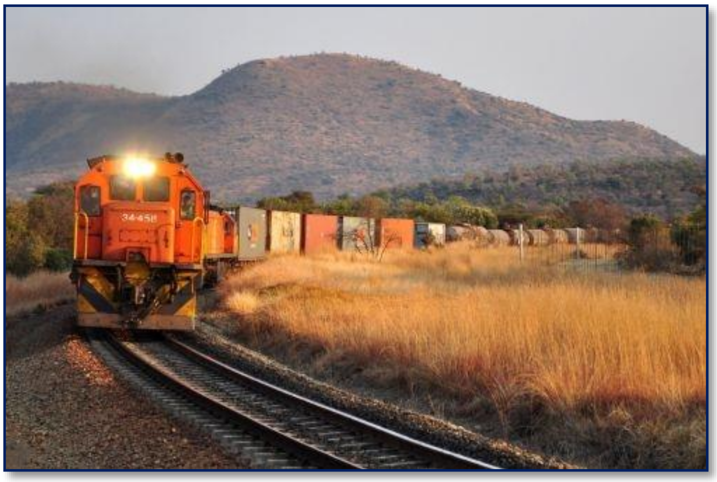

Wetland Assessment for the Proposed Expansion of Railway Loops at Thabazimbi, Ferrogate and Northam, Limpopo Province.

April 2017

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Declaration of Independence

I, **Lizette Delport**, in my capacity as principal wetland specialist for Delterra Consulting (Pty) Ltd, hereby declare that I -

- Act as an independent consultant;
- Do not have any financial interest in the undertaking of the activity, other than remuneration for the work performed in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- Undertake to disclose, to the competent authority, any material information that has or may have the potential to influence the decision of the competent authority or the objectivity of any report, plan or document required in terms of the National Environmental Management Act, 1998 (Act 107 of 1998);
- As a registered member of the South African Council for Natural Scientific Professions, will undertake my profession in accordance with the Code of Conduct of the Council, as well as any other societies to which I am a member; and
- Based on information provided to me by the project proponent, and in addition to information obtained during the course of this study, have presented the results and conclusion within the associated document to the best of my professional judgement.

Indemnity

Although the author exercised due care and diligence in rendering services and preparing documents, she accepts no liability, and the client, by receiving this document, indemnifies the author against all actions, claims, demands, losses, liabilities, costs, damages and expenses arising from or in connection with services rendered, directly or indirectly by the author and by the use of this document.

This report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken. The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as information available at the time of study. Therefore the author reserves the right to modify aspects of the report, including the recommendations, if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

Specialists	Lizette Delport Environmental Scientist/ Wetland specialist SACNASP Reg. No. 100144/15 Antoinette Bootsma Ecologist/Botanist/Wetland specialist SACNASP Reg. No. 400222-09

Table of Contents

Figures

Tables

1 INTRODUCTION

Delterra Consulting (Pty) Ltd was appointed by Nsovo Environmental Consulting to undertake a wetland and/or riparian delineation and functional assessment for the proposed expansion of railway loops at Thabazimbi, Ferrogate and Northam, Limpopo Province.

1.1. Terms of Reference

The terms of reference for the current study were as follows:

- Identify and delineate the wetland areas on site;
- Classify the watercourse according to the system proposed in the national wetlands inventory if relevant;
- Establish the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of the wetlands;
- Undertake a strategic functional assessment of wetlands areas within the area assessed;
- Recommend suitable buffer zones; and
- Identify impacts and develop appropriate mitigation measures for the project.

1.2. Legislation

This section outlines the definitions, key legislative requirements and guiding principles of the wetland study and the Water Use Authorisation process.

The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world".

The National Water Act, 1998 (Act No. 36 of 1998) [NWA] provides for Constitutional water demands including pollution prevention, ecological and resource conservation and sustainable utilisation. In terms of this Act, all water resources are the property of the State and are regulated by the Department of Water and Sanitation (DWS). The NWA sets out a range of water use related principles that are to be applied by DWS when taking decisions that significantly affect a water resource. The NWA defines a water resource as including a watercourse, surface water, estuary or aquifer. A watercourse includes a river or spring; a natural channel in which water flows regularly or intermittently; a wetland, lake, pan or dam, into which or from which water flows; any collection of water that the Minister may declare to be a watercourse; and were relevant its beds and banks.

The NWA defines a wetland as *"land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil."*
In addition to water at or near the surface, other distinguishing indicators of wetlands include hydromorphic soils and vegetation adapted to or tolerant of saturated soils (DWA, 2005).

Riparian habitat often perform important ecological and hydrological functions, some similar to those performed by wetlands (DWA, 2005). Riparian habitat is also the accepted indicator used to delineate the extent of a river's footprint (DWAF, 2005). It is defined by the NWA as follows: "*Riparian habitat includes the physical structure and associated vegetation of the areas associated with a watercourse, which are commonly characterised by alluvial soils, and which are inundated or flooded to an extent and with a frequency sufficient to support vegetation of species with a composition and physical structure distinct from those of adjacent land areas*".

In terms of section 22 of the National Water Act (36 of 1998)(NWA) a person may only use water if it is permissible under Schedule 1, a continuation of an ELU, a GA, a licence or the requirement for a licence has been dispensed with under section 22(3). There are 11 different types of water uses contemplated in section 21, but the purpose of this Risk- Based Water Use Authorisation Guideline is to deal with section 21(c) and (i) water uses only. Water uses for which authorisation must be obtained from DWS are indicated in Section 21 of the NWA. Section 21 (c) and (i) is applicable to any activity related to a wetland:
Section 21(c): Impeding or diverting the flow of water in a watercourse; and
Section 21(i): Altering the bed, banks, course or characteristics of a watercourse.

The DWS has developed a risk assessment matrix to assist in quantifying expected impacts. The scores obtained in this assessment are useful in evaluating how the proposed activities should be authorised.

Authorisations related to wetlands are regulated by Government Notices R.1198 and R.1199 of 18 December 2009. GN 1198 and 1199 of 2009 grants General Authorisation (GA) for the above water uses on certain conditions:
GN R.1198: Any activity in a wetland for the rehabilitation of a wetland for conservation purposes.
GN R.1199: Any activity more than 500 m from the boundary of a wetland.

These regulations also stipulate that these water uses must the registered with the responsible authority. Any activity that is not related to the rehabilitation of a wetland and which takes place within 500 m of a wetland are excluded from a GA under either of these regulations. Wetlands situated within 500 m of proposed activities should be regarded as sensitive features potentially affected by the proposed development (GN 1199). Such an activity requires a Water Use Licence (WUL) from the relevant authority.

In addition to the above, the proponent must also comply with the provisions of the following relevant national legislation, conventions and regulations applicable to wetlands and riparian zones:

- Convention on Wetlands of International Importance - the Ramsar Convention and the South African Wetlands Conservation Programme (SAWCP).
- National Environmental Management Act, 1998 (Act No. 107 of 1998) [NEMA].
- National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004).
- National Environment Management Protected Areas Act, 2003 (Act No. 57 of 2003).
- Regulations GN R.982, R.983, R. 984 and R.985 of 2014, promulgated under NEMA
- Conservation of Agriculture Resources Act, 1983 (Act 43 of 1983).
- Regulations and Guidelines on Water Use under the NWA.
- South African Water Quality Guidelines under the NWA.
- Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).

1.3. Assumptions and Limitations

Wetland assessments are based on environmental indicators such as vegetation that are subjected to seasonal variation as well as external factors such as drought. The information within this report is mainly based on observations made during the field survey.

The handheld GPS used in the field is accurate up to 5m, therefore the special data included in this study may be offset by up to 5m in any direction. It is therefore recommended to mark buffers in the field by means of pegs and tape for better accuracy of boundaries.

Geohydrological studies, fauna and flora, and aquatic assessments were not included as they fall outside the scope of the current assessment.

2 METHODOLOGY

A hand held GPS is used to capture co-ordinates in the field. 1:50 000 cadastral maps and available GIS data are used as reference material for the mapping of the preliminary watercourse boundaries. These are converted to digital image backdrops and delineation lines and boundaries are imposed accordingly after the field survey.

Documents used to determine the various assessments of wetlands in this study included:

- Updated manual for identification and delineation of wetlands and riparian areas (DWAF, 2008)
- Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis et al, 2013)
- Minimum Requirements for Biodiversity Assessments (GDACE, 2009)
- Wetland Buffer Guidelines (SANBI & WRC, 2015)
- Wetland Offsets: A Best Practice Guideline for South Africa (SANBI & DWS, 2016)
- These guidelines describe the use of indicators to determine the outer edge of the wetland and riparian areas such as soil and vegetation forms as well as the terrain unit indicator.

2.1 Wetland Classification and Delineation

Wetlands are delineated based on scientifically sound methods, and utilizes a tool from the Department of Water Affairs and Forestry named 'A practical field procedure for identification and delineation of wetlands and riparian areas' (DWAF, 2005). The decision as to whether a particular area qualifies as a wetland is based on the different indicators it displays. The edges of a wetland are established at the point where these indicators are no longer present.

- Wetlands are identified based on one or more of the following attributes (DWAF, 2005) (Figures 1):
- The Terrain Unit Indicator helps to identify those parts of the landscape where wetlands are more likely to occur;

- The Soil Form Indicator identifies the soil forms, as defined by the Soil Classification Working Group (1991), which are associated with prolonged and frequent saturation.
- The Vegetation Indicator identifies hydrophilic vegetation associated with frequently saturated soils.
- The Soil Wetness Indicator identifies wetland (hydromorphic) soils that display characteristics(such as 'mottling') resulting from prolonged saturation; and
- A high water table that results in saturation at or near the surface, leading to anaerobic conditions developing within 50cm of the soil surface, which can be examined by means of hand auger.

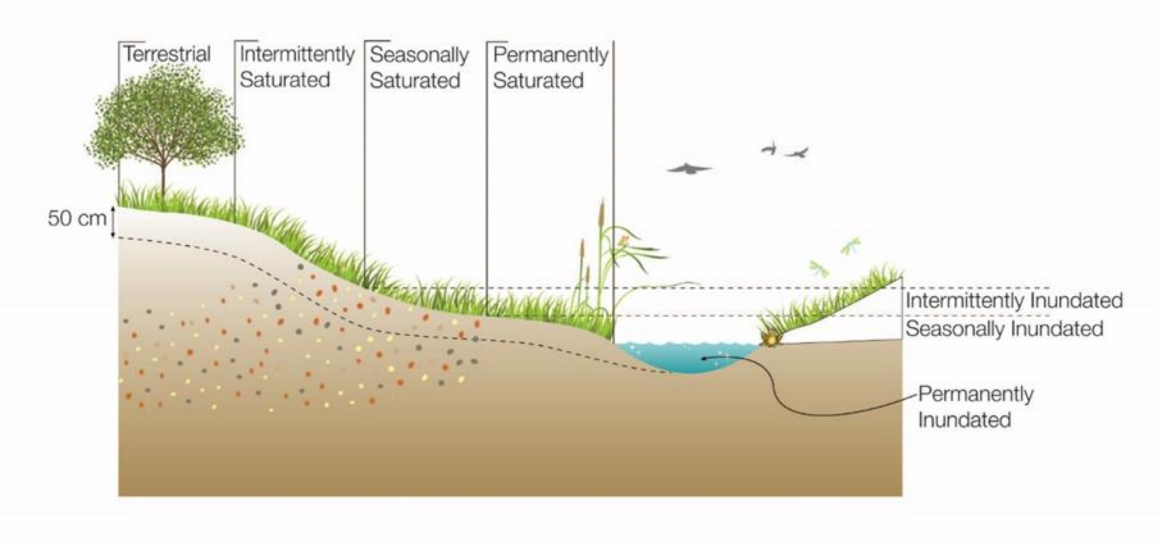


Figure 1: Typical cross section of wetland (Ollis, 2013)

2.1.1 The Terrain Unit Indicator

The terrain unit indicator (Figure 2) is an important guide for identifying the parts of the landscape where wetlands might possibly occur. Some wetlands occur on slopes higher up in the catchment where groundwater discharge is taking place through seeps. An area with soil wetness and/or vegetation indicators, but not displaying any of the topographical indicators should therefore not be excluded from being classified as a wetland. The type of wetland which occurs on a specific topographical area in the landscape is described using the Hydrogeomorphic classification which separates wetlands into 'HGM' units. The classification of Ollis, *et al*. (2013) is used, where wetlands are classified on Level 4 as either Rivers, Floodplain wetlands, Valley-bottom wetlands, Depressions, Seeps, or Flats (Figure 2).

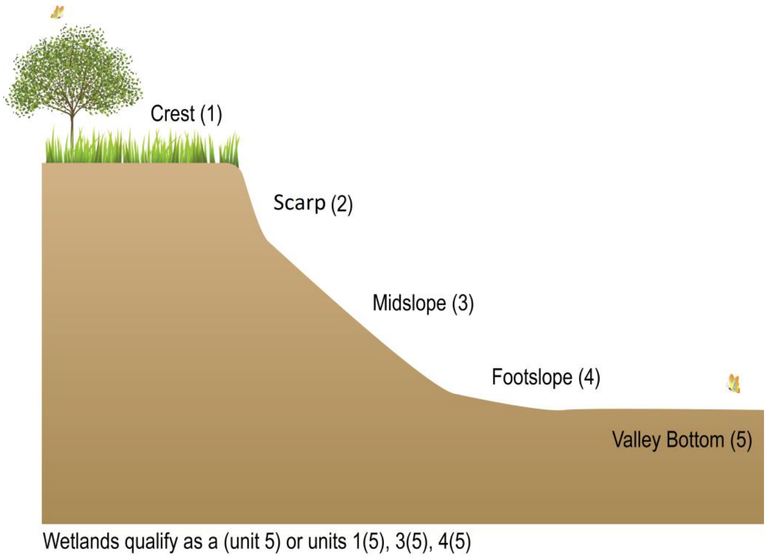


Figure 2: Terrain units (DWAF, 2005).

2.1.2 The Soil Form Indicator

Hydromorphic soils display unique characteristics resulting from prolonged and repeated saturation. These anaerobic conditions result in a change in the chemical characteristics of the soil. Soil components, such as iron and manganese, can thus be leached out of the soil profile. Iron that has been dissolved out of a soil due to prolonged anaerobic conditions will show greyish, greenish or bluish matrix. Such soil said to be gleyed. Wetlands that are seasonally or temporarily saturated, create alternating aerobic and anaerobic conditions in the soil due to the fluctuating water table. This results in iron deposits in the soil known as mottles. Decades of this cycle recurring, results in the mottles becoming brighter and more concentrated. Therefore, a gleyed soil with mottles can be interpreted as seasonally or temporarily saturated. It is important to note that not all wetland soils will show such characteristics and should not be excluded as being classified as wetlands.

2.1.3 The Soil Wetness Indicator

While some wetlands display all of the indicators under undisturbed conditions, reliance on only one indicator as the determinant of a wetland should be avoided. Many plant species can grow in or out of wetlands, and soil wetness indicators may persist for decades following alteration of the hydrology. The presence of multiple indicators provides a logical and defensible basis for identifying an area as a wetland. However, an area should display a minimum of either soil wetness or vegetation indicators in order to be classified as a wetland. Soil form and terrain unit is then used as verification of the delineation since the more indicators present, the higher the confidence in the delineation.

2.1.4 The Vegetation Indicator

Vegetation is a key component of the wetland definition in the National Water Act. However, using vegetation as a primary indicator requires undisturbed conditions and expert knowledge. Greater emphasis should be placed on the soil wetness indicator. Vegetation is a helpful field guide in finding the boundary of the wetland since plant communities undergo distinct changes in species composition as one moves along the wetness gradient. Emphasis is placed on the dominant species groups, not individuals. The changes in composition aid in the determination of wetland boundaries.

2.2 Hydro-geomorphic Types

The classification system developed for the National Wetlands Inventory is based on the principles of the hydro-geomorphic (HGM) approach to wetland classification (SANBI, 2009). The approach classifies wetlands in terms of a functional unit in line with a level three category. HGM units take into consideration factors that determine the nature of water movement into, through and out of the wetland system. In general HGM units encompass three key elements (Kotze *et al,* 2005):

- Geomorphic setting - This refers to the landform, its position in the landscape and how it evolved (e.g. through the deposition of river borne sediment);

- Water source - There are usually several sources, although their relative contributions will vary amongst wetlands, including precipitation, groundwater flow, stream flow, etc.; and

- Hydrodynamics - This refers to how water moves through the wetland.

HGM types are shown in Figure 3.

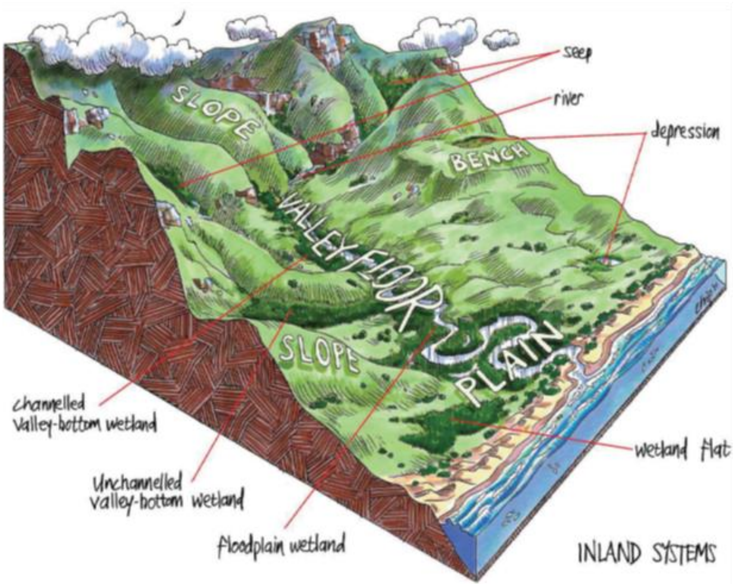
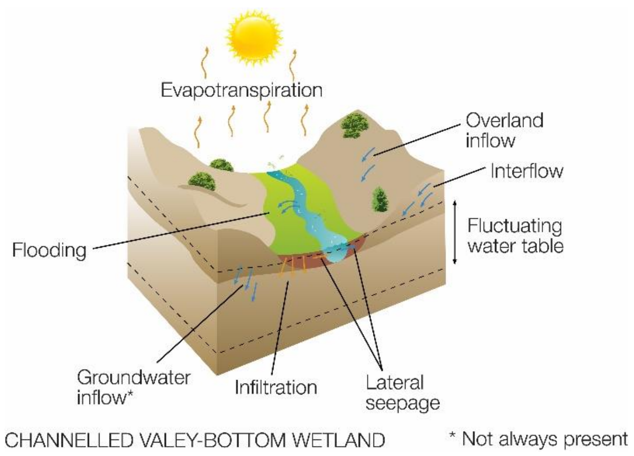
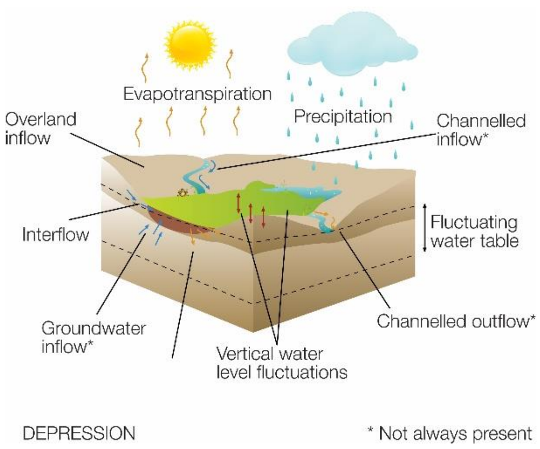


Figure 3: Wetland Units based on hydrogeomorphic types (Ollis* et al. *2013)

The Classification of wetland areas found in this study (adapted from DWAF, 2008) are as follows (table 1):

Table 1: Wetland Hydro-geomorphic types and descriptions.

Hydro-geomorphic types	**Description**
Valley bottom with a channel 	Linear fluvial, net depositional valley bottom surfaces which have a straight channel with flow on a permanent or seasonal basis. Episodic flow is thought to be unlikely in this wetland setting. The straight channel tends to flow parallel with the direction of the valley (i.e. there is no meandering), and no ox-bows or cut-off meanders are present in these wetland systems. The valley floor is, however, a depositional environment such that the channel flows through fluvially-deposited sediment. These systems tend to be found in the upper catchment areas.
Depressional pans 	Small (deflationary) depressions which are circular or oval in shape; usually found on the crest positions in the landscape. The topographic catchment area can usually be well-defined (i.e. a small catchment area following the surrounding watershed). Although often apparently endorheic (inward draining), many pans are "leaky" in the sense that they are hydrologically connected to adjacent valley bottoms through subsurface diffuse flow paths.

2.3 Riparian Areas

A riparian area can be defined as a linear fluvial, eroded landform which carries channelized flow on a permanent, seasonal or ephemeral/episodic basis. The river channel flows within a confined valley (gorge) or within an incised macro-channel. The "river" includes both the active channel (the portion which carries the water) as well as the riparian zone (Figure 4) (Kotze, 1999).

Riparian habitat is classified primarily by identifying riparian vegetation along the edge of the macro stream channel. The macro stream channel is defined as the outer bank of a compound channel and should not be confused with the active river bank. The macro channel bank often represents a dramatic change in the energy with which water passes through the system. Rich alluvial soils deposit nutrients making the riparian area a highly productive zone. This causes a very distinct change in vegetation structure and composition along the edges of the riparian area (DWAF, 2008). The marginal zone has also been referred to as active features or wet bank (Van Niekerk and Heritage, 1993, cited in DWAF, 2008). It includes the area from the water level at low flow, to those features that are hydrologically activated for the greater part of the Year (Kleyhans, 2008). The non-marginal zone is the combination of the upper and lower zones (Figure 4).

Riparian areas can be grouped into different categories based on their inundation period per year. Perennial rivers are rivers with continuous surface water flow, intermittent rivers are rivers where surface flow disappears but some surface flow remains, temporary rivers are rivers where surface flow disappears for most of the channel. Two types of temporary rivers are recognized, namely "ephemeral" rivers that flow for less time than they are dry and support a series of pools in parts of the channel, and "episodic" rivers that only flow in response to extreme rainfall events, usually high in their catchments (Seaman *et al,* 2010).

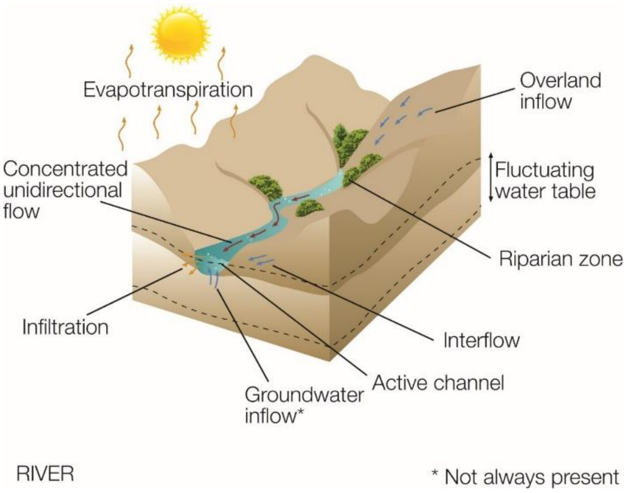


Figure 4: A schematic representation of the processes characteristic of a river area (Ollis* et al, *2013).

2.4 Buffer Zones

A buffer zone is defined as a strip of land surrounding a wetland or riparian area in which activities are controlled or restricted (DWAF, 2005). A development has several impacts on the surrounding environment and on a wetland. The development changes habitats, the ecological environment, infiltration rate, amount of runoff and runoff intensity of the site, and therefore the water regime of the entire site. An increased volume of storm water runoff, peak discharges, and frequency and severity of flooding is therefore often characteristic of transformed catchments.

Buffer zones have been shown to perform a wide range of functions and have therefore been widely proposed as a standard measure to protect water resources and their associated biodiversity. These include maintaining basic hydrological processes, reducing impacts on water resources from surrounding activities and land uses, sediment trapping, erosion control and providing habitat for various aspects of biodiversity.

Buffer zones are therefore proposed as a standard mitigation measure to reduce impacts of land uses / activities planned adjacent to water resources. These must however be considered in conjunction with other mitigation measures. Local government policies require that protective buffer zones be calculated from the outer edge of the temporary zone of a wetland (KZN DAEA, 2002; CoCT, 2008; GDARD, 2012). Although research is underway to provide further guidance on appropriate defensible buffer zones, there is no current standard other than the generic recommendation of 30m for wetlands inside the urban edge and 50 m outside the urban edge (GDARD, 2012).

2.5 Wetland Functionality, Status and Sensitivity

Wetland functionality is defined as a measure of the deviation of wetland structure and function from its natural reference condition. The natural reference condition is based on a theoretical undisturbed state extrapolated from an understanding of undisturbed regional vegetation and hydrological conditions. In the current assessment the hydrological, geomorphological and vegetation integrity was assessed for the wetland unit associated with the study site, to provide a Present Ecological Status (PES) score (Macfarlane *et al*, 2007) and an Environmental Importance and Sensitivity category (EIS) (DWAF, 1999).

The allocations of scores in the functional and integrity assessment are subjective and are thus vulnerable to the interpretation of the specialist. Collection of empirical data is precluded at this level of investigation due to project constraints including time and budget. Water quality values, species richness and abundance indices, surface and groundwater volumes, amongst others, should ideally be used rather than a subjective scoring system such as is presented here.

The functional assessment methodologies presented below take into consideration subjective recorded impacts to determine the scores attributed to each functional Hydrogeomorphic (HGM) wetland unit. The aspect of wetland functionality and integrity that are predominantly addressed include hydrological and geomorphological function (subjective observations) and the integrity of the biodiversity component (mainly based on the theoretical intactness of natural vegetation) as directed by the assessment methodology. In the current study the wetland was assessed using, WET-Health (Macfarlane *et al*, 2007) and EIS (DWAF, 1999).

2.5.1 Present Ecological Status (PES) – WET-Health

A summary of the three components of the WET-Health namely Hydrological; Geomorphological and Vegetation Health assessment for the wetlands found on site is described in Table 4. A Level 1 assessment was used in this report. Level 1 assessment is used in situations where limited time and/or resources are available.

Table 2: Health categories used by WET-Health for describing the integrity of wetlands (Macfarlane *et al*, 2007)

Description	Impact Score Range	PES Score	Summary
Unmodified, natural.	0.0.9	A	Very High
Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B	High
Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C	Moderate

Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4-5.9	D	Moderate
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E	Low
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.10	F	Very Low

A summary of the change class, description and symbols used to evaluate wetland health are summarised in Table 5.

Table 3: Trajectory class, change scores and symbols used to evaluate Trajectory of Change to wetland health (Macfarlane *et al*, 2007)

Change Class	Description	Symbol
Improve	Condition is likely to improve over the over the next 5 years	(↑)
Remain stable	Condition is likely to remain stable over the next 5 years	(→)
Slowly deteriorate	Condition is likely to deteriorate slightly over the next 5 years	(↓)
Rapidly deteriorate	Substantial deterioration of condition is expected over the next 5 years	(↓↓)

2.5.2 Ecological Importance and Sensitivity (EIS)

The Ecological Importance and Sensitivity (EIS) score forms part of a larger assessment called the Wetland Importance and Sensitivity scoring system which also addresses hydrological importance and direct human benefits relevant to a HGM unit. Both PES and EIS form part of a larger reserve determination process documented by the Department of Water and Sanitation.

Ecological importance is an expression of a wetland's importance to the maintenance of ecological diversity and functioning on local and wider spatial scales. Ecological sensitivity refers to the system's ability to tolerate disturbance and its capacity to recover from disturbance once it has occurred (DWAF, 1999). This classification of water resources allows for an appropriate management class to be allocated to the water resource and includes the following:

- Ecological Importance in terms of ecosystems and biodiversity such as species diversity and abundance.

- Ecological functions including groundwater recharge, provision of specialised habitat and dispersal corridors.
- Basic human needs including subsistence farming and water use.

Explanations of the scores are given in Table 4.

Table 4: Environmental Importance and Sensitivity rating scale used for the estimation of EIS scores (DWAF, 1999)

Ecological Importance and Sensitivity Categories	Rating	Recommended Ecological Management Class
Very High Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water in major rivers	>3 and <4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers	>2 and <3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water in major rivers	>1 and <2	C
Low/Marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers	>0 and <1	D

2.6 NEMA (2014) Impact Ratings

As required by the 2014 NEMA regulations, impact assessment should provide quantified scores indicating the expected impact, including the cumulative impact of a proposed activity. This assessment follows the format presented below:

The impact assessment score below are calculated using the following parameters:

- Direct, indirect and cumulative impacts of the issues identified through the specialist study, as well as all other issues must be assessed in terms of the following criteria:
    - The **nature**, which shall include a description of what causes the effect, what will be affected and how it will be affected.

- The **extent**, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high):
- The **duration**, wherein it will be indicated whether:
  - The lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  - The lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  - Medium-term (5–15 years) – assigned a score of 3;
  - Long term (> 15 years) - assigned a score of 4; or
  - Permanent - assigned a score of 5;
- The consequences (magnitude), quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).
- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The **significance** is calculated by combining the criteria in the following formula:

- S=(E+D+M)P
- S = Significance weighting
- E = Extent
- D = Duration
- M = Magnitude
- P = Probability

The **significance weightings** for each potential impact will be determined as follows (Table 5):

Table 5: Significance Weightings

Points	Significant Weighting	Discussion
< 30 points	Low	This impact would not have a direct influence on the decision to develop in the area.

31-60 points	Medium	The impact could influence the decision to develop in the area unless it is effectively mitigated.
> 60 points	High	The impact must have an influence on the decision process to develop in the area.

3 Results

3.1 Locality of the Study Site

The study site is located in the west of the R511 (Figure 1). A total of three loops are proposed, namely Thabazimbi, Ferrogate and Northam. The Thabazimbi Loop is north of the R510 within the Kumba Iron Ore Mine property and is approximately 3.7km in length. The Ferrogate Loop runs parallel to the R510 from south to north for approximately 3.8km. The Northam Loop is approximately 3.6km from south to north immediately east of Northam town. Start and end point coordinates are as follows (Table 6):

Table 6: Study site coordinates

Loop	Start	End
Thabazimbi Loop	24°39'45.52"S 27°19'44.63"E	24°38'54.01"S 27°21'39.89"E
Ferrogate Loop	24°43'06.46"S 27°19'37.13"E	24°41'06.75"S 27°19'32.69"E
Northam Loop	24°58'34.85"S 27°15'44.37"E	24°56'39.96"S 27°16'21.36"E

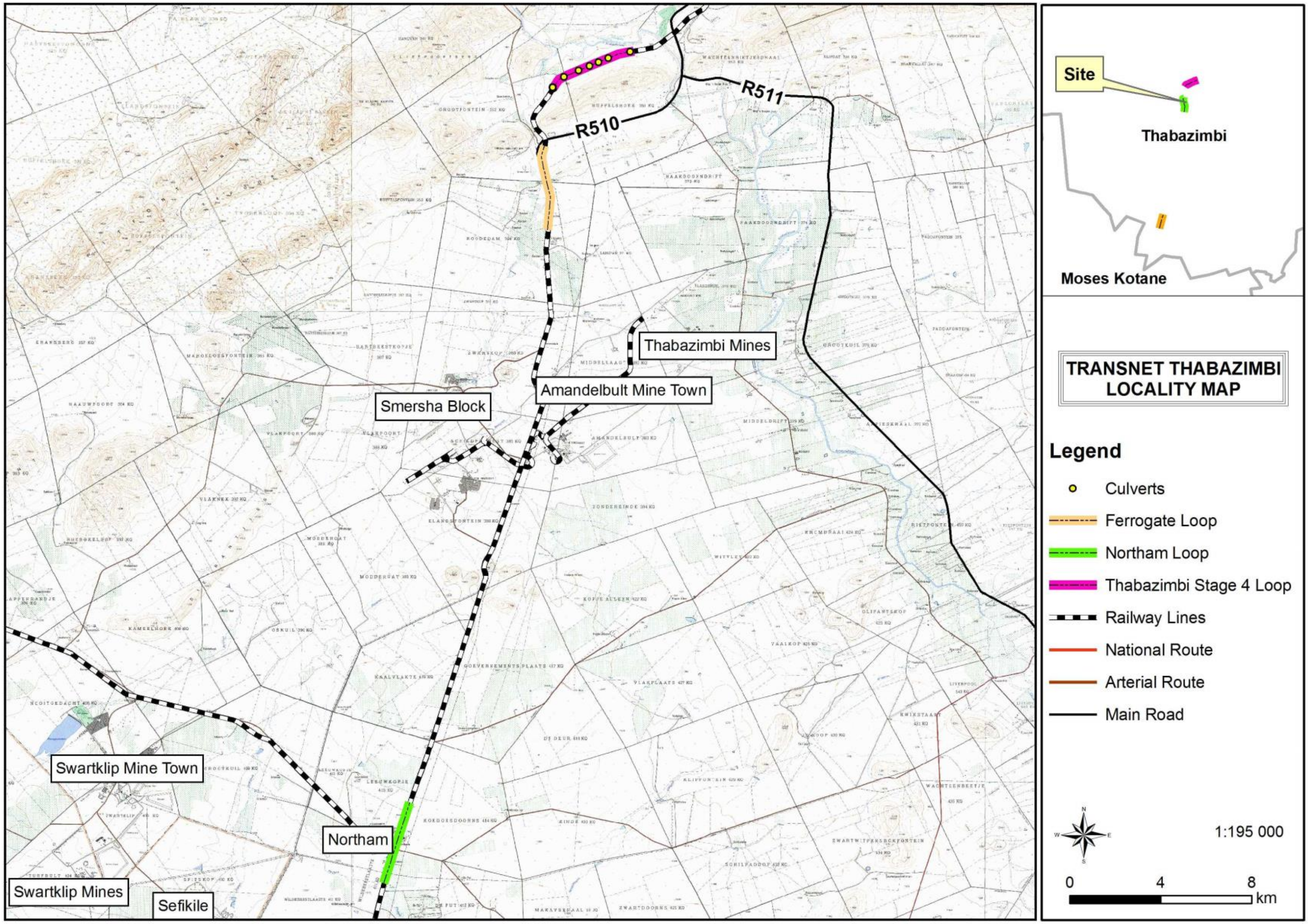


Figure 5: Location of the study sites

3.2 Description of the Receiving Environment

A review of available literature and spatial data formed the basis of a characterisation of the biophysical environment in its theoretically undisturbed state and consequently an analysis of the degree of impact to the ecology of the study site in its current state.

Regional Hydrology

The non-perennial Crocodile River flows north of the Thabazibi Loop and crosses the railway 390m to the east of the starting point. The Bierspruit, a non-perennial river, joins the Crocodile River to the west of the Thabazimbi Loop and flows west of the Ferrogate Loop. The Bierspruit is mostly natural while the Crocodile River is highly modified. The Phufane River is to the south for the Northam Loop.

Vegetation

The vegetation type of the study area is characterised as Dwaalboom Thornveld, while the Thabazimbi Loop is bordered on the south by Waterberg Mountain Bushveld (Figure 6).

- Dwaalboom Thornveld (Mucina and Rutherford, 2006)

The Dwaalboom Thornveld is characterised by plains with layers of scattered, low to medium high, deciduous microphyllous trees and shrubs with a few broad-leaved tree species, and an almost continuous herbaceous layer dominated by grass species. *Acacia tortilis* and *A. nilotica* dominate on the medium clays. *A. erubescens* is the most prominent tree. Low Shrubs: *Acacia tenuispina (d, Abutilon austro-africanum, Aptosimu elongatum, Hirpicium bechuanense, Pavonia burchellii, Solanum delagoense*. Succulent Shrubs: *Kalanchoe rotundifolia, Talinum caffrum*. *Herbaceous Climber: Rhynchosia minima*. Graminoids: *Aristida bipartita, Bothriochloa insculpta, Digitaria eriantha, Ischaemum afrum, Panicum maximum*, *Cymbopogon pospischilii, Eragrostis curvula, Sehima galpinii, Setaria incrassata.*

Vertic black ultramafic clays which developed from norite and gabbro, also locally in small depressions along streams. Some areas have less clay. Some with high base status and eutrophic red soils. Contains some very clayey soils that swell when wet and shrink when dry. On the clays, woody plant biomass is generally low and productivity of woody plants is usually lower than that of herbaceous plants. These areas with ultramafic soils are, contrary to Sekhukhuneland, low in species diversity and in endemic species.

Least threatened. Some 6% statutorily conserved out of a target of 19%, mostly within the Madikwe GameReserve in the west. About 14% transformed mainly by cultivation. Erosion is very low to low. Main use in the area is extensive cattle grazing.

- Waterberg Mountain Bushveld (Mucina and Rutherford, 2006)

Broad-leafed deciduous bushveld (dominated by *Diplorhynchus condylocarpon*) on rocky mid- and footslopes to *Burkea africana–Terminalia sericea* savanna in the lower-lying valleys as well as on deeper sands of the plateaus. The grass layer is moderately developed or well developed.

Mainly sandstone, subordinate conglomerate, siltstone and shale of the Kransberg Subgroup and medium- to coarse-grained sandstone, conglomerate, trachytic lava and quartz porphyry of the Swaershoek Formation, Nylstroom Subgroup (both Mokolian Waterberg Group). Dystrophic, acidic sandy, loamy to gravelly soil. Glenrosa and Mispah Forms. Land types mainly Ib, Ac, Fa and Ad.

Least threatened. About 9% statutorily conserved out of a target of 24%, mainly in the Marakele National Park and Moepel Nature Reserve. More than 3% transformed, mainly by cultivation. Human population density is low. Erosion is generally very low to low.

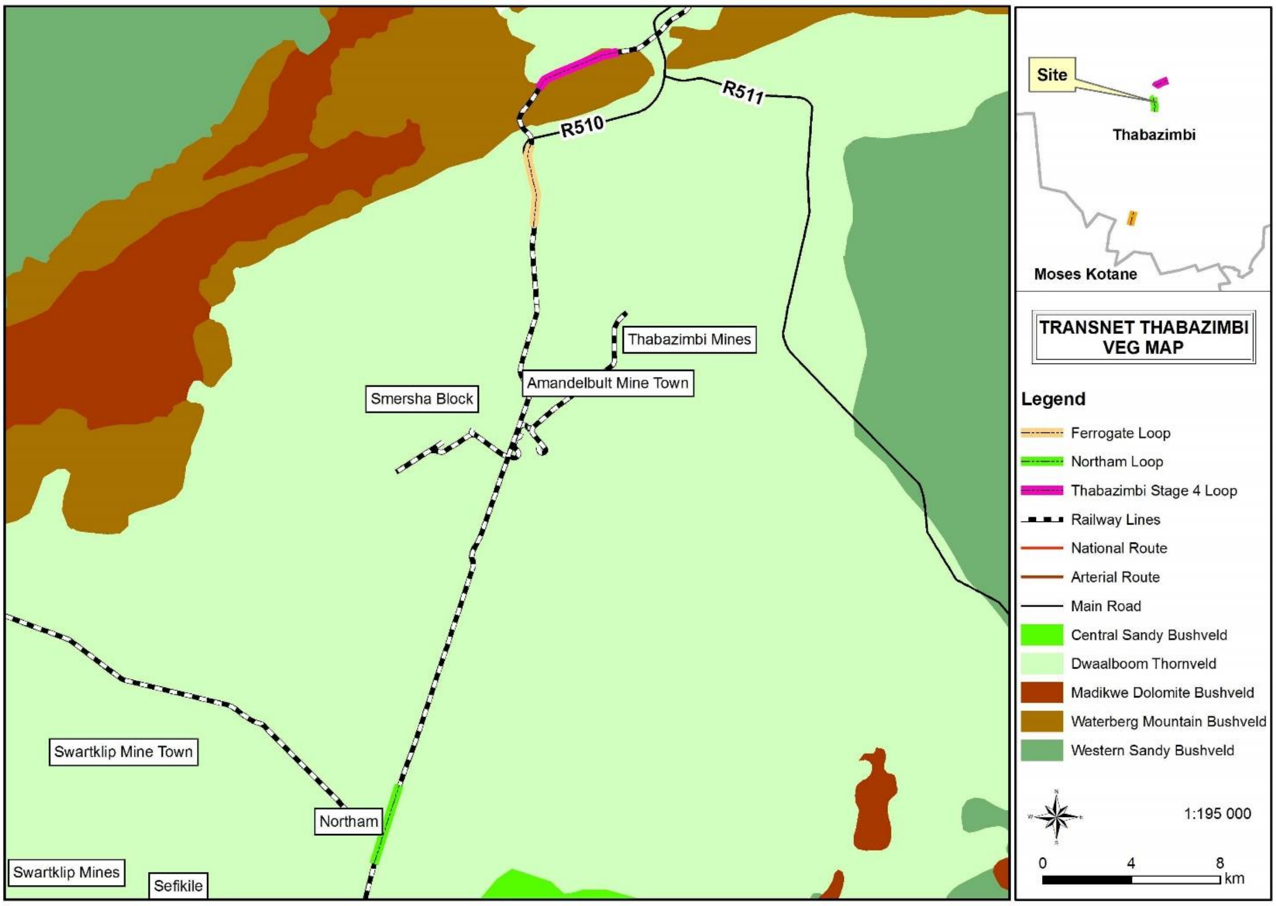


Figure 6: Vegetation for the study area

<u>Geology and Soils</u>

The geology of this area is dominated by a very stable block of ancient continental crust, known as the Kaapvaal Crato. The craton hosts a number of significant sedimentary basins and igneous intrusions, thus pre-serving a geological record spanning 3.5 billion years. Figures 7 and 8. Land types associated with each study area are:

Thabazimbi Loop: Ea153 - These soils are undifferentiated, dark or red coloured with strongly structured topsoil and subsoil. Soils are mostly clay to clay loam with high fertility, although difficult to cultivate. Soils have a high water-holding capacity.

Ib308 - Miscellaneous land classes and soils with rocky areas. Areas where 60-80% of the surface is occupied by exposed rock and stones/boulders and the slopes are usually steep. The rest of the area comprises mostly shallow soils, directly underlain by hard or weathered rock.

Ae239, Ae240 - Soils are red to yellow freely drained and over 300mm deep. They occur in areas with low to moderate rainfall and have a high fertility. Textures vary from sandy to loam to clay.

Northam Loop: Ae64 – Soils are red to yellow freely drained and over 300mm deep. They occur in areas with low to moderate rainfall and have a high fertility. Textures vary from sandy to loam to clay.

Ferrogate Loop: Ae240 - Soils are red to yellow freely drained and over 300mm deep. They occur in areas with low to moderate rainfall and have a high fertility. Textures vary from sandy to loam to clay.

Ea70 - These soils are undifferentiated, dark or red coloured with strongly structured topsoil and subsoil. Soils are mostly clay to clay loam with high fertility, although difficult to cultivate. Soils have a high water-holding capacity.

Ib: Miscellaneous land classes and soils with rocky areas. Areas where 60-80% of the surface is occupied by exposed rock and stones/boulders and the slopes are usually steep. The rest of the area comprises mostly shallow soils, directly underlain by hard or weathered rock.

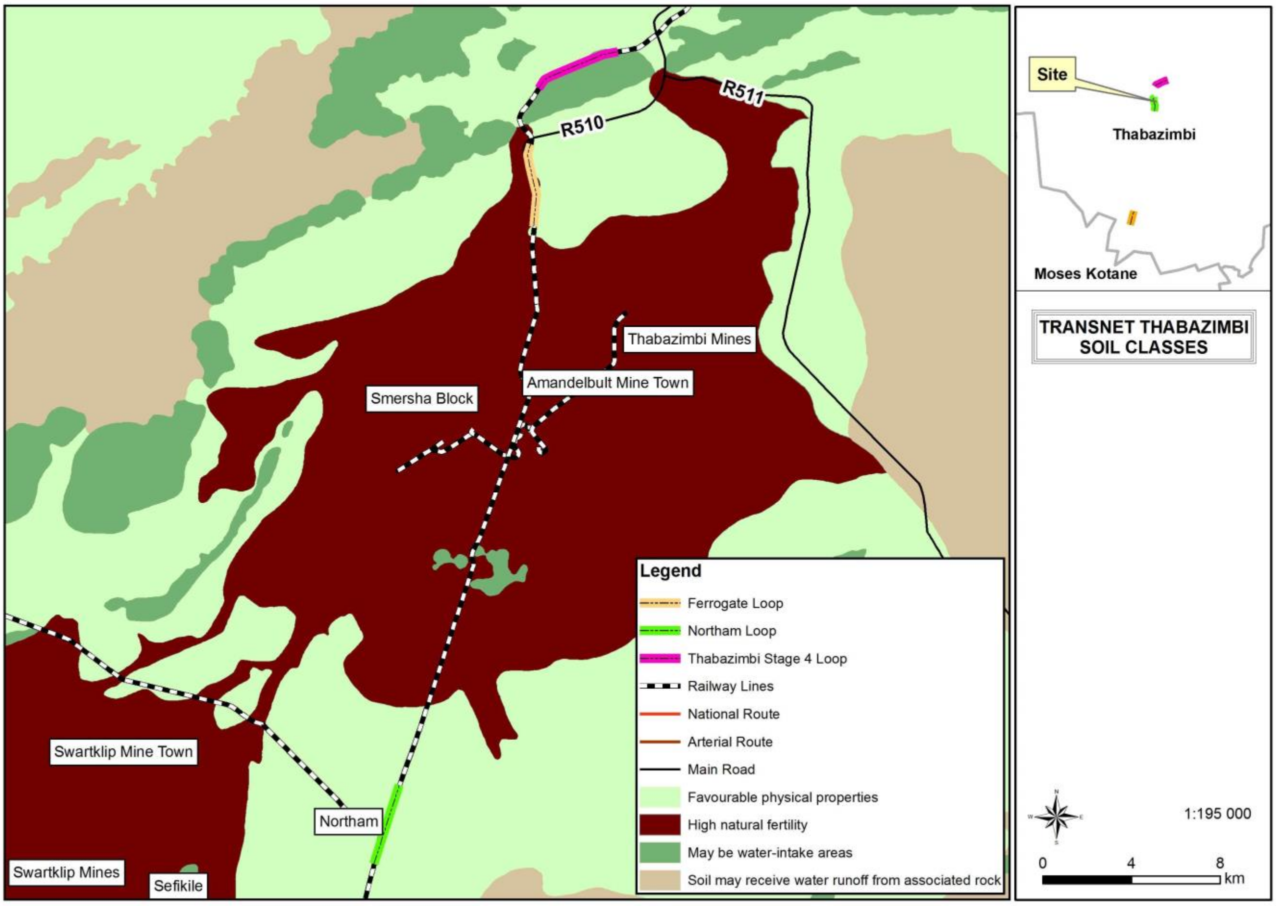


Figure 7: Soil classes of the study site and surrounds

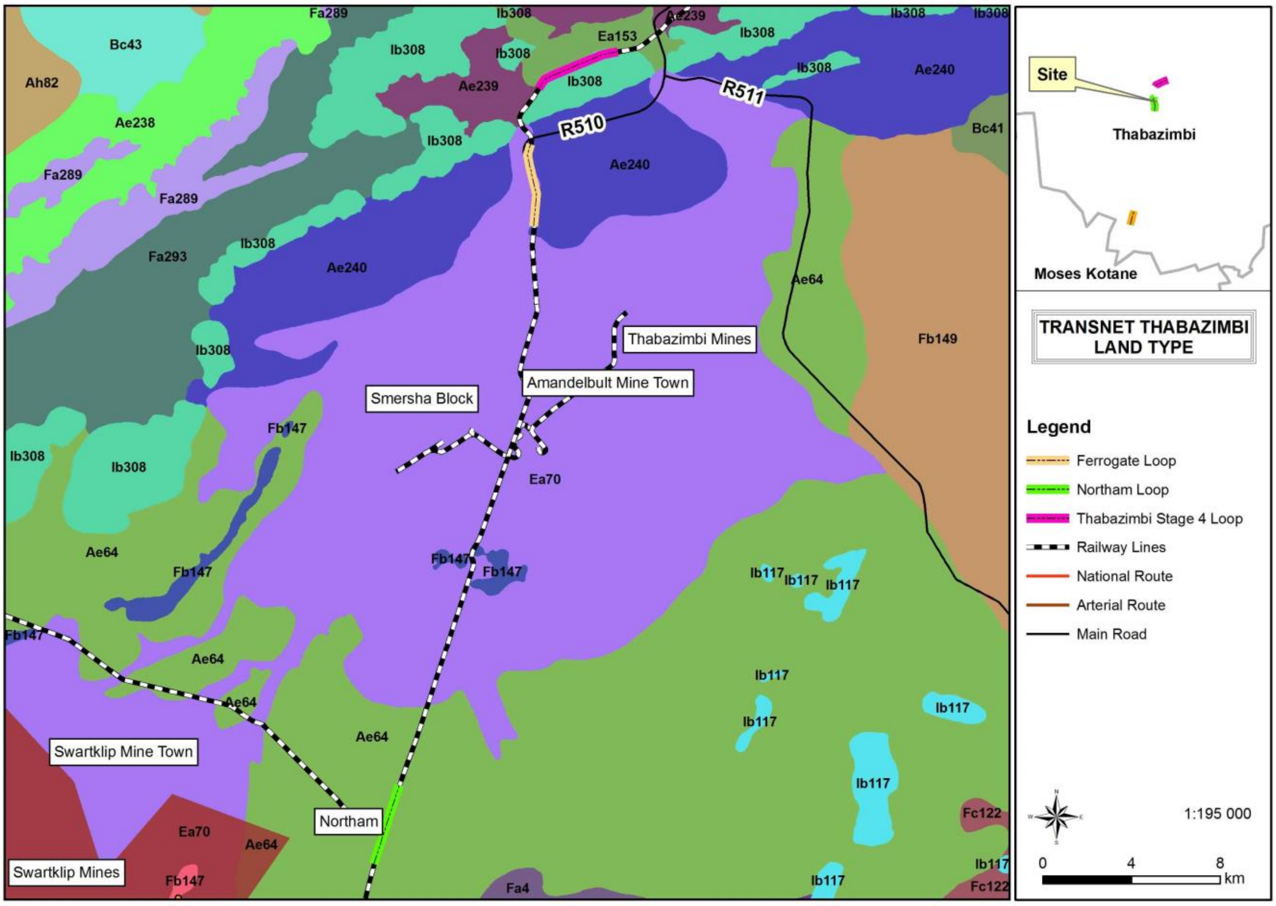


Figure 8: Land type of the study site

Limpopo Biodiversity Assessment

The Limpopo Conservation plan (CPlan) objective was to produce a conservation plan for the Limpopo Province that conforms to the Bioregional Planning Guidelines of SANBI (Limpopo CPlan, 2013).

Thabazimbi Loop and the Ferrogate Loop fall within Critical Biodiversity Areas 1 (CBA1) and 2 (CBA2), where conservation is of great importance (figures 9 and 11). CBA1 are irreplaceable areas that are required to meet biodiversity targets, which cover 22% of the province. No further loss of natural habitat should be allowed to occur. CBA2 are best design selected sites that are required to meet biodiversity targets and cover 18% of the province. A large portion (75%) of the Thabazimbi site occurs in the Ben Alberts conservation area. The Ferrogate Loop also occurs in an ecological support area (ESA1), which are intact natural areas that support CBA. ESA1 covers 16% of the province.

The Northam Loop occurs in an urbanised town with little to no natural areas remaining (Figure 10).

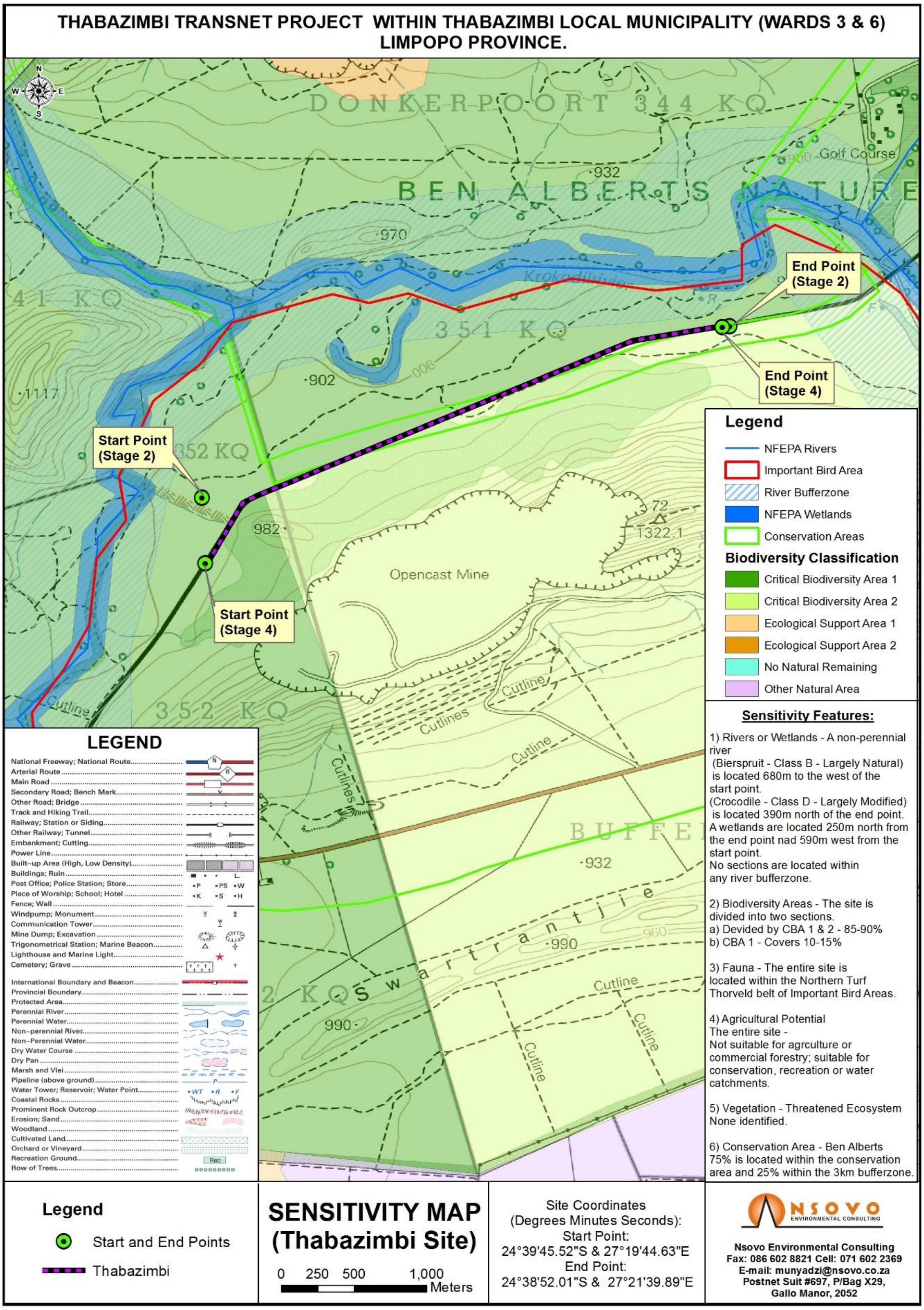


Figure 9: Sensitivity map for the proposed Thabazimbi loop

Please align the coordinates as per the latest engineering information and alternatives as it is assumed that the second loop would be within the river buffer area

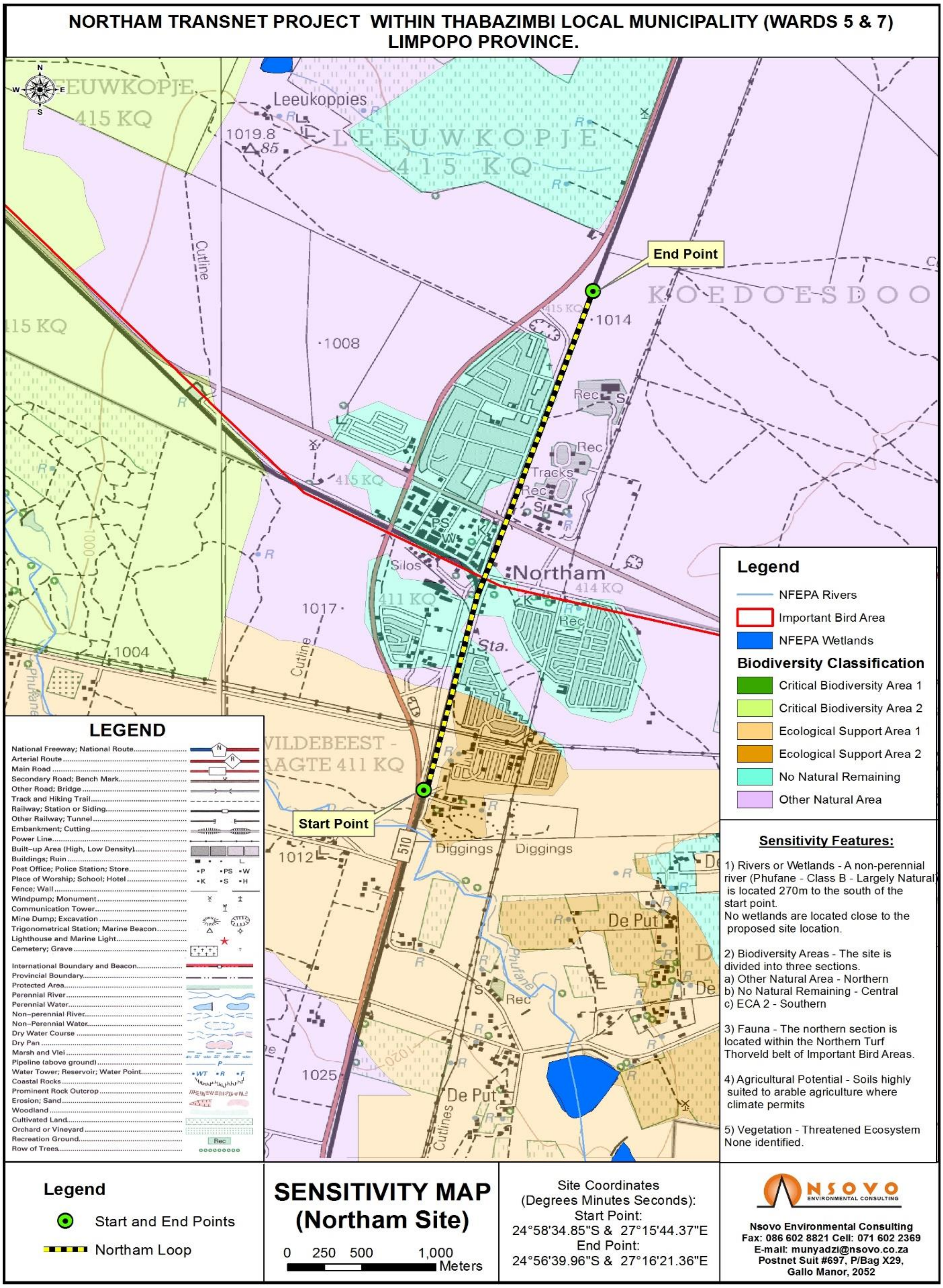


Figure 10: Sensitivity map for the proposed Northam loop

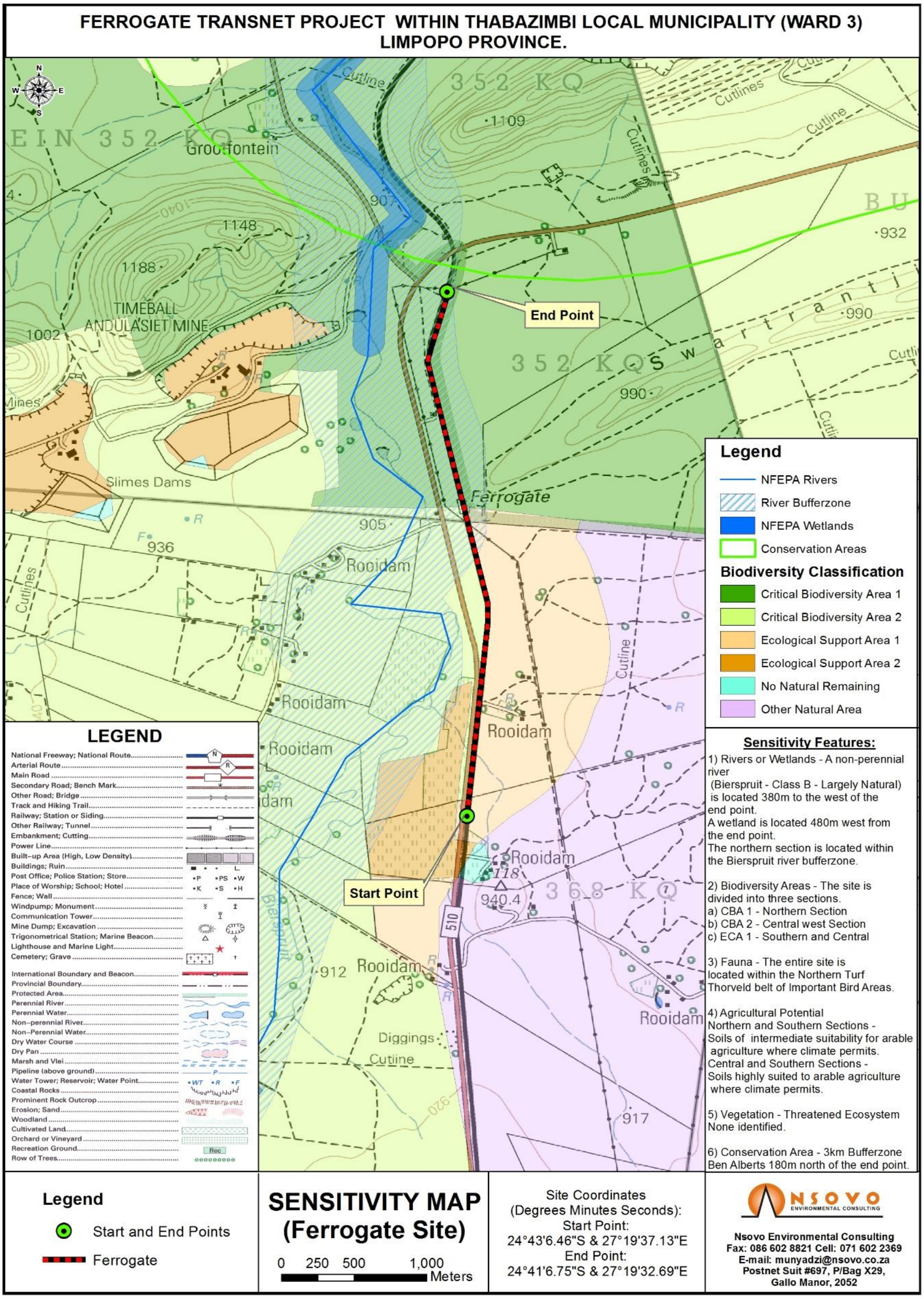


Figure 11: Sensitivity map for the proposed Ferrogate loop

3.3 Land Use and Land Cover

The Thabazimbi site falls within a decommissioned iron ore mine that is currently under rehabilitation as a wildlife reserve. The surrounding area is dominated by game and cattle farm, interspersed with small towns such as Northam.

3.4 Wetland Classification and Delineation

3.4.1 Thabazimbi Loop

A channelled valley bottom wetland associated with the Crocodile River was found on the proposed Thabazimbi Loop. A wetland is present approximately 400m to the north of the site but does not form part of the study area.

Soils in the site were clay/loam and varied in colour from red-brown closer to the mine heap, to more brown nearer the river. Iron-rich soil deposits were evident in lower lying areas, possibly due to flow from the adjacent mine heap during rainfall events. These deposits were visible due to their red colour and formation of a thick, hard layer over the natural coloured soils.

The vegetation of the Thabazimbi study site north of the railway was characterised by good ground cover and thick grass stands (Table 7). However, ground cover consisted mostly of shrubs and not *Poaceae* (grasses). Wetland areas were identifiable by dense *Cyperacea sp* growth. Large bare areas of soil were present on the southern side of the railway line, with dense growth of Acacia bushes. Ground cover was low possibly due to the impact of Iron rich sediment from the adjacent mine heap retarding growth.

A summary of the area conditions is described in Table 8.

Table 7: Dominant vegetation species of the study areas

Site	Dominant Vegetation	Notes
Thabazimbi	*Pennicetum setaceum* *Cymbopogon pospischilii* *Cyperacea sp* *Digitaria eriantha* *Setaria sphacelata*	*P. setaceum* formed dense stands along the mine roads. It is a declared exotic invasive species. It grows in disturbed, rocky areas which are present at the site. *C. pospischilii* grows in all soil types in open bushveld. Isolated stands were found over the entire site. *D. eriantha* and *S. sphacelata* occurred mostly along the railway and roads. Cyperacea is a known indicator of wetland habitat. Growth in the wetland areas on site was of mostly *Cyperacea*, with few other grasses present.

Table 8: Summary of area conditions on the Thabazimbi site (adapted from Job, 2010).

Site Conditions:	
Do normal circumstances exist on the site?	Yes

Is the site significantly disturbed (difficult site)?	Yes	
Indicators of soil wetness within 50 cm of soil surface:		
Sulfidic odour	N/A	
Mineral and Texture	Loam/sandy	
Gley	No	
Mottles or concretions	Yes	
Organic streaking or oxidised rhizopheres	No	
High organic content in surface layer	No	
Setting:		
valley bottom		
Additional indicators of wetland presence:		
Concave		No
Bedrock		No
Dense clay		Yes
Flat		Yes
Associated with a river		Yes
Hydrology - permanent zone:		
Inundated: No		
Depth to saturated soil: N/A		
Depth of Surface Water : <5cm		
Seasonal zone:		
Depth to saturated soil: None found		
Temporary zone:		
None found		
Wetland indicator Vegetation:		
Cyperacea		

3.4.2 Ferrogate Loop

Two small wetlands associated with the Bierspruit River were present on the proposed Ferrogate Loop. The northernmost wetland appears to be as a result of a depression created by the R510. A culvert under the freeway connects the depression to the Bierspruit in the west. However, the site is characterised by a variety of plant species which can create habitat for birds and small mammals. The southern wetland is found along the west of the site and is disconnected from the railway by the R510. A culvert allows for water flow from the railway edge in a westerly direction to the Bierspruit River.

The Ferrogate Loop soils were brown to dark brown clay-loam in the depression wetlands. The Ferrogate Loop site appears to be mostly natural vegetation growth with low occurrence of invasive species. The high fertility of the soil is evident by the vigorous growth of a variety of grass species (Table 9).

A summary of site characteristics is described in Table 10.

Table 9: Dominant vegetation for Ferrogate

Site	Dominant Vegetation	Notes
Ferrogate	*Cenchris ciliaris* *Aristida sp* *Heteropogon contortus* *Eragrostis trichophora* *Dicanthium annulatum* *Phragmitis australis* *Pennisetum clandestinum* (Kikuyu Grass) *Cyperacea sp*	

Table 10: Summary of area conditions on the Ferrogate site (adapted from Job, 2010)

Site Conditions:	
Do normal circumstances exist on the site?	Yes
Is the site significantly disturbed (difficult site)?	Yes
Indicators of soil wetness within 50 cm of soil surface:	
Sulfidic odour	N/A
Mineral and Texture	Loam/clay
Gley	No
Mottles or concretions	Yes
Organic streaking or oxidised rhizopheres	Yes
High organic content in surface layer	No
Setting:	
valley bottom	
Additional indicators of wetland presence:	
Concave	No

Bedrock	No
Dense clay	No
Flat	Yes
Associated with a river	Yes
Hydrology - permanent zone:	
Inundated: Yes	
Depth to saturated soil: N/A	
Depth of Surface Water : >10cm	
Seasonal zone:	
Depth to saturated soil: 15cm	
Temporary zone:	
None found	
Wetland indicator Vegetation:	
Cyperacea, Typha capensis	

3.4.3 Northam Loop

No wetlands were found on the proposed Northam Loop.

The site highly developed, therefore natural vegetation is absent or minimal and characterised by invasive species (e.g. kikuyu Grass).

Wetland delineations and site characteristics are illustrated in Figures 12-15.

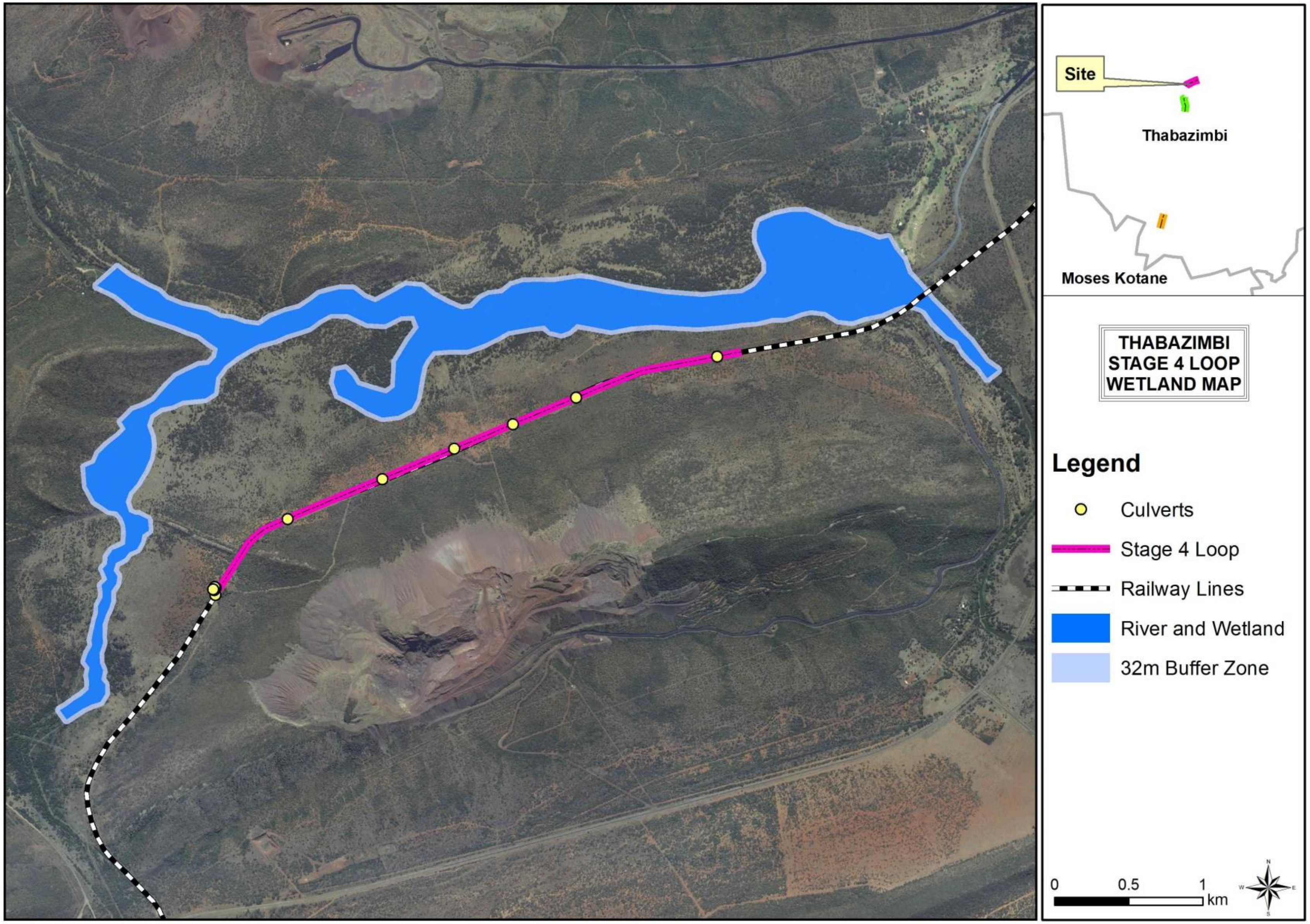


Figure 12: Wetland areas delineated together with associated buffer zones for the Thabazimbi Loop (indicates culverts to be upgraded)

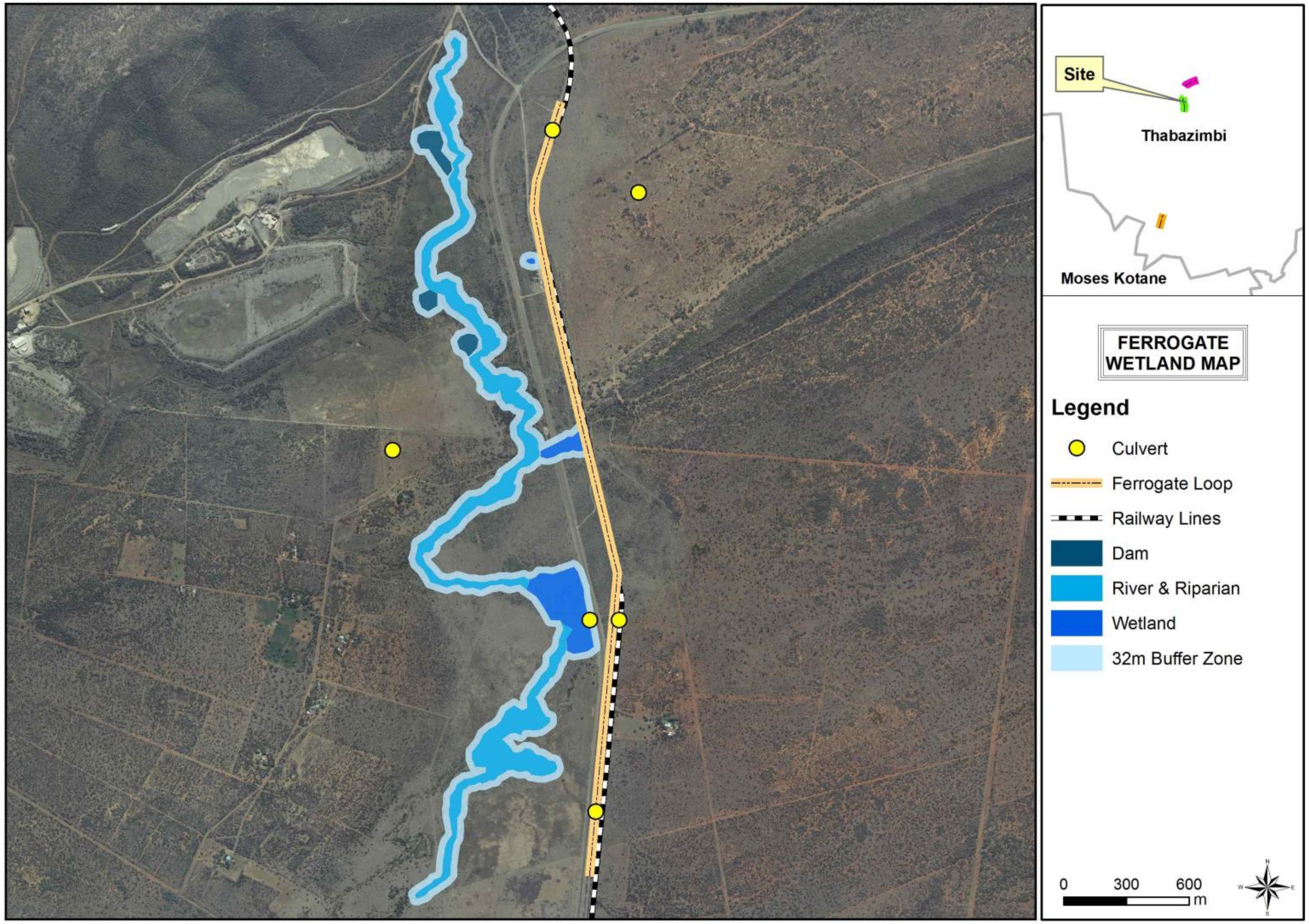
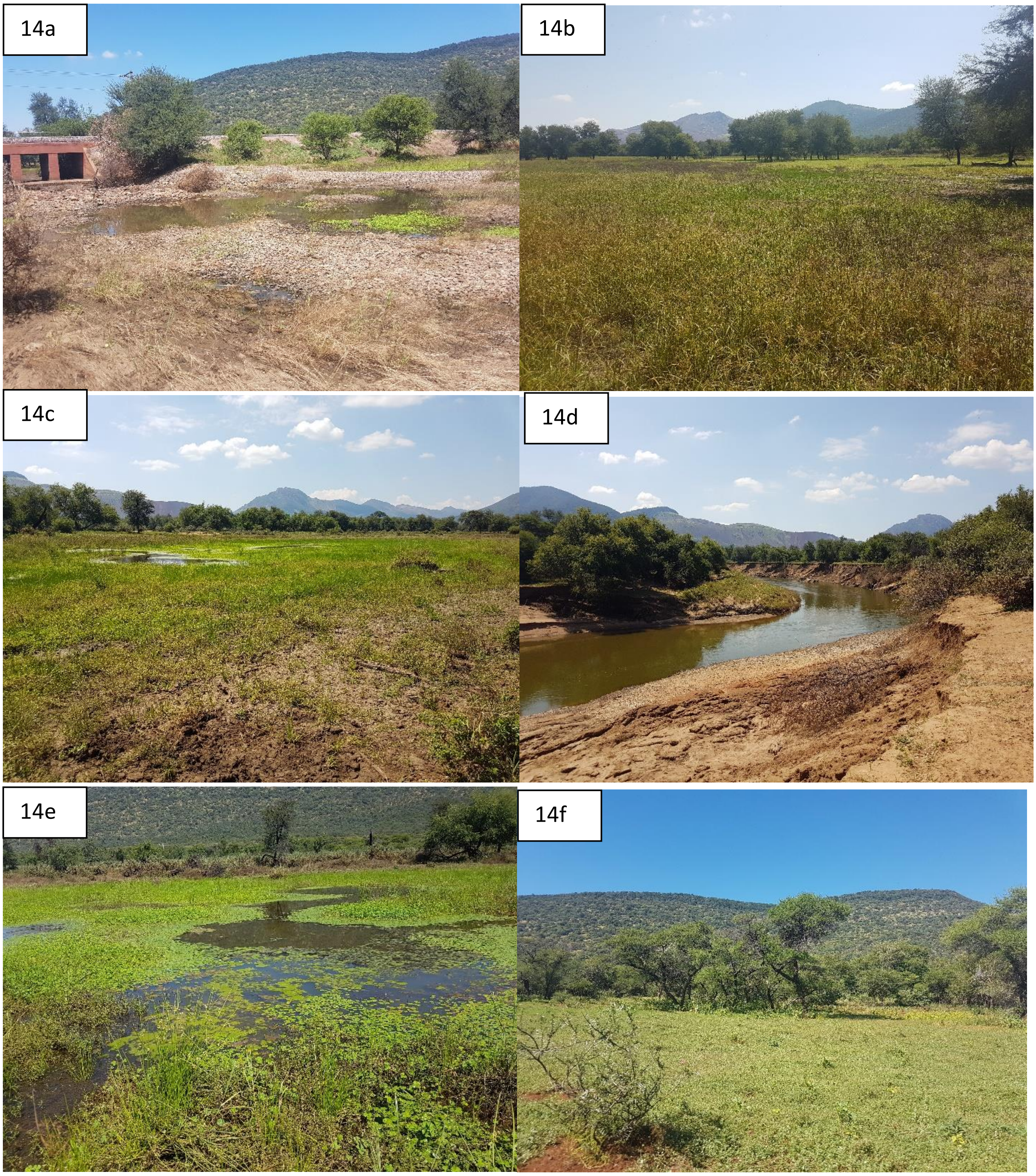


Figure 13: Wetland areas delineated together with associated 32m buffer zones for the Ferrogate Loop (indicates current culverts)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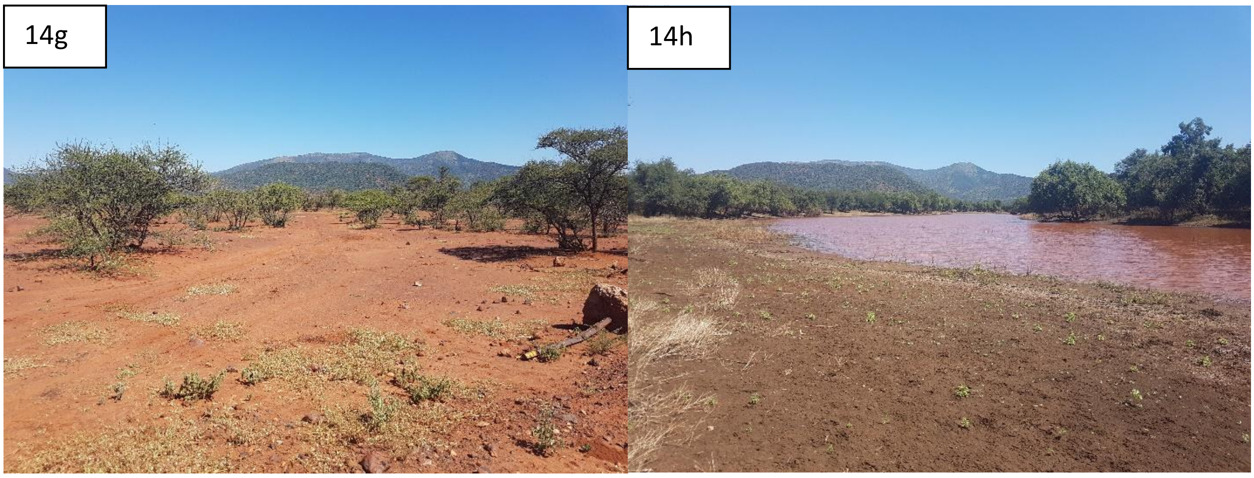

Figure 14: Thabazimbi Loop site characteristics

Figure 1: Ferrogate Loop site characteristics.

<u>Present Ecological Status (PES)</u>

Thabazimbi – the wetland condition is expected to improve over time as the site is currently undergoing rehabilitation. Moderately modified. The total **PES score is 2.4** and the **category C** - A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact (Table 11).

Ferrogate - the wetland condition is expected to remain stable due to the isolated locality of the site, although hydrological process are affected by culverts and roads. The total **PES score is 3.5** and the **category C** - A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact (Table 12).

Table 11: Summary of hydrology, geomorphology and vegetation health assessment for the channelled valley bottom wetland on the study site (Macfarlane *et al,* 2009).

Wetland Unit	Area (Ha)	Hydrology		Geomorphology		Vegetation		Overall Health Score	
		Impact Score	Change Score	Impact Score	Change Score	Impact Score	Change Score	Impact Score	Health class
Thabazimbi Loop		3.5		0.6		3.2		2.4	
PES Category and Projected Trajectory		C	↑	A	↑	C	↑↑		**C**
Ferrogate Loop		6.0		1.0		3.5		3.5	
PES Category and Projected Trajectory		E	↓	B	↔	C	↔		**C**

Table 12: Summary of the most prominent impacts of the wetlands on site.

Aspect	Comment
Thabazimbi Loop	
Aspect	**Comment**
Hydrology PES	• Deep river bed reduces lateral flow. Flow occurs from the mine heap in the south towards the river • Railway with small culverts limits flow towards the river during peak rain events • Surface roughness is low due to grazing and mining impacts
Geomorphology PES	• Gullies and drains located within the wetlands • Sediment deposition from mine heap • Access roads present throughout the site
Vegetation PES	• Low ground cover of pioneer species
Ferrogate Loop	
Aspect	**Comment**
Hydrology PES	• Flow from river split by R510 freeway • Upstream dams reduce water input
Geomorphology PES	• Altered by freeway and railway
Vegetation PES	• Grass cutting around border reduces wetland plant growth

Ecological Importance and Sensitivity (EIS)

The Thabazimbi Loop wetland is surrounded by a variety of habitats for birds and mammals. Water flow form the surrounding mine heaps and mountains flow through the wetland before reaching the Crocodile River, allowing for nutrient assimilation and erosion prevention. The loop is found within a decommissioned iron ore mine which is currently undergoing rehabilitation as a wildlife reserve. Many species of antelope and birds are present, which is evidence of the improvement of the ecological condition of the area. The EIS classification is **Moderate**. The wetland is considered as ecologically important and sensitive on a provincial and local scale. The biodiversity of the wetland is not usually sensitive to flow and habitat modifications and plays a small role in moderating the quantity and quality of water in a major river.

The Ferrogate Loop wetland classification is **Low/Marginal**. The wetland is not ecologically import or sensitive at any scale. The biodiversity of the wetland is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers.

Table 13: Combined EIS scores obtained for the wetland on the Thabazimbi study site. (DWAF, 1999).

WETLAND IMPORTANCE AND SENSITIVITY	Importance	Confidence
Ecological importance & sensitivity	2.7	*4,2*
Hydro-functional importance	1.9	*4,0*
Direct human benefits	1.5	*4,0*
Overall EIS score	**2.0**	

Table 14: Combined EIS scores obtained for the wetland on the Ferrogate study site. (DWAF, 1999).

WETLAND IMPORTANCE AND SENSITIVITY	Importance	Confidence
Ecological importance & sensitivity	1.6	*4,2*
Hydro-functional importance	1.6	*4,0*
Direct human benefits	0.3	*5,0*
Overall EIS score	**1.1**	

3.5 Impacts and Mitigations

The delineated wetlands will potentially be impacted in the following ways:

- Changes in water flow regime due to the alteration of surface characteristics
- Changes in water quality due to toxic contaminants and increased nutrient levels entering the system.
- Changes in the amount of sediment entering and exiting the system.
- Loss and disturbance of wetland habitat and fringe vegetation.
- Introduction and spread of alien invasive vegetation.

Suggested mitigation/management measures are summarised in Tables 15 - 19

Table 15: Changes in water flow regime impact ratings

Nature: Changing the quantity and fluctuation properties of the watercourse by for example stormwater input, or restricting water flow		
ACTIVITY: Changing the quantity and fluctuation properties of the watercourse by for example stormwater input, or restricting water flow. The sources of this impacts include: • The compaction of soil, the removal of vegetation, surface water redirection and construction of infrastructure		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Highly probable (4)	Probable (3)
Duration	Long term (4)	Short term (2)
Extent	Limited to Local Area (2)	Limited to Local Area (2)
Magnitude	Moderate (6)	Low (4)
Significance	**48 (medium)**	**24 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Improbable (2)	Improbable (2)
Duration	medium term (3)	medium term (3)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	Moderate (6)	Low (4)
Significance	**22 (low)**	**16 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation: • No activities should take place in the watercourses and associated buffer zone. Where the above is unavoidable, only the construction footprint and access roads can be considered. This is subjected to authorization by means of a water use license. • Construction must be restricted to the dryer winter months where possible. • A temporary fence or demarcation must be erected around No-Go Areas outside the proposed works area prior to any construction taking place as part of the contractor planning phase when compiling work method statements to prevent access to the adjacent portions of the watercourse. • Effective stormwater management should be a priority during both construction and operational phase. This should be monitored as part of the EMP. High energy stormwater input into the watercourses should be prevented at all cost. Changes to natural flow of water (surface water as well as water flowing within the soil profile) on the site above the river/wetland area resulting from the proposed railway line should be taken into account.
Cumulative impacts: Construction activities throughout the proposed railway infrastructure may result in cumulative impact to the water courses within the local catchments and beyond. It is very important that protective measures should be put into place and monitored. A rehabilitation plan should be put into action should any degradation be observed as a result from stormwater or sediment input.
Residual Risks: Impacts to the flow characteristics of this watercourse are likely to be permanent unless rehabilitated.

Table 16: Changes in sediment entering and exiting the system impact ratings

Nature: Changes in sediment entering and exiting the system.		
Activity: Changing the amount of sediment entering water resource and associated change in turbidity (increasing or decreasing the amount). Construction and operational activities will result in earthworks and soil disturbance as well as the removal of natural vegetation. This could result in the loss of topsoil, sedimentation of the wetland and increase the turbidity of the water. Possible sources of the impacts include: • Earthwork activities during construction of the railway line • Clearing of surface vegetation will expose the soils, which in rainy events would wash through the watercourse, causing sedimentation. In addition, indigenous vegetation communities are unlikely to colonise eroded soils successfully and seeds from proximate alien invasive trees can spread easily into these eroded soil. • Disturbance of soil surface • Disturbance of slopes through creation of roads and tracks adjacent to the watercourse • Erosion (e.g. gully formation, bank collapse)		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Highly Probable (4)	Probable (3)

Duration	Medium-term (3)	Medium-term (3)
Extent	Limited to Local Area (3)	Limited to Local Area (2)
Magnitude	Moderate (6)	Low (4)
Significance	**48 (medium)**	**27 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Highly probable (4)	Improbable (2)
Duration	Permanent (4)	Permanent (4)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	Low (4)	Low (4)
Significance	**40 (medium)**	**18 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

- Water may seep into earthworks. It is likely that water will be contaminated within these earthworks and should thus be cleaned or dissipated into a structure that allows for additional sediment input and slows down the velocity of the water thus reducing the risk of erosion. Effective sediment traps should be installed.
- Construction in and around watercourses must be restricted to the dryer winter months where possible.
- Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area (DWAF, 2005).
- Remove only the vegetation where essential for construction and do not allow any disturbance to the adjoining natural vegetation cover.
- Rehabilitation plans must be submitted and approved for rehabilitation of damage during construction and that plan must be implemented immediately upon completion of construction.
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- During the construction phase measures must be put in place to control the flow of excess water so that it does not impact on the surface vegetation.

• Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within and adjacent to the construction camp and work areas. • Runoff from the construction area must be managed to avoid erosion and pollution problems. • Implementation of best management practices • Source-directed controls • Buffer zones to trap sediments • Monitoring should be done to ensure that sediment pollution is timeously dressed
Cumulative impacts: Expected to be moderate. Should mitigation measure not be implemented and changes made to the bed or banks of watercourse unstable channel conditions may result causing erosion, meandering, increased potential for flooding and movement of bed material, which will result in property damage adjacent to and downstream of the site. Reversing this process is unlikely and should be prevented in the first place.
Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

Table 17: Introduction and spread of alien vegetation impact ratings.

Nature: Introduction and spread of alien vegetation.		
• ***Activity:*** The moving of soil and vegetation resulting in opportunistic invasions after disturbance and the introduction of seed in building materials and on vehicles. Invasions of alien plants can impact on hydrology, by reducing the quantity of water entering a wetland, and outcompete natural vegetation, decreasing the natural biodiversity. Once in a system alien invasive plants can spread through the catchment. If allowed to seed before control measures are implemented alien plans can easily colonise and impact on downstream users.		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Medium-term (3)	Short-term (2)
Extent	Limited to Local Area (3)	Limited to Local Area (2)
Magnitude	Moderate (6)	Low (4)
Significance	**36 (Medium)**	**16 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Improbable (2)	Very Improbable (1)
Duration	Short-term (2)	Very Short (1)
Extent	Limited to Local Area (2)	Limited to the Site (1)

Magnitude	High (6)	Low (4)
Significance	**20 (low)**	**6 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	
Mitigation: • Weed control • Retain vegetation and soil in position for as long as possible, removing it immediately ahead of construction / earthworks in that area and returning it where possible afterwards. • Monitor the establishment of alien invasive species within the areas affected by the construction and maintenance and take immediate corrective action where invasive species are observed to establish. • Rehabilitate or revegetate disturbed areas		
Cumulative impacts: Expected to be moderate to high. Construction areas within the watercourses along the proposed servitude can experience an increased invasion if mitigation is not implemented or implemented correctly. Regular monitoring should be implemented during construction, rehabilitation including for a period after rehabilitation is completed.		
Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.		

Table 18: Loss and disturbance of wetland/riparian habitat and fringe vegetation impact ratings.

Nature: Loss and disturbance of wetland/riparian habitat and fringe vegetation impact ratings.		
• ***Activity:*** Direct development within wetland/riparian areas. Loss and disturbance of wetland/riparian habitat and fringe vegetation due to direct development on the wetland as well as changes in management, fire regime and habitat fragmentation.		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Medium-term (3)	Short-term (2)
Extent	Limited to Local Area (2)	Limited to Local Area (2)
Magnitude	Moderate (6)	Low (4)

Significance	**33 (medium)**	**16 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Improbable (2)	Very Improbable (1)
Duration	Short duration (2)	Very short duration (1)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	Low (4)	Minor (2)
Significance	**16 (low)**	**4 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation:

- The development footprint should be designed around current wetland and wetland buffers.
- Where construction occurs in the demarcated wetland and buffer, extra precautions should be implemented to so as to minimise wetland loss.
- Where wetlands are lost, compensation should be made to protect the remaining wetlands and their catchments, increase their buffers and rehabilitate their condition and functionality.
- Other than approved and authorized structure, no other development or maintenance infrastructure is allowed within the delineated watercourse or associated buffer zones.
- Demarcate the watercourse areas and buffer zones to limit disturbance, clearly mark these areas as no-go areas
- Operational activities should not take place within watercourses or buffer zones, nor should edge effects impact on these areas
- Operational activities should not impact on rehabilitated or naturally vegetated areas

Cumulative impacts: Expected to be moderate.

Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

Table 19: Changes in water quality due to foreign materials and increased nutrients impact ratings.

Nature: Changes in water quality due to foreign materials and increased nutrients impact ratings.		
• ***Activity:*** Construction, operational and decommissioning activities will result in the discharge of solvents and other industrial chemicals, leakage of fuel/oil from vehicles and the disposal of sewage resulting in the loss of sensitive biota in the wetlands/rivers and a reduction in wetland function as well as human and animal waste. Could possibly impact on groundwater		
	Without mitigation	**With mitigation**
CONSTRUCTION PHASE		
Probability	Probable (3)	Improbable (2)
Duration	Short duration (2)	Very short duration (1)
Extent	Limited to Local Area (3)	Limited to Local Area (2)
Magnitude	Moderate (6)	Low (4)
Significance	**33 (medium)**	**14 (low)**
Status (positive or negative)	Negative	Negative
OPERATIONAL PHASE		
Probability	Improbable (2)	Very Improbable (1)
Duration	Very short duration (1)	Very short duration (1)
Extent	Limited to Local Area (2)	Limited to the Site (1)
Magnitude	Low (4)	Low (4)
Significance	**14 (low)**	**6 (low)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Moderate
Irreplaceable loss of resources?	Low	Low
Can impacts be mitigated?	Yes	

Mitigation: • Provision of adequate sanitation facilities for construction workers located outside of the watercourse/riparian area or its associated buffer zone. • Implementation of appropriate storm water management around the excavation to prevent the ingress of run-off into the excavation and to prevent contaminated runoff into the watercourse. • The development footprint must be fenced off from the watercourse and no related impacts may be allowed into the watercourse e.g. water runoff from cleaning of equipment, vehicle access etc. • After construction, the land must be cleared of rubbish, surplus materials, and equipment, and all parts of the land shall be left in a condition as close as possible to that prior to use. • Maintenance of construction vehicles / equipment should not take place within the watercourse or watercourse buffer. • Control of waste discharges • Maintenance of buffer zones to trap sediments with associated toxins • Treatment of pollution identified should be prioritized accordingly.
Cumulative impacts: Expected to be moderate. Once in the system it may take many years for some toxins to be eradicated.
Residual Risks: Expected to be limited provided that the mitigation measures are implemented correctly and effective rehabilitation of the site is undertaken where necessary.

4 CONCLUSION

A channelled valley bottom wetland associated with the Crocodile River was found within 500m of the proposed Thabazimbi Loop. A wetland is present approximately 400m to the north of the site but does not form part of the study area. The wetland is surrounded by a variety of habitats for birds and mammals.

Water flow from the surrounding mine heaps and mountains flow through the wetland before reaching the Crocodile River, allowing for nutrient assimilation and erosion prevention. The loop is found within a decommissioned iron ore mine which is currently undergoing rehabilitation as a wildlife reserve. Many species of antelope and birds are present, which is evidence of the improvement of the ecological condition of the area. The **EIS classification is Moderate**. The wetland is considered as ecologically important and sensitive on a provincial and local scale. The biodiversity of the wetland is not usually sensitive to flow and habitat modifications and plays a small role in moderating the quantity and quality of water in a major river. The wetland condition is expected to improve over time as the site is currently undergoing rehabilitation. Moderately modified. The total **PES score is 2.4** and the **category C** - A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.

Two small wetlands associated with the Bierspruit River were present within 500m of the proposed Ferrogate Loop. The northernmost wetland appears to be as a result of a depression created by the R510 freeway. A culvert under the freeway connects the depression to the Bierspruit in the west. However, the site is characterised by a variety of plant species which can create habitat for birds and small mammals. The southern wetland is found along the west of the site and is disconnected from the railway by the R510. A culvert allows for water flow from the railway edge in a westerly direction to the Bierspruit River.

The Ferrogate Loop wetland **EIS classification is Low/Marginal**. The wetland is not ecologically import or sensitive at any scale. The biodiversity of the wetland is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water in major rivers. The wetland condition is expected to remain stable due to the isolated locality of the site, although hydrological process are affected by culverts and roads. The total **PES score is 3.**5 and the **category C** - A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.
No wetlands occur on the Northam Loop. The area is high urbanised with residential, commercial and other developments.

The construction phase impacts should be mitigated by relatively standard measures associated with best practice methods, together with effective monitoring and rehabilitation where this becomes necessary. The long term presence of the railway line, particularly in the northern section of the line will have a significant effect on the hydro-geomorphology of the landscape since the railway line affects the valley bottom wetland by changing how surface water input enters the wetland. Berms associated with railway lines may cut off surface water flows or lead to ponding of water. Where the railway line crosses the wetland at a perpendicular angle to the south, this problem can be mitigated by ensuring the optimal design of the watercourse crossing. However, in the northern section of the line, mitigation measures may not be effective. It is therefore important that annual monitoring as part of the EMP highlight potential degradation to the downstream hydrological network and that rehabilitation measures be implemented as required.

The development may be successfully mitigated in order to limit impacts to the wetland areas. The proposed development may proceed provided that these mitigation measures are applied throughout the lifespan of the project.

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APPENDIX A: GLOSSARY OF TERMS

Buffer	A strip of land surrounding a wetland or riparian area in which activities are controlled or restricted, in order to reduce the impact of adjacent land uses on the wetland or riparian area
Hydrophyte	any plant that grows in water or on a substratum that is at least periodically deficient in oxygen as a result of soil saturation or flooding; plants typically found in wet habitats
Hydromorphic soil	soil that in its undrained condition is saturated or flooded long enough during the growing season to develop anaerobic conditions favouring the growth and regeneration of hydrophytic vegetation (vegetation adapted to living in anaerobic soils)
Seepage	A type of wetland occurring on slopes, usually characterised by diffuse (i.e. unchannelled, and often subsurface) flows
Sedges	Grass-like plants belonging to the family Cyperaceae, sometimes referred to as nutgrasses. Papyrus is a member of this family.
Soil profile	the vertically sectioned sample through the soil mantle, usually consisting of two or three horizons (Soil Classification Working Group, 1991)
Wetland:	"*land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil*." (National Water Act; Act 36 of 1998).
Wetland delineation	the determination and marking of the boundary of a wetland on a map using the DWAF (2005) methodology. This assessment includes identification of suggested buffer zones and is usually done in conjunction with a wetland functional assessment. The impact of the proposed development, together with appropriate mitigation measures are included in impact assessment tables