THE BASIC ASSESSMENT AND WATER USE LICENCE APPLICATION FOR THE CONSTRUCTION OF BOSHOEK LOOP, NORTH WEST PROVINCE

DEA Reference: Not issued yet

AQUATIC AND WETLAND STUDY

Prepared for:
Prepared by: **EOH Coastal & Environmental Services** Block D, Gillooly's View Office Park (EOH Business Park), 1 Osborne Lane, Bedfordview, Johannesburg, 2007. *Also in Grahamstown, East London, Port Elizabeth, Cape Town and Maputo (Mozambique)* www.cesnet.co.za | www.eoh.co.za
www.cesnet.co.za www.eoh.co.za

May 2018

This Report should be cited as follows: EOH Coastal & Environmental Services, May 2018: The Basic Assessment and Water Use Licence application for the construction of the Boshoek Loop, North West Province. Aquatic and Wetland Study, EOH CES, Johannesburg.

REVISIONS TRACKING TABLE

EOH Coastal and Environmental Services

Report Title: The Basic Assessment and Water Use Licence application for the construction of the Boshoek Loop, North West Province. Aquatic and Wetland Study.
Report Version: Draft, V1.
Project Number: P280

Name	Responsibility	Signature	Date
Gideon Raath	Author		April 2018
Kim Brent	Reviewer		April 2018

INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

On 7 April 2017, the Environmental Impact Assessment Regulations promulgated in terms of the National Environmental Management Act (Act no. 107 of 1998 as amended; NEMA) dated 8 December 2014 were amended. In terms of Appendix 6 of the Amended EIA Regulations (2017), a Specialist Report must contain all the information necessary for a proper understanding of the nature of issues identified, and must include–

(1) A specialist report prepared in terms of the Amended NEMA EIA Regulations (2017) must contain-
(a) Details of- (i) The specialist who prepared the report; and (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae; (b) A declaration that the specialist is independent in a form as may be specified by the competent authority;
(c) An indication of the scope of, and the purpose for which, the report was prepared;
(cA) An indication of the quality and age of the base data used for the specialist report;
(cB) A description of the existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(e) A description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;
(f) Details of an assessment of a specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;
(j) A description of the findings and potential implications of such findings on the impact of the proposed activity or activities;
(k) Any mitigation measures for inclusion in the EMPr;
(l) Any conditions for inclusion in the environmental authorisation;
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n) A reasoned opinion- (i) whether the proposed activity, activities or portions thereof should be authorised; and (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, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;
(o) A description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto; and
(q) Any other information requested by the competent authority.
(2) Where a government notice gazetted by the minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

THE PROJECT TEAM

In terms of Appendix 6 of the Amended NEMA EIA Regulations (2017) a specialist report must contain-

(a) Details of-
- (iii) The specialist who prepared the report; and
- (iv) The expertise of that specialist to compile a specialist report including a curriculum vitae;

(b) A declaration that the specialist is independent in a form as may be specified by the competent authority;

1.1 Details of specialist

Mr Gideon Raath (Report Writer and Aquatic Specialist), *Pr.Sci.Nat*.
Mr Gideon Raath, (Environmental Consultant) holds an MSc (Geography and Environmental Management; SU), a BSc Honours (Ecology and Environmental Studies - Cum laude; Wits) and a BSc (Geography and Environmental Management; UJ). His MSc thesis focussed on the hydrological impact on the spatial distribution of invasive Eucalyptus trees along the Breede River, while his honours thesis evaluated ethnobotanical relationships around the Rio Tinto copper mine in Phalaborwa. Most recently he has worked as the Monitoring & Evaluation Project Manager for the City of Cape Town's invasive species unit. Gideon's consulting and project management expertise includes project management, EIA and EMPr applications, integrated water use licence applications, specialist botanical and ecological impact assessments, specialist wetland delineation and impact assessments, GIS applications and mapping. Gideon currently works from the Johannesburg office, and is interested in invasion ecology, treatment of groundwater pollution through phytoremediation, botanical and wetland specialist studies, GIS application for ecology and environmental management, and the EIA processes in general.

Ms Kim Brent, (Report review and quality control), *Pr.Sci.Nat*.
Kim is a senior consultant with over 7 years' experience and is the second line Branch Manager in the Port Elizabeth Office. Kim is registered with the South African Council for Natural Scientific Professional (SACNASP) and holds a BSc degree with majors in Botany and Geography as well as a BSc (Hons) degree in Botany focussing on Environmental Management and GIS systems; both from NMMU. Her honours year focused on Environmental Impact Assessments, Environmental Management and Geographic Information Systems. Kim's interests include Environmental Auditing, Scoping and Environmental Impact Assessments, Geographic information systems and Ecological Assessments. Kim's is well versed in the environmental legislation such as NEMA, the EIA regulations, the National Water Act, the MPRDA etc., as well as the local and provincial biodiversity spatial and planning tools for the Eastern, Western and Northern Cape Provinces. Kim has conducted a number of Prospecting Right Applications (in accordance with the MPRDA and NEMA), Basic Assessments and EIAs (in accordance with NEMA) in South Africa, and has been involved in a number of local mining projects within South Africa. Internationally, Kim assisted on various ESIAs and ESMPs such as the Syrah Resources ESHIA for a Graphite Mine in Balama, the Baobab Iron Ore Mining Development Project, Mozambique and the Sentinel Deposit, in Zambia.

In addition to the above, Kim has been the financial and technical manager on a large number of projects ranging from Basic Assessments (Bridges/River crossings, Prospecting, Cemeteries, Mixed-Use Developments, Private and Social Housing Developments, WEF, Section 24 (G)s etc.) to EIAs (largely Housing and Mining) and ECO projects (Jeffery's Bay WEF, Kouga WEF, Housing ECO services etc.). Furthermore, Kim has conducted a number of Ecological Impact Assessments, Alien Vegetation Management Plans and Rehabilitation and Re-vegetation Plans for projects such as the Wicklow Citrus Packaging Warehouse in Addo, various Prospecting Applications in the Western Cape and Northern Cape, KurlandBrik Clay Mining Project the PPC Grassridge Mine in Port Elizabeth, The Scarlet Ibis WEF, The Fort Cox WWTW upgrade, NMMU Private Nature Reserve, The Ukomeleza WEF and various low-level River crossings and bridges (Slang River, Kap River, Baakens River etc.). Kim has good knowledge of the applicable Biodiversity legislation such as the CARA Regulations, the NEM Biodiversity Act and the NEM Protected Areas Act. Kim has recently completed the Rhodes University short course on Tools for Wetland Assessments as well as a training course on IWRM, the NWA, and Water Use Authorisations, focusing on WULAs and IWWMPs.

1.2 Expertise

Projects Gideon and Kim have worked on which have relevance to wetland, ecological and vegetation studies include:

Name of project	Description of responsibility	Date completed
Kraaifontein Hospital Development, Cape Town	Ecological and Wetland Study	February 2016
SANRAL N2 Caledon Road Upgrade	Ecological Study	November 2016
Element Barberton IAPS WWTW	SASS5 baseline assessment and monitoring	March 2017
SANRAL R510 Bierspruit Road Upgrade	Ecological Study	August 2017
Triton Ancuabe and Nicanda Hills, Grafex Lda Rehabilitation	Ecological study and rehabilitation baseline	November 2017
City of Johannesburg Proclamation	Vegetation Assessment and delineation report	Current
TRANSNET Heysterkrand Road Upgrade	Ecological Study	Current
Triton Ancuabe Grafex Lda Vegetation Monitoring	Vegetation monitoring baseline assessment	Current
Wicklow Trust Citrus Packaging Warehouse, Sundays River Municipality, Eastern Cape	Ecological Assessment and Alien Vegetation Management Plan	January 2016
The re-construction and upgrading of the Slang river low-level crossing near Oyster Bay, Kouga Local Municipality Eastern Cape	Ecological and Wetland Impact Assessment	January 2016
PPC Grassridge Quarry, Port Elizabeth	Botanical Survey and Rehabilitation Plan	November 2016
The Kap River Bridge, Ndlambe Municipality, Easter Cape	Ecological and Wetland Assessment	March 2017
Fort Cox College WWTW upgrade	Aquatic / Wetland Assessment	April 2017

1.3 Declaration

- I, Gideon Raath, declare that, in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014;
- 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 report 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.

1 INTRODUCTION

In terms of Appendix 6 of the Amended EIA Regulations (2017) a specialist report must contain-

(c) An indication of the scope of, and the purpose for which, the report was prepared;
(cA) An indication of the quality and age of the base data used for the specialist report;
(d) The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;
(i) A description of any assumptions made and any uncertainties or gaps in knowledge;
(o) A description of any consultation process that was undertaken during the course of preparing the specialist report;
(p) A summary and copies of any comments received during any consultation process and where applicable all responses thereto

1.1 Project description

Transnet SOC Ltd have appointed EOH Coastal & Environmental Services to conduct a Basic Assessment Process, in accordance with the National Environmental Management Act (107 of 1998), Amended EIA Regulations (2017), for the proposed expansion of a railway line at Boshoek Loop, North-West Province. In addition to the application for Environmental Authorisation (EA), a Water Use Authorisation (WUA) will also be applied for in terms of section 21 (c) and (i) as set out in the National Water Act (Act 36 of 1998, as amended), and a heritage authorisation as set out in the National Heritage Resources Act (Act 25 of 1999) in the form of a heritage permit from the South African Heritage Resources Authority (SAHRA) will be applied for.

The project forms part of the Transnet Waterberg rail corridor expansion programme between Ermelo, located in the Mpumalanga province, and Lephalale, located in the Limpopo Province. The railway line is a key corridor to Transnet for the transportation of various commodities, including coal, chrome, ferrochrome, cement, lime, granite, iron ore, container and general freight. The construction activities focus specifically on the upgrades required for the coal expansion of the line.

Unlocking the Waterberg area is a key priority in Government's National Development Plan and has been identified as part of Strategic Infrastructure Projects (SIP 1) by the Presidential Infrastructure Coordinating Commission (PICC). Specifically, coal, expansion in rail capacity was identified as a strategic initiative and received much attention from Government as a key driver for the South African economy. The latest rail capacity demand from coal miners in the Waterberg is formed by mine expansion projects and proposed new mine developments.

In line with these strategic priorities for the country, Transnet has developed a programme for expansion of railway infrastructure between Lephalale in the Limpopo Province and Pyramid South in Gauteng. The expansions will ultimately improve the heavy haul Coal line for increased coal exports through the Port of Richards Bay and also deliver coal to several powers stations along the existing rail route.

The scope of the project includes the construction of the new Boshoek loop of 1.6 km along the railway line. The construction work includes track work, required for the doubling of the existing line. The construction work is divided into two phases, namely the construction of the 1,671 km line (phase I), with the remaining 500 m being reserved for phase II. The construction of the new loop will be undertaken within the Transnet servitude, however Transnet will need to acquire additional land (lease agreement) for the purpose of stockpiling and site camp establishment.

The following coordinates apply to the proposed loop (Table 1.1):

Table 1.1: Proposed loop coordinates.

Description	Km points	DMS Coordinates
Start	132.82	**Lat:** -25°, 30', 43.4839"; **Long**: 27°, 07', 11.7180"
End	160.95	**Lat**: -25°, 29', 51.4338"; **Long**: 27°, 06', 12.0742"

The construction works will are aimed at developing a 1,671 km long loop of 20t axle loading formation layers, according to the S410 Specification for Railway Earthworks (March, 2006). The new loop is located between Km 132.82 and Km 125.00. The railway line traverses through a fairly flat terrain from Km 132.82 to Km 134.8 and it also passes through an embankment approaching the river bridge at Km 134.970.

Perway details include:

- 1,671 km of track comprising 60 kg UIC60 rails on PY sleepers;
- To construct 1:20 RH set at Km 159.55.
- To construct a 1:20 LH set at Km 160.95.

Signalling

Install a localised remote control system to enable the Train Driver to remotely operate the 1:20 tangential point sets on both sides of the loop. The system uses a radio control to operate. Both will be self-normalised and ML Track circuits to detect the train presence.

Structures

There are five (5) box culverts (Table 1.2) which will be extended in order to accommodate the new loop. The culvert opening will be kept unchanged and the length of the culverts will be extended to suit the new loop line.

Table 1.2: Box culvert description and location.

Description	Km	DMS Coordinates
Culvert 1: 1.80 m x 4.90 m box culvert	133.10	**Lat**: -25°, 30', 37.3942"; **Long**: 27°, 07', 06.0789"
Culvert 2: 1.90 m x 4.90m box culvert	133.96	**Lat**: -25°, 30', 16.0228"; **Long**: 27°, 06', 46.2882"
Culvert 3: 1.90 m x 4.90m box culvert	134.41	**Lat**: -25°, 30', 05.4372"; **Long**: 27°, 06', 35.4205"
Culvert 4: 0.50m pipe culvert	134.82	**Lat**: -25°, 29', 58.0180"; **Long**: 27°, 06', 23.0570"
Culvert 5: 2.4/5m x 6.70m arched culvert	135.13	**Lat**: -25°, 29', 52.3852"; **Long**: 27°, 06', 13.6585"

Figure 1.1 below illustrates the overall location of the project within the broader context of the Sun City and Rustenburg areas.

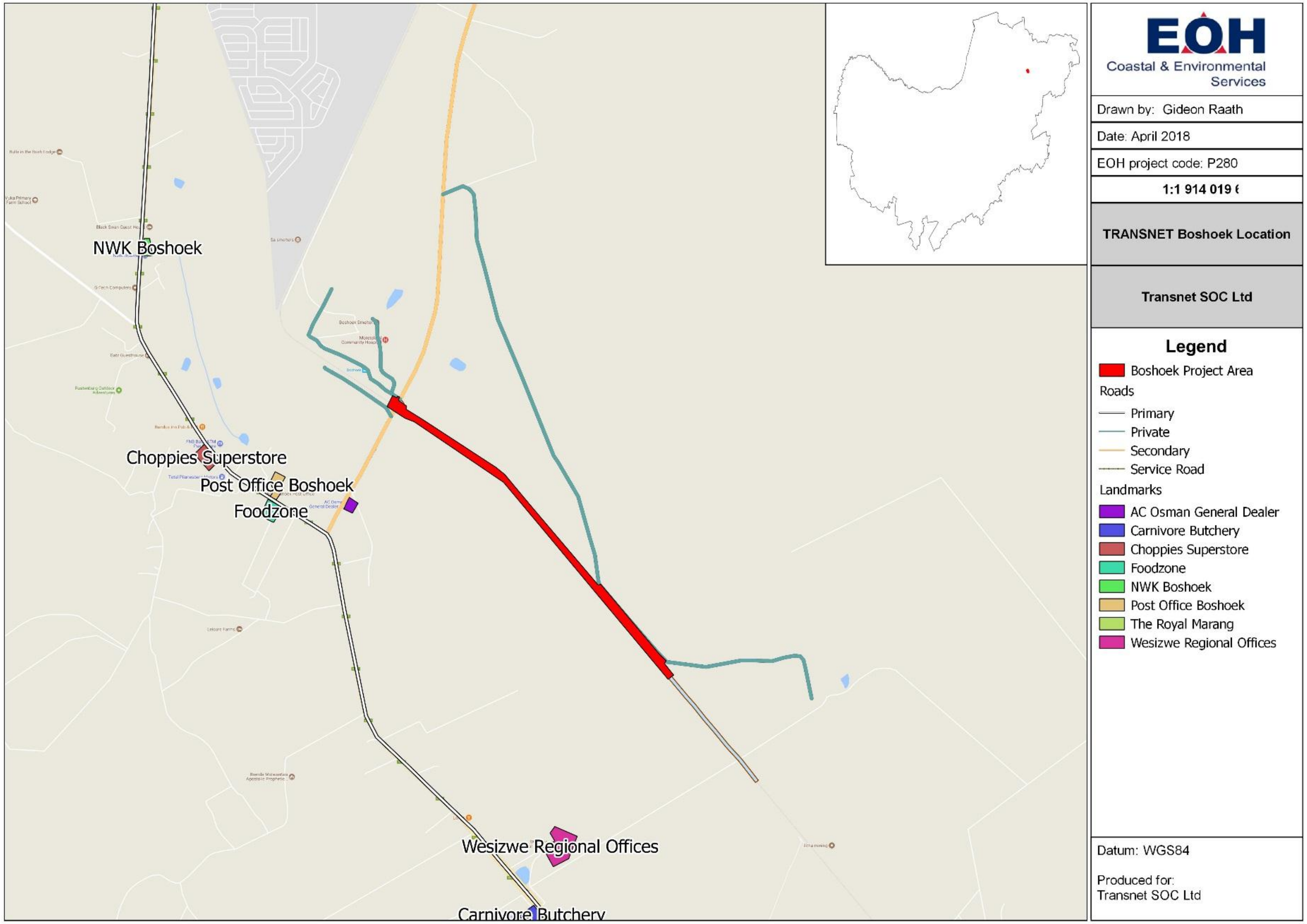

Figure 1.1: Locality Map of the proposed Boshoek Loop rail upgrade, near Rustenburg.

1.2 Alternatives

- Alternative 1 - The preferred alternative considered in the Basic Assessment involves placing a single rail line immediately adjacent the existing rail line (to the northern side of the existing track). Only the preferred alternative will be assessed in this impact assessment as this alternative will have the largest environmental impact.
- Alternative 2 - The other alternative considered in the BA involves the no-go option, in which case no development will occur. This has not been assessed in this report.

1.3 Public Participation Process

The Public Participation Process (PPP) followed to date has been described in detail in the Draft Basic Assessment Report (DBAR). Once the draft report is available for public review, a formal 30 day commenting and review period will be scheduled. All proof and correspondence to date is available in the DBAR. Any comments received on this report will be included in the final report.

1.4 Objectives and Terms of Reference

The objectives of the aquatic and wetland study were to:

- Provide a general description of the status of the surface water resources of the area according to published literature;
- Review relevant legislation, policies, guidelines and standards;
- Delineate identified wetland areas and include appropriate buffer zones and provide the appropriate maps;
- Assess the health and state of nearby watercourses;
- Derive Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) of affected watercourses (using available desktop PES and EIS data);
- Provide a sensitivity map and define and map no-go areas;
- Provide an assessment of the potential direct and indirect impacts resulting from the proposed development both on the footprint and the immediate surrounding area during construction and operation; and
- Provide a detailed description of appropriate mitigation measures that can be adopted to reduce negative impacts for each phase of the project, where required including appropriate recommendations.
- Supply the client with geo-referenced GIS shape files of the surfacewater features.
- The above detail could be required for inclusion in the Water Use License Application (WULA) / General Authorisation (GA) submitted to DWS.

1.5 Approach

The study site and surrounding areas were assessed using a two-phased approach. Firstly, a desktop assessment of the site was conducted in terms of current biodiversity programmes and plans. Thereafter, a site visit was conducted in March 2018 in order to determine the actual condition of the surface water features within the proposed study area. The site visit also served to inform potential impacts of the proposed project and how significantly it would impact on the surrounding aquatic environment. The study area for this report is a 1 km wide corridor (500 m on either side of the centre line) around the proposed section of rail to be upgraded. The site visits took place towards the end of summer, beginning autumn. The season was not chosen for any particular reason but rather based on the availability of specialist to conduct the site survey and will not have a large impact on the outcome of the assessment.

1.6 Assumptions and Limitations

This report is based on currently available information and, as a result, the following limitations and assumptions are implicit:–

- The report is based on a project description taken from design specifications for the proposed activity provided to EOH CES by the engineers, which is likely to undergo a number of iterations and refinements before it can be regarded as final; and
- Descriptions of the natural environments are based on limited fieldwork and available literature.

2 RELEVANT LEGISLATION

In terms of Appendix 6 of the Amended EIA Regulations (2017) a specialist report does not legally have to cover a review of the applicable legislation however this has been included to provide the reader with an overview of the legal requirements related to the Aquatic environment.

Environmental legislation relevant to the proposed activity is summarised in Table 2.1 below. Biodiversity Plans and Programmes are discussed in Chapters 3 and 4, where they are used to describe the desktop ecological conditions of the study area.

Table 2.1: Environmental legislation considered in the preparation of the Aquatic and Wetland Study for the proposed rail upgrade.

Title of Environmental legislation, policy or guideline	Implications for the road upgrade
Constitution Act (108 of 1996)	• Obligation to ensure that the proposed development will not result in pollution and ecological degradation; and • Obligation to ensure that the proposed development is ecologically sustainable, while demonstrating economic and social development.
National Environmental Management Act (NEMA) (107 of 1998) as amended	• The developer must apply NEMA principles, the fair decision-making and conflict management procedures that are provided for in NEMA. • The developer must apply the principles of Integrated Environmental Management and consider, investigate and assess the potential impact of existing and planned activities on the environment, socio-economic conditions and the cultural heritage.
National Environment Management: Biodiversity Act (10 of 2004)] Alien Invasive Species Regulations, 2014.	• The proposed development must conserve endangered ecosystems and protect and promote biodiversity; • Must assess the impacts of the proposed development on endangered ecosystems; • No protected species may be removed or damaged without a permit; • The proposed site must be cleared of alien vegetation using appropriate means.
National Water Act (36 of 1998) as amended	• Provides details of measures intended to ensure the comprehensive protection of all water resources, including the water reserve and water quality.

3 ASSESSMENT METHODOLOGY

In terms of Appendix 6 of the Amended EIA Regulations (2017) a specialist report must contain-
(e) A description of the methodology adopted in preparing the report or carrying out the specialised process, inclusive of equipment and modelling used;

3.1 Aquatic Assessment

The aim of this assessment is to identify the aquatic importance of the rivers affected by the project and to evaluate the sensitivity of the rivers.

The following literature was consulted for the desktop assessment of the rivers:

- The National Spatial Biodiversity Assessment (2004);
- North West Biodiversity Sector Plan (2015);
- The National Freshwater Ecosystem Priority Areas (NFEPA) project (2011 - 2014)
- Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model (2014); and
- Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland (2007).

A site visit was conducted on the 3rd and 4th of April 2018 in order to obtain photographic evidence of the current state of the affected rivers/drainage lines and wetlands.

3.2 Wetland Assessment

Wetland Definition

"*Wetland*" is a name given to a variety of ecosystems ranging from rivers, springs, seeps and mires in upper catchments, to midland marshes, pans and floodplains, coastal lakes, mangrove swamps and estuaries at the bottom of a catchment. These ecosystems all share the common primary driver of water and its prolonged presence is a fundamental determinant of soil characteristics, vegetation and animal life (DWAF, 2005).

The National Water Act (Act No. 36, 1998) defines wetlands 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."*

Thus wetlands must have one or more of the following characteristics:

- **Hydromorphic soils**: characteristic soils of prolonged saturation;
- **Hydrophytes**, at least occasionally: highly saturated plants; and
- **High water table**: a high water table that results in saturation at or near the surface, leading to anaerobic conditions developing in the top 50 cm of the soil.

Wetlands are formed from a combination of geology, hydrology and topography. These landforms form in parts of a catchment where the movement of water is slowed down or obstructed, causing soil to become temporarily, seasonally or permanently waterlogged.

Wetland Importance

South Africa is a Contracting Party to the Ramsar Convention on Wetlands and has thus committed itself to the intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem. The treaty was adopted in the Iranian city of Ramsar in 1971 and the Convention's member countries cover all geographic regions of the planet. Wetland conservation in South Africa is now driven by SANBI under the requirements of the National Environmental Management: Biodiversity Act (NEMBA, 10, 2004).

In natural capital terms, wetlands may be seen as a significant economic investment. This monetary value is rooted to the fact that the primary tasks of a wetland are to process water and regulate runoff. This is important as the South African economy is heavily dependent on water and yet the climatic variability of the country has meant that for the most part rainfall occurs as intermittent, high intensity storms. The inherent value of wetlands is that they protect and regulate this water source by acting like sponges, soaking up water during flood events and releasing it during dry periods (DWAF, 2005). By regulating water flows during floods, wetlands may reduce flood damage and help prevent soil erosion. As natural filters wetlands help to purify water by trapping pollutants, heavy metals and disease causing organisms.

The most common ecosystem services provided by wetlands are:

- Improved water quality;
- Flood attenuation;
- Sediment trapping;
- Reduce number of water borne diseases;
- Herbal medicine; and
- Water storage.

These ecosystem services are provided at very little cost but with significant payback for the South African economy.

Despite being classified as the third most significant life support system on earth (IUCN, 1980), wetlands are some of the most threatened habitats in the world today. Breen & Begg (1989) reported that more than 50% of the wetland inventory in South Africa had disappeared. The main issues have been draining wetlands for crops and pastures, poorly managed burning and grazing resulting in headcut and donga erosion, planting alien invasive vegetation, mining, pollution and urban development. These have been significant as they alter the natural flow of water in wetlands and as water is the driver of wetland formation it follows that any changes would be damaging. A buffer around a wetland is usually recommended in order to protect the wetland from development in the vicinity.

Aside from the negative impacts of construction in the vicinity of a watercourse or wetland, a major impact that needs to be considered should be the geotechnical competence of soil which is often waterlogged and prone to flooding. Wetland soils are usually high in clay and prone to wet and dry periods, allowing for expansion and contraction of soils. The wetland and watercourse buffers are therefore also important with regards to the demarcation of areas that are not good to build on/in due to the high soil moisture content and unstable soils. Developing solutions to these problems would be expensive and may not be sustainable in the long term.

3.3 Tools available to define wetlands and watercourses

3.3.1 National Freshwater Ecosystem Priority Areas (NFEPA, 2011-2014)

After several years of development and testing, a National Wetland Classification System (NWCS) was completed in 2013. The South African National Biodiversity Institute (SANBI), through its National Wetland Inventory project, initiated a collaborative process to develop a classification by which wetland habitat types with shared natural attributes can be grouped together. The classification system is intended to be used throughout the country for a number of different applications, with a view to provide wetland specialists, academics, government and other role players with a common language when distinguishing different types of wetlands for management and conservation purposes. The National Wetland Inventory maps are provided by SANBI through

National Freshwater Ecosystem Priority Area (NFEPA) wetland maps, which classify the major wetlands and waterbodies in the country at a coarse spatial scale. The classification was applied to the wetlands included in the inventory's National Wetland Map after extensive field testing throughout the country and through the National Freshwater Ecosystem Priority Areas (NFEPA) project.

The NFEPA programme provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or FEPAs. The system comprises a hierarchical classification process of defining a wetland based on the principles of the hydro-geomorphic (HGM) approach at higher levels, with structural features being included at the finer levels (SANBI, 2009). Wetland ecosystem types were used by NFEPA for representing natural examples of the diversity of wetland ecosystem types across South Africa. Wetlands of the same ecosystem type are expected to share similar functionality and ecological characteristics. The biodiversity target for freshwater ecosystems in South Africa is 20%, which means that we should keep at least 20% of each wetland ecosystem type in a natural or near-natural condition. This serves to conserve many common species and communities, and the habitats in which they evolve. Information used to classify wetlands as FEPAs included:

- Ramsar status;
- Known threatened frog and waterbird occurrences; and
- Expert knowledge on biodiversity importance.

For the purposes of this study Version 4 of the National Wetland Classification System (NWCS) was used as baseline information, as per SANBI's BGIS interactive tool.

The NWCS uses hydrological and geomorphological traits to distinguish the direct factors that influence wetland function. This is presented as a 6 tiered structure with four spatially nested primary levels that are applied in a hierarchical manner between different wetland types on the basis of these direct factors (SANBI, 2009).

» **Level 1:** Distinguishes between marine, estuarine and inland ecosystems based on the degree of connectivity the systems have with the ocean.
» **Level 2:** Categorises the regional wetland setting using a combination of biophysical attributes at the landscape level.
» **Level 3:** Assesses the topographical position of inland wetlands.
» **Level 4**: Concerns the hydrogeomorphic (HGM) units as defined as follows:
  - *Landform*- considering the shape and localised setting of the wetland;
  - *Hydrological characteristics*- nature of water movement into, through and out of the wetland; and
  - *Hydrodynamics*- the direction and strength of flow through the wetland.

The HGM unit is considered the focal point for NWCS as the upper levels mean to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, whilst the lower levels provide more descriptive detail.

As wetlands are formed under the influence of geology, hydrology and topography it is necessary to note these features when delineating a wetland.

- **Geology:** Geology influences the formation of a wetland by geological obstructions such as erosion resistant rock or impervious material close to the surface forcing groundwater to move close to or onto the soil surface.
- **Hydrology*:*** The water transfer mechanisms such as source, movement and exit are important features of a wetland.
- **Topography:** The topography of the landscape influences the likelihood of whether a wetland will form. For instance, under the right conditions wetlands may form in floodplains, valley bottoms, hillslopes, depressions and coastal flats.

A range of 'hydro-geomorphic' types can be defined by considering the above features. Six HGM units are defined for South African inland wetlands (SANBI, 2009):

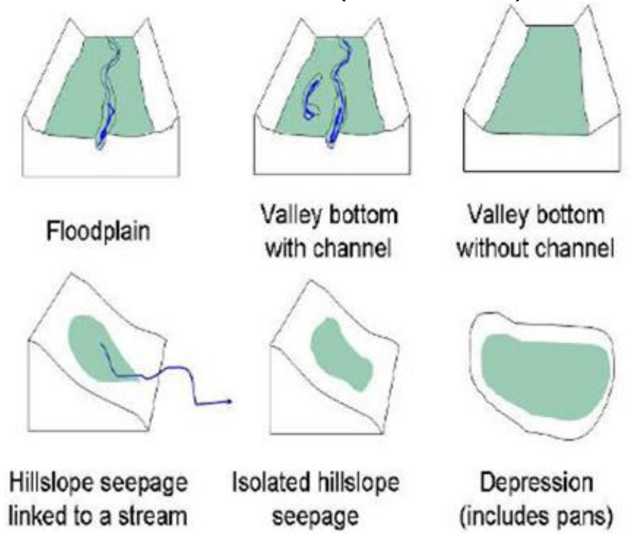

Figure 3.1: The HGM types for South African Inland wetlands (SANBI, 2009).

Important rivers are also classified according to the NFEPA rivers maps. These rivers are considered Freshwater Ecosystem Priority Areas (FEPAs). FEPAs are strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources. FEPAs are an essential part of an equitable and sustainable water resource strategy meaning that they need to stay in a good condition to manage and conserve freshwater ecosystems, and to protect water resources for human use. This means that the areas should be supported by good planning, decision-making and management to ensure that human use does not impact on the aquatic ecosystem.

Wetland FEPAs were chosen based on significant specialist input that relates to information as diverse as crane breeding areas and protected frog habitats.

3.4 Tools available for wetland delineation

3.4.1 DWAF (2005) wetland delineation

The DWAF (2005) guidelines for "a practical field procedure for delineation of wetlands and riparian areas" are recommended in Gazette No. 19182, Notice No. 1091 of the National Water Act, 1998. This guideline explains the field indicators and methods for determining whether an area is a wetland or a riparian area, and how to find its boundaries. Although the primary driver of a wetland is water, due to its dynamic nature water is not a very useful parameter for identifying the outer boundary of a wetland. What is needed is a method of identifying the indirect indicators of prolonged saturation by water. This includes wetland plants (hydrophytes) and wetland (hydromorphic) soils. Their presence or absence implies the frequency and duration of saturation and is a satisfactory indicator to classify the area as a wetland (DWAF, 2005).

In wetland delineation there are three zones which are distinguished according to a changing frequency of saturation. These are the **permanent, seasonal** and **temporary** zone. The primary objective of wetland delineation is usually to define the outer edge of the temporary zone as it marks the boundary between the wetland and the adjacent terrestrial zone. There are four important indicators that are used to define the boundaries of a wetland. The most important one is the soil wetness indicator with terrain unit, soil form and vegetation acting as confirmation. The point where wetland indicators are not present is regarded as the edge of the wetland.

The **permanently wet zone** is characterised by dark grey, clay soil, caused by a lack of oxygen required for the oxidation of minerals such as iron in the soil. The **seasonally wet zone** is characterised by grey soils with lots of orange and black mottles. It is recommended that there should be a 100m buffer zone between the edge of the delineated **temporary zone** and any development.

Important indicators of each zone are as follows:

» ***Wetland vegetation***
In order to tolerate the anaerobic conditions of seasonal or permanent flooding, hydrophytes (water loving plants) have evolved a number of adaptations. Their presence can therefore indicate a moist soil habitat and thus provide a potential boundary of a wetland's seasonally flooded or permanent flooded zones (Macfarlane *et al*., 2007).

- The ***temporary zone*** of a wetland will show mainly grasses, some woody species and some sedges.
- The **seasonal zone** will begin to show more hydrophytic (or water loving) sedges with tall grasses (over 1m).
- The **permanent zone** will be noticeable by emergent reeds and sedges, bulrushes or floating and submerged plants. Woody species will have adaptations for permanent wetness such as prop roots (Mangroves).

» ***Wetland soils***
Low oxygen levels result in a reduced rate of organic matter decomposition within the soil, where sulphur tends to exist in its reduced form, hydrogen sulphide (H_2S), noticeable by its tell-tale rotten-egg smell. These conditions also serve as a catalyst for the metals in the soil to become soluble and begin leaching (DWAF, 2005). The metals produce rich colours of yellow, orange and reds.

- The ***temporary*** or ***seasonal zone*** of a wetland, where there is more seasonal flooding, produces mottling of colours, as the metals are still in the process of precipitating. These mottles occur within a grey matrix where the metals have already leached.
- The ***permanent zone*** of a wetland, where there is more permanent flooding of the soil, produces leaching of metals, with soils remaining a grey ("gleyed") colour.
- It is recommended by DWAF (2005) that soils be sampled on the surface (0-10cm) and between 40 and 50cm.

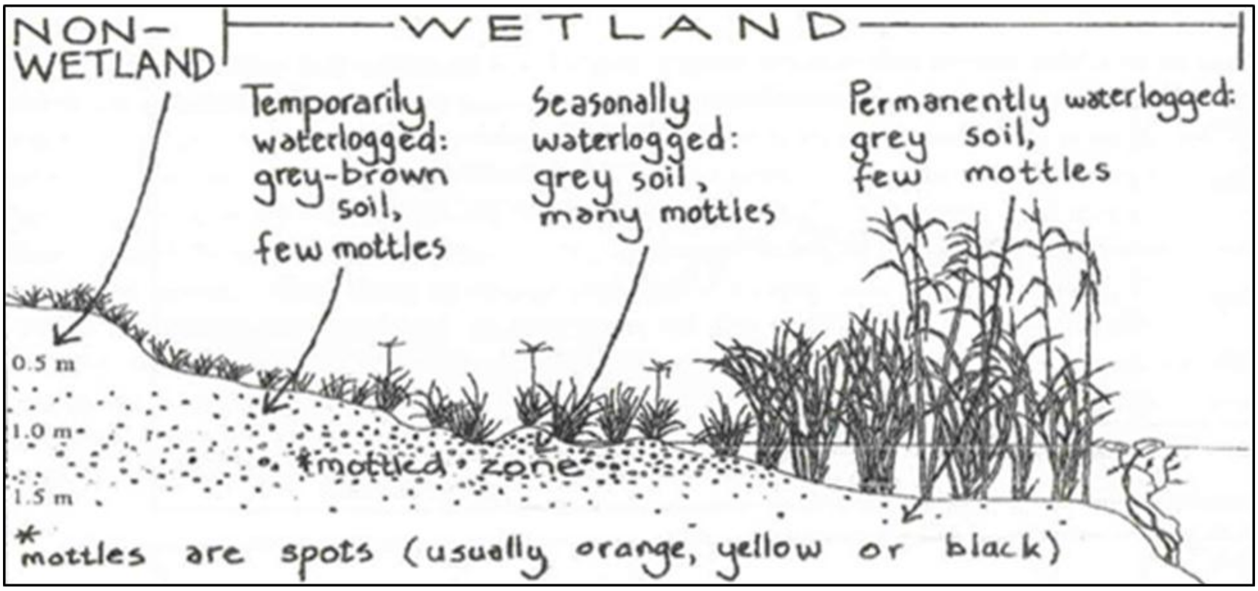

Figure 3.2: A cross-section through a wetland, indicating how the soil wetness and vegetation indicators change as one moves along a gradient of decreasing wetness, from the middle to the edge of the wetland (DWAF, 2005).

3.5 Impact assessment

3.5.1 Impact rating methodology

To ensure a direct comparison between various specialist studies, a standard rating scale has been defined and will be used to assess and quantify the identified impacts. This is necessary since impacts have a number of parameters that need to be assessed. Five factors need to be considered when assessing the significance of impacts, namely:

- Relationship of the impact to **temporal scales** - the temporal scale defines the significance of the impact at various time scales, as an indication of the duration of the impact.

- Relationship of the impact to **spatial scales** - the spatial scale defines the physical extent of the impact.

- The severity of the impact - the **severity/beneficial scale** is used in order to scientifically evaluate how severe negative impacts would be, or how beneficial positive impacts would be on a particular affected system (for ecological impacts) or a particular affected party.

  The **severity** of impacts can be evaluated with and without mitigation in order to demonstrate how serious the impact is when nothing is done about it. The word ‘mitigation’ means not just ‘compensation’, but also the ideas of containment and remedy. For beneficial impacts, optimization means anything that can enhance the benefits. However, mitigation or optimization must be practical, technically feasible and economically viable.

- The **likelihood** of the impact occurring - the likelihood of impacts taking place as a result of project actions differs between potential impacts. There is no doubt that some impacts would occur (e.g. loss of vegetation), but other impacts are not as likely to occur (e.g. vehicle accident), and may or may not result from the proposed development. Although some impacts may have a severe effect, the likelihood of them occurring may affect their overall significance.

- Each criterion is ranked with scores assigned as presented in the Table below to determine the **overall significance** of an activity. The criterion is then considered in two categories, viz. effect of the activity and the likelihood of the impact. The total scores recorded for the effect and likelihood are then read off the matrix presented in the Tables below, to determine the overall significance of the impact. The overall significance is either negative or positive.

  The significance scale is an attempt to evaluate the importance of a particular impact. This evaluation needs to be undertaken in the relevant context, as an impact can either be ecological or social, or both. The evaluation of the significance of an impact relies heavily on the values of the person making the judgment. For this reason, impacts of a social nature need to reflect the values of the affected society.

Cumulative Impacts

Cumulative impacts affect the significance ranking of an impact because the impact is taken in consideration of both onsite and offsite sources. For example, pollution making its way into a river from a development may be within acceptable national standards. Activities in the surrounding area may also create pollution which does not exceed these standards. However, if both onsite and offsite activities take place simultaneously, the total pollution level may exceed the standards. For this reason it is important to consider impacts in terms of their cumulative nature.

Seasonality

Although seasonality is not considered in the ranking of the significance, if may influence the evaluation during various times of year. As seasonality will only influence certain impacts, it will only be considered for these, with management measures being imposed accordingly (i.e. dust suppression measures being implemented during the dry season).

Table 3.1: Significance Rating Table.

Temporal Scale (The duration of the impact)	
Short term	Less than 5 years (many construction phase impacts are of a short duration).
Medium term	Between 5 and 20 years.
Long term	Between 20 and 40 years (from a human perspective almost permanent).
Permanent	Over 40 years or resulting in a permanent and lasting change that will always be there.
Spatial Scale (The area in which any impact will have an affect)	
Individual	Impacts affect an individual.
Localised	Impacts affect a small area of a few hectares in extent. Often only a portion of the project area.
Project Level	Impacts affect the entire project area.
Surrounding Areas	Impacts that affect the area surrounding the development
Municipal	Impacts affect either the Local Municipality, or any towns within them.
Regional	Impacts affect the wider District Municipality or the province as a whole.
National	Impacts affect the entire country.
International/Global	Impacts affect other countries or have a global influence.
Will definitely occur	Impacts will definitely occur.
Degree of Confidence or Certainty (The confidence with which one has predicted the significance of an impact)	
Definite	More than 90% sure of a particular fact. Should have substantial supportive data.
Probable	Over 70% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Only over 40% sure of a particular fact, or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact, or of the likelihood of an impact occurring.

Table 3.2: Impact Severity Rating.

Impact severity (The severity of negative impacts or how beneficial positive impacts would be on a particular affected system or affected party)	
Very severe	Very beneficial
An irreversible and permanent change to the affected system(s) or party(ies) which cannot be mitigated. For example the permanent loss of land.	A permanent and very substantial benefit to the affected system(s) or party(ies), with no real alternative to achieving this benefit. For example the vast improvement of sewage effluent quality.
Severe	Beneficial
Long term impacts on the affected system(s) or party(ies) that could be mitigated. However, this mitigation would be difficult, expensive or time	A long term impact and substantial benefit to the affected system(s) or party(ies). Alternative ways of achieving this benefit would be difficult,

consuming, or some combination of these. For example, the clearing of forest vegetation.	expensive or time consuming, or some combination of these. For example an increase in the local economy.
Moderately severe	Moderately beneficial
Medium to long term impacts on the affected system(s) or party(ies), which could be mitigated. For example constructing the sewage treatment facility where there was vegetation with a low conservation value.	A medium to long term impact of real benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are equally difficult, expensive and time consuming (or some combination of these), as achieving them in this way. For example a 'slight' improvement in sewage effluent quality.
Slight	Slightly beneficial
Medium or short term impacts on the affected system(s) or party(ies). Mitigation is very easy, cheap, less time consuming or not necessary. For example a temporary fluctuation in the water table due to water abstraction.	A short to medium term impact and negligible benefit to the affected system(s) or party(ies). Other ways of optimising the beneficial effects are easier, cheaper and quicker, or some combination of these.
No effect	Don't know/Can't know
The system(s) or party(ies) is not affected by the proposed development.	In certain cases it may not be possible to determine the severity of an impact.

Table 3.3: Overall Significance Rating.

Overall Significance **(The combination of all the above criteria as an overall significance)**	
VERY HIGH NEGATIVE	VERY BENEFICIAL
These impacts would be considered by society as constituting a major and usually permanent change to the (natural and/or social) environment, and usually result in **severe** or **very severe** effects, or **beneficial** or **very beneficial** effects. **Example:** The loss of a species would be viewed by informed society as being of VERY HIGH significance. **Example:** The establishment of a large amount of infrastructure in a rural area, which previously had very few services, would be regarded by the affected parties as resulting in benefits with VERY HIGH significance.	
HIGH NEGATIVE	BENEFICIAL
These impacts will usually result in long term effects on the social and/or natural environment. Impacts rated as HIGH will need to be considered by society as constituting an important and usually long term change to the (natural and/or social) environment. Society would probably view these impacts in a serious light. **Example:** The loss of a diverse vegetation type, which is fairly common elsewhere, would have a significance rating of HIGH over the long term, as the area could be rehabilitated. **Example:** The change to soil conditions will impact the natural system, and the impact on affected parties (such as people growing crops in the soil) would be HIGH.	
MODERATE NEGATIVE	SOME BENEFITS
These impacts will usually result in medium to long term effects on the social and/or natural environment. Impacts rated as MODERATE will need to be considered by society as constituting a fairly important and usually medium term change to the (natural and/or social) environment. These impacts are real but not substantial. **Example:** The loss of a sparse, open vegetation type of low diversity may be regarded as MODERATELY significant.	
LOW NEGATIVE	FEW BENEFITS
These impacts will usually result in medium to short term effects on the social and/or natural environment. Impacts rated as LOW will need to be considered by the public and/or the specialist as constituting a fairly unimportant and usually short term change to the (natural and/or social) environment. These impacts are not substantial and are likely to have little real effect. **Example:** The temporary changes in the water table of a wetland habitat, as these systems are adapted to fluctuating water levels. **Example:** The increased earning potential of people employed as a result of a development would only result in benefits of LOW significance to people who live some distance away.	
NO SIGNIFICANCE	
There are no primary or secondary effects at all that are important to scientists or the public. **Example:** A change to the geology of a particular formation may be regarded as severe from a geological perspective, but is of NO significance in the overall context.	

DON'T KNOW
In certain cases it may not be possible to determine the significance of an impact. For example, the primary or secondary impacts on the social or natural environment given the available information. **Example:** The effect of a particular development on people's psychological perspective of the environment.

4 DESCRIPTION OF THE BIOPHYSICAL ENVIRONMENT

In terms of Appendix 6 of the Amended EIA Regulations (2017) a specialist report must contain-

(f)Details of an assessment of a specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure inclusive of a site plan identifying alternatives;
(g) An identification of any areas to be avoided, including buffers;
(h) A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

4.1 Desktop Investigation

Published literature on the ecology of the area was referenced in order to describe the study site in the context of the region and the North West Province. The following documents/plans are referenced:

- The National Spatial Biodiversity Assessment (2004);
- North West Biodiversity Sector Plan (2015);
- The National Freshwater Ecosystems Protected Areas Programme (2011);
- Department of Water and Sanitation Desktop Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) Model (2014); and
- Department of Water Affairs and Forestry: Level 2 River Ecoregional Classification System for South Africa, Lesotho and Swaziland (2007).

Wetlands in the region were identified using:

- Satellite imagery (Google Earth); and
- NFEPA wetland shapefiles.

4.1.1 Rivers

The affected rail section is located within the quaternary catchment A22F (primary catchment A) and falls within Water Management Area (WMA) 3, the Crocodile West and Marico region (Figure 4.1). The rail section does not traverse any NFEPA Rivers (Figure 4.2) and only one non-perennial drainage line crosses the study area.

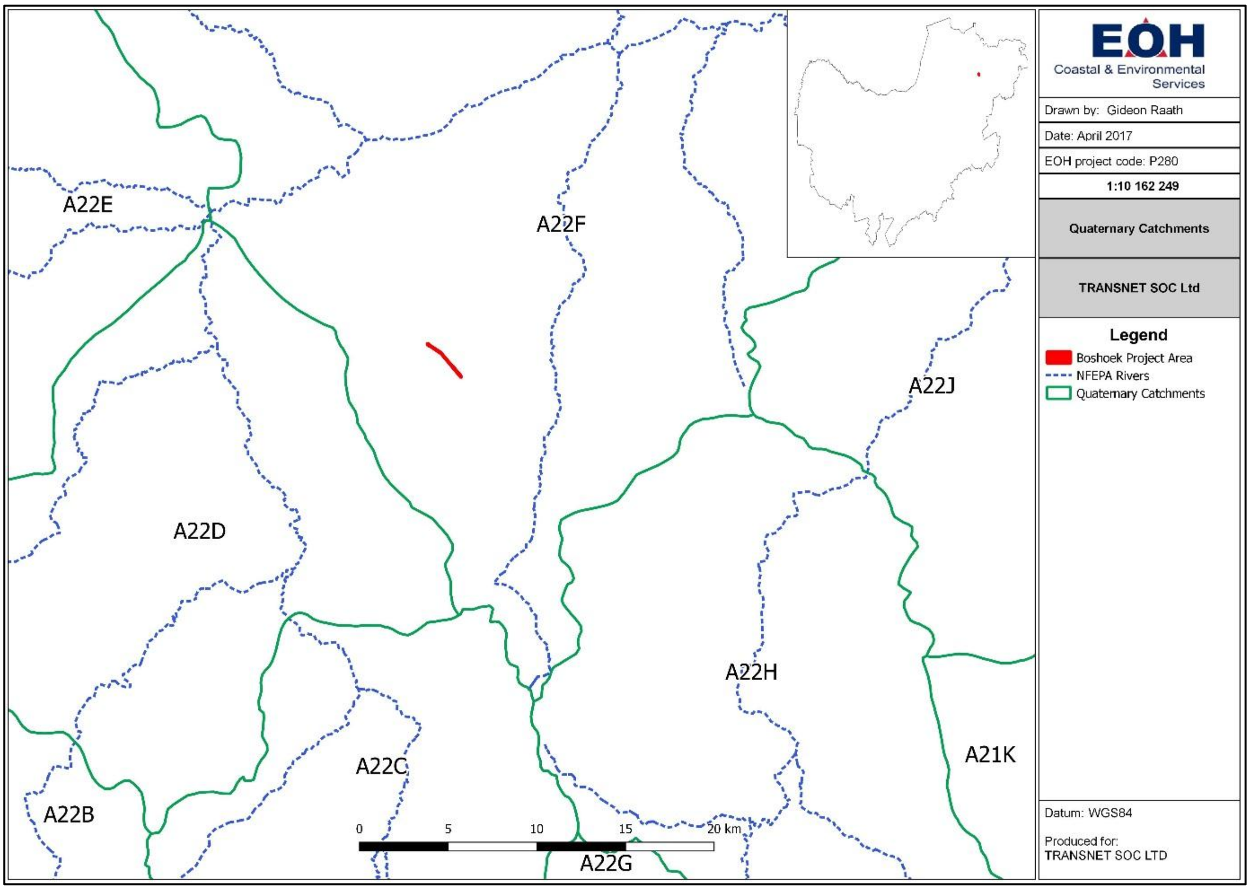

Figure 4.1: Quaternary catchment and broader hydrological setting within which the project area (red) is located.

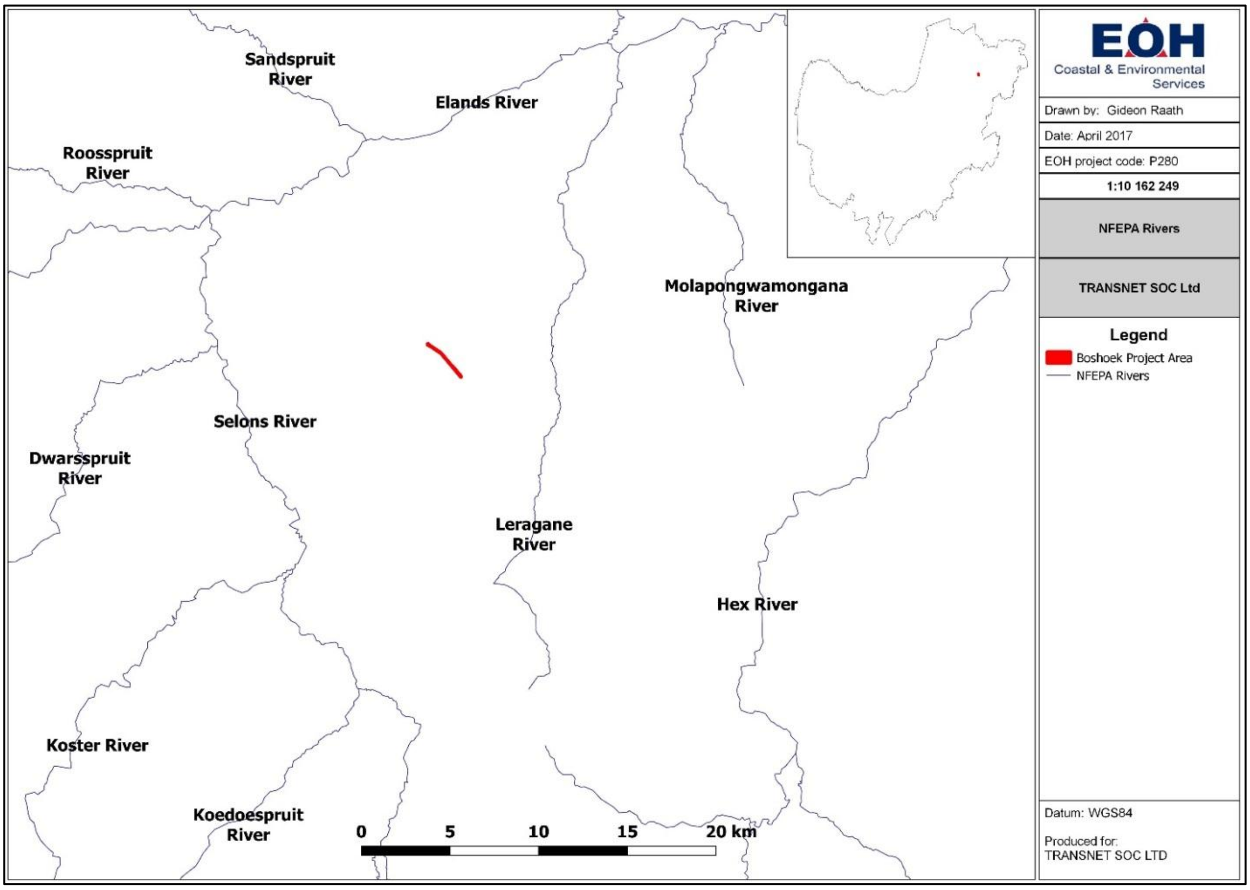

Figure 4.2: Affected rivers in the study area.

4.1.2 The National Spatial Biodiversity Assessment (2004)

The National Spatial Biodiversity Assessment of 2004 is a framework document within which fine-scale conservation planning in identified priority areas should occur. The NSBA integrates terrestrial, river, marine, estuarine and wetland ecosystems using available spatial data, relevant conservation planning software and a series of expert and stakeholder workshops. It is important to note that the NSBA was conducted at a national scale (1:250 000), and thus can only provide a general context for biodiversity assessments at a local level.

An important tool used in the NSBA is conservation status. Conservation status aims at identifying threatened ecosystems, and is based on the classification scheme developed by the IUCN to categorise species. Of the 120 rivers in South Africa that have been classified using this categorisation, 44 % are critically endangered, 27 % are endangered, 11 % are vulnerable and 18 % are least threatened. All the rivers identified in the broader region of the study area have been listed as **CRITICALLY ENDANGERED** (Figure 4.3). Critically endangered ecosystems have lost so much of their original natural habitat that ecosystem functioning has broken down and species associated with the ecosystem have been lost or are likely to be lost. Endangered ecosystems have lost significant amounts of their original natural habitat, so their functioning is compromised. Of South Africa's 120 river heterogeneity signatures, 44% are critically endangered.

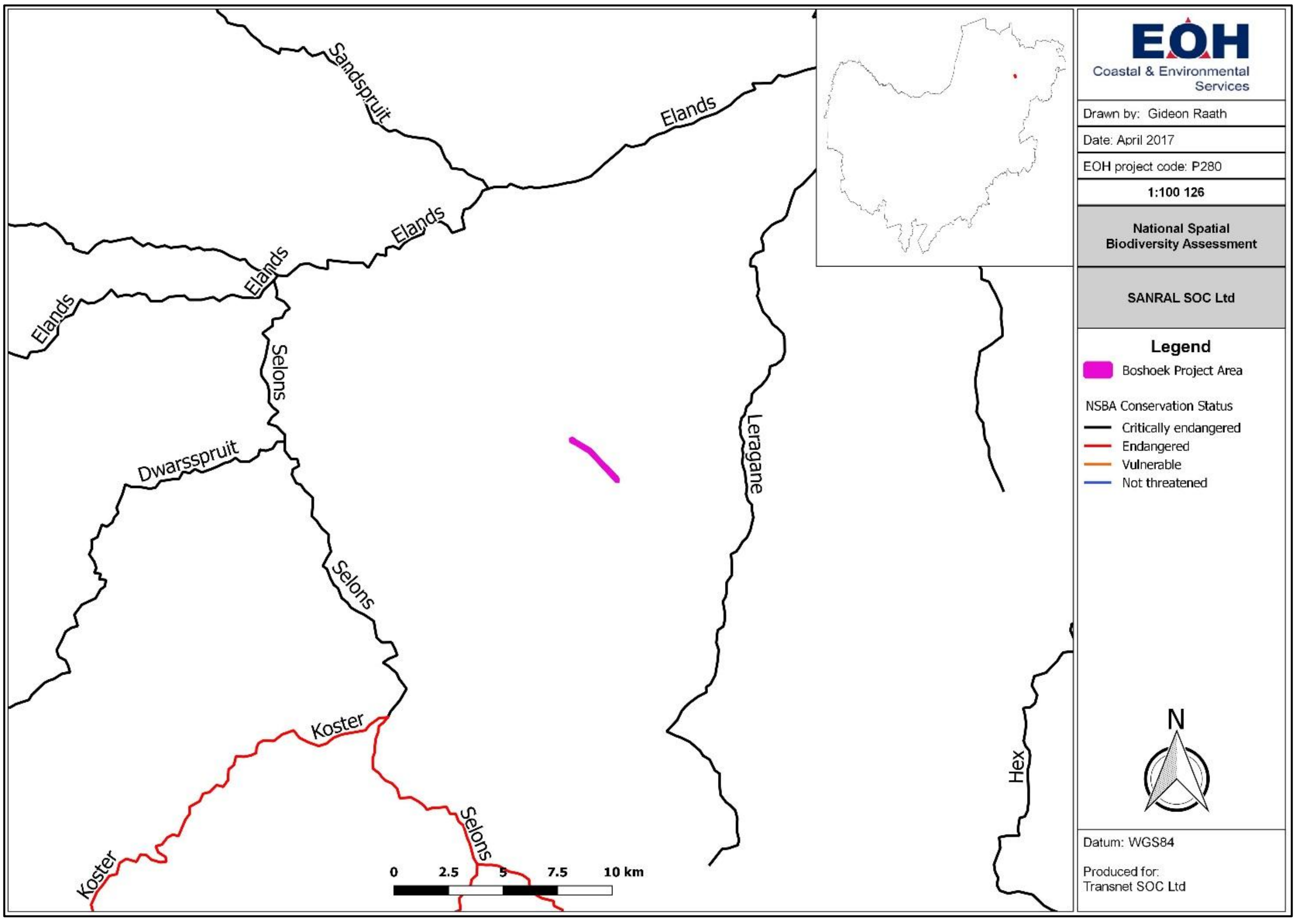

Figure 4.3: Conservation status of the rivers in the broader region (NSBA, 2004).

4.1.3 National Freshwater Ecosystem Priority Areas (NFEPA), 2011-2014

The National Freshwater Ecosystem Priority Areas (NFEPA) project provides strategic spatial priorities for conserving South Africa's freshwater ecosystems and supports sustainable use of water resources. These priority areas are called Freshwater Ecosystem Priority Areas, or 'FEPAs'.

FEPAs were identified based on:

- Representation of ecosystem types and flagship free-flowing rivers;
- Maintenance of water supply areas in areas with high water yield;
- Identification of connected ecosystems;
- Representation of threatened and near-threatened fish species and associated migration corridors;
- Preferential identification of FEPAs that overlapped with:
    - Any free-flowing river
    - Priority estuaries identified in the National Biodiversity Assessment 2011
    - Existing protected areas and focus areas for protected area expansion identified in the National Protected Area Expansion Strategy.

The NFEPA Rivers within the study area have been classified as FEPA code 0, i.e. not classified (Figure 4.4).

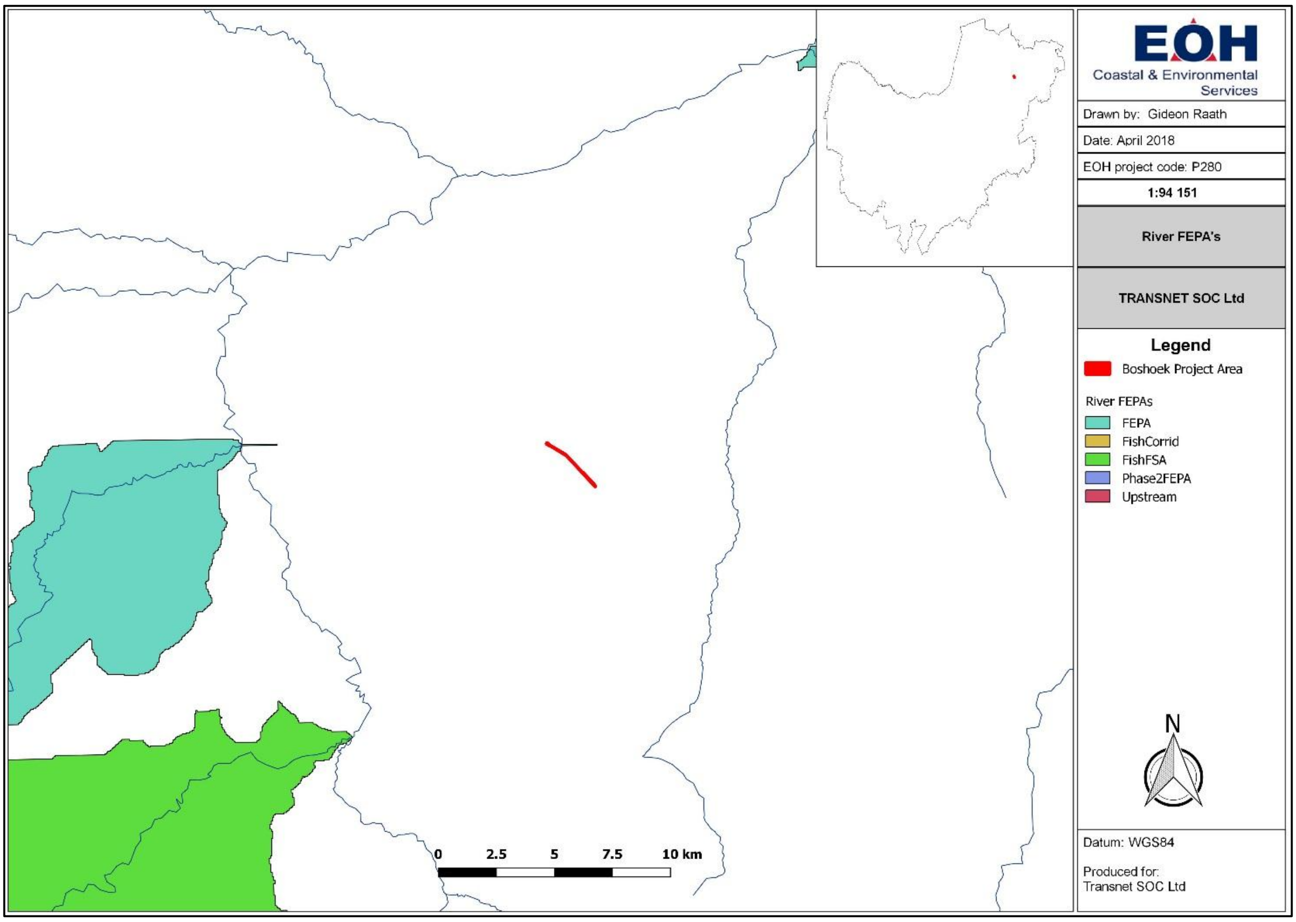

Figure 4.4: Freshwater Ecosystem Priority Area status of the rivers in the study area (NFEPA, 2011-2014).

4.1.4 Present Ecological State (PES)

As no NFEPA rivers or natural wetlands occur within the study area, no desktop assessment of the Present Ecological State (PES), Ecological Importance (EI) and Ecological Sensitivity (ES) of these features could be made. A site specific PES and EIS has however been included into the following chapters.

4.1.5 The North West Biodiversity Sector plan (2015)

The North West Biodiversity Sector Plan identifies a network of Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) in the province based on a systematic biodiversity plan. Collectively, the CBAs and ESAs cover 57% of the province (BGIS, 2018). These were first identified in the North West Biodiversity Conservation Assessment (DACERD, 2009), and are comprehensively re-assessed and updated for this plan. This Biodiversity Sector Plan therefore represents the most current information available on biodiversity in the province and is an update of the data given in the NW Environment Outlook Report (2013) and other assessments that precede it, such as the National Biodiversity Assessment (2011), the National Freshwater Ecosystem Priority Assessment (2011-2014) (BGIS, 2018).

The Provincial Biodiversity Sector Plan is intended to be the biodiversity sector's input into government sector planning and development processes. The aim of the Biodiversity Sector Plan is to identify the minimum area necessary to conserve and maintain biodiversity and major ecological infrastructure in the province (BGIS, 2018). Where possible, it is spatially aligned with other relevant spatial plans for the province, such as the Provincial Spatial Development Framework and gazetted Environmental Management Frameworks (BGIS, 2018).

According to the metadata sheet for the Biodiversity Sector plan, the following categories were mapped, and are described as below (Table 4.1).

Table 4.1: North West Biodiversity Sector Plan classification metadata.

Field	Criterion Description	Description of biodiversity features used to define CBA Map Category	CBA Designation
CBA_W 1	FEPA Rivers (including FEPA rivers, Phase2FEPAs, Sanctuary and Freeflow rivers) and river buffers 100m	All FEPA river lines (FEPA rivers, fish sanctuary and free-flowing rivers) buffered by 100 m as identified in NFEPA and modified by DWS National River Ecostatus Monitoring Program (REMP) and experts.	CBA1 (river) and CBA2 (buffer)
CBA_W 2	Wetlands, instream (Nacelles model)	Modelled instream wetlands based on the SRTMv3 90m DEM.	ESA2
CBA_W 2_1	Pans (modelled NOT from FEPA layer)	Modelled Wetlands: Pans, instream wetlands and riparian areas modelled from a digital terrain model.	CBA1
CBA_W 3	FEPA catchments	FEPA Fish Catchments: Catchments supporting FEPA fish rivers.	ESA1 if natural, ESA2 if not natural
CBA_W 4	Pan clusters (modelled)	Wetland/Pan Clusters: Clusters of larger wetlands and pans and their collective buffer (500 m).	ESA1 if natural, ESA2 if not natural
CBA_W 5	Strategic water recharge areas (dolomite recharge areas)	Strategic Water Resource Areas) Dolomite Recharge Area: The karst landscape of central North West around which all major eyes emerge and based on topography is the most likely area for the dolomitic aquifer recharge zone.	ESA1 if natural, ESA2 if not natural
CBA_W 6	Peat wetlands	Important Habitats: Peat wetlands as mapped by experts.	CBA1
CBA_W 7	Peat wetland buffers 500m	Peat Wetland Buffers: 500 m buffer around peat wetlands.	ESA1
CBA_W 8	Expert areas from 2008 conservation assessment	Expert mapped important aquatic features as used in the 2008 NW Biodiversity Assessment.	CBA1
CBA_W 9	Dolomitic eyes and Tufa points buffered by 500m, selected PUs	Important Habitats: Dolomitic eyes as mapped by experts.	CBA1 if natural, ESA2 if not natural

The following land use guidelines have been set for the various aquatic and terrestrial CBA categories, which thus inform the suitable development types and extent for each of the categories. The blue highlighted cells indicate the management objective applicable to this project and this report.

Table 4.2: Land Use guidelines.

CBA MAP CATEGORY	LAND MANAGEMENT OBJECTIVE
Protected Area	As per protected area management plan
Critical Biodiversity Area 1 (CBA 1)	Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process: • Ecosystems and species fully or largely intact and undisturbed. • These are areas with high irreplaceability or low flexibility in terms of meeting biodiversity pattern targets. If the biodiversity features targeted in these areas are lost then targets will not be met. • These are biodiversity features that are at, or beyond, their limits of acceptable change.
Critical Biodiversity Area 2 (CBA 2)	Maintain in a natural or near-natural state that maximises the retention of biodiversity pattern and ecological process: • Ecosystems and species fully or largely intact and undisturbed. • Areas with intermediate irreplaceability or some flexibility in terms of meeting biodiversity targets. There are options for loss of some components of biodiversity in these landscapes without compromising the ability to achieve biodiversity targets, although loss of these sites would require alternative sites to be added to the portfolio of CBAs. • These are biodiversity features that are approaching but have not passed their limits of acceptable change.
Ecological Support Area 1 (ESA 1)	Maintain in at least a semi-natural state as ecologically functional landscapes that retain basic natural attributes: • Ecosystem still in a natural, near-natural state or semi-natural state, and has not been previously developed. • Ecosystems moderately to significantly disturbed but still able to maintain basic functionality. • Individual species or other biodiversity indicators may be severely disturbed or reduced. • These are areas with low irreplaceability with respect to biodiversity pattern targets only.
Ecological Support Area 2 (ESA 2)	Maintain as much ecological functionality as possible (generally these areas have been substantially modified): • Maintain current land use or restore area to a natural state. • Ecosystem NOT in a natural or near-natural state, and has been previously developed (e.g. ploughed). • Ecosystems significantly disturbed but still able to maintain some ecological functionality. • Individual species or other biodiversity indicators are severely disturbed or reduced and these are areas that have low irreplaceability with respect to biodiversity pattern targets only. • These are areas with low irreplaceability with respect to biodiversity pattern targets only. These areas are required to maintain ecological processes especially landscape connectivity.
Other Natural Areas and No Natural Habitat Remaining	Production landscapes: • Manage land to optimise sustainable utilisation of natural areas.

The study area falls within an Aquatic ESA 1 area linked to one of the tributaries of the Eland's River (Figure 4.5).

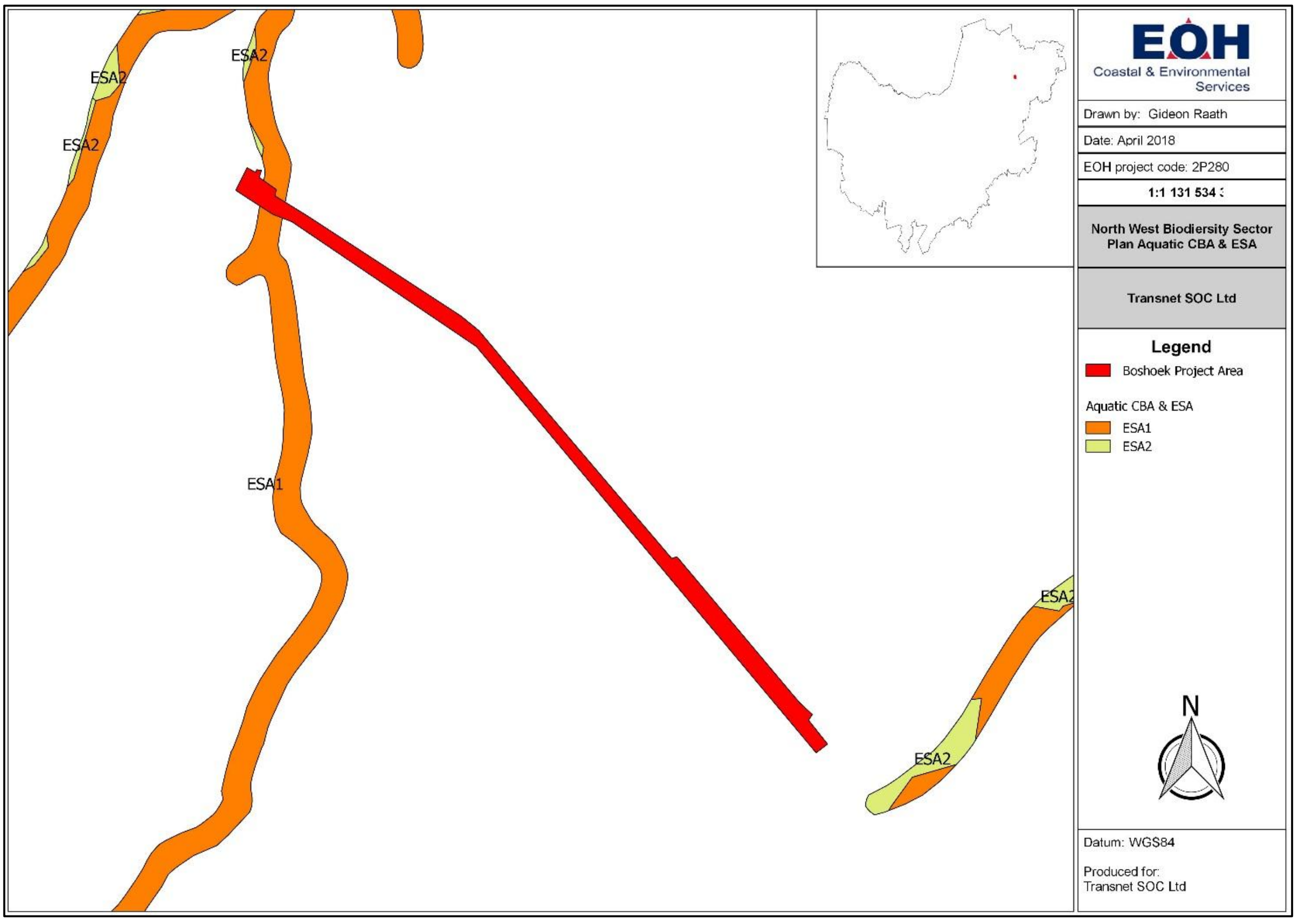

Figure 4.5: Aquatic Critical Biodiversity Areas for the study area (ECBCP, 2007).

4.1.6 Ecoregions

South Africa is a geologically, geomorphologically, climatically and ecologically complex country, and this has resulted in a diverse range of ecosystems, including rivers. River ecoregional classification or typing allows the grouping of rivers according to similarities based on a top-down nested hierarchy. The principle of river typing is that rivers grouped together at a particular level of the typing hierarchy will be more similar to one another than rivers in other groups. Ecological regions are regions within which there is relative similarity in the mosaic of ecosystems and ecosystem components (biotic and abiotic, aquatic and terrestrial).

According to the Department of Water Affairs and Forestry (2005) Level 2 River Ecoregional Classification System, the study area falls within **Ecoregion 07.05: Western Bankenveld.**

This ecoregion has the following characteristics, according to Kleynhans, Thirion & Moolman (2005):

> *"This region has a complex topography that varies from lowlands, hills and mountains to closed hills and mountains with the relief varying from moderate to high. Although various Bushveld and Grassland types occur, Mixed Bushveld is the most definitive vegetation type of the region.*
>
> *Several rivers traverse this region, e.g. the Marico, the Crocodile (west), the Elands (west) and the Pienaars. Some perennial tributaries of these rivers rise in the southern part of the region in particular. The perennial tributary of the Sand River has its source in the northern part of the region"* (Kleynhans, Thirion & Moolman 2005, p. 26-27).

- Mean annual precipitation: Low to moderate.
- Coefficient of variation of annual precipitation: Moderate.

- Drainage density: Moderate but low in parts.
- Stream frequency: Low to medium.
- Slopes <5%: Varies from <20%, 20-50%, 60-80% and in few cases >80%.
- Median annual simulated runoff: Moderate/low to moderate.
- Mean annual temperature: Moderate to hot in limited areas.

Table 4.3: Main attributes of the Western Bankenveld Ecoregion 07.05 (Kleynhans, Thirion & Moolman 2005, p. 26-27).

Main Attributes	Western Bankenveld Ecoregion 07.05
Terrain Morphology: Broad division (dominant types in bold) (Primary)	Plains; Low Relief; Plains; Moderate Relief; **Lowlands; Hills and Mountains; Moderate and High Relief;** **Open Hills; Lowlands; Mountains; Moderate to High Relief;** **Closed Hills; Mountains; Moderate and High Relief;**
Vegetation types (dominant types in bold) (Primary)	**Waterberg Moist Mountain Bushveld; Mixed Bushveld;** Kalahari Plains Thorn Bushveld (limited); Clay Thorn Bushveld; (limited) Rocky Highveld Grassland; Dry Clay Highveld Grassland; (limited)
Altitude (m above sea-level) ((Modifying)	400 to 700
Coefficient of Variation (% of annual precipitation)	20 to 35
Rainfall concentration index	60 to >65
Rainfall seasonality	Early to mid-summer
Mean annual temp. (°C)	14 to 22
Mean daily max. temp. (°C): February	24 to 32
Mean daily max. temp. (°C): July	14 to 24
Mean daily min. temp. (°C): February	12 to 20
Mean daily min temp. (°C): July	0 to 6
Median annual simulated runoff (mm) for quaternary catchment	20 to 80, 80 to 100 (limited)

4.1.7 Wetlands

Wetlands in South Africa have been mapped on a broad-scale by various stakeholders and have been included in the National Freshwater Ecosystem Priority Assessment (NFEPA, 2011-2014). Due to the broad-scale nature of the NFEPA map it is not spatially accurate and therefore some error is expected. The location of NFEPA wetlands was derived from the National Land Cover 2000 (Van Den Berg *et al*., 2008) and inland water features from the Department of Land Affairs' Chief Directorate: Surveys and Mapping (DLA-CDSM). All wetlands are classified as either 'natural' or 'artificial' water bodies.

The NFEPA wetland map identifies important or sensitive wetlands and wetland clusters. A wetland cluster is a group of wetlands all within 1 km of each other and which are surrounded by relatively natural vegetation. Figure 4.6 indicates the wetlands listed in the inventory surrounding the study area, along with a 500 m regulatory buffer around each visible wetland. In addition, each wetland is shown to be either artificial or natural. Only one (1) **artificial** wetland was found to occur within 500 m of the rail (i.e. within 500 m of the project area).

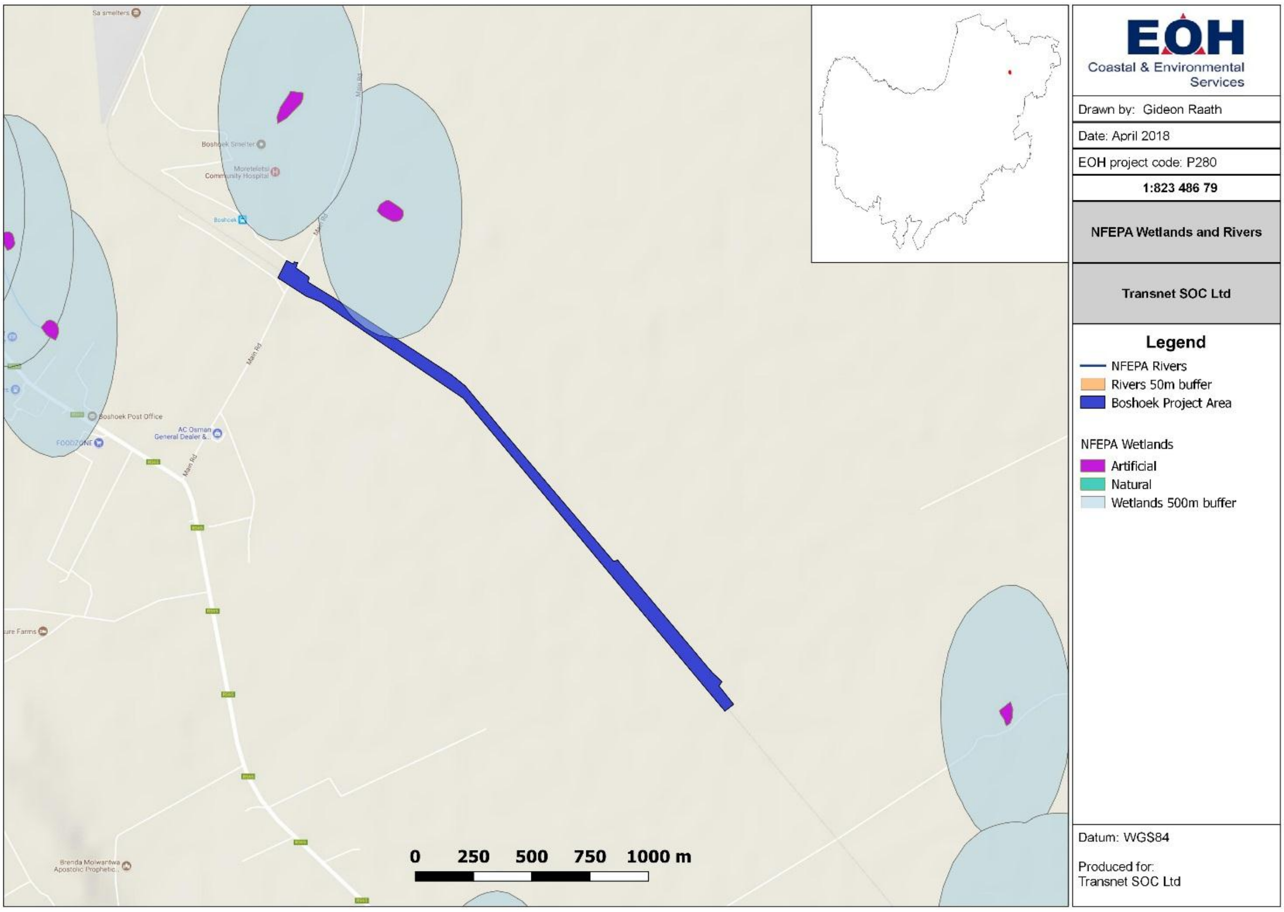

Figure 4.6: NFEPA Wetland map, with 500 m regulatory buffer and showing artificial (pink) and natural (blue) wetlands).

Table 4.4 lists the artificial NFEPA wetland within 500 m of the project region.

Table 4.4: NFEPA wetland classification for the wetland within the study area.

Wetland	Level 3: Landscape Unit	Level 4: HGM Unit	
	Landscape setting	HGM Type	Wetland Type
Wetland 1	Slope	Seep	Central Bushveld Group 2 Seep

4.2 Collection of site data

Information on the project area and surrounding environments was gathered during the site visit in March 2018. The data gathering process involved ground-truthing the desktop study area, delineating wetlands observed within the study area and assessing the current ecological state of the environment. This included describing the following features:

- Possible impacts on the aquatic environment;
- Proximity and description of watercourses or wetlands.

4.3 Present Ecological State

The PES, Ecosystem Functions and EIS are not normally assessed for artificial wetlands, as these habitats are not considered to be priority wetlands or wetlands with high biodiversity value. Standard practice is to conduct these assessments if the wetland habitat is considered important. However, over time an artificially created wetland could become an integral part of a new hydrological scheme while providing some valuable ecosystem services. The one wetland found within 500 m of the rail is deemed an artificial wetland (dam) by the NFEPA database. The PES of this wetland was thus not assessed. According to the NFEPA wetland database the wetland condition of this wetland is classified as **Z3: heavily to critically modified**.

4.4 Site survey

4.4.1 Site description

The site is a very narrow strip of railway, bounded by the rail reserve on either side of the railroad track, which is connected and accessible via a single dirt, service road running adjacent to the track along the northern side of the rail. The railway reserve is a maximum of 15 m on either side of the existing track, however due to the additional loop being proposed, another 3 m section towards the north of the track will be required. This will allow for sufficient space to develop the loop track (on the exact footprint of the existing service road), and then to extend the service road northwards (by 3 m – one single car road width), to allow for future servicing of both these rails.

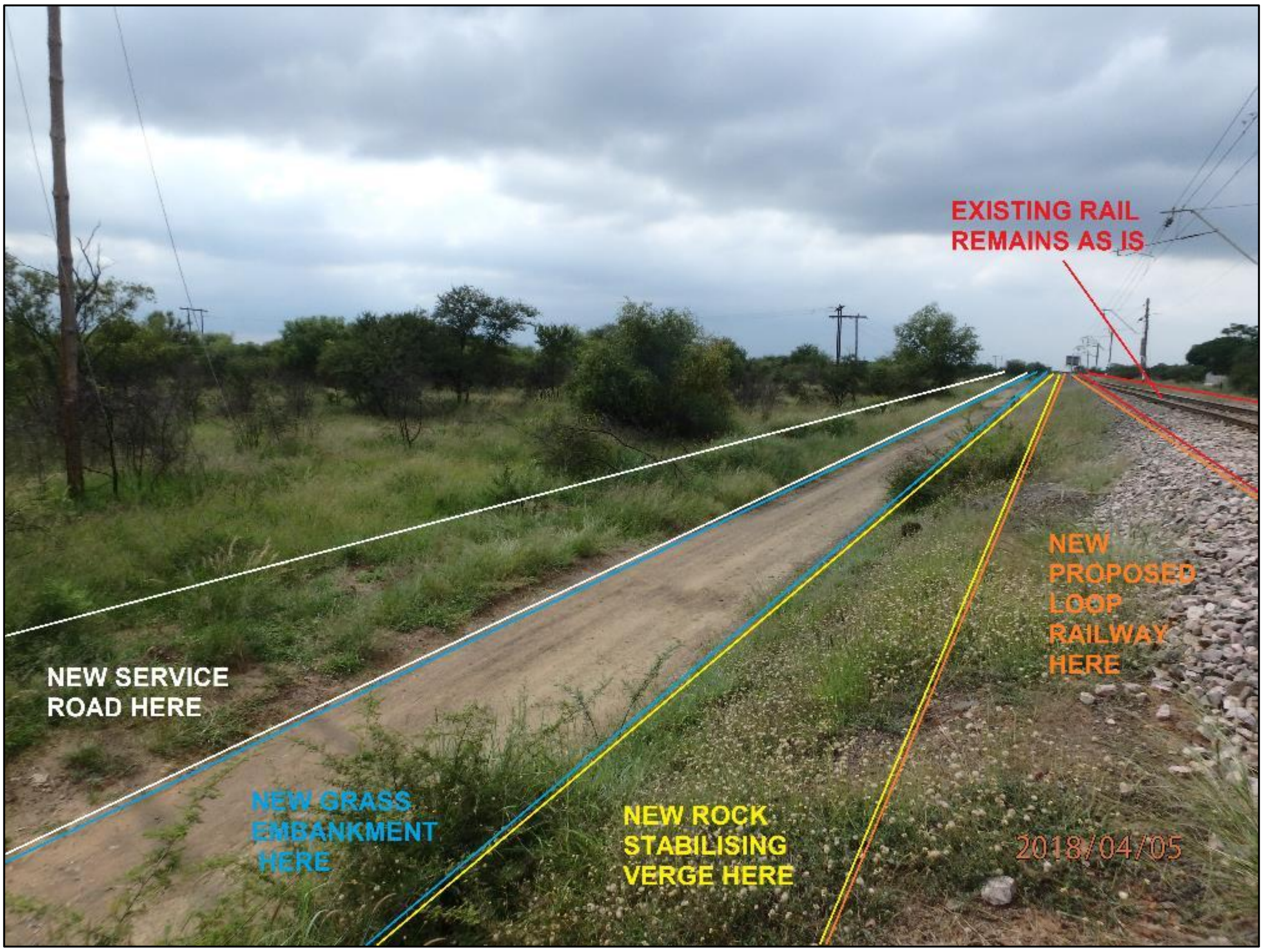

Figure 4.7: Pictorial illustration of the proposed works.

Figure 4.7 above indicates the proposed works on a picture of the existing infrastructure, as a guide to the development proposal. Figure 4.8 and 4.9 below further shows the current layout and the proposed layout for the new loop and the new service road from an aerial perspective. Please note, in all cases the new loop is proposed to be developed adjacent to the existing track. In order to do so, the existing rock stabilising verge, the embankment (usually grassed) on which the existing track is located must then also be extended, and the access/service road thus also needs to be placed one lane width towards the outer boundary of the rail reserve.

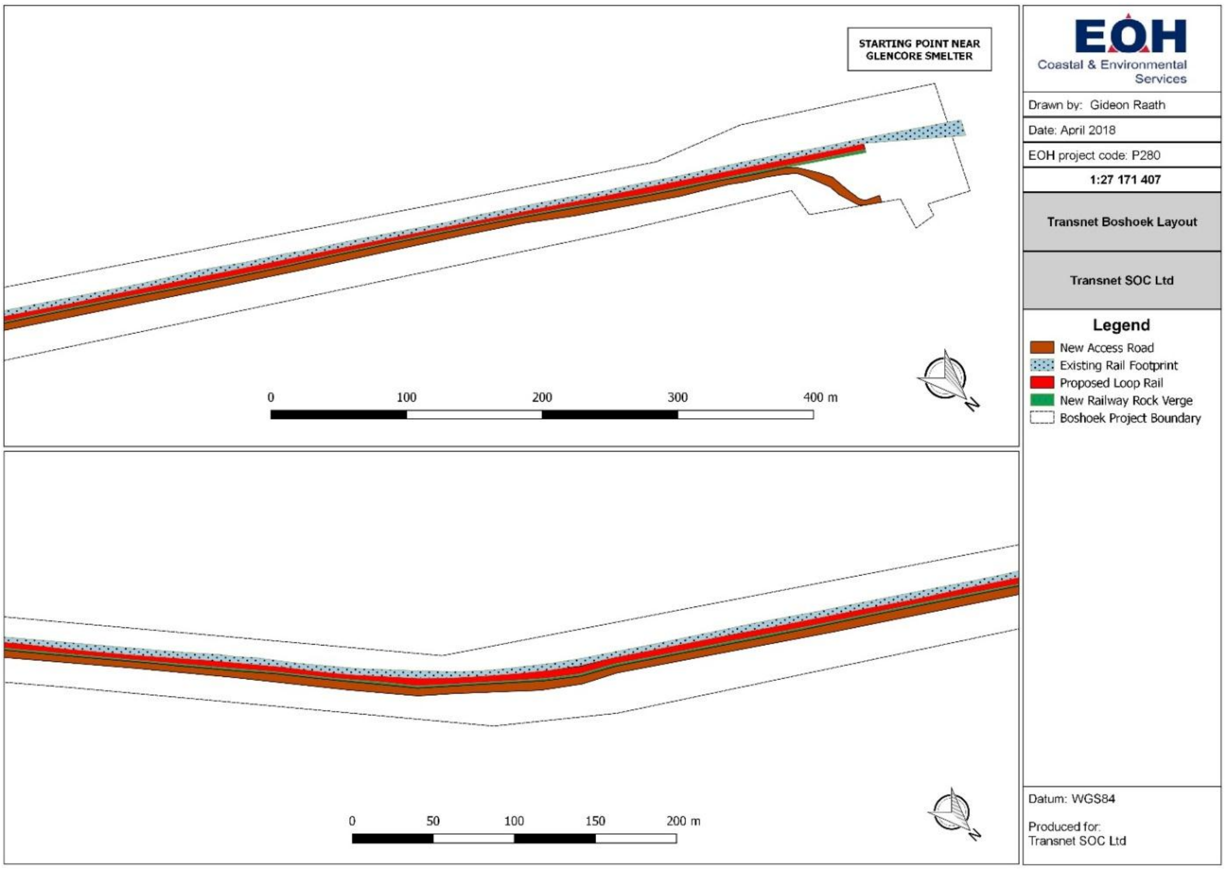

Figure 4.8: Layout map showing the existing rail footprint, the proposed new loop rail and rock verge footprint, as well as the overall project boundary.

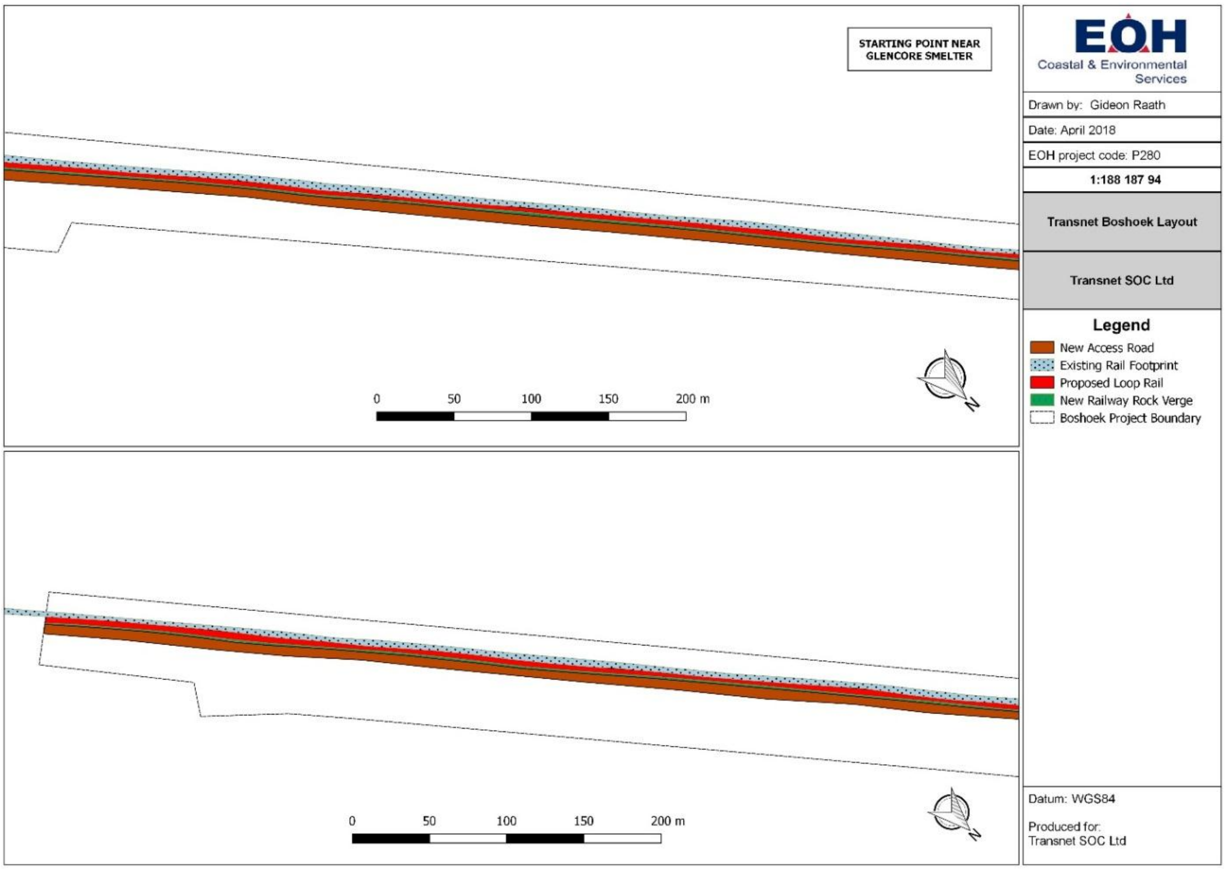

Figure 4.9: Layout map showing the existing rail footprint, the proposed new loop rail and rock verge footprint, as well as the overall project boundary.

At present, five minor drainage lines cross the railway, which receives their main water input from runoff from culverts along the road, allowing for flow during high rainfall events underneath the railway. These can be seen on Figure 4.10, numbered from 1 through 5. Furthermore, nearest the Glencore smelter, a railway bridge is located over a non-perennial river, which runs for a very short period of time during the year (numbered 6 on Figure 4.10 below). During the field survey, the river was dry despite the survey having occurred during the latter part of the wet season). Towards the opposite end of the rail (project site), a small man-made wetland has developed due to the ponding of water between the existing service road, and the Glencore dirt road (visible on the northern side of the road on Figure 4.10, at culvert location 1).

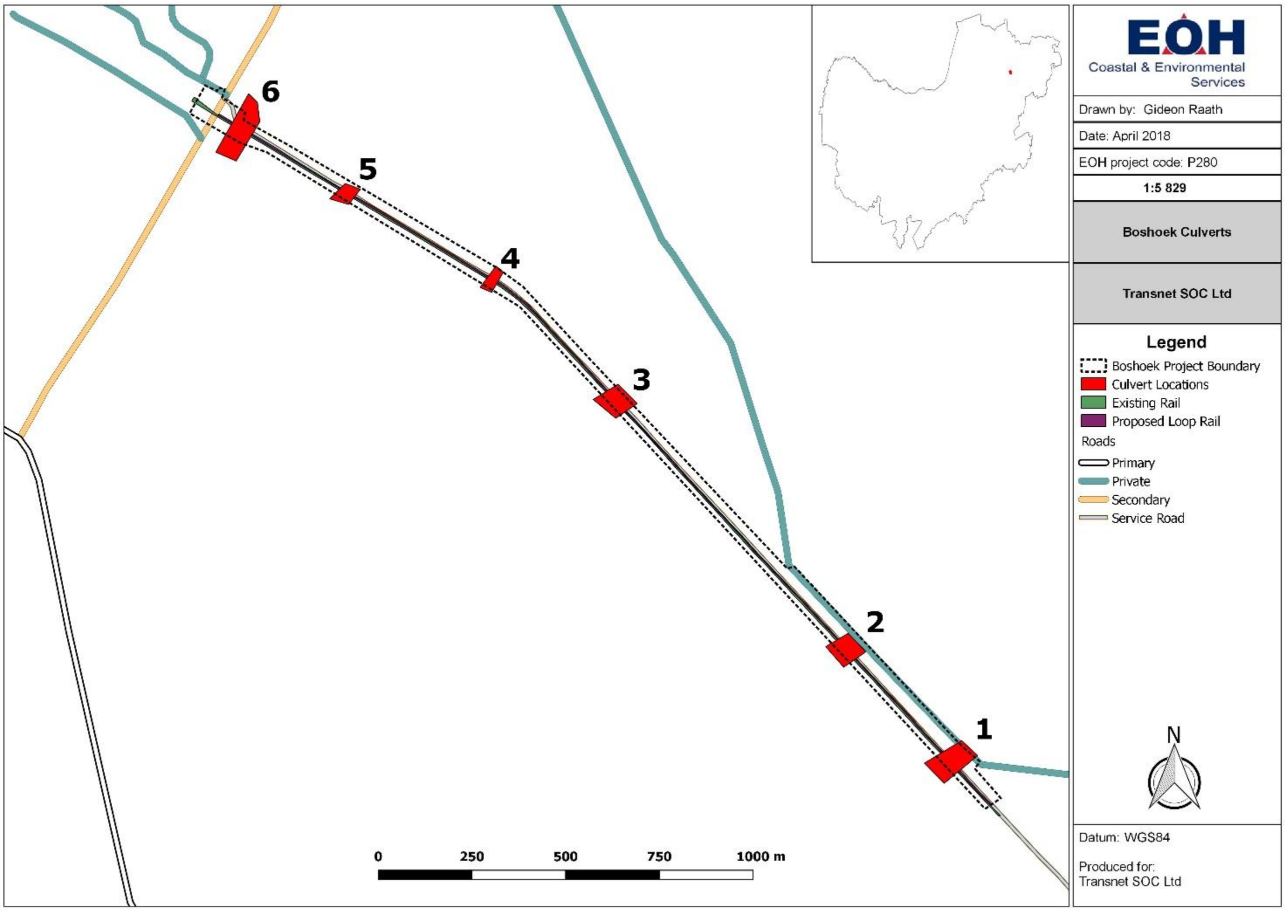

Figure 4.10: Culvert locations along the existing railroad.

Below is a photo sequence showing the one affected river and the culvert locations along the route.

The rail bridge over the existing river near the Glencore smelter end of the project area (No 6 on Figure 4.10). GPS coordinates: 25°29'52.24"S, 27° 6'13.52"E.

Vegetation immediately adjacent the railroad at culvert No.5 (on Figure 4.10). GPS coordinates: 25°29'58.03"S, 27° 6'22.99"E.

Drainage line filled with terrestrial vegetation immediately adjacent the railroad at culvert No. 4 (on Figure 4.10). GPS coordinates: 25°30'5.46"S, 27° 6'35.39"E.

Drainage line filled with terrestrial vegetation immediately adjacent the railroad at culvert No. 3 (on Figure 4.10). GPS coordinates: 25°30'16.03"S, 27° 6'46.17"E.

Drainage line filled with terrestrial vegetation immediately adjacent the railroad at culvert No. 2 (on Figure 4.10). GPS coordinates: 25°30'37.41"S, 27° 7'5.99"E.

Drainage line filled with aquatic vegetation immediately adjacent the railroad at culvert No. 1 (on Figure 4.10). GPS coordinates: 32°48'7.48"S, 26°46'47.90"E.

View towards the road across the upper artificial wetland, located at culvert No. 1 (on Figure 4.10). GPS coordinates: 25°30'46.99"S, 27° 7'15.31"E.

General view of the railway verge on the side without the access road (i.e. southern facing side). Note the rock verge used to stabilise the tracks.

General view of the railway on the northern facing side, with access road present.

General view of the existing railway line.

Current access road to the site (also designated as the service road for rail repairs).

5 WETLAND DELINEATION

5.1 Field survey and delineation

As per the DWAF (2005) methodology, an initial desktop survey of the site was conducted, to evaluate the presence and/or absence of any wetland units within the study area. Examination of historical aerial imagery and the design plans for the development indicated a possible 6 locations for wetlands, locations 1 – 6 on Figure 4.10 in the chapter above.

During fieldwork, it was confirmed that only two of those locations (number 1 and number 6 on Figure 4.10) contained wetlands (further shown on opposite ends of the existing rail line in Figure 5.1), based on the vegetation and soil characteristics observed on site. Confirmatory visits and single point soil samples were taken for the remainder of the site (numbers 2-5 on Figure 4.10), which indicated a clear absence of hydric soil conditions and no aquatic vegetation, thus eliminating any possible wetland classification within those areas.

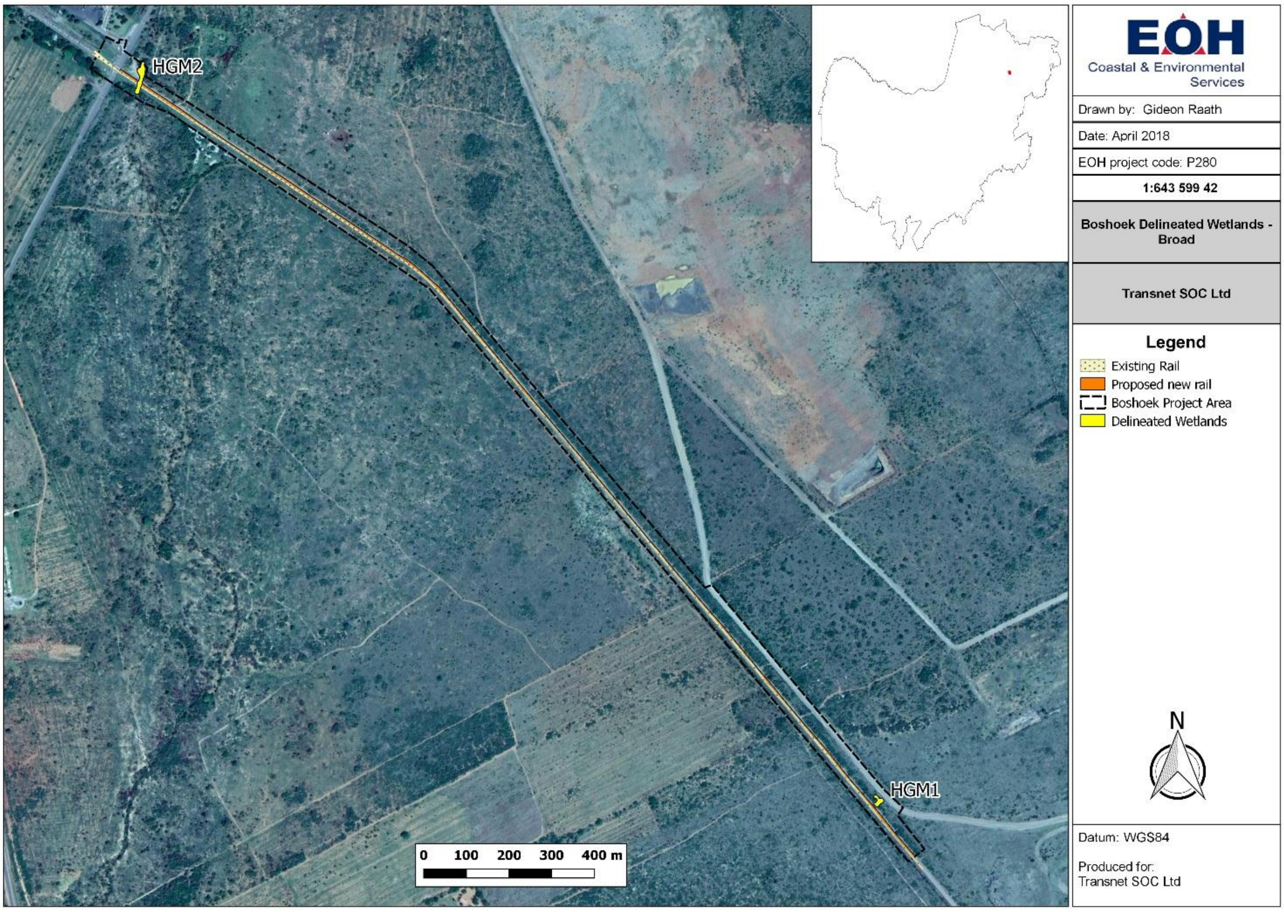

Figure 5.1: Map illustrating the delineated wetlands found on site.

Subsequently, soil and vegetation sampling was carried out along transects across the previously identified potential wetlands at locations 1 and 6 of Figure 4.10 within the study area. At each sample point, soil was sampled at 0-50 cm depth and dominant vegetation within a 5 m radius of the sample point was recorded. The value and chroma was recorded for each soil sample according to the Munsell Soil Colour Chart, as well as the degree and colour of mottling (or any other redoximorphic characteristics). At each sampling point, a hand-held Garmin E-trex GPS (with 3 metre average horizontal accuracy) was used to capture the location.

5.2 Wetland classification

The two wetland units were then classified according to the SANBI (2009) wetland classification system, and divided into two distinct hydrogeomorphic units (HGM), for analysis in the WET-Health and WET-Ecosystems services assessments.

The HGM unit principle incorporates the hydrology and geomorphology of a region as they are the major determinants of how a wetland ecosystem functions, and can consequently be used for identification (Ollis *et al*. 2013). Six tiers are used to determine the unit type, according to Ollis *et al*. (2013):

1. Marine, estuarine or inland;
2. Regional setting;
3. Landscape units;
4. Hydrogeomorphic unit;
5. Hydrological regime; and
6. Descriptors.

The following descriptors were found for the two distinct wetland units on site:

Tier	Attribute	
1	Inland	
2	Western Bankenveld Ecoregion	
3	Slope (gradient of slightly above 1:100)	
4	**HGM1:** Endorheic depression without channelled in or outflow	**HGM2:** Endorheic depression with channelled in and out flow
5	**Both HGM1& HGM2:** Intermittently inundated at both levels A and B and seasonally saturated (b) – predominant inundation (75-95%)	
6	HGM unit 1 (**HGM1**) – Artificial wetland due to ponding caused by road construction, high clay substrate with moderate organic soil (peat < 30%). Vegetation a mixture of grasses, restio's and terrestrial woody vegetation further afield. HGM unit 2 (**HGM2**) – Artificial wetland due to ponding caused by road construction, with runoff that created a riverbank within which intermittent water flows are observed after intense rainfall, moderate clay and sand substrate with moderate organic soil (peat < 30%). Vegetation a mixture of grasses, herbs, reeds and terrestrial woody vegetation on embankments.	

5.3 Soil wetness indicators

The criteria for soil wetness indicators according to the Munsell colour chart for this particular soil type is, according to the DWAF (2005) methodology:

- If hue is 2.5Y, then values of 5 or more and chroma values of 2 or less; or values of 6 or more and chroma values of 4 or less.
- If hue is l0YR, then a value of 4 and chroma values of 2 or less; or values of 5 or more and chroma values of 3 or less; or values of 6 or more with a chroma of 4.
- If hue is 7.5YR then values of 5 or more with a chroma of 2 or less; or values of 6 or more with a chroma of 4 or less.
- If hue is 5YR, then a value of 5 and chroma values of 2 or less; or values of 6 or more and chroma values of 4 or less.
- If hue is 5Y, then values of 5 or more and chroma values of 2 or less.

HGM1

This unit generally displayed dark brown to grey clay soils (Plate 5.1), with little to no mottling visible. These soils, though having dark topsoil and relatively high organic content, were indicative of wetness as they were characterised by low chroma and value colour profiles (5YR, 2/3 generally). This unit exhibited stagnant, surface water, as the region had experienced recent, weeklong rainfall with overcast conditions throughout. Soil indicators supported prolonged periods of saturation.

Plate 5.1: Typical soil sample taken from HGM1.

Vegetation within this unit (Plate 5.2) consisted almost entirely of *Juncaceae oxycarpus*, an obligate palustrine wetland species along with the grass mixes of *Andropogon appendiculatus*, *Cymbopogon plurinodis*, *Cymbopogon plurinodis*, *trachypogon spicatus*, *Trachypogon spicatus* which are mainly terrestrial grasses and do not denote wetland conditions necessarily. Due to the presence of *Juncaceae oxycarpus*, HGM1 displays possible signs of hydric conditions, however, outside the impoundment created by the road (which has a sharp boundary), the dominant vegetation remained facultative dry-land species (mainly grasses with mixed *Senegalia mellifera* and *Vachellia tortilis*. The temporary boundary was clearly observable from the vegetation indicator, due to the highly impoundment nature of the site between the two road verges. The terrain unit indicator for this unit was: valley-bottom, depression with a small drainage line from the road (passing through the culvert) as the apparent inflow, but no apparent outflow.

Plate 5.2: Typical vegetation at HGM1.

In combination, the presence of soil wetness indicators; the presence of hydric conditions through the presence of obligate wetland species, the presence of surface water and the potential for wetland creation due to the terrain indicator, prompted the author to assign this HGM unit as an artificial wetland. The delineated wetland is show at a finer scale in Figure 5.2 below.

Figure 5.2: A zoomed in view of HGM1, at the further end of the site (furthest away from the Glencore smelter).

HGM2

The samples within this unit generally displayed (Plate 5.3) brown to moderate grey, moderately organic laden sandy soil, of medium values and Chroma within the 7.5YR (2/5) chart. Numerous orange (iron) mottles were observed, however, a few samples indicated moderate amounts of manganese (black) mottles. One sample had a very strong variation in texture between the different soil layers, from fine clay (orange coloured) to fine sand (light grey) These soils are generally indicative of hydric soils experiencing semi-permanent and permanent inundation.

Plate 5.3: Typical soil sample taken from HGM2.

Vegetation within this unit (Plate 5.4) consisted almost entirely of *Phragmites australis* (common reed), an obligate palustrine wetland species along with the grass mixes of *Andropogon appendiculatus*, *Cymbopogon plurinodis*, *Cymbopogon plurinodis*, *trachypogon spicatus* and *Trachypogon spicatus*, which are mainly terrestrial grasses and do not denote wetland conditions necessarily. Due to the presence of *Phragmites australis*, HGM2 displays possible signs of hydric conditions (in terms of the vegetation indicator).

Plate 5.4: Typical vegetation around HGM2.

The terrain unit indicator for this unit was: valley-bottom, depression, with a clear inflow and outflow (i.e. the river running underneath the existing rail bridge, which is partially influenced by the formation of the parallel running road and its steep embankment). Due to the earthworks having occurred historically (for the road and rail development), this wetland was also deemed artificial. In combination, the presence of facultative and obligate wetland vegetation within the unit and the low 'value' and 'Chroma' results, indicated clear boundary zones for this artificial wetland. The terrain unit indicator further indicated the formation of wetland soil. The delineated wetland is show at a finer scale in Figure 5.3 below.

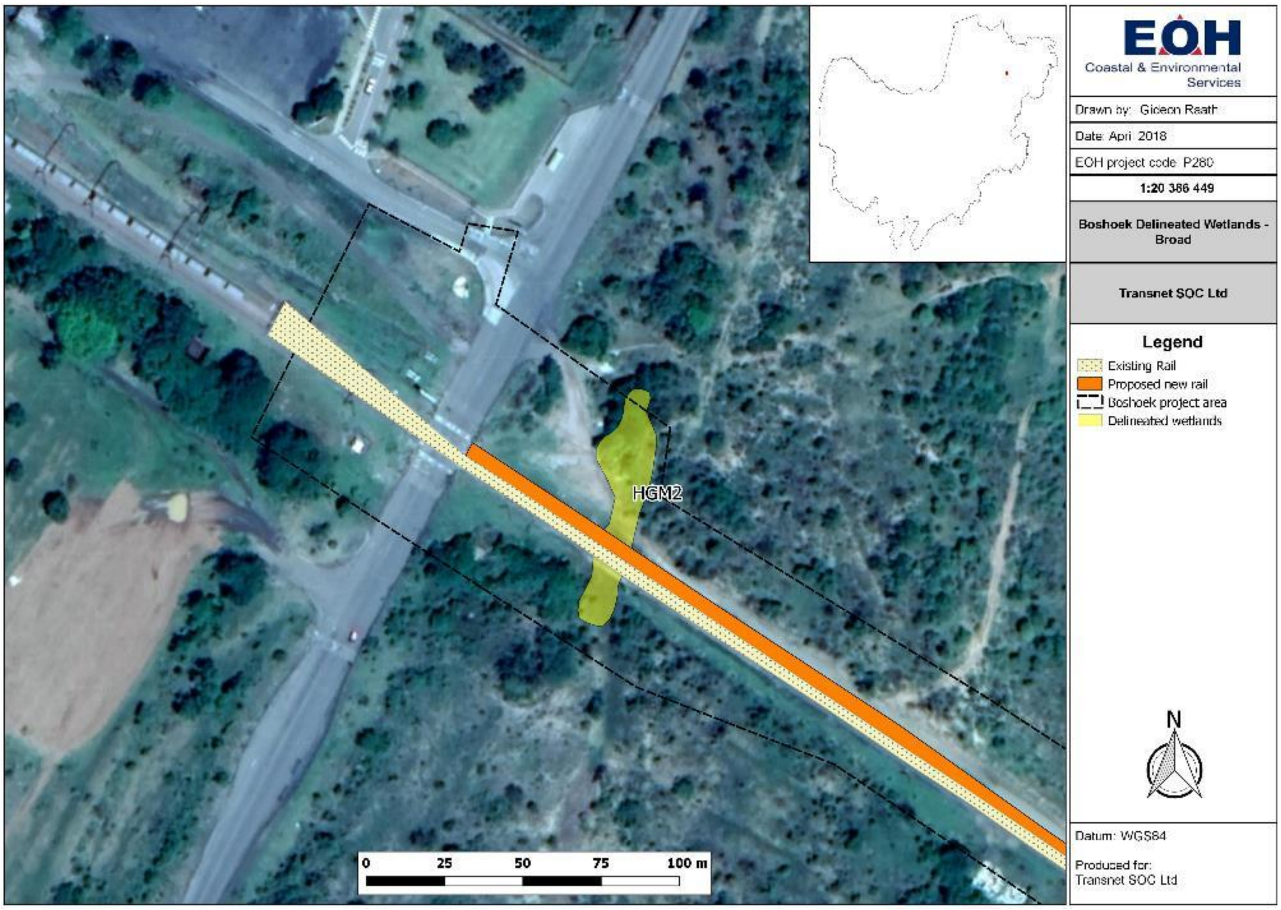

Figure 5.3: A zoomed in view of HGM2, at the further end of the site (furthest away from the Glencore smelter).

6 WETLAND HEALTH ASSESSMENT

HGM1 and HGM2 were both subjected to a WET-Health assessment which uses the hydrological, geomorphological and vegetation characteristics of the wetland to produce a health score. Evaluation scores within each category are then combined to produce an overall impact of activities on the wetland system which corresponds to a Present State Health Category for each component such as Hydrology, Geomorphology and Vegetation. HGM1 indicated a Present Ecological State (PES) category of C – Moderately modified, while HGM2 indicated a Present Ecological State (PES) category of A – unmodified.

6.1 Present Ecological State (PES)

For the overall present ecological health state, the following equation was used:

Overall Health Score = ((Hydrology score) x3 + (Geomorphology score) x2 + (Vegetation score) x2)) ÷ 7

Combined PES Health Score = 10 – overall health score

6.1.1 HGM1

HGM1 was located very close to the dirt service road, and was bound on the far side by the dirt road currently servicing the mining haul trucks. As such, water was ponding between the two roads and creating wetland conditions. Inflow into the region is predominantly via the culverts and stormwater structures of the existing rail, directing water into the ditch between the mining dirt road and the access road. No clear outflow was visible. Minor vegetation impacts were evident, primarily through the construction of the access road (initially), and the ongoing encroachment of invasive species, however for the most part the vegetation condition within this wetland remained similar to the surrounding terrestrial environment. This unit is approximately 0.04 ha in size and has been classified as a depression.

Summary

Table 6.1: HGM1 WET-Health scoring summary.

HGM1	**Hydrology**		**Geomorphology**		**Vegetation**	
	Impact Score	**Change Score**	**Impact Score**	**Change Score**	**Impact Score**	**Change Score**
Area weighted impact scores	6.5	-1	0.9	-1	1.1	0
PES Categories	**E**	↓	**A**	↓↓	**B**	→
Overall health score	3.4					
Combined PES category	**C**					
Combined PES health score	6.6					
Combined PES description	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.					

6.1.2 HGM2

HGM2 was located closest to the road, and was near the excavated, exposed area used for dumping. Many footpaths traversed this area, with impacts from dumping, extraction, swimming and vegetation harvesting observed. This unit is approximately 0.09 ha in size and has been classified as a depression.

Summary

Table 6.2: HGM2 WET-Health scoring summary.

HGM1	**Hydrology**		**Geomorphology**		**Vegetation**	
	Impact Score	**Change Score**	**Impact Score**	**Change Score**	**Impact Score**	**Change Score**
Area weighted impact scores	3.5	-1	0.9	-2	1.0	-2
PES Categories	**C**	↓	**A**	↓↓	**B**	↓↓
Combined PES Score	2.04					
Combined PES category	**C**					
Combined PES health score	8					
Combined PES description	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.					

The above scores indicates the extent of the impacts from the adjacent road, foot traffic from the public (and hence littering and pollution), as well as the impact of the access road crossing this wetland.

6.2 Ecological Importance and Sensitivity (EIS)

The following categories for EIS are provided:

Ecological Importance and Sensitivity Category (EIS)	**Range of Median**	**Recommended Ecological Management Class[1]**
Very high Floodplains that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these floodplains is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers.	>3 and <=4	A
High Floodplains that are considered to be ecologically important and sensitive. The biodiversity of these floodplains 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 Floodplains that are considered to be ecologically important and	>1 and <=2	C

[1] Ed's note: Author to confirm exact wording for version 1.1

sensitive on a provincial or local scale. The biodiversity of these floodplains is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.		
Low/marginal Floodplains that are not ecologically important and sensitive at any scale. The biodiversity of these floodplains is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.	>0 and <=1	D

Following assessment of both wetlands, the results indicated that both fall **within category C – MODERATE EIS** values (scoring '2' for both).

6.3 Buffers

A buffer is a designated portion of land adjacent to a given sensitive feature, which is set aside and for which stricter mitigation measures, or normally a complete ban (no-go) on development activities, apply. This area is intended to reduce impacts from adjacent development activities, in order to protect or preserve the given sensitive features. The size of a buffer zone is determined by the extent and magnitude of the adjacent development impacts anticipated, as well as the sensitivity of the feature to be protected. Different buffer zones have been proposed for the protection of wetlands and rivers in South Africa, mostly ranging between 30 m and 100 m.

For both artificial wetlands identified, the nature of the development is such that earthworks and vegetation clearing within both wetlands will be unavoidable should this development proceed. Regardless, given the artificial nature of these wetlands, their limited extent and thus small contribution to the aquatic ecosystems on a regional scale, as well as their current moderate EIS scores and the existing impacts, a buffer of 5 m from each wetland was deemed reasonable whilst being practical.

7 SITE SENSITIVITY

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(f) the specific identified sensitivity of the site related to the activity and its associated structures and infrastructure;
(g) an identification of any areas to be avoided, including buffers;
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;

A sensitivity map (Figure 7.1 below) was developed based on desktop and site information gathered, and was classified into areas of high, moderate and low sensitivity.

High Sensitivity (red)

- All natural wetlands and rivers, inclusive of a buffers (32 m buffer).

All activities within high sensitivity areas must be closely monitored by a qualified ECO to ensure that all proposed mitigation measures are implemented to manage and minimize potential impacts on the watercourse.

Moderate sensitivity (orange)

- All artificial wetlands with buffers. The wetlands were given a **50 m sensitivity buffer** as they are artificial. However, any construction activity within 500 m of a wetland (both artificial and natural) will still require authorisation from DWS.

Moderate sensitivity areas act as buffers for the high sensitivity areas. Activities that may have an indirect impact on high sensitivity areas are not to occur within these buffer areas. Such activities would include:

- Stockpiling of topsoil, subsoil, etc.
- Temporary ablution facilities
- Site camp establishment
- Temporary laydown areas for equipment/materials
- Overnight parking of heavy machinery/vehicles.
- Concrete batching

Low Sensitivity

- All areas outside the rivers and wetlands identified within the study area.

From the sensitivity map below, it is clear that the only sensitive areas within the project are the 50 m buffers surrounding the artificial wetlands on either side of the project area, as well as the 50 m buffer around the drainage line (near the Glencore smelter portion of the property). These two sites must therefore be addressed in the EMPr and in the WUA, to ensure limited disturbance and appropriate management of these sites.

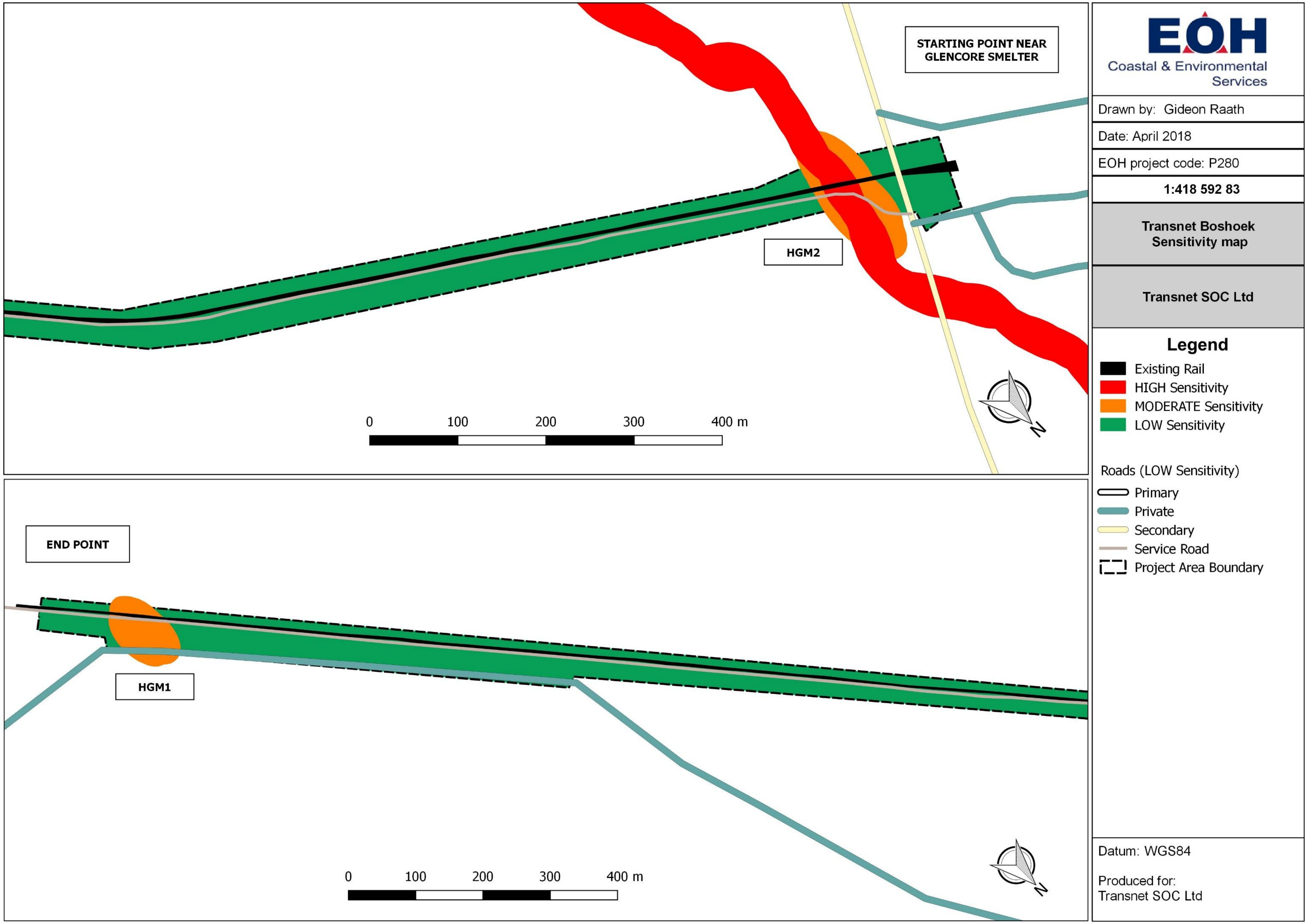

Figure 7.1: Sensitivity map.

8 MANNER IN WHICH THE ENVIRONMENT MAY BE AFFECTED

In terms of Appendix 6 of the EIA Regulations (2014) a specialist report must contain-

(cB) A description of the existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;
(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;
(k) any mitigation measures for inclusion in the EMPr;

Impacts were identified during the Planning and Design, Construction and Operation Phase of the proposed Boshoek rail upgrade and are described below. These included the consideration of direct, indirect and cumulative impacts that may occur.

Table 8.1 below is a summary of the issues identified and their applicability to each phase of construction.

Table 8.1: Issues identified for the proposed Boshoek Rail upgrade project.

Theme	Applicability to each phase		
	Planning and Design	**Construction**	**Operation**
Legal and policy compliance	YES Non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment.	N/A	N/A
Stockpiling of construction materials	N/A	YES Stockpiling of construction material within 50 m of a watercourse could result in erosion and mobilisation of the materials into the nearby watercourse.	N/A
Scheduling of construction	YES Inappropriate construction scheduling	N/A	N/A
Changes to fluvial geomorphology	YES Incorrect design of infrastructure and culverts	N/A	N/A
Stormwater management	YES Inappropriate design of stormwater structures.	YES Inappropriate routing of stormwater.	YES Inappropriate routing of stormwater.
Invasion of alien species	YES Failure to plan for the removal and management of alien vegetation	YES Removal of existing natural vegetation resulting in invasion by alien species. Failure to monitor alien vegetation during construction.	N/A
Water Quality	N/A	YES	N/A

Theme	Applicability to each phase		
	Planning and Design	Construction	Operation
		Accidental contamination by wet concrete Accidental chemical or other spills in the vicinity of rivers /wetlands	
Riparian vegetation	N/A	YES In appropriate clearance of riparian vegetation could result in bank erosion and sedimentation of watercourses downstream of construction activities. Indiscriminate removal of riparian vegetation.	N/A
Hydrology	N/A	YES Earthworks within the wetlands may permanently change the hydrology.	N/A

Table 8.2: Impacts and mitigation measures for the Planning and Design Phase of the Boshoek Loop construction.

PLANNING AND DESIGN PHASE									
ISSUE	**DESCRIPTION OF IMPACT**	**NATURE OF IMPACT**	**SPATIAL SCALE (EXTENT)**	**TEMPORAL SCALE (DURATION)**	**CERTAINTY SCALE (LIKELIHOOD)**	**SEVERITY/ BENEFICIAL SCALE**	**SIGNIFICANCE PRE-MITIGATION**	**MITIGATION MEASURES**	**SIGNIFICANCE POST-MITIGATION**
Legal and policy compliance	During the planning and design phase non-compliance with the laws and policies of South Africa as they pertain to the aquatic environment could lead to damage to the aquatic environment, unnecessary delays in construction activities, and potentially criminal cases, based on the severity of the non-compliance, being brought against the proponent and his/her contractors.	**DIRECT**	**Study area**	**Short term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• All legal matters pertaining to permitting must be completed prior to any construction activity. • In particular, all necessary Water Use Authorisations must be in order for any construction activities within the 1:100 year floodline, (or within 100 m of a watercourse), within 500 m of a wetland or where infrastructure will traverse rivers or drainage lines.	**LOW NEGATIVE**
Scheduling of construction	During the planning and design phase inappropriate construction scheduling that does not take into account the seasonal requirements of the aquatic environment, e.g. allowing for unimpeded flood events, could lead to short-term (and potentially long-term) impacts on the aquatic environment such as excessive sediment mobilization, etc.	**INDIRECT**	**Study area**	**Short term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc. • When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.	**LOW NEGATIVE**
Changes to fluvial geomorphology and hydrology	During the planning and design phase incorrect design of infrastructure or upgraded culverts may result in scouring of the river bed in areas immediately surrounding the pilings or	**DIRECT**	**Study area**	**Long term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• Scour counter measures must be incorporated into the design of the bridge upgrade, new bridge construction and all	**LOW NEGATIVE**

	culverts or changes to the hydrology of the river.							culverts in the study area. • Any upgraded culverts must be designed in such a manner so as not to impede or divert base flows or increase upstream flood inundation. • Box culverts should be selected over pipe culverts, if possible, as they are less restrictive in terms of flow and also aid in reducing habitat fragmentation.	
Stormwater management	During the planning and design phase the inappropriate design of stormwater structures may result in increased levels of erosion, sedimentation and pollution of the watercourses and wetlands.	**DIRECT**	**Study area**	**Long-term**	**Possible**	**Severe**	**HIGH NEGATIVE**	• Appropriate stormwater structures (for the rail and access road) must be designed to minimise erosion and sedimentation of watercourses/wetlands. • All rail sections situated on slopes must incorporate stormwater diversion. • Stormwater design must be in line with TRANSNET and DWS requirements.	**MODERATE NEGATIVE**
Invasion of alien species	During the planning and design phase, failure to plan for the removal and management of alien vegetation could result in the invasion of alien vegetation in riparian areas during the construction and operation phase of the road upgrade. This would have an adverse impact on the aquatic ecosystem.	**INDIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• A Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.	**LOW NEGATIVE**

Table 8.3: Impacts and mitigation measures for the Construction Phase of Boshoek Loop development.

ISSUE	IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Material Stockpiling	During the construction phase stockpiling of construction material within 50 m of a watercourse / wetland could result in erosion and mobilisation of the materials into these systems, resulting in sedimentation and a decrease in water quality and aquatic habitat.	**DIRECT INDIRECT CUMULATIVE**	**Study area, downstream of water courses**	**Medium-term**	**Possible**	**Moderately negative**	**MODERATE NEGATIVE**	• No construction material must be stored within 50 m of a watercourse. • Stockpiles within 100 m of watercourses must be monitored for erosion and mobilisation of materials towards watercourses. If this is noted by an ECO, suitable cut-off drains or berms must be placed between the stockpile area and the nearest watercourse.	**LOW NEGATIVE**
Water Quality	During the construction phase, accidental contamination of wet concrete (highly alkaline) in the rivers/wetland systems could result in mortality of macro-invertebrates and fish species that may be present	**DIRECT CUMULATIVE**	**Study area**	**Short-term**	**Possible**	**Moderately severe**	**MODERATENEGATIVE**	• During the construction phase no concrete mixing must take place within 32 m of any river bank or wetland system. • A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into the river. • The mitigation measures in Appendix B (concrete mixing) must be used in conjunction with this report.	**LOW NEGATIVE**
	During the construction phase, accidental chemical spills or other spills	**DIRECT CUMULATIVE**	**Study area**	**Short-term**	**Possible**	**Severe**	**HIGH NEGATIVE**	• During the construction phase no machinery must be parked overnight within 50 m of the	**LOW NEGATIVE**

	(sewage, etc.) in the vicinity of the rivers/wetlands will result in water pollution, adversely affecting the aquatic ecosystem.							rivers/wetlands. • All stationary machinery must be equipped with a drip tray to retain any oil leaks. • Chemicals used for construction must be stored safely on bunded surfaces in the construction site camp. • Emergency plans must be in place in case of spillages onto road surfaces or within water courses. • No ablution facilities should be located within 50 m of any river or wetland system. • Chemical toilets must be regularly maintained/ serviced to prevent ground or surface water pollution.	
Stormwater management	During the construction phase the inappropriate routing of stormwater will lead to stream sedimentation, adversely affecting the aquatic environment.	**DIRECT**	**Study area, downstream of water courses**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• Flood attenuation and storm water management plans must be drawn up and implemented. • An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers/ wetlands.	**LOW NEGATIVE**
Riparian vegetation	During the construction phase, the removal of sensitive riparian vegetation for road/bridge widening and upgrading of	**DIRECT**	**Study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• During the construction phase all riparian vegetation removal must take place under supervision of the Environmental Control Officer	**LOW NEGATIVE**

	culverts will adversely affect the aquatic environment (particularly if detours are used when widening bridges).							(ECO). • A Rehabilitation and Alien Vegetation Management Plan must be developed and implemented. • Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.	
	During the construction phase, indiscriminate removal of riparian vegetation at water crossing sites, within wetlands or encroachment into surrounding areas could lead to destabilisation of bank structures and an increase in erosion rates.	**DIRECT**	**Study area**	**Medium-term**	**Possible**	**Moderately severe**	**MODERATE NEGATIVE**	• During the construction phase removal of riparian vegetation must take place under the supervision of the ECO. • Removal of the alien invasive vegetation should be prioritised. • Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed. • Vehicles and machinery should not encroach into areas outside/surrounding the road upgrade footprint.	**LOW NEGATIVE**
Invasion of alien species	During the construction phase the removal of existing natural riparian vegetation creates 'open' habitats that will favour the establishment of undesirable species in the area that are typically very difficult to eradicate. This alien vegetation may adversely	**INDIRECT**	**Localised, study area**	**Long-term**	**Probable**	**Moderately severe**	**MODERATE NEGATIVE**	• A Rehabilitation and Alien Management Plan must be implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species. • Alien plants must be removed from the site through appropriate methods such as hand pulling, application of	**LOW NEGATIVE**

	affect the aquatic ecosystem.							chemicals, cutting, etc. • Vehicles and machinery should not encroach into areas outside/surrounding the planned project footprint. • Eradicate alien plants from the impacted area as they appear; and • Monitor the project area for any new growth of invasive plants until completion of construction. Short-term monitoring for a period of 12 months after construction has been completed should be conducted.	

Table 8.4: Impacts and mitigation measures for the Operational Phase of the Boshoek Loop.

ISSUE	IMPACT	NATURE OF IMPACT	SPATIAL SCALE (EXTENT)	TEMPORAL SCALE (DURATION)	CERTAINTY SCALE (LIKELIHOOD)	SEVERITY/ BENEFICIAL SCALE	SIGNIFICANCE PRE-MITIGATION	MITIGATION MEASURES	SIGNIFICANCE POST-MITIGATION
Stormwater management	During the operation phase inappropriate routing of stormwater will lead to stream sedimentation.	**DIRECT**	**Localised, study area and downstream**	**Long term**	**Probable**	**Severe**	**HIGH NEGATIVE**	• Flood attenuation and storm water management plans must be drawn up by a qualified engineer and approved by DWS. • An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers.	**LOW NEGATIVE**

9 IMPACT STATEMENT, CONCLUSION & RECOMMENDATIONS

In terms of Appendix 6 of the Amended EIA Regulations (2017) a specialist report must contain-

(l) Any conditions for inclusion in the environmental authorisation;
(m) Any monitoring requirements for inclusion in the EMPr or environmental authorisation;
(n) A reasoned opinion-
(i) whether the proposed activity, activities or portions thereof should be authorised; and
(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, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan;
(q) Any other information requested by the competent authority.

9.1 Conclusions

Transnet SOC Ltd has proposed the expansion of a railway line at Boshoek Loop, North-West Province, by addition of a new loop.

The majority of the study area falls within the A22F quaternary drainage region. Two wetlands were identified on site, both artificial and currently impacted on by the ongoing use of the access road and mining roads in close proximity, as well foot traffic and pollution from the general public. PES categories were determined for both, being class C for HGM1 and for HGM2. Furthermore, both were classified as EIS category C, and a buffer proposed for both.

A comparison of impacts in terms of the number of impacts per phase is illustrated in Table 9.1 below. HIGH pre-mitigation impacts relate to hydrology, stormwater management and water quality. The majority of the impacts can be mitigated using the recommended mitigation measures to LOW/MODERATE post-mitigation impacts.

Table 9.1: Assessment of pre- and post-mitigation impact significance.

	PRE-MITIGATION				POST-MITIGATION			
	LOW	MOD	HIGH	VERY HIGH	LOW	MOD	HIGH	VERY HIGH
Planning and Design	0	4	1	0	4	1	0	0
Construction	0	6	1	0	7	0	0	0
Operation	0	0	1	0	1	0	0	0
TOTAL	0	10	3	0	12	1	0	0

9.2 Water Use Licensing

Water Use Authorisations (WUAs) are required for any construction activity within 500 m of a wetland in terms of the following triggers from the National Water Act (No. 36 of 1998):

- Sec 21 (c) - impeding or diverting the flow of water in a watercourse; and
- Sec 21 (i) - altering the bed, banks, course or characteristics of a watercourse.

Water course crossings (indicated in Table 9.2 below) and construction within 500 m of a wetland must be authorised by the Department of Water and Sanitation prior to commencement of construction.

Table 9.2: Water course crossings affected by the road upgrade

Water Course Crossing (from west to east)	Longitude, Latitude
1	25°30'47.20"S, 27° 7'15.06"E
2	25°29'52.30"S, 27° 6'13.56"E

9.3 Recommendations for the proposed new Boshoek Loop.

All the mitigation measures provided below are to be implemented in the Planning and Design, Construction and Operation Phases of the rail upgrade.

9.3.1 Planning and Design

- All legal matters pertaining to permitting must be completed prior to any construction activity.
- In particular, all necessary Water Use Authorisations must be in order for abstraction (if required) or any construction activities within 500 m of a wetland.
- Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc.
- When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.
- Scour countermeasures must be incorporated into the design of the bridge upgrades, new bridge construction and all culverts in the study area.
- Any upgraded culverts must be designed in such a manner so as not to impede or divert base flows or increase upstream flood inundation.
- Box culverts should be selected over pipe culverts, if possible, as they are less restrictive in terms of flow and also aid in reducing habitat fragmentation.
- Appropriate stormwater structures (for the road and borrow pits/quarries) must be designed to minimise erosion and sedimentation of watercourses.
- All road sections or borrow pits situated on slopes must incorporate stormwater diversion.
- Stormwater design must be in line with SANRAL and DWS requirements.
- A Rehabilitation and Alien Vegetation Management Plan must be designed to reduce the establishment and spread of undesirable alien plant species.

9.3.2 Construction

- Wherever possible, construction activities should be undertaken during the driest part of the year to minimize downstream sedimentation due to excavation, etc.
- When not possible, suitable stream diversion structures must be used to ensure the river is not negatively impacted by construction activity.
- No construction/ borrow pit material must be stored within 50 m of a watercourse.
- Stockpiles within 100 m of watercourses must be monitored for erosion and mobilisation of materials towards watercourses. If this is noted by an ECO, suitable cut-off drains or berms must be placed between the stockpile area and the nearest watercourse.
- During the construction phase no concrete mixing must take place within 32 m of any river bank or wetland system.
- A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into the river.
- The mitigation measures in Appendix A must be used in conjunction with this report.
- During the construction phase no machinery must be parked overnight within 50 m of the rivers/wetlands.
- All stationary machinery must be equipped with a drip tray to retain any oil leaks.
- Chemicals used for construction must be stored safely on bunded surfaces in the construction site camp.
- Emergency plans must be in place in case of spillages onto road surfaces or within water courses.

- No ablution facilities should be located within 50 m of any river or wetland system.
- Chemical toilets must be regularly maintained/ serviced to prevent ground or surface water pollution.
- Flood attenuation and storm water management plans must be drawn up and implemented.
- An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers/ wetlands.
- During the construction phase all riparian vegetation removal must take place under supervision of the Environmental Control Officer (ECO).
- A Rehabilitation and Alien Vegetation Management Plan must be developed and implemented.
- Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.
- During the construction phase removal of riparian vegetation must take place under the supervision of the ECO.
- Removal of the alien invasive vegetation should be prioritised.
- Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.
- Vehicles and machinery should not encroach into areas outside/surrounding the road upgrade footprint.
- During the construction phase coffer dams (if required) must not be left in place for longer than 30 days.
- All work within the rivers should be completed during the dry season, when flows are at their lowest.
- Water in the rivers must be allowed to pass downstream of the construction activity. If necessary this should be achieved via a temporary diversion – this should not be in place for more than 30 days.
- A Rehabilitation and Alien Management Plan must be implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species.
- Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc.
- No ablution facilities must be located within the 50 m no-go buffer.

9.3.3 Operation

- Flood attenuation and storm water management plans must be drawn up by a qualified engineer and approved by DWS.
- An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers.

9.4 Environmental statement and Opinion of the Specialist

The aquatic impacts of all aspects for the proposed road upgrade were assessed and considered to be acceptable, provided that the mitigation measures provided in this report are implemented. All impacts are rated as MODERATE to HIGH pre-mitigation, therefore implementation of recommended mitigation measures coupled with comprehensive rehabilitation and monitoring in terms of re-vegetation and restoration is an important element of the mitigation strategy. Implementing the recommended mitigations measures will reduce impacts to MODERATE and LOW. It is recommended that an ECO be appointed for the duration of construction activity, as well as the abovementioned mitigation measured be implemented in order to reduce the impacts from the proposed development. A WUL or GA application must be submitted to DWS to authorise any construction activities within 100 m of a river/drainage line, the 1:100 year floodline of a river or within 500 m of a wetland.

10 REFERENCES

Department of Water and Sanitation (2014). A Desktop Assessment of the Present Ecological State, Ecological Importance and Ecological Sensitivity per Sub Quaternary Reaches for Secondary Catchments in South Africa.

Department of Water Affairs and Forestry (2007). A level 2 Ecoregional Classification System for South Africa, Lesotho and Swaziland.

Kleynhans, CJ, Thirion, C and Moolman, J (2005). A Level I River Ecoregion classification System for South Africa, Lesotho and Swaziland. Report No. N/0000/00/REQ0104. Resource Quality Services, Department of Water Affairs and Forestry, Pretoria, South Africa.

Mucina, L. and Rutherford, M.C. (Eds) (2006). The vegetation of South Africa, Lesotho and Swaziland. Strelitzia 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management Act (No 107 of 1998) as amended in 2010.

National Environmental Management: Biodiversity Act (No 10 of 2004).

National Spatial Biodiversity Assessment (2004).

National Water Act (No 36 of 1998).

NFEPA Atlas, 2011.

SANBI (bgis.sanbi.org).

Technical Report for the National Freshwater Ecosystem Priority Areas project.

The Constitution Act (108 of 1996).

APPENDIX A

Concrete Works – Information and Mitigation

Background

Concrete, cement, mortars, grouts and other Portland cement or lime-containing construction materials are basic or alkaline materials. They are highly toxic to fish and must only be used near water with extreme care.

What are acceptable pH ranges?

A pH level around 7 is typical for most watercourses, and this neutral pH is required for the survival of aquatic organisms. Should the pH rise or drop out of this range, fish and other aquatic organisms will become stressed and may die. Complete isolation of the work area is needed to ensure that pH value in the surrounding waterbody does not rise (become more alkaline) during works. The Ministry of Water, Land, and Air Protection's ***British Columbia Approved Water Quality Criteria for pH sets the range for acceptable pH*** change with respect to fresh water aquatic life between 6.5 and 9.0. However, any increase in pH noted in conjunction with concrete works should be monitored and emergency protection measures implemented in accordance with the best practices below.

Objectives

The objective of this set of best practices is to ensure no concrete materials or leachates enter any watercourses.

Operational or Construction-related Best Practices

To ensure your works meet the requirements of applicable legislation:

Concrete Works

- Use pre-cast concrete structures whenever possible.
- As concrete leachate is alkaline and highly toxic to fish and other aquatic life, ensure that all works involving the use of concrete, cement, mortars, and other Portland cement or lime containing construction materials (concrete) will **not** deposit, directly or indirectly, sediments, debris, concrete, concrete fines, wash or contact water into or about any watercourse.
- Concrete materials cast in place must remain inside formed structures.
- Keep a carbon dioxide (CO2) tank with regulator, hose and gas diffuser readily available during concrete work. Use it to release carbon dioxide gas into the affected area to neutralize pH levels should a spill occur. Train workers to use the tank.
- Provide containment facilities for the wash-down water from concrete delivery trucks, concrete pumping equipment, and other tools and equipment.
- Report immediately any spills of sediments, debris, concrete fines, wash or contact water. Implement emergency mitigation and clean-up measures immediately.
- Completely isolate all concrete work from **any** water within or entering into **any** watercourse or stormwater system.
- Monitor the pH frequently in the watercourse immediately downstream of the isolated worksite until completion of the works. Emergency measures will be implemented if downstream pH has changed **more than 1.0 pH unit**, measured to an accuracy of +/- 0.2 pH units from the background level, or is recorded to be **below 6.0 or above 9.0 pH units**.
- Prevent any water that contacts uncured or partly cured concrete during activities like exposed aggregate wash-off, wet curing, or equipment washing from directly or indirectly entering any watercourse or stormwater system.

- Maintain complete isolation of all cast-in-place concrete and grouting from fish-bearing waters for a minimum of 48 hours if ambient air temperature is above 0°C and for a minimum of 72 hours if ambient air temperature is below 0°C.
- Isolate and hold any water that contacts uncured or partly cured concrete until the pH is **between 6.5 and 8.0 pH units**, and the turbidity is **less than 25 nephelometric turbidity units (NTU)**, measured to an accuracy of +/- 2 NTU.

For further information regarding the safe use of concrete materials, refer to the following websites:

Cement and Concrete: Environmental Considerations
http://www.buildinggreen.com/features/cem/cementconc.html

Carbon Dioxide for Concrete Wash Water Treatment
http://www.praxair.com/Praxair.nsf/d63afe71c771b0d785256519006c5ea1/78b5b272ccfbcd88852565550069e32d?OpenDocument

APPENDIX B

Risk Assessment in support of the application for Water Use Authorisation in terms of S21 c and i of the National Water Act (Act No. 36 of 1998).

A total of 2 wetlands were identified in the Aquatic Specialist Impact Assessment. The Risk Assessment below is applicable to both.

RISK ASSESSMENT KEY (Based on DWS 2015 publication: Section 21 c and I water use Risk Assessment Protocol)

Negative Rating

TABLE 1- SEVERITY

How severe does the aspects impact on the resource quality (flow regime, water quality, geomorphology, biota, habitat)?

Insignificant / non-harmful	1
Small / potentially harmful	2
Significant / slightly harmful	3
Great / harmful	4
Disastrous / extremely harmful and/or wetland(s) involved	5
Where "or wetland(s) are involved" it means that the activity is located within the delineated boundary of any wetland. The score of 5 is only compulsory for the significance rating.	

TABLE 2 – SPATIAL SCALE

How big is the area that the aspect is impacting on?

Area specific (at impact site)	1
Whole site (entire surface right)	2
Regional / neighbouring areas (downstream within quaternary catchment)	3
National (impacting beyond secondary catchment or provinces)	4
Global (impacting beyond SA boundary)	5

TABLE 3 – DURATION

How long does the aspect impact on the resource quality?

One day to one month, PES, EIS and/or REC not impacted	1
One month to one year, PES, EIS and/or REC impacted but no change in status	2
One year to 10 years, PES, EIS and/or REC impacted to a lower status but can be improved over this period through mitigation	3
Life of the activity, PES, EIS and/or REC permanently lowered	4
More than life of the organisation/facility, PES and EIS scores, a E or F	5

PES and EIS (sensitivity) must be considered.

TABLE 4 – FREQUENCY OF THE ACTIVITY

How often do you do the specific activity?

Annually or less	1
6 monthly	2
Monthly	3
Weekly	4
Daily	5

TABLE 5 – FREQUENCY OF THE INCIDENT/IMPACT

How often does the activity impact on the resource quality?

Almost never / almost impossible / >20%	1
Very seldom / highly unlikely / >40%	2
Infrequent / unlikely / seldom / >60%	3
Often / regularly / likely / possible / >80%	4
Daily / highly likely / definitely / >100%	5

TABLE 6 – LEGAL ISSUES

How is the activity governed by legislation?

No legislation	1
Fully covered by legislation (wetlands are legally governed)	5
Located within the regulated areas	

TABLE 7 – DETECTION

How quickly/easily can the impacts/risks of the activity be observed on the resource quality, people and property?

Immediately	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered	5

TABLE 8: RATING CLASSES

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.
56 – 169	M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Licence required.
170 – 300	(H) High Risk	Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve. Licence required.

A low risk class must be obtained for all activities to be considered for a GA

TABLE 9: CALCULATIONS

Consequence = Severity + Spatial Scale + Duration
Likelihood = Frequency of Activity + Frequency of Incident + Legal Issues + Detection
Significance\Risk = Consequence X Likelihood

The completed Risk Assessment Matrix, which will be submitted to DWS as part of the Water Use Authorisation application, is provided below.

No.	Phases	Activity	Aspect	Impact	Flow Regime		Physical & Chemical (Water Quality)		Habitat (Geomorphic + Vegetation)		Biota		Severity	Spatial scale	Duration		Consequence
1	Construction Phase	Construction of the Boshoek Railway Loop within the 500m buffer of the two (2) wetlands identified on site.	Material Stockpiling	During the construction phase stockpiling of construction material within 50 m of a watercourse / wetland could result in erosion and mobilisation of the materials into these systems, resulting in sedimentation and a decrease in water quality and aquatic habitat.	The flow regime of the wetlands may be altered should any material stockpiling occur within or near the wetlands.	2	The water quality of the wetlands may be reduced should any material stockpiling occur within or near the wetlands.	2	A reduction in water quality may result in the disturbance of wetland habitats.	2	A reduction in water quality may result in the disturbance and/or loss of wetland biota.	2	2	1	2		5
2			Cement-mixing and concrete work	During the construction phase, accidental contamination of wet concrete (highly alkaline) in the rivers/wetland systems could result in mortality of macro-invertebrates and fish species that may be present.	The flow regime of the wetlands is unlikely to be altered by this aspect of the construction activities.	1	The water quality of the wetlands may be significantly reduced should any spillage of cement or concrete material occur.	5	A reduction in water quality may result in the disturbance of wetland habitats.	5	A reduction in water quality may result in the disturbance and/or loss of wetland biota.	5	4	1	2		7
3			Implementation of temporary ablution facilities, storage of chemicals and/or use of potentially hazardous substances	During the construction phase, accidental chemical spills or other spills (sewage, etc.) in the vicinity of the rivers/wetlands will result in water pollution, adversely affecting the aquatic ecosystem.	The flow regime of the wetlands is unlikely to be altered by this aspect of the construction activities.	1	The water quality of the wetlands may be significantly reduced should any spillage of sewerage, chemicals or other hazardous material occur.	5	A reduction in water quality may result in the disturbance of wetland habitats.	5	A reduction in water quality may result in the disturbance and/or loss of wetland biota.	5	4	1	2		7
4			Stormwater Management	During the construction phase the inappropriate routing of stormwater will lead to stream sedimentation, adversely affecting the aquatic environment.	The clearance of vegetation and levelling of areas may result in increased stormwater inflow towards the wetlands.	3	The water quality of the wetlands may be significantly reduced should the increased stormwater inflow result in significant sedimentation.	3	A reduction in water quality may result in the disturbance of wetland habitats.	3	A reduction in water quality may result in the disturbance and/or loss of wetland biota.	3	3	2	2		7
5			Removal of Riparian Vegetation	During the construction phase, the removal of sensitive riparian vegetation for road/bridge widening and upgrading of culverts will adversely affect the aquatic environment (particularly if detours are used when widening bridges).	The clearance of riparian vegetation may reduce the effectiveness of the wetland in absorbing water and could therefore result in an increased water flow through the wetland.	4	The water quality of the wetlands is unlikely to be significantly altered by the clearance of riparian vegetation.	1	The removal of sensitive riparian will in turn result in the loss of habitat and biota within the wetlands.	5	The removal of sensitive riparian will in turn result in the loss of habitat and biota within the wetlands.	5	3	1	4		8
6			Invasion of Alien Species	During the construction phase the removal of existing natural riparian vegetation creates ‘open’ habitats that will favour the establishment of undesirable species in the area that are typically very difficult to eradicate. This alien vegetation may adversely affect the aquatic ecosystem.	The infestation of alien species may lead to increased water absorption by plants within the wetlands. This may result in a decrease in wetland outflow.	3	The water quality of the wetlands may be reduced as a result of the infestation of alien species.	2	The infestation of alien species may result in the further loss of sensitive riparian vegetation and have negative implications on the wetland biota.	4	The infestation of alien species may result in the further loss of sensitive riparian vegetation and have negative implications on the wetland biota.	4	3	1	4		8
7	Operational Phase	Operation of the Boshoek Railway Loop within the 500m buffer of the two (2) wetlands identified on site.	Stormwater Management	During the operational phase, inappropriate routing of stormwater will lead to stream sedimentation.	The additional permanent impermeable surfaces and levelled areas may result in increased stormwater inflow towards the wetlands.	3	The water quality of the wetlands may be significantly reduced should the increased stormwater inflow result in significant sedimentation.	3	A reduction in water quality may result in the disturbance of wetland habitats.	3	A reduction in water quality may result in the disturbance and/or loss of wetland biota.	3	3	2	4		9

No.	Frequency of activity	Frequency of impact	Legal Issues	Detection		Likelihood	Significance	Initial Risk Rating	Confidence level	Control Measures	Borderline LOW MODERATE Rating Classes	PES AND EIS OF WATERCOURSE
1	1	1	5	2		9	45	LOW	90%	• No construction material must be stored within 50 m of a watercourse. • Stockpiles within 100 m of watercourses must be monitored for erosion and mobilisation of materials towards watercourses. If this is noted by an ECO, suitable cut-off drains or berms must be placed between the stockpile area and the nearest watercourse.	LOW	The wetlands have been assigned a category 'C' Present Ecological State (PES) rating, which is described as '*Moderately modified - loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged*.' The wetlands also fall within Category 'C' (Moderate) according to the Ecological Importance and Sensitivity (EIS) rating.
2	1	1	5	2		9	60	MODERATE	80%	• During the construction phase no concrete mixing must take place within 32 m of any river bank or wetland system. • A serviced fire extinguisher (to neutralise pH levels if a spill occurs) must be available on site in the event that wet concrete is accidentally spilled into the river. • The mitigation measures in Appendix B (concrete mixing) must be used in conjunction with this report.	LOW	
3	1	1	5	3		10	67	MODERATE	80%	• During the construction phase no machinery must be parked overnight within 50 m of the rivers/wetlands. • All stationary machinery must be equipped with a drip tray to retain any oil leaks. • Chemicals used for construction must be stored safely on bunded surfaces in the construction site camp. • Emergency plans must be in place in case of spillages onto road surfaces or within water courses. • No ablution facilities should be located within 50 m of any river or wetland system. • Chemical toilets must be regularly maintained/ serviced to prevent ground or surface water pollution.	LOW	
4	1	2	5	2		10	70	MODERATE	80%	• Flood attenuation and storm water management plans must be drawn up and implemented. • An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers/ wetlands.	LOW	
5	1	1	5	1		8	67	MODERATE	90%	• During the construction phase all riparian vegetation removal must take place under supervision of the Environmental Control Officer (ECO). • A Rehabilitation and Alien Vegetation Management Plan must be developed and implemented. • Banks should be artificially stabilized as soon as possible if significant riparian vegetation is removed.	LOW	
6	1	1	5	1		8	64	MODERATE	80%	• A Rehabilitation and Alien Management Plan must be implemented during the construction phase to reduce the establishment and spread of undesirable alien plant species. • Alien plants must be removed from the site through appropriate methods such as hand pulling, application of chemicals, cutting, etc. • Vehicles and machinery should not encroach into areas outside/surrounding the planned project footprint. • Eradicate alien plants from the impacted area as they appear; and • Monitor the project area for any new growth of invasive plants until completion of construction. Short-term monitoring for a period of 12 months after construction has been completed should be conducted.	LOW	
7	1	2	5	2		10	90	MODERATE	80%	• Flood attenuation and storm water management plans must be drawn up by a qualified engineer and approved by DWS. • An Erosion and Sediment Management Plan must be developed and implemented to minimize the ingress of sediment-laden stormwater into the rivers.	LOW	