been completed in part, as a process separate to the Soil Impact Assessment. No formal consultation was undertaken as part of this assessment. Should any I&AP comments be submitted in relevance to soil resources during the SEP, these will be considered in the final BA report.

12. Recommendations

The following actions are recommended to reduce adverse effects on the soil resources of the Project Area (Table 12-1):

Table 12-1: Possible Impacts and Recommendations

Possible Impacts	Recommendations
Loss of the soil resource due to change in land use, and removal of the soil.	• If any erosion occurs, corrective actions must be taken to minimise any further erosion from taking place at regular intervals or after high rainfall events. Such as revegetation, erosion berms, culverts or gabions.
Loss of the soil resource due to the wind, and water erosion of unprotected soils.	• Re-vegetate the area as soon as reshaping has taken place to prevent exposed soils; • The area must be fenced from any activities until the vegetation is self-sustaining; and • Runoff must be controlled and managed using proper stormwater management measures.
Change in soil characteristics (soil geomorphology) due to compaction of areas and	• Restriction of vehicle movement over sensitive areas to reduce compaction; and • Do not rip/shape the area in the wet season.

Possible Impacts	Recommendations
associated mine infrastructure.	
Contamination of the soil resource due to hydrocarbons spillages.	• If soil is polluted, treat the soil using in-situ bioremediation; • If in-situ treatment is not possible then the polluted soil must be classified according to the minimum requirements for the handling, classification, and disposal of hazardous material, and disposed at an appropriate, permitted or licensed disposal facility; • All vehicles and machines must be parked within hard park areas, and must be checked daily for fluid leaks; • Re-fuelling must take place on a sealed surface area away from soils to prevent seepage of hydrocarbons into the soil; • Place drip trays where vehicles or machinery leaks are occurring; • Fuel, grease, and oil spills should be remediated using a commercially available emergency clean up kits; • Any contractors on site must ensure that all employees are aware of the procedure for dealing with spills, and leaks, and undergo training on-site; and • Soil pollution monitoring should be conducted at selected locations on the project site to detect any extreme levels of pollutants.
Loss of the soil resource due to the disturbance and clearing of vegetation.	• Establishment of effective soil cover such as lawn grass around constructed infrastructure for adequate protection from wind, and water erosion; and • Minimise unnecessary removal of the natural vegetation cover outside the development footprint.

13. Reasoned Opinion Whether Project Should Proceed

Based on the aforementioned information and impact ratings, it is the opinion of the specialist that this project will have minor to negligible impacts on the soil, land use and land capability when mitigation measures are followed. The pipeline may have a positive effect on the long-term on the soils as the contaminated water will be stopped from entering the system. The Project Area is heavily disturbed in its current state. It is however important to follow the mitigation measures provided to ensure minimal impacts to the area. The soils are high in clays (vertic soils) and thus highly susceptible to erosion. It is highly advised to implement erosion control and not to leave stockpiled soils in barren conditions for long periods.

A Rehabilitation Audit Program and Erosion Monitoring Program, one year after the Rehabilitation Phase is recommended to ensure successful rehabilitation and to achieve the committed land use and sustainability of the soils, land use and land capability after mining activities have ceased.

14. Conclusion

A soil reconnaissance assessment was undertaken for the proposed pipeline. The findings were compared to the previously conducted Impact Assessment (Digby Wells Environmental, 2019).

The soil forms within the Project Area are Arcadia, Rensburg and Witbank soil forms. The typical augured soil horizons were identified as Vertic A-horizons overlying a G-horizon or unspecified material in the low-lying areas. These soils are high in clay content, young soils with evidence of emerging soil development in the form of colour variations and clay lamellae. These soils are mainly associated with wetlands and low-lying areas. The Witbank soils were a mixture of topsoil, sub-soil and gravel, associated with historical mining activities, including the conveyor belt construction, road construction and trench construction. The soils were shallow and heavily disturbed with evidence of excavations, stockpiling and AIPs.

The dominant land use of the Project Area is mining together with all mining related activities and infrastructure. The cumulative impacts of the current land use have a significant effect on the current soil resources and therefore impacting the land use and land capability of the Project Area. Contaminated soil will directly impact the water quality and quantity as well as vegetation of the area.

However, based on the impact assessment and the baseline information, it is in the opinion of the specialist that the project can commence, given the proposed mitigation measures are followed and implemented from the Construction Phase through to after the Rehabilitaiton Phase.

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Appendix A: Methodology

Methodology

This section provides the methodology used in the compilation of the Soil Impact Assessment. To complete the proposed scope of work, there were several tasks which needed to be completed and these tasks are explained separately below.

Desktop Assessment and Literature Review

Digby Wells conducted a desktop review of the baseline data and findings related to the soil surveys and other relevant existing documentation:

- Baseline soil information was obtained from the South African land type data published with maps at a scale of 1:250 000 by the Institute for Soil, Climate and Water (ISCW) of the Agricultural Research Council (ARC) (ARC, 2006). These maps indicate delineated areas of relatively uniform terrain, soil pattern, and climate (Land Type Survey Staff, 1972 - 2006). These maps and their accompanying reports provide a statistical estimate of the different soils that can be expected in the area;
- Aerial imagery was analysed to determine areas that are most likely to be suitable for agriculture. The aerial imagery analysis focused on lower lying areas where suitable soils for agriculture are more likely to occur;
- Land use and land capability were described with specific reference to the interaction between water and land use through a review of existing studies conducted in the area as well as publicly available information; and
- All relevant studies previously completed by Digby Wells within or nearby the Project Area, namely:
    - Soil Impact Assessment Report (Digby Wells Environmental, 2019);
    - Twistdraai Land Contamination Assessment (Digby Wells Environmental, 2020); and
    - Integrated Water and Waste Management Plan (Digby Wells Environmental, 2021).

Soil Classification

A soil assessment on the Project Area was conducted during a field visit in March 2021.

The site was traversed by vehicle and on foot. A hand soil auger was used to determine the soil type and depth. Soils were investigated using a Bucket and Cradle auger to a maximum depth of 1.2 metres (m) or to the first restricting layer. Survey positions were recorded as waypoints using a handheld Global Positioning System (GPS). Other features such as existing open trenches and diggings were helpful to determine soil form and depth. Mapping unit boundaries were determined by changes in topography with subsidiary indications from vegetation and parent material.

The soils were classified using the Soil Classification: A Taxonomic System for South Africa (Soil Classification Working Group, 1991). The following attributes were included at each observation:

- Topography, aspect and slope;
- Soil form and family;
- Soil depth;
- Estimated soil texture;
- Soil structure, coarse fragments, calcareousness;
- Underlying material; and
- Vegetation.

Land Use

The current land use was identified by aerial imagery during the desktop assessment and by on-site inspection during the EIA phase. The maps indicate delineated areas of similar land use (Land Type Survey Staff, 1972 - 2006). Land use categories are split into:

- Plantations;
- Natural;
- Waterbodies;
- Mines;
- Urban built-up; and
- Agriculture.

Impact Assessment

The soil impacts were assessed based on the impact's magnitude as well as the receiving environment's sensitivity, resulting in an impact significance rating which identified the most important impacts that require management. Based on national guidelines and legislation, the following criteria were taken into consideration when potentially significant impacts were examined relating to soils:

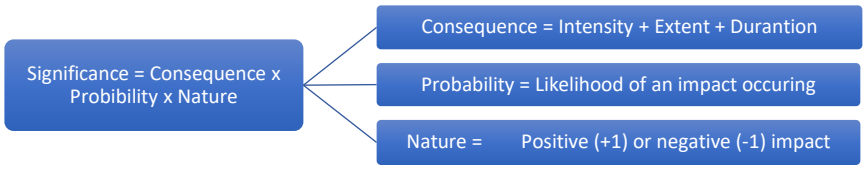
- Nature of impacts (direct/indirect and positive/negative);
- Duration (short/medium/long-term; permanent (irreversible)/temporary (reversible) and frequent/seldom);
- Extent (geographical area and size of affected population/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability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

Significance Rating

Impacts and risks have been identified based on the description of the activities to be undertaken. Once the impacts were identified, a numerical environmental significance rating process was undertaken that utilises the probability of an event occurring and the severity of the impact as factors to determine the significance of a specific environmental impact.

The severity of an impact was determined by taking the spatial extent, the duration and the severity of the impacts into consideration. The probability of an impact was then determined by the frequency at which the activity takes place or is likely to take place and by how often the type of impact in question has taken place in similar circumstances.

Following the identification and significance ratings of potential impacts, mitigation and management measures were incorporated into the EMP. 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:



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 calculated the rating out of 147, whereby intensity, extent, duration and probability were each rated out of seven as indicated in Table 2. The weight assigned to the various parameters was then multiplied by +1 for positive and -1 for negative impacts.

Parameter Rating

Impacts are rated prior to mitigation and again after consideration of the mitigation proposed in this report. The significance of an impact is then determined and categorised into one of seven categories, as indicated in Table 2, which is extracted from Table 3. The description of the significance ratings is discussed in Table 4.

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.

Mitigation Hierarchy

The aim of the Impact Assessment is to strive to avoid damage to or loss of ecosystems and services that they provide, and where they cannot be avoided, to reduce and mitigate these impacts (Department of Environmental Affairs, Department of Mineral Resources, Chamber of Mines, South African Mining and Biodiversity Forum, & South African National Biodiversity Institute, 2013). Offsets to compensate for loss of habitat are regarded as a last resort, after

all efforts have been made to avoid, reduce and mitigate. The mitigation hierarchy is represented in Table 1.

Table 1: Mitigation Hierarchy

	**Avoid or Prevent**	Refers to considering options in Project location, sitting, scale, layout, technology and phasing to avoid impacts on biodiversity, associated ecosystem services and people. This is the best option but is not always possible. Where environmental and social factors give rise to unacceptable negative impacts, mining should not take place. In such cases, it is unlikely to be possible or appropriate to rely on the other steps in the mitigation.
	Minimize	Refers to considering alternatives in the Project location, sitting, scale, layout, technology and phasing that would minimize impacts on biodiversity, associated ecosystem services. In cases where there are environmental constraints, every effort should be made to minimize impacts.
	Rehabilitate	Refers to rehabilitation of areas where impacts are unavoidable, and measures are provided to return impacted areas to near natural state or an agreed land use after mine closure. Rehabilitation can, however, fall short of replicating the diversity and complexity of natural systems.
	Offset	Refers to measures over and above rehabilitation to compensate for the residual negative impacts on biodiversity after every effort has been made to minimize and then rehabilitate the impacts. Biodiversity offsets can provide a mechanism to compensate for significant residual impacts on biodiversity.

Table 2: Impact Assessment Parameter Ratings

Rating	Intensity/Replicability		Extent	Duration/Reversibility	Probability
	Negative Impacts (Nature = -1)	**Positive Impacts (Nature = +1)**			
7	**Irreplaceable loss** or damage to biological or physical resources or **highly sensitive** environments. Irreplaceable damage to **highly sensitive** cultural/social resources.	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 loss** or damage to biological or physical resources or **moderate to highly** sensitive environments. Irreplaceable damage to cultural/social resources of **moderate to highly** sensitivity.	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. >65 but <80% probability.
5	**Serious loss** and/or damage to physical or biological resources or **highly sensitive** environments, limiting ecosystem function. Very serious widespread social impacts. 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	**Serious loss** and/or damage to physical or biological resources or **moderately sensitive** environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures/items of cultural 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.
3	**Moderate loss** and/or damage to biological or physical resources of **low to moderately sensitive** environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local including the site and its immediate surrounding 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 loss and/or effects** to biological or physical resources or **low sensitive** environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited extending only as far as the development site area.	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 to no loss** and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and/or social benefits felt by a very small percentage of the baseline.	Very Limited/Isolated 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 3: Probability/Consequence Matrix

Probability \ Significance	-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
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

Consequence

Table 4: 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	A positive impact. 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. 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	A minor negative impact 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 moderate negative impact may prevent the implementation of the Project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and/or social) environment and result in severe changes.	Moderate (negative) (-)
-109 to -147	A major negative impact 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) (-)

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