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Desktop Hydropedology Assessment for the Proposed Karpowership 132kV Transmission Line - Richards Bay Port

Report

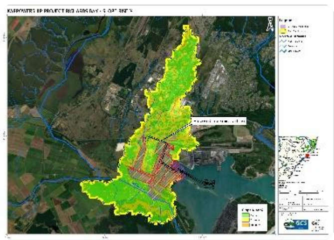
Version - Final 1

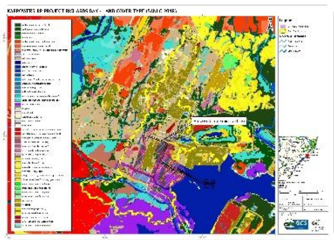
31 October 2022

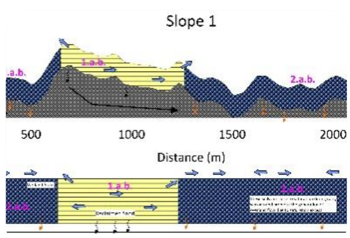
Triplo4 Sustainable Solutions (Pty) Ltd

GCS Project Number: 22-0886

Client Reference: 22-0886_PED1







DESKTOP HYDROPEDOLOGY ASSESSMENT FOR THE PROPOSED KARPOWERSHIP 132kV TRANSMISSION LINE - RICHARDS BAY PORT

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DECLARATION OF INDEPENDENCE

GCS (Pty) Ltd was appointed to conduct this specialist study and to act as the independent hydropedological specialist. GCS objectively performed the work, even if this results in views and findings that are not favourable. GCS has the expertise in conducting the specialist investigation and does not have a conflict of interest in the undertaking of this study. This report presents the findings of the investigations which include the activities set out in the scope of work.

APPENDIX 6 OF THE EIA REGULATION – CHECKLIST AND REFERENCE FOR THIS REPORT

Table 1 - Requirements from Appendix 6 of GN 326 EIA Regulation 2017

Requirements from Appendix 6 of GN 326 EIA Regulation 2017	Chapter
(a) Details of: (i) The specialist who prepare the reports; and (ii) the expertise of that specialist to compile a specialist report including a curriculum vitae	Page ii
(b) Declaration that the specialist is independent in a form as may be specialities by the competent authority	Appendix B.
(c) Indication of the scope of, and purpose for which, the report was prepared	Page ii
(cA) Indication of the quality and age of base data used for the specialist report	Appendix B.
(cB) A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change	Section 1.
(d) Duration, Date and seasons of the site investigation and the relevance of the season to the outcome of the assessment	Sections 1, 2 and 3.
(e) Description of the methodology adopted in preparing the report or carrying out the specialised process include of equipment and modelling used	Section 4.
(f) Details of an assessment of the specifically identified sensitivity of the site related to the proposed activity or activities and its associate's structures and infrastructure, inclusive of a site plan identifying alternative	Section 1.3.
(g) Identification of any areas to be avoided, including buffers	Section 1.2
(h) Map superimposing the activity and associated structures and infrastructure on environmental sensitivities of the site including areas to be avoided, including buffers	Sections 1, 2, 3, 4
(i) Description of any assumptions made and uncertainties or gaps in knowledge	Section 5.1
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity including identified alternatives on the environment or activities	Sections 1, 2 and 3
(k) Mitigation measures for inclusion in the EMPr	Sections 2, 4, and 5.
(l) Conditions for inclusion in the environmental authorisation	Executive summary, Section 5.
(m) Monitoring requirements for inclusion in the EMPr or environmental authorisation	Section 5.
(n) Reasoned opinion – (i) as to whether the proposed activity, activities or portions thereof should be authorised. (iA) regarding the acceptability of the proposed activity or activities; and (ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, and avoidance, management, and mitigation measures should be included in the EMPr, and where applicable, the closure plan	Refer to Section 5.
(o) Description of any consultation process that was undertaken during preparing the specialist report	Refer to Section 5.
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto	Section 5.
(q) Any other information requested by the competent authority	None required.

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LIST OF ACRONYMS

Acronym	Description
A	Diagnostic A horizon
A/B	Interflow soil type A/B
A/Bedrock	Interflow soil type A/Bedrock
B (B1, B2, B3 etc.)	Diagnostic B horizon
BA	Basic Assessment
BOD	Biological oxygen demand
COD	Chemical oxygen demand
CSWMP	A conceptual stormwater management plan
CVB	channel valley bottom wetland
CVB	Channelled valley bottom wetland
DEM	Digital Elevation Model
DWS	Department of Water and Sanitation
E	Diagnostic E horizon
G	G Horizon/soil
GCS	GCS Water and Environment (Pty) Ltd.
GN704	General Notice 704
ha	Hectare
HOSASH	Hydrology of South African Soils and Hillslopes
HRU	Hydrological Response Unit
HST	Hydrological Soil Type
m^3	Cubic Metres
MAE	Mean annual evaporation
MAR	Mean Annual Runoff
MIPI	Midgley and Pitman
NEMA	National Environmental Management Agency
n-Value	Manning's Roughness Coefficients
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O	Orthic Horizon/soil
PCD	Pollution Control Dam
PFD	Process flow diagram
RP	Riparian zone/wetland
S	Seepage wetland
SDF	Standard design flood
SW	Surface Water
TDS	Total dissolved solids
TIN	Triangulated Irregular Network
UCVB	Unchanneled valley bottom wetland
UVB	un-channelled valley bottom
V	Vertic Horizon/soil
WMA	Water Management Area
WR2012	Water Resources of South Africa 2012
WTW	Water Treatment Works
PES	Present Ecological State
EIS	Ecological importance and Sensitivity

1 INTRODUCTION

GCS Water and Environment (Pty) Ltd (GCS) was appointed by Triplo4 Sustainable Solutions (Pt) Ltd (Triplo4) to undertake a desktop hydropedology assessment for the proposed development of a transmission line, associated with the proposed gas to power via Powerships project in Richards Bay, KZN. As the mobile powers will be moored in the nearby bay, the project focused on land-based activities which may result in hydropedological impacts. The project is situated in Quaternary Catchment W21F of the Pongola -Mtamvuna (DWS, 2016) Water Management Area (WMA 4).

1.1 Project background

The Project Concept comprises gas engine power ships or barges provided by Karpower moored on a spread mooring close to the shore or in the protection of a harbour to export power via transmission cables to an Eskom transmission switching station on the shore (refer to Figure 1-1 and Figure 1-2).

The Project entails the generation of electricity by two Powerships moored in the Port of Richards Bay, fed with natural gas from a third ship, a Floating Storage & Regasification Unit (FSRU). The three ships will be moored in the port for the Project's anticipated 20-year lifespan. A Liquefied Natural Gas Carrier (LNGC) will bring in liquified natural gas (LNG) and offload it to the FSRU approximately once every 20 to 30 days, dependent on power demand which is determined by the buyer, ESKOM. The FSRU stores the LNG onboard and turns the liquid form into gaseous form (Natural Gas) upon demand from the Powership (Regassification). Natural gas will be transferred from the FSRU to the Powerships via a subsea gas pipeline. The Project's design capacity is 540MW. Electricity will be generated on Powerships by 27 reciprocating engines, each having a heat input in excess of 10MW (design capacity of 18.32MW each at full capacity). Heat generated by operation of the reciprocating engines is captured, and that energy is used to create steam to drive three steam turbines that each have a heat input of circa 15.45MW. The contracted capacity of 450MW, which cannot be exceeded under the terms of the RMIPPPP, will be evacuated via a 132kV transmission line over a distance of approximately 3km, from the Richards Bay Port tie-in point to the Eskom line, at a connection point (necessitating a new switching station) in proximity to the existing Bayside Substation, which feeds electricity into the national grid.

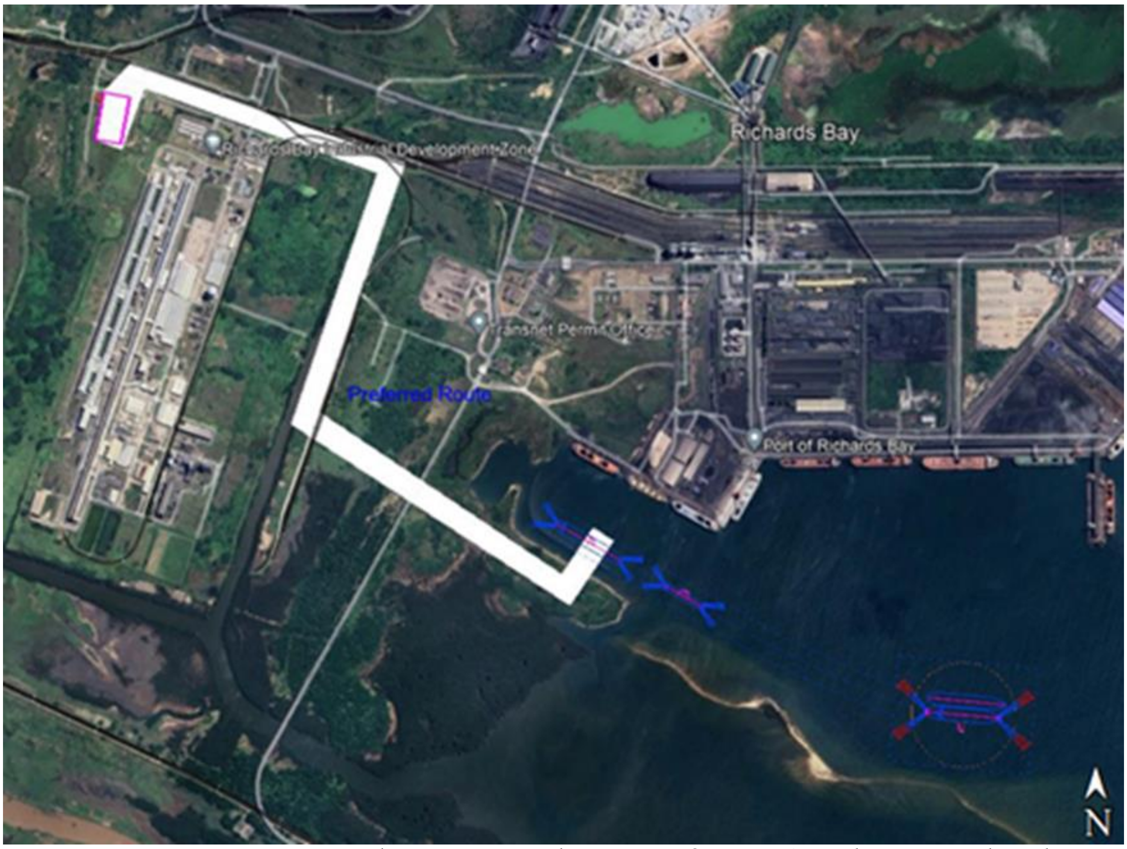


Figure 1-1: Proposed transmission line route from KPS to the national grid

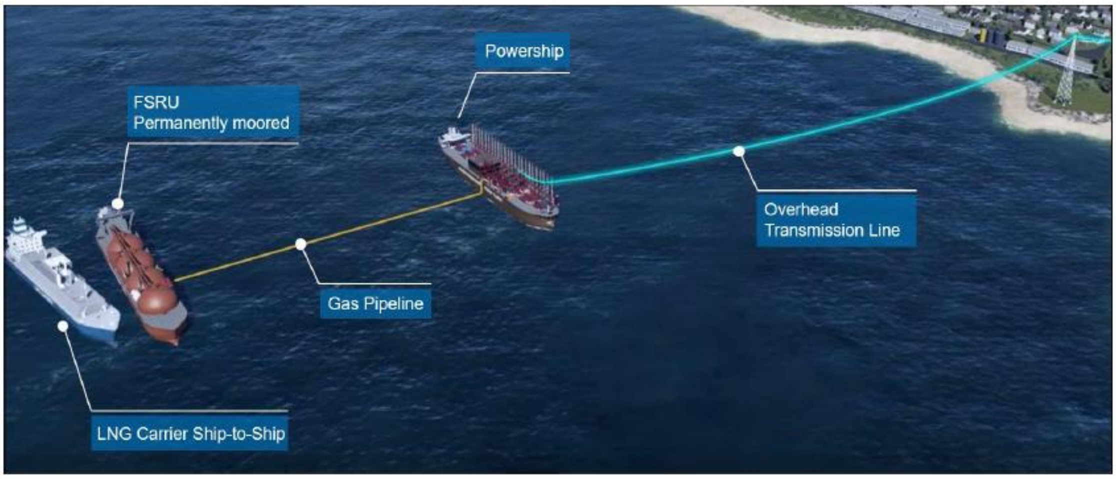


Figure 1-2: Generic Project Concept (Triplo4, METHOD STATEMENTS FOR THE PROPOSED KARPOWERSHIP FOR GAS TO POWER PROJECT, 2022)

1.2 Study objectives and methodology

The hydropedology assessment focused on the proposed construction areas associated with the transmission lines and pylons (i.e. from the connection to the endpoint of the transmission line). The hydropedology assessment report will supplement the Environmental Impact Assessment (EIA) for the Richards Bay Site.

Soils develop over time under the influence of chemical, physical, and biological processes (refer to Figure 1-3). Soils are predominantly the result of in-situ weathering of the host rock (i.e. has characteristics associated with the parent geological occurrence/rock). Soil has an interactive relationship with hydrology (i.e. climate, rainfall duration, runoff patterns, groundwater contribution to baseflow, evaporation etc.). It is a product of water-related processes (physical and chemical) and a first-order control of the destination of rainwater. Though hydrological processes change seasonally, soil characteristics and water transfer capabilities remain similar throughout the year. Hence, a once-off study was undertaken.

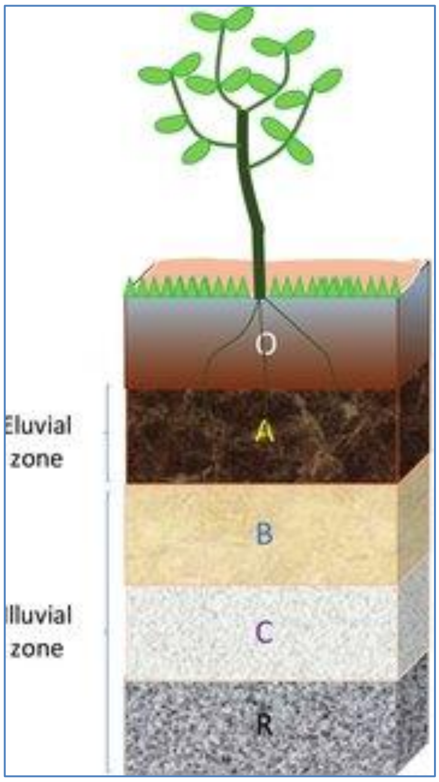


Figure 1-3: Typical soil genesis (Researchgate, 2020)

The objectives of this hydropedological assessment were to:

1. Evaluate the soils in the study area:
    - Soils were classified per the taxonomic system for South Africa (Department of Agricultural Development, 1991).
    - Soil permeability was estimated based on available data (i.e. field characterised textures and public soil data) and according to best practice guidelines (FAO, 1980); and (DWS, 2011).
2. Derive hydropedological flow regimes and interaction areas:
    - In the determination of Hydrological Soil Types (HST), soils were divided into classes based on their expected hydrological responses (Van Tol, Le Roux, & Lorentz, 2013).
3. Conceptualise the water flow dynamics and derive hydropedological flow buffer areas (if required) for wetlands identified in the area.
    - Hydrological processes were perceived from traceable signatures in the soil matrix resulting from the soil's ability to transmit, store and react with water (Le Roux, et al., 2011).
4. Identify potential hydropedological impacts per standard DWS & EIA impact criteria and risk rating (refer to **Appendix A**).

1.3 Scope of work

The scope of work completed was as follows:

1. **Desktop study:**
    a. All available reports (which were provided by the client) relating to the site were assessed.
    b. A desktop-level soil survey was undertaken of the project area, targeting likely soils associated with hillslope, crest, and foot slope topographical areas.
    c. The soils identified in the area were classified according to Soil Classification guidelines (Department of Agricultural Development, 1991)
2. **Hydropedological assessment:**
    a. All data obtained for the area was assessed in terms of suitable practices and screening protocols. This includes the HOSASH (Hydrology of South African Soils and Hillslopes) index and guidelines on hydropedology (Van Tol, Le Roux, & Lorentz, 2013).
    b. Meteorological evaluation.
    c. Catchment delineation.
3. **Risk assessment:**
    a. The risk and impact criteria (Refer to **Appendix A**) were applied to the study area, to evaluate hydropedological risks.
4. **Mapping and report:**
    a. Several hydrological hillslope profiles, soil distribution and hydrological soil type maps were produced.
    b. This report was compiled.

1.4 Gaps and limitations

The following study limitations are recognised:

- The concepts presented are simplifications of the temporal variability of water transfer functions. Realistically, water transfer functions, such as throughflow and groundwater sources, may take a few months up to several years to recharge streams (Le Roux, et al., 2011) However, hydropedology hillslopes have been effectively applied to simulate runoff response mechanisms (Van Tol, Le Roux, & Lorentz, 2013).
- Per minimum requirements for hydropedology studies published by DWS (Van Tol, J.J., Bouwer, D. & Le Roux, P.A.L., 2021), this “Level 2” study was undertaken (field investigation, conceptualisation of hillslopes and soil flow suppression). No numerical unsaturated flow modelling (Level 3 and Level 4) was undertaken and was pre-determined by the project activity (i.e. limited small scale activities that could potentially impact the soil flow regime).

1.5 Study relevance to the season in which it was undertaken

This study was undertaken as a once-off study and relies on historical hydrological and climate data for the site, as well as recognised hydrological and water resource databases for South Africa. Data generated during the time of this study is not seasonally bound as average yearly data was applied where required and as scientifically acceptable.

2 SITE ASSESSMENT

The following section supplies a brief overview of the regional setting, topography, climate, and geological and hydropedological occurrences in the project area. The information in this section was obtained from public domain data and internal GCS databases.

2.1 Regional setting, topography and sub-catchment

The proposed transmission line ("The Site") is situated near and in the port of Richards Bay, KwaZulu-Natal Province (refer to Figure 2-6). The site is situated in Quaternary Catchment W21F of the Pongola -Mtamvuna (DWS, 2016) Water Management Area (WMA 4).

One (1) sub-catchment was delineated for the project area and describes the natural drainage of the area. The site is bound to the south by a canal that drains to the Richards Bay harbour, and the Mhlatuze River is situated further downstream of the south (across the canal). Several non-perennial streams drain the site towards the north, and the southern portion is drained via several drainage lines. Elevations on the site typically range from 0 to 50 metres above mean sea level (mamsl).

2.2 Climate

The Köppen Climate Classification suggest Richards Bay is situated in a humid subtropical climate (class = Cfa) which receives rainfall in the summer months (Kottek, Grieser, Beck, Rudolf, & Rubel, 2006). The Mean Annual Precipitation (MAP) is in the order of 1 285 mm/annum and the Mean Annual Evapotranspiration (MAE) is in the order of 1300 mm/a (S-Pan) (WRC, 2015).

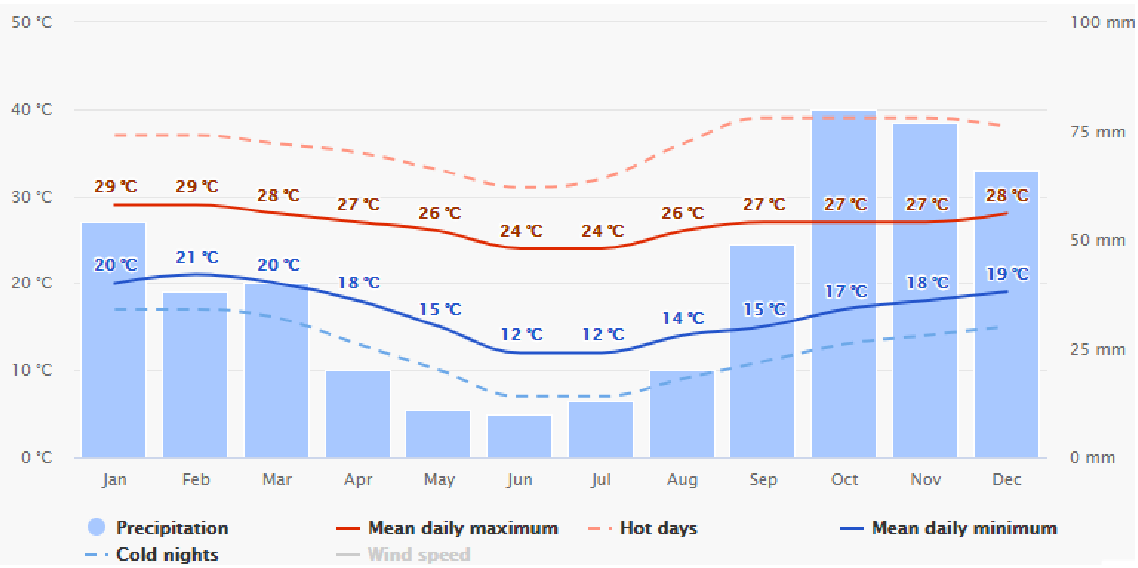


Figure 2-1: Average temperature and rainfall - Richards Bay (Meteoblue, 2022)

2.2.1 Climate change considerations

Projected changes in climate for 2021 - 2050 under the RCP 8.5 which could potentially impact the hydrological environment (CSIR, 2019), are recorded as follows:

- The projected increase in MAP by 2050 is – 53.24 mm/yr (less);
- Projected changes are at least 9.2 more hot days compared to 2022;
- Projected increase in temperatures by as much as 1.77°C; and
- Projected increase in extreme rainfall days to increase by 1.38 days.

2.3 Local geology

According to the 2732 Durban-1:250 000 Geological map series (DMEA, 1998), the local geology at the site is characterised by undifferentiated quaternary sands, underlain by older Swazian aged Gneiss (refer to Figure 2-6).

2.4 Depth to groundwater

According to DWAF (2006), the groundwater depth on a quaternary scale is in the order of 16.5 mbgl. WRC (2015) data suggest that the groundwater table ranges from 3 to 15 mbgl, for the sub-catchment. The literature further suggests that the groundwater table mimics the surface topography. Shallower groundwater levels will typically be associated with low-lying areas near the Mhlatuze River.

2.5 Wetlands and recognised water courses

The site falls within an area classified as a subtropical wetland (estuary) (Van Deventer, 2018). The estuary is classified as being poorly protected. No recognised surface water streams or rivers are associated with the project area.

Triplo4 (2022) undertook a wetland assessment and identified wetlands within a 500 m buffer of the proposed transmission line. The wetland areas and water courses are shown in Figure 2-2.

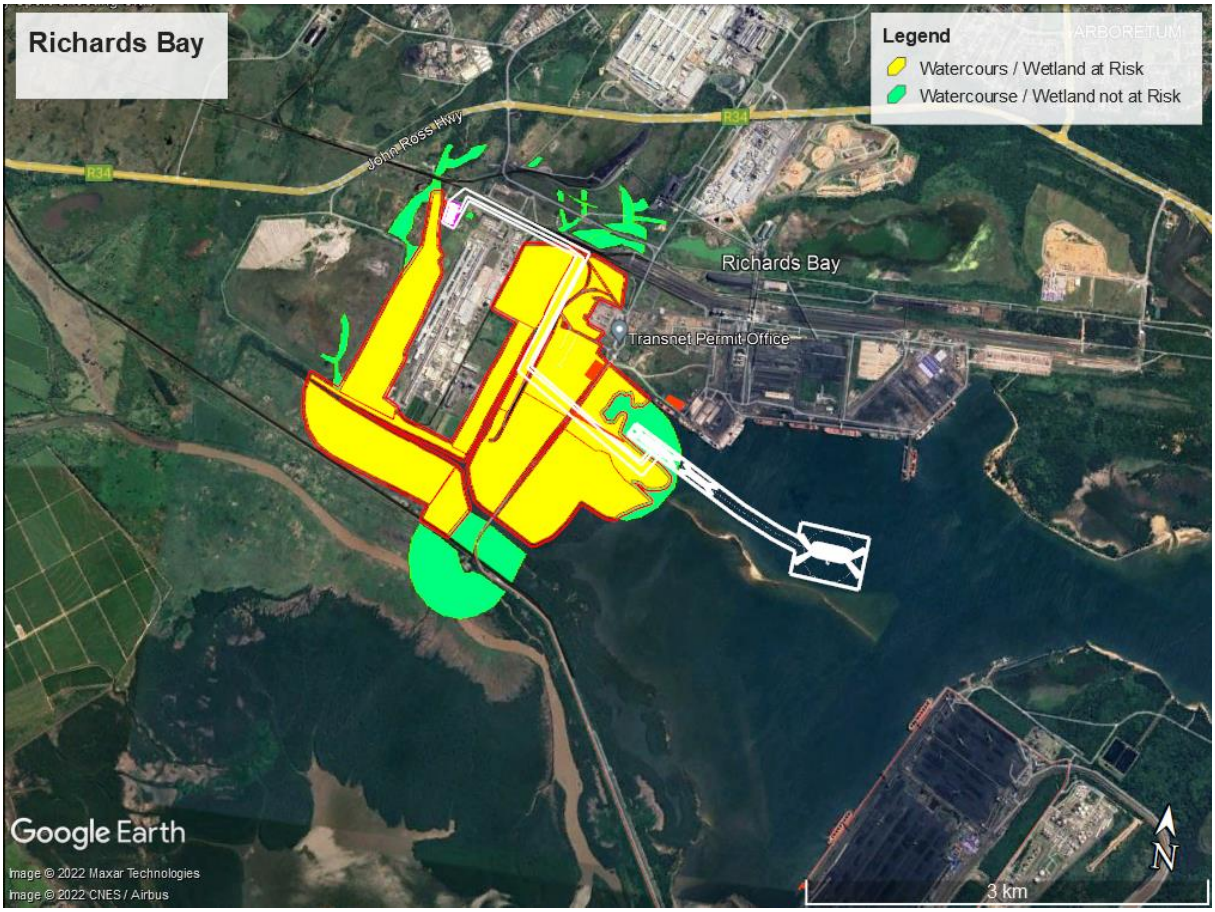


Figure 2-2: Wetland areas & watercourses identified by wetland specialists (Triplo4, 2022)

In terms of wetland geo-hydrology, baseflow is considered the most important contributor to wetland health. Baseflow (refer to Figure 2-3) is a non-process-related term to signify low amplitude high-frequency flow in a river during dry or fair-weather periods. Baseflow is not a measure of the volume of groundwater discharged into a river or wetland, but it is recognised that groundwater contributes to the baseflow component of river or wetland flow.

Available literature (WRC, 2015; DWAF, 2006) suggests groundwater contribution to baseflow ranges from 51.12 mm/yr [Pitman Model] to 131.37 mm/yr [Hughes Model], which relates to about 4 to 10% of the MAP.

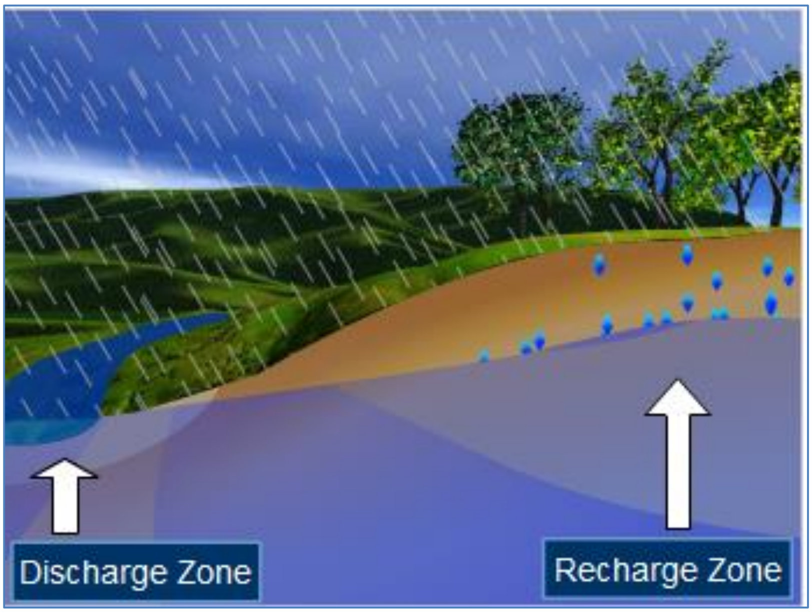


Figure 2-3: Groundwater baseflow concept (DWS, 2011)

2.6 Present ecological state (PES) and Ecological Importance and Sensitivity

The PES for quaternary catchment W21F is classified as Class C: Moderately Modified and the Ecological Importance and Sensitivity (EIS) as moderately sensitive (SANBI, 2011).

2.7 Soils and land morphology

According to the Land types of South Africa databases (ARC, 2006), the soils in the project area fall within Ia74 (deep alluvial soils comprise > 60% of land type) land types [Freely drained, yellow, eutrophic, apedal soils comprise > 40% of the land type (red soils comprise < 10%)].

In general, the moisture regime of the land types is dominated by surface flows of water with infiltration and subsequent lime and gypsum translocation. As these land types occur more readily in dry to arid environments the dominance of lime in the soil will mask most redox morphology features due to alkaline conditions. These conditions lead to the potential development of redox depletions in the form of grey colours but will not readily yield high chroma redox accumulations (in the form of Fe oxides and hydroxides) due to the dominance of white $FeCO_3$ minerals (as the dominant Fe minerals in alkaline soil solution conditions). Additionally, the youthful nature of the soils leads to limited expression of mottling (Der Waals, 2019); (Job, et al., 2019).

Different soil types are encountered within shoulder, mid-slope and valley positions of the project area, and this is mainly due to sub-surface geology, products of weathering, degree of saturation, soil texture and slope position (refer to Figure 2-4).

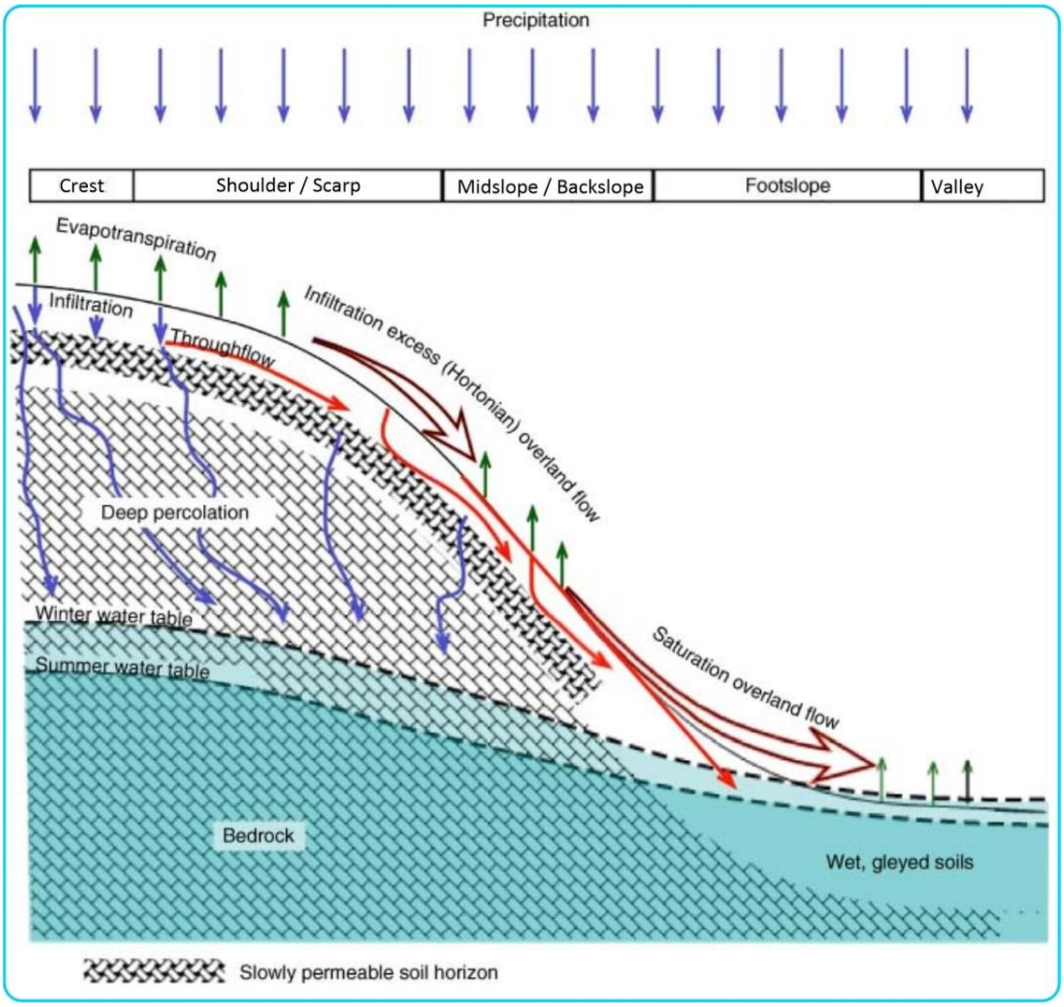


Figure 2-4: Land morphology concept (Almond, 2016)

The soils in the project predominantly consist of reclaimed land consisting of sand and man-made sand deposits (ARC, 2006) - refer to Figure 2-5. The combined average diagnostic depth of all the soils is > 1200 mm. Average clay content for footslope soils ranges from 20 to 40% (ARC, 2006).

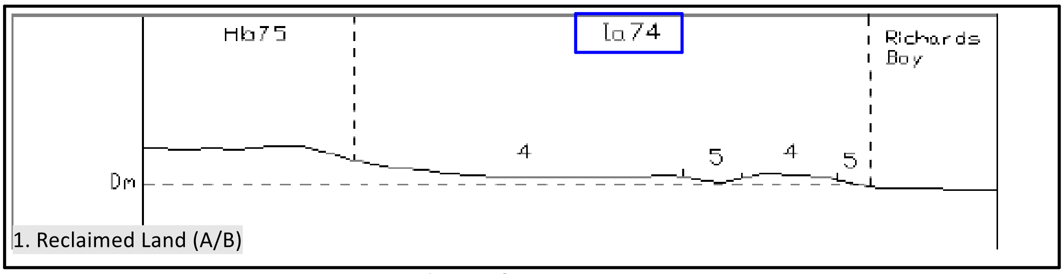


Figure 2-5: Ia74

2.7.1 Soil distribution

Figure 2-7 provides an estimate of the soil distribution for the study area. Soil occurrences were derived from available data and extrapolated to areas based on available Google Earth Imagery (i.e. similar vegetation types relative to land morphology will likely have similar soils as investigated areas).

2.7.2 Soil permeability

Table 2-1 to Table 2-3 lists general soil permeability rates for various soil texture classes. As per the previous section fine to medium-grained sand is expected for the study area.

The permeability of the diagnostic soils in the area is therefore expected to range from 2 to 5 cm/hr and will be predominantly governed by slope, soil texture and clay content (i.e. clayey areas in flat areas will have a lower permeability as appose to sandy soils on a steep slope).

Table 2-1: Soil permeability classes for agriculture and conservation (Food and Agriculture Organization (FAO, 1980)

Soil Texture	Permeability (cm/hour)
Sand	5
Sandy Loam	2.5
Loam	1.3
Clay Loam	0.8
Silty Clay	0.25
Clay	0.05

Table 2-2: Average permeability for different soil textures in cm/hour Food and Agriculture Organization (FAO, 1980)

Soil permeability class	Permeability (cm/hour) - Saturated samples under a constant water head of 1.25 cm	
	cm/hour	cm/day
Very slow	< 0.13	< 3
Slow	0.13 – 0.3	3 – 12
Moderately slow	0.5 – 2	12 – 48
Moderate	2 - 6.3	48 – 151
Moderately rapid	6.3 – 12.7	151 – 305
Rapid	12.7 – 25	306 – 600
Very Rapid	> 25	> 600

Table 2-3: DWS range of hydraulic conductivities in different soil types (DWS, 2011)

Type	Saturated Hydraulic Conductivity, K_s (cm/s)
Gravel	$3x10^{-2}$ – 3
Coarse Sand	$9x10^{-5}$ – $6x10^{-1}$
Medium Sand	$9x10^{-5}$ – $5x10^{-2}$
Fine Sand	$2x10^{-5}$ – $2x10^{-2}$
Loamy Sand	$4.1x10^{-3}$
Sandy Loam	$1.2x10^{-3}$
Loam	$2.9x10^{-4}$
Silt, Loess	$1x10^{-7}$ – $2x10^{-3}$
Silt Loam	$1.2x10^{-4}$
Till	$1x10^{-10}$ – $2x10^{-4}$
Clay	$1x10^{-9}$ – $4.7x10^{-7}$
Sandy Clay Loam	$3.6x10^{-4}$
Silty Clay Loam	$1.9x10^{-5}$
Clay Loam	$7.2x10^{-5}$
Sandy Clay	$3.3x10^{-5}$
Silty Clay	$5.6x10^{-6}$
Un-weathered marine clay	$8x10^{-11}$ – $2x10^{-7}$

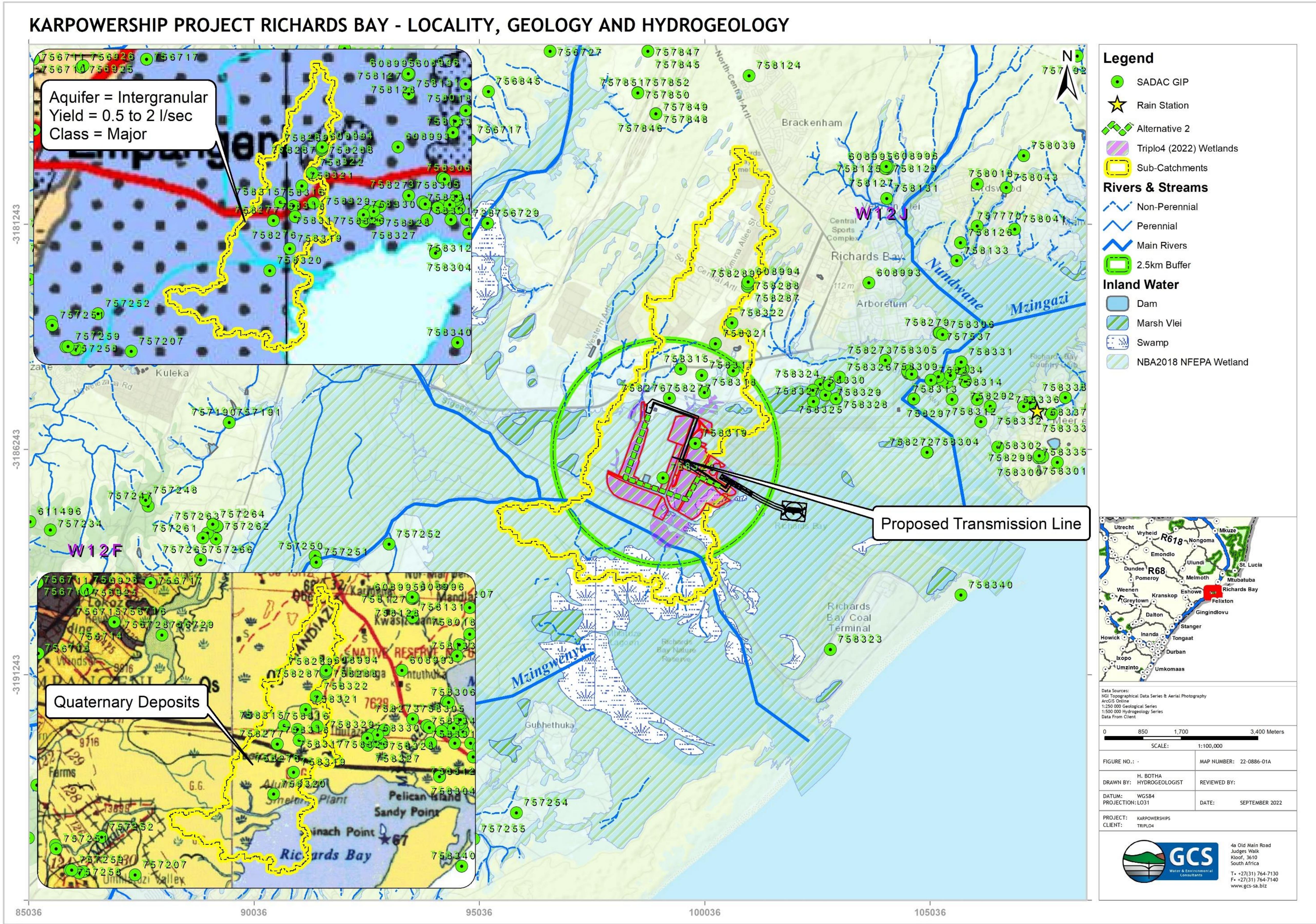


Figure 2-6: Site locality, local geology and hydrogeology

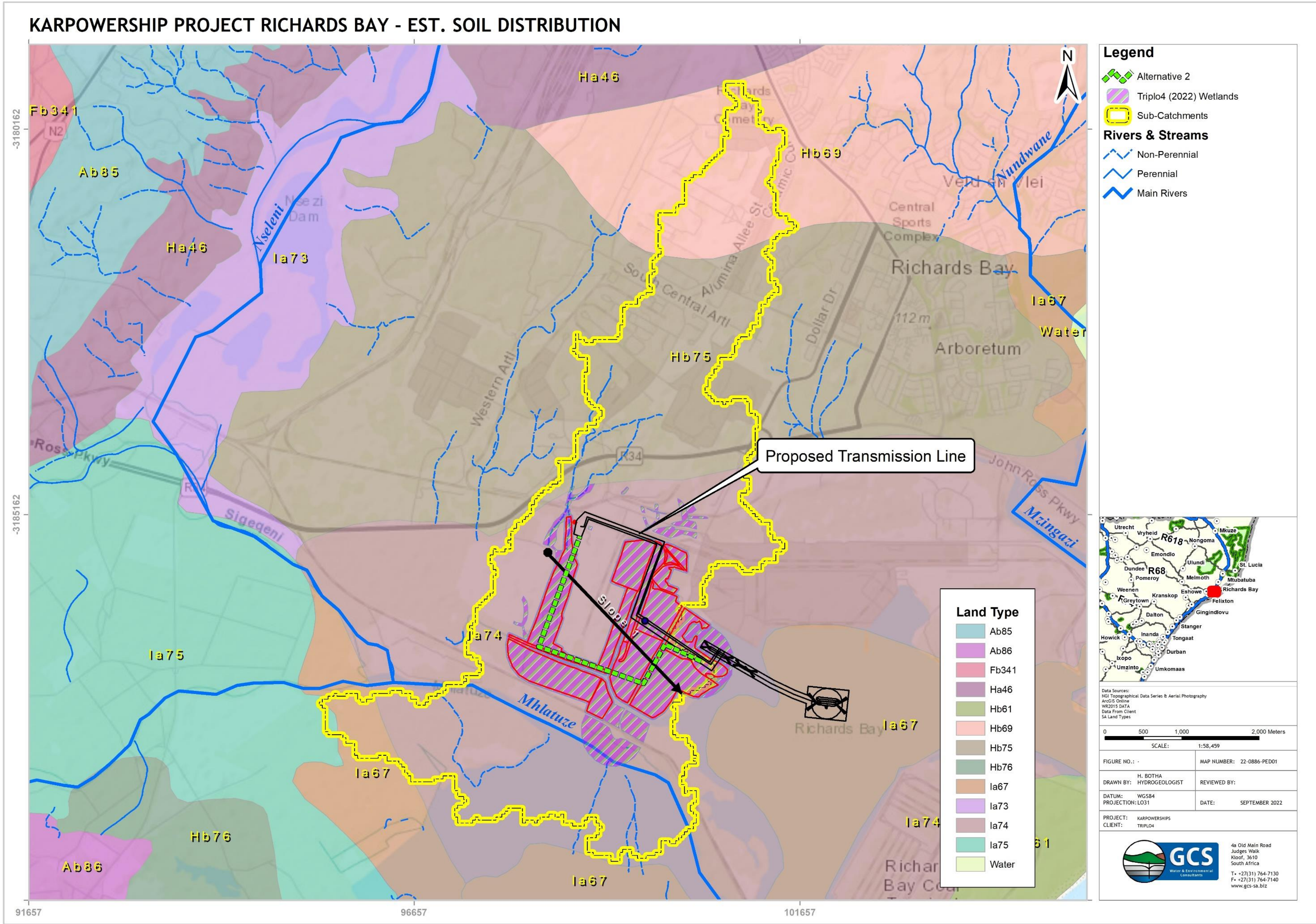


Figure 2-7: Estimated Soil distribution (ARC, 2006)

3 HYDROPEDOLOGICAL ASSESSMENT

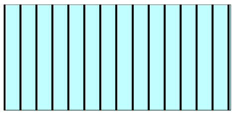
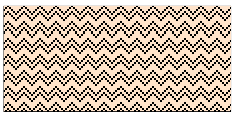
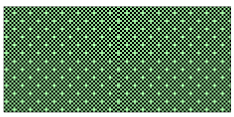
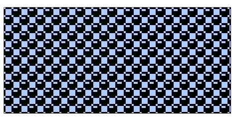
Soil genesis is influenced by physical and chemical water-related processes and soils are, therefore, the first-order control of hydrological processes. The water transfer function of soils varies on several factors including soil properties, topography, and climate.

Characteristic soil properties make it possible to conceptualise hillslope hydrological responses within catchments. The approach followed in this study includes the classification of hillslopes for the site, and the development of a soil map (refer to Section2.7), which were used to determine the hydrological soil types (HST). Finally, a conceptualization of hydrological processes that occur on the various hillslopes, based on HST was undertaken.

3.1 Hydrological Soil Types (HST)

In the determination of Hydrological Soil Types (HST), soils were divided into classes based on their expected hydrological responses (Van Tol, Le Roux, & Lorentz, 2013). Hydrological processes were perceived from traceable signatures in the soil matrix resulting from the soil's ability to transmit, store and react with water (Le Roux, et al., 2011). The HST descriptions and representative symbols are presented in Table 3-1, below. HSTs identified in the project area are shown in Figure 3-1.

Table 3-1: Hydrological soil types

Hydrological soil type	Description	Symbol
Recharge	The soils do not have any morphological indication of saturation. Vertical flow through and out of the profile into the underlying bedrock is the dominant flow path. These soils are deep and freely drained and are experiencing the leaching of nutrients to underlying soil horizons.	
Interflow (A/B)	The soils have a textural discontinuity which facilitates the build-up of water in the topsoil, the water that sits on the upper layer then flows laterally into the stream on the A/B horizon interface. The flow path is predominantly downslope in a lateral direction.	
Interflow (Soil/Bedrock) Or Interflow (A/ Bedrock)	Soils overlying relatively impermeable bedrock. Hydromorphic properties signify the temporal build of water on the soil/bedrock interface and slow discharge in a predominantly lateral direction.	
Responsive (Shallow)	The soils are shallow, and they are over a relatively less permeable weathered rock or bedrock. They have limited storage capacity which results in the generation of overland flow after rainfall events.	
Responsive (Saturated)	Soils with morphological evidence of long periods of saturation. These soils are close to saturation during rainy seasons and promote the generation of overland flow due to saturation.	

*Adapted from (Van Tol, Le Roux, & Lorentz, 2013)

3.2 Hillslopes and hillslope hydrology

Hillslopes and preferential soil flow paths were evaluated based on a 30 m ALOS digital terrain model (DTM) (JAXA, 2019), and can be seen in Figure 3-1. The hillslopes generally feed into responsive soil types, streams/rivers. One (1) hillslope is associated with the project area (i.e. associated with the proposed development site).

3.3 Conceptual hydrological flow processes

The hydrological processes associated with the soils in the project area are discussed concerning the numbered arrows (refer to Figure 3-1).

1. Available data suggest that interflow (A/B) soils are dominant across the study area.
    a. In interflow (A/B) soils (Reclaimed Sand) the flow path is predominantly downslope in a lateral direction. If interflow soils are upslope from responsive soil types (typically estuary areas or wet topographic depressions) overland flow may occur at the contact (i.e. predicting a wetland stream).
    b. Deep secondary flow towards the saturated zone is expected, which will act as recharge soils.
2. The areas associated with the likely wetlands and estuaries will primarily be responsive (wet).
    a. In responsive (wet) soils associated with the project area, the build-up of water is expected in the B and upper A horizons after rain and overland discharge and minor lateral seepage are expected (due to saturation excess). Secondary vertical seepage to deeper soil zones from the saturated B horizon is expected.
    b. In areas where responsive (wet) soils occur, secondary lateral and vertical losses to the surrounding soils are expected. These processes will largely be dominated by rainfall and runoff in the area (i.e. recharging of the shallow responsive soils during a rain event).

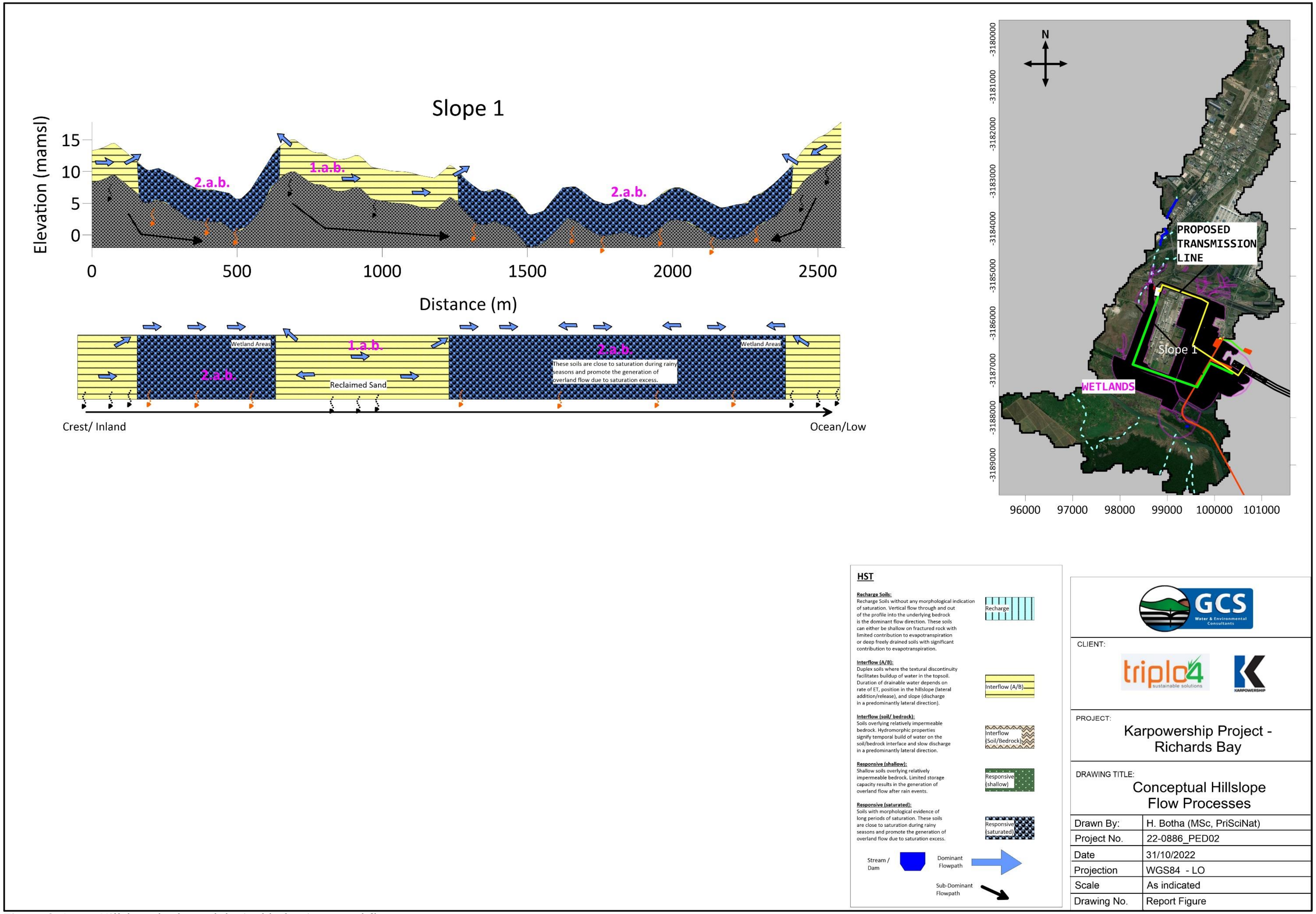


Figure 3-1: Hillslope hydropedological behaviours and flow zones

4 IMPACT AND RISK ASSESSMENT

The anticipated hydropedology risk concerning the construction and operation phase of the project was assessed. **As stated previously the study is limited to land-based activities associated with the project.** The SPR model (DWAF, 2008) was used to evaluate potential pollution sources and primary receptors within the study area.

Risk assessment entails the understanding of the generation of a hazard, the probability that the hazard will occur, and the consequences if it should occur. The net consequence is established by the following equation:

Consequence = (Duration + Extent + Irreplaceability of resource) x Severity

And the environmental significance of an impact was determined by multiplying consequence by probability. The risk significance rating is summarised in Table 4-1.

Table 4-1: Risk rating scale

Criteria	Rating Scales
Significance	Very high - negative (-49 to -66)
	High - negative (-37 to -48)
	Moderate - negative (-25 to -36)
	Low - negative (-13 to -24)
	Neutral - Very low (0 to -12)
	Low - positive (0 to 12)
	Moderate - positive (13 to 24)
	High-positive (37 to 48)
	Very high - positive (49 to 66)

The potential impacts identified and environmental significance for the construction and operational phase of the site is presented in Table 4-4 and Table 4-5, below. Closure phase risks/impacts will be like operational risks.

Based on the available development layout plans the following will likely contribute to the impacts of hydropedological flow drivers, and soil quality:

- **Construction:**
  - Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities.
  - Disturbing vadose zone during soil excavations/infilling activities.
  - In-situ placement of new soils, altering existing soil-flow processes (i.e. infilling of wetlands and cut-and-fill areas).
  - Soil compaction.
  - Soil & surface water contamination and sedimentation from the following activities:

        - Leakages from vehicles, machines, and building materials.
        - Erosion and sedimentation of watercourses if excavations are left open due to unforeseen circumstances (i.e. bad weather); and
        - Alteration of natural drainage lines may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).
    - Vegetation loss could decrease soil infiltration and increase runoff.
- **Operational:**
    - Nett implications of alterations to natural soil flow that occur during the construction phase.
    - Soil & surface water contamination and sedimentation from the following activities:
        - Oil & fuel leakages from maintenance and service vehicles.
        - Spillages from switch stations associated with the project.
- **Closure/decommission phase:**
    - Similar impacts as per the construction/preparation phase are anticipated.

4.1 Polycentric integrative approach to assessment

A polycentric approach to the proposed project requires the holistic consideration of all relevant factors, inclusive of potential impacts that the proposed Project could have on the local as well as the broader community. Section 2(4)(b) of NEMA states that Environmental management must be integrated, acknowledging that all elements of the environment are linked and interrelated, and it must take into account the effects of decisions on all aspects of the environment and all people in the environment by pursuing the selection of the best practicable environmental option. Sustainable development as per NEMA requires the integration of social, economic, and environmental factors in the planning, implementation, and evaluation of proposed projects, to ensure that development serves the needs of present and future generations.

This specialist assessment considered both the positive and negative impacts of actual and potential impacts on the geographical, physical, biological, social, economic, and cultural aspects of the environment in a polycentric and holistic approach:

- To ensure that all aspects are weighed up against each other;
- To identify the risks and consequences of alternatives and options for mitigation of activities, to minimise negative impacts, maximise benefits, and promote compliance with the principles of environmental management as set out in section 2 of NEMA.

A specialist integrative workshop and weekly meetings were held during the EIA process where specialists raised matters to be considered by the specialist team and also verified technical information to prevent any discrepancies and where relevant, to coordinate approaches.

This approach ensured that there are no gaps contained between the various specialist reports and provides a holistic picture of the project and allows a polycentric assessment of environmental and socio-economic impacts and the identification of appropriate mitigations and recommendations for potential negative impacts and the maximisation of positive impacts and the value of the project to society.

4.1.1 Polycentric integrated specialist reports considered in the assessment

For this investigation, the following specialist reports were considered to verify potential cumulative impacts and sources in the receiving surface-groundwater environments.

- GCS (2022) Aquatic Assessment for the Richards Bay Port; and
- Triplo4 (2022) Wetland Delineation & Functional Assessment for the Proposed Transmission Lines from the Port of Richards Bay to the proposed Switching Station, uMhlathuze Local and Uthungulu District Municipalities, KwaZulu-Natal.

It was found that the sources and receivers as identified in this investigation, align with those of the reports reviewed and information brought forward weekly meetings held during the EIA process. The wetland report provided input in terms of verified wetland units that may be at risk, as indicated in the wetland and recognised water courses section of this report. The wetland report was further used to derive verified responsive soil types in the project area.

4.1.2 Polycentric approach to the recommendations and conclusions

The following specialists considered the hydropedology findings and recommendations and internalised these within their reports to ensure a polycentric integrative approach to evaluations, assessment and recommendations:

- Aquatic Assessment; and
- Wetland Assessment.

4.2 Estimated impacts on flow drivers

Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed), no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating to no likely change in PES or EIS.

Table 4-2 summarises the criteria used for the hydropedological flow driver impact assessment.

Table 4-2: Impact categories for describing the impact on the wetlands and associated hydropedological drivers

Severity	Flow Driver Reduction	Change Class	Description
No Impact	0 – 2.5%	No change	The hydropedological process is predicted to be unmodified and the functionality of the wetland will remain unchanged
Low	2.5 – 5%	No Significant change	A small effect on the hydropedological process is predicted, however, the functionality of the wetland remains unchanged and no change in resource class is expected.
Low to Moderate	5 - 10%	Limited change with a change in the PES category is possible	A slight change in hydropedological processes is predicted and a small change in the wetland may have taken place but is changed to the (present ecological state) PES, EIS (ecological importance and sensitivity) or wetland functionality and eco service provision is limited with no more than one PES class predicted.

Severity	Flow Driver Reduction	Change Class	Description
Moderate	10 - 15%	A significant change with a change in PES Category definite and possibly a change of more than one category	A moderate change in the hydropedological processes is predicted to occur, the change in PES may exceed one category but no change in EIS takes place. No loss of important eco-services is predicted to occur
High	15 - 22.5%	A very significant change with a change in PES of more than two categories	Modifications have reached a very significant level and the hydropedological processes are predicted to be largely modified with a large change in the PES, and EIS of the wetland feature as well as a significant loss in eco service provision.
Very High	22.5 -60%	Serious to Critical change with a change in PES of more than three categories or a permanent complete loss of wetland resource	Modifications have reached a serious level and the hydropedological processes have been seriously modified with an almost complete loss of wetland integrity, functionality, and service provision.

4.3 Cumulative Impacts associated with similar projects

As the proposed activities will stretch over several sub-catchments and take place close to other proposed power development there will be cumulative impacts (however, limited due to the project type).

The following similar projects are known to occur/are proposed within a 30 km radius of the study area (refer to Table 4-3).

Table 4-3: Similar projects within a 30km radius

Project name and description	Applicant
320MW Emergency Risk Mitigation Power Plant (RMPP) and associated infrastructure near Richards Bay. The Project site is to be located in Alton, near the Richards Bay Industrial Development Zone (IDZ). The facility will have an installed generating capacity of 320MW, to operate with liquified petroleum gas (LPG) or naphtha as an initial source and will convert to utilising natural gas once this is available in Richards Bay. EAP - Savannah Environmental	Phinda Power Producers (Pty) Ltd
RBGP2 400MW gas to power project at the RBIDZ 1F (proposed amendments to the existing Environmental Authorisation and EMPr). The scope includes 6 gas turbines for mid-merit/peaking plant power provision, with 2 steam turbines utilizing the heat from the engineers in a separate steam cycle, as well as 3 fuel tanks of 2000m^3 each for on-site fuel storage. EAP - Savannah Environmental	Richards Bay Gas Power (Pty) Ltd
Nseleni Independent Floating Power Plant - Port/ old Bayside complex. Floating gas powered power station made up of floating Combined Cycle Gas Turbine (CCGT) power plants and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, in the Port of Richards Bay. Four Floating Power Barges generating a nominal 700 MW per barge resulting in 2 800 MW generation capacity. EAP – SE Solutions	Nseleni Power Corporation (Pty) Ltd and Anchor Energy (Pty) Ltd
Eskom 3000 MV CCPP and associated infrastructure on Portion 2 of Erf 11376 and Portion 4 of Erf 11376 within the RBIDZ Zone 1D. The	Eskom Holdings SoC Limited

Project name and description	Applicant
facility will operate with natural gas as the main fuel resource and diesel as a back-up resource. EAP - Savannah Environmental.	

From a review of the above-mentioned draft EIA reports for the projects, the impacts in terms of wetlands which are predominantly sustained by hydropedological attributes are described as being insignificant.

Based on available information for the study area, and in terms of the potential contributing impact on the hydropedological system after consideration of this project, it is concluded that the contributing impact to other similar projects in the area will be low to neutral. The cumulative impact in terms of construction and operation phases associated with this project is anticipated to be low to neutral (refer to the previous section).

Table 4-4: Estimated hydropedological risks (Preparation & Construction Phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Soil interflow processes: • Infilling of wetlands and watercourses inducing alternative flow paths. • Alteration to natural hydropedological flow paths. • Impacts on the macro-soil structure. • Impacts on the hydropedological processes supporting the watercourses. Soil structure & land capability: • Exposure of soils, leading to increased runoff from cleared areas and erosion of the watercourses, and thus increased the potential for sedimentation of the watercourses. • Vegetation loss. • Soil compaction; and Soil erosion. Soil quality: • Natural nutrient content decreases due to soil exposure. • Loss of natural bio-organisms essential to soil processes.	Site preparation, including placement of contractor laydown areas and storage (i.e. temporary stockpiles, bunded areas etc.) facilities.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (0 to -6) (-5)	Probable (1)	Neutral/ Negligible (0 to -12) (-5)	Only excavate areas applicable to the project area. Backfill the material in the same order it was excavated to reduce contamination of deeper soils with shallow oxidised soils. Cover excavated soils with a temporary liner to prevent contamination. Keep the site clean of all general and domestic wastes. All development footprint areas remain as small as possible and vegetation clearing is limited to what is essential. Retain as much indigenous vegetation as possible. Exposed soils are to be protected using a suitable covering or revegetating. Existing roads should be used as far as practical to gain access to the site, and crossing watercourses in areas where no existing crossing is apparent should be unnecessary, but if it is essential crossings should be made at right angles. Have emergency fuel & oil spill kits on site.	Short-term (2)	Site (2)	Yes (1)	Negligible (0)	Negligible (0 to -6) (-4)	Probable (1)	Neutral/ Negligible (0 to -12) (-4)	Medium
	Disturbing vadose zone during soil excavations/infilling activities.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
	In-situ placement of new soils, altering existing soil-flow processes (i.e. infilling of wetlands or excavations).	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
	Vegetation clearing & soil stockpiling.	Earthworks	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)		Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Surface water (wetland) quality	Leakages from vehicles and machines. Surface water contamination and sedimentation from the following activities: • Equipment and vehicles are washed in the water bodies (when there is water); • Erosion and sedimentation of watercourses due to unforeseen circumstances (i.e. bad weather); and • Alteration of natural drainage lines which may lead to ponding or increased runoff patterns (i.e. may cause stagnant water levels or increase erosion).	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Visual soil assessment for signs of contamination at vehicle holding, parking and activity areas. Place oil drip trays under parked construction vehicles and hydraulic equipment at the site. Surface water monitoring if visual signs of pollution are noted.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Soil quality	Oil & fuel spills from vehicles installing the transmission line	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low - negative (-13 to -24) (-20)	Have emergency fuel & oil spill kits on site.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

Table 4-5: Estimated hydropedological risks (Operational Phase)

Component Being Impacted On	Activity Which May Cause the Impact	Activity	Pre- Mitigation							Recommended Mitigation Measures	Post Mitigation							Confidence
			Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance		Duration (D)	Extent (E)	Potential for impact on irreplaceable resources (I)	Severity (S)	Consequence (C)	Probability (P)	Significance	
Soil interflow processes: • Infilling of wetlands and watercourses inducing alternative flow paths. • Alteration to natural hydropedological flow paths. • Impacts on the macro-soil structure. • Impacts on the hydropedological processes supporting the watercourses.	Disturbing the inner-soil architecture of the original soil profile will disturb natural flow processes – during the construction phase. Excavated soil will be placed in other areas (i.e. on top of other soils) and will have an impact on the flow dynamics of the soil it is dumped on top of. This may reduce rainfall infiltration and induce runoff.	The net result of earthworks & development activities.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low – negative (-13 to -24) (-20)	Revegetate areas (with vegetation growing at the site) where heavy machinery was used to excavate the soils to prevent erosion. Cover excavated soils to be protected using a suitable covering.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium
Soil quality	Oil & fuel spills from vehicles installing the transmission line	Mechanised machinery & seepage/runoff from building materials.	Short-term (2)	Site (2)	Yes (1)	Moderate (-2)	Slightly detrimental (-7 to -12) (-10)	Definite (2)	Low – negative (-13 to -24) (-20)	Have emergency fuel & oil spill kits on site.	Short-term (2)	Site (2)	Yes (1)	Low (-1)	Negligible (-6 to 0) (-5)	Definite (2)	Neutral/ Negligible (0 to -12) (-10)	Medium

5 CONCLUSIONS

Available soil data were evaluated for the project area to produce a soil distribution map. The soil map was used to categorize the hydrological soil types (HST), into the following categories:

- Recharge.
- Responsive (shallow).
- Responsive (saturated).
- Interflow (A/B); and
- Interflow (A/bedrock).

Generally, interflow (A/B) soils (Reclaimed Sand) are dominant in the project area. In these HSTs the flow path is predominantly downslope in a lateral direction. If interflow soils are upslope from responsive soil types (typically estuary areas or wet topographic depressions) overland flow may occur at the contact (i.e. predicting a wetland stream). Deep secondary flow towards the saturated zone is expected, which will act as recharge soils.

Areas associated with wetlands and estuaries will primarily be responsive (wet). In responsive (wet) soils associated with the project area, the build-up of water is expected in the B and upper A horizons after rain and overland discharge and minor lateral seepage are expected (due to saturation excess). Secondary vertical seepage to deeper soil zones from the saturated B horizon is expected.

Several hydropedological risks were identified for the construction and operational phase of the transmission line (refer to Section 4). The risk associated with the construction and operational phase is estimated to be low and decrease to neutral after consideration of proposed mitigation measures.

Due to the project type (i.e. linear development over a large area, where only a small soil area will be disturbed), no impacts on hydropedological flow drivers are anticipated. In context, this would mean that a 'no change' in the hydropedological processes is predicted to occur for the proposed activities relating to no likely change in PES or EIS. Based on the project type, no hydropedological flow buffers will be required.

5.1 Identification of any areas that should be avoided

No dedicated buffer areas were identified as part of this hydropedology assessment, as the predicted impacts associated with the proposed activity on the hydropedological environment are deemed low to neutral. It is however proposed to:

- Maintain the construction buffer around wetlands identified by Triplo4 (2022) in the project area (as specified by the wetland report); and
- Maintain the operational phase buffer (working servitude) for any vehicles servicing the transmission line.

5.2 Recommendations

The recommendations are made:

- Appropriate erosion and protection barriers/structures should be considered for areas where land will be cleared.
- There is some potential for erosion. Measures should be taken to ensure that this is minimized where possible.
- The Department of Environmental Affairs (DEA) published a generic Environmental Management Plan (EMPr) for substations and powerlines (22 March 2019). It is proposed that the mitigation and monitoring plan presented in this report be further supplemented by the generic EMP document.
- It is recommended that mitigation measures, as described in Section 4 be implemented during the construction and operational phase of this project.

5.3 Reasoned opinion on whether the activity should be authorized

This assessment cannot find any grounds or identify high hydropedological risks to not authorising the proposed transmission lines. This is grounded on the assumption that the proposed mitigation measures (Section 4) and recommendations are implemented during the construction and operational phase of the transmission lines.

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APPENDIX A: HYDROPEDOLOGICAL RISK ASSESSMENT METHODOLOGY

Due to the assessment forming part of a larger risk assessment for the study area, the potential impacts and the determination of impact significance were assessed. The process of assessing the potential impacts of the project encompasses the following four activities:

1. Identification and assessment of potential impacts.
2. Prediction of the nature, magnitude, extent, and duration of potentially significant impacts.
3. Identification of mitigation measures that could be implemented to reduce the severity or significance of the impacts of the activity; and
4. Evaluation of the significance of the impact after the mitigation measures have been implemented i.e., the significance of the residual impact.

Per GNR 982 of the EIA Regulations (2014), the significance of potential impacts was assessed in terms of the following criteria:

I. Cumulative impacts.
II. Nature of the impact.
III. The extent of the impact.
IV. Probability of the impact occurring.
V. The degree to which the impact can be reversed.
VI. The degree to which the impact may cause irreplaceable loss of resources; and
VII. The degree to which the impact can be mitigated.

Table 6-1 provides a summary of the criteria used to assess the significance of the potential impacts identified. An explanation of these impact criteria is provided in Table 6-2.

Consequence = (Duration + Extent + Irreplaceability of resource) x Severity

And the environmental significance of an impact was determined by multiplying consequence by probability.

Table 6-1: Proposed Criteria and Rating Scales to be used in the Assessment of the Potential Impacts

Criteria	Rating Scales	Notes
Nature	Positive (+)	An evaluation of the effect of the impact related to the proposed development.
	Negative (-)	
Extent	Footprint (1)	The impact only affects the area in which the proposed activity will occur.
	Site (2)	The impact will affect only the development area.
	Local (3)	The impact affects the development area and adjacent properties.
	Regional (4)	The effect of the impact extends beyond municipal boundaries.
	National (5)	The effect of the impact extends beyond more than 2 regional/ provincial boundaries.
	International (6)	The effect of the impact extends beyond country borders.
Duration	Temporary (1)	The duration of the activity associated with the impact will last 0-6 months.

Criteria	Rating Scales	Notes
	Short-term (2)	The duration of the activity associated with the impact will last 6-18 months.
	Medium-term (3)	The duration of the activity associated with the impact will last 18 months-5 or years.
	Long-term (4)	The duration of the activity associated with the impact will last more than 5 years.
Severity	Low (1)	Where the impact affects the environment in such a way that natural, cultural and social functions and processes are minimally affected.
	Moderate (2)	Where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way; and valued, important, sensitive, or vulnerable systems or communities are negatively affected.
	High (3)	Where natural, cultural, or social functions and processes are altered to the extent that the natural process will temporarily or permanently cease; and valued, important, sensitive, or vulnerable systems or communities are substantially affected.
Potential for impact on irreplaceable resources	No (0)	No irreplaceable resources will be impacted.
	Yes (1)	Irreplaceable resources will be impacted.
Consequence	Extremely detrimental (-25 to -33)	A combination of extent, duration, intensity, and the potential for impact on irreplaceable resources.
	Highly detrimental (-19 to -24)	
	Moderately detrimental (-13 to -18)	
	Slightly detrimental (-7 to -12)	
	Negligible (-6 to 0)	
	Slightly beneficial (0 to 6)	
	Moderately beneficial (13 to 18)	
	Highly beneficial (19 to 24)	
	Extremely beneficial (25 to 33)	
Probability (the likelihood of the impact occurring)	Improbable (0)	It is highly unlikely or less than 50 % likely that an impact will occur.
	Probable (1)	It is between 50 and 70 % certain that the impact will occur.
	Definite (2)	It is more than 75 % certain that the impact will occur, or the impact will occur.
Significance	Very high - negative (-49 to -66)	A function of Consequence and Probability.
	High - negative (-37 to -48)	
	Moderate - negative (-25 to -36)	
	Low - negative (-13 to -24)	
	Neutral - Very low (0 to -12)	
	Low - positive (0 to 12)	
	Moderate - positive (13 to 24)	
	High-positive (37 to 48)	
	Very high - positive (49 to 66)	

Table 6-2: Explanation of Assessment Criteria

Criteria	Explanation
Nature	This is an evaluation of the type of effect the construction, operation, and management of the proposed development would have on the affected environment. Will the impact of change on the environment be positive, negative, or neutral?
Extent or Scale	This refers to the spatial scale at which the impact will occur. The extent of the impact is described as footprint (affecting only the footprint of the development), site (limited to the site), and regional (limited to the immediate surroundings and closest towns to the site). The extent of scale refers to the actual physical footprint of the impact, not to the spatial significance. It is acknowledged that some impacts, even though they may be of a small extent, are of very high importance, e.g., impacts on species of very restricted range. To avoid “double counting, specialists have been requested to indicate spatial significance under “intensity” or “impact on irreplaceable resources” but not under “extent” as well.
Duration	The lifespan of the impact is indicated as temporary, short, medium, and long-term.
Severity	This is a relative evaluation within the context of all the activities and the other impacts within the framework of the project. Does the activity destroy the impacted environment, alter its functioning, or render it slightly altered?
Impact on irreplaceable resources	This refers to the potential for an environmental resource to be replaced, should it be impacted. A resource could be replaced by natural processes (e.g., by natural colonization from surrounding areas), through artificial means (e.g., by reseeding disturbed areas or replanting rescued species) or by providing a substitute resource, in certain cases. In natural systems, providing substitute resources is usually not possible, but in social systems, substitutes are often possible (e.g., by constructing new social facilities for those that are lost). Should it not be possible to replace a resource, the resource is essentially irreplaceable e.g., red data species that are restricted to a particular site or habitat to a very limited extent.
Consequence	The consequence of the potential impacts is a summation of the above criteria, namely the extent, duration, intensity, and impact on irreplaceable resources.

Criteria	Explanation
Probability of occurrence	The probability of the impact occurring is based on the professional experience of the specialist with environments of a similar nature to the site and/or with similar projects. It is important to distinguish between the probability of the impact occurring and the probability that the activity causing a potential impact will occur. Probability is defined as the probability of the impact occurring, not as the probability of the activities that may result in the impact.
Significance	Impact significance is defined to be a combination of the consequence (as described below) and the probability of the impact occurring. The relationship between consequence and probability highlights that the risk (or impact significance) must be evaluated in terms of the seriousness (consequence) of the impact, weighted by the probability of the impact occurring. In simple terms, if the consequence and probability of an impact are high, then the impact will have a high significance. The significance defines the level to which the impact will influence the proposed development and/or environment. It determines whether mitigation measures need to be identified and implemented and whether the impact is important for decision-making.
Degree of confidence in predictions	Specialists and the EIR team were required to indicate the degree of confidence (low, medium, or high) that there is in the predictions made for each impact, based on the available information and their level of knowledge and expertise. The degree of confidence is not considered in the determination of consequence or probability.
Mitigation measures	Mitigation measures are designed to reduce the consequence or probability of an impact or to reduce both consequence and probability. The significance of impacts has been assessed both with mitigation and without mitigation.

APPENDIX B: DISCLAIMER AND DECLARATION OF INDEPENDENCE

The opinions expressed in this Report have been based on site /project information supplied to GCS Water and Environment (Pty) Ltd (GCS) by Triplo4 and are based on public domain data, field data and data supplied to GCS by the client. GCS has acted and undertaken this assessment objectively and independently.

GCS has exercised all due care in reviewing the supplied information. Whilst GCS has compared key supplied data with expected values, the accuracy of the results and conclusions are entirely reliant on the accuracy and completeness of the supplied data. GCS does not accept responsibility for any errors or omissions in the supplied information and does not accept any consequential liability arising from commercial decisions or actions resulting from them.

Opinions presented in this report, apply to the site conditions and features as they existed at the time of GCS's investigations, and those reasonably foreseeable. These opinions do not necessarily apply to conditions and features that may arise after the date of this report, about which GCS had no prior knowledge nor had the opportunity to evaluate.

APPENDIX C: DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Desktop Hydropedology Assessment for the Proposed Karpowership 132kV Transmission Line - Richards Bay Port

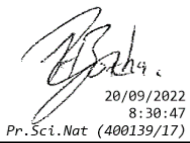
SPECIALIST INFORMATION

Specialist Company Name:	GCS Environmental SA			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	2	Percentage Procurement Recognition	
Specialist name:	Hendrik Botha			
Specialist Qualifications:	MSc Environmental Sciences (Geohydrology & Geochemistry) BSc Hons. Environmental Sciences (Hydrology) BSc. Geology and Chemistry			
Professional affiliation/registration:	PR SCI NAT 400139/17			
Physical address:	1 Karbochem Road, Newcastle, KZN			
Postal address:				
Postal code:	2940	Cell:		
Telephone:	071 102 3819	Fax:		
E-mail:	hendrikb@gcs-sa.biz			

DECLARATION BY THE SPECIALIST

I, _Hendrik Botha, declare that –

- I act as the independent specialist in this application.
- I will perform the work relating to the application objectively, 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 concerning 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.



Signature of the Specialist

GCS

Name of Company:

31 October 2022

Date

CV OF SPECIALIST

Hendrik Botha

Technical Director

CORE SKILLS

- Project management
- Analytical and numerical groundwater modelling
- Geochemical assessments and geochemical modelling
- Hydropedology and hydrological assessments
- Hydrology, floodline modelling & storm water management
- Groundwater vulnerability, impact, and risk assessments
- Technical report writing
- GIS and mapping

DETAILS

Qualifications

- BSc Chemistry and Geology (Environmental Sciences) (2012)
- BSc Hons Hydrology (Environmental Sciences) (2013)
- MSc Geohydrology and Hydrology (Environmental Sciences) (2014-2016)

Membership

- Groundwater Division of GSSA
- Groundwater Association of KwaZulu Natal Member
- International Mine Water Association (IMWA)

Languages

- Afrikaans - Speak, read, write.
- English - Speak, read, write.

Projects undertaken in

- South Africa
- Nigeria
- Namibia
- Liberia

PROFILE

Hendrik (Henri) Botha is currently the manager of the GCS Newcastle Office and occupies the role of principal hydrogeologist. Groundwater, geochemistry and surface hydrology, as well as knowledge of water chemistry together with GIS, analytical and numerical modelling skills, is some of his sought-after expertise. General and applied logical knowledge are his key elements in problem-solving.

Professional Affiliations:

SACNASP Professional Natural Scientist (400139/17)

Areas of Expertise:

- Waste classification and Impact Assessments
- Aquifer vulnerability assessments
- Geochemical sampling, data interpretation and modelling
- Geophysical surveys and data interpretation
- GIS
- Water quality sampling and data interpretation
- Groundwater impact and risk assessments
- Numerical and Conceptual Visual Modelling (Visual Modflow, ModflowFLEX, Voxler, RockWorks, Surfer and Excel)
- Hydropedology (Hydrological Soil Types) & Soils Assessments
- Floodline Modelling (HEC-RAS)
- Stormwater Management Systems and Modelling
- Surface Water Yield Assessments
- Water and Salt Balances

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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

	(For official use only)
File Reference Number:	
NEAS Reference Number:	DEA/EIA/14/12/16/3/3/2007
Date Received:	02 November 2020

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

The Proposed Gas to Power Powership Project at the Port of Richards Bay, Umhlathuze Local Municipality, King Cetshwayo District, Kwazulu-Natal.

Kindly note the following:

1. This form must always be used for applications that must be subjected to Basic Assessment or Scoping & Environmental Impact Reporting where this Department is the Competent Authority.
2. This form is current as of 01 September 2018. It is the responsibility of the Applicant / Environmental Assessment Practitioner (EAP) to ascertain whether subsequent versions of the form have been published or produced by the Competent Authority. The latest available Departmental templates are available at https://www.environment.gov.za/documents/forms.
3. A copy of this form containing original signatures must be appended to all Draft and Final Reports submitted to the department for consideration.
4. All documentation delivered to the physical address contained in this form must be delivered during the official Departmental Officer Hours which is visible on the Departmental gate.
5. All EIA related documents (includes application forms, reports or any EIA related submissions) that are faxed; emailed; delivered to Security or placed in the Departmental Tender Box will not be accepted, only hardcopy submissions are accepted.

Departmental Details

Postal address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Private Bag X447
Pretoria
0001

Physical address:
Department of Environmental Affairs
Attention: Chief Director: Integrated Environmental Authorisations
Environment House
473 Steve Biko Road
Arcadia

Queries must be directed to the Directorate: Coordination, Strategic Planning and Support at:
Email: EIAAdmin@environment.gov.za

1. SPECIALIST INFORMATION

Specialist Company Name:	GCS (pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	4	Percentage Procurement recognition	100%
Specialist name:	Hendrik Johannes Botha			
Specialist Qualifications:	MSc. Geohydrology and Geochemistry			
Professional affiliation/registration:	SACNASP Professional Natural Scientist (400139/17)			
Physical address:	74 Victoria Road Newcastle			
Postal address:	PO BOX 819 Gillits			
Postal code:	3603	Cell:	0711023819	
Telephone:	031 764 7130	Fax:	031 764 7140	
E-mail:	hendrikb@gcs-sa.biz			

2. DECLARATION BY THE SPECIALIST

I, Hendrik Johannes Botha , 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.

Signature of the Specialist

GCS (pty) Ltd

Name of Company:

12/10/2022

Date

3. UNDERTAKING UNDER OATH/ AFFIRMATION

I, Hendrik Botha, swear under oath / affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signature of the Specialist

GCS.

Name of Company

27-10-2022

Date

DATE AND SIGNATURE:

LEON PIETER BOTHA, MARRIAGE OFFICER AND COMMISSIONER OF OATHS, REG NO: BD 44601 CALEB MINISTRIES TRUST, TRUST: IT 4106/2009

Signature of the Commissioner of Oaths

2022-10-27

Date